NaSCoIT 2016 Published Papers

8th National Students' Conference on Information Technology

3D Modelling using Uncalibrated Images

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Abstract—**The proposed system uses uncalibrated images for three dimensional modelling, unlike most of the existing systems that use calibrated images, thereby eliminating the immense burden of image calibration. Our aim is to make a three dimensional model of an object by taking its multiple two dimensional images from various angles. The input images are taken with the camera of a smart phone. The various transformation parameters of camera are found using the gyro sensor and the accelerometer present in the device. We have realised this system by integrating it to a remotely controlled robot for capturing images. Multiple units in this system that includes a smart phone, Raspberry Pi and a laptop (server) communicate with each other through a wireless local area network to achieve efficient and faster processing. With some limitations, we have created the system to generate the three dimensional model with a fair amount of accuracy. The system can still be further enhanced if high precision devices are used.**

Keywords—**3D modelling, Surface reconstruction, Uncalibrated images, SURF, DBSCAN, Triangulation, Ball-pivoting algorithm**

1. INTRODUCTION

In this paper, we have presented a system that generates the 3D model of an object using its multiple 2D images captured from different viewing angles. The existing systems for this process work either through user driven techniques or by scanning 3D image, and are tedious if not costly to be used by the consumers. Our idea is to create a system that solves this problem optimally. Our proposed approach consists primarily of two major aspects. The first part consists of a device that will capture and transfer the images along with required parameter. Images along with sensor data are transferred to superior computing device via a secured wireless ad-hoc network using client-server architecture. The second part is to process the images and its parameters to form the 3D model where features are detected, triangulated and then outliers are removed. Finally the surface is reconstructed. Thus, our proposed system gives good feature detection, matching and surface reconstruction using the sequence of images captured by the consumer smart phone.

2. THEORETICAL BACKGROUND

2.1 Projection Matrix

The Projection Matrix gives the Euclidean transformation between the camera and the world coordinates. The projection matrix is the result of combined 3D transform of rotation and translation. It is given as:

$$X_c = RX_{w+T} \qquad (1)$$

$$\begin{bmatrix} Xc \\ Yc \\ Zc \\ 1 \end{bmatrix} = \begin{bmatrix} R & T \\ 0 & 1 \end{bmatrix} \begin{bmatrix} Xw \\ Yw \\ Zw \\ 1 \end{bmatrix} \qquad (2)$$

where,

Xc is new position vector

Xw is old position vector

R is rotation matrix

T is translation matrix

2.2 Rotation Matrix

Rotation matrix represents rotation in Euclidean space. Each point to be rotated must be represented by column vector usually as vectors in X, Y and Z direction. The vector is multiplied by the rotation matrix to get the rotated vector which is the rotated point in space. The rotation matrix is a square matrix specified by the angle of rotation with respect to the defined axes.

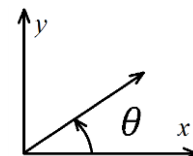In 2D, rotation matrix has following form if it rotated by an angle θ:

Fig. 2.1.Rotation about angle θ

$$R(\theta) = \begin{bmatrix} cos\theta & -sin\theta \\ sin\theta & cos\theta \end{bmatrix} \qquad (3)$$

In three dimensions, it is also similar. The rotation with respect to X, Y and Z axes are given below.

$$Rx(\alpha) = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & cos\alpha & -sin\alpha & 0 \\ 0 & sin\alpha & cos\alpha & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \qquad (4)$$

$$Ry(\beta) = \begin{bmatrix} cos\beta & 0 & sin\beta & 0 \\ 0 & 1 & 0 & 0 \\ -sin\beta & 0 & cos\beta & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \qquad (5)$$

$$Rz(\gamma) = \begin{bmatrix} cos\gamma & -sin\gamma & 0 & 0 \\ sin\gamma & cos\gamma & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \qquad (6)$$

Then, the composite rotation matrices for rotation about X, Y then Z axes are calculated by multiplying the matrices in the order Rz Ry Rx and that about Z, Y and X axes are calculated by multiplying the matrices in the order Rx Ry Rx.

2.3 Translation Matrix

Translation matrix represents translation in Euclidean geometry in given direction. A translation can also be interpreted as the addition of a constant vector to every point, or as shifting the origin of the coordinate system.
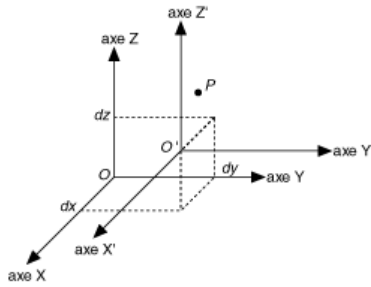

Fig. 2.2. Translation of point O to O' [1]

The translation matrix is represented as follows for a translation of dx, dy and dz translation in X, Y and Z directions:

$$T(O) = \begin{bmatrix} 1 & 0 & 0 & dx \\ 0 & 1 & 0 & dy \\ 0 & 0 & 1 & dz \\ 0 & 0 & 0 & 1 \end{bmatrix} \qquad (7)$$

2.4 SURF (Speeded-Up Robust Features)

SURF is a local feature detector and descriptor that can be used for tasks such as object recognition, image registration, classification or 3D reconstruction. It is partly inspired by the scale-invariant feature transform (SIFT) descriptor but several times faster.

SURF approximates Laplacian of Gaussian (LoG) with Box Filter. Convolution with box filter can be easily calculated with the help of integral images and it can be done in parallel for different scales. Also the SURF rely on determinant of Hessian matrix for both scale and location.
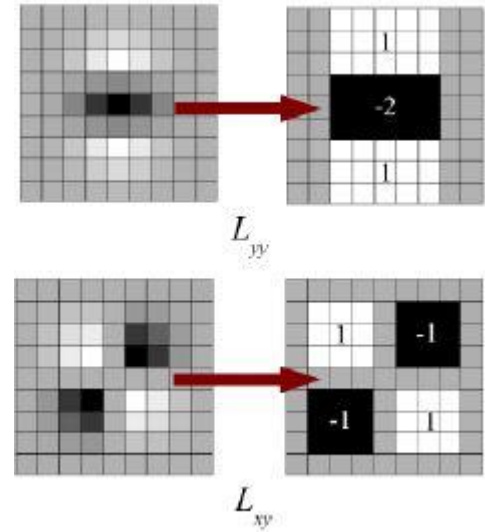

Fig. 2.3. Approximation of LoG with Box Filter [2]

For feature description, SURF uses wavelet responses in horizontal and vertical direction. A neighbourhood of size 20s x 20s is taken around the key point where s is the size. It is divided into 4 x 4 sub regions. For each sub region, horizontal and vertical wavelet responses are taken and a vector is formed using the following equation.

$$v = (\Sigma dx, \Sigma dy, \Sigma|dx|, \Sigma|dy|) \qquad (8)$$

This when represented as a vector gives SURF feature descriptor with total 64 dimensions. Lower the dimension, higher the speed of computation and matching, but provide better distinctiveness of features.

Use of sign of Laplacian for underlying interest point distinguishes bright blobs on dark backgrounds from the reverse situation making only feature comparison of same type of contrast necessary. It adds no computational cost and allows for faster matching, without reducing the descriptor' performance.

2.5 Triangulation with SVD

2.5.1 Singular Value Decomposition (SVD)

Suppose $\mathbf{M}$ is a $m \times n$ matrix whose entries come from the field K, which is either the field of real numbers or the field of complex numbers. Then there exists a factorization, called a singular value decomposition of $\mathbf{M}$, of the form:

$$M = U \Sigma V^* \qquad (9)$$

In above equation, $\mathbf{U}$ is a $m \times m$, unitary matrix, $\mathbf{\Sigma}$ is a diagonal $m \times n$ matrix with non-negative real numbers on the diagonal, and $\mathbf{V}^*$ is a $n \times n$, unitary matrix over K [3]. (If $K = \mathbf{R}$, unitary matrices are orthogonal matrices) .

$\mathbf{V}^*$ is the conjugate transpose of the $n \times n$ unitary matrix, $\mathbf{V}$. The diagonal entries σ_i of Σ are known as the singular values of $\mathbf{M}$. A common convention is to list the singular values in descending order.

2.5.2 Triangulation

Given known camera matrices, a set of point correspondences can be triangulated to recover the 3D positions of these points. The basic algorithm is fairly simple. For two views with camera matrices P1 and P2, each with a projection x1 and x2 of the same 3D point X the camera matrix gives the following relation.

$$\begin{bmatrix} P_1 & -x_1 & 0 \\ P_2 & 0 & -x_2 \end{bmatrix} \begin{bmatrix} X \\ \lambda_1 \\ \lambda_2 \end{bmatrix} = 0 \qquad (10)$$

Using SVD, we can get a least squares estimate of the 3D point.

2.6 DBSCAN clustering

Density-based spatial clustering of applications with noise (DBSCAN) is a data clustering algorithm in which given a set of points in some space, it groups together points that are closely packed together (points with many nearby neighbours), marking as outliers points that lie alone in low-density regions (whose nearest neighbours are too far away). DBSCAN has a notion of noise, and is robust to outliers. All points within the cluster are mutually density-connected. If a point is density-reachable from any point of the cluster, it is part of the cluster as well.

2.7 Surface Reconstruction with Ball Pivoting Algorithm

Ball-Pivoting Algorithm (BPA) computes a triangle mesh interpolating a given point cloud [4]. Typically, the points are surface samples acquired with multiple range scans of an object. The principle of the BPA is very simple.
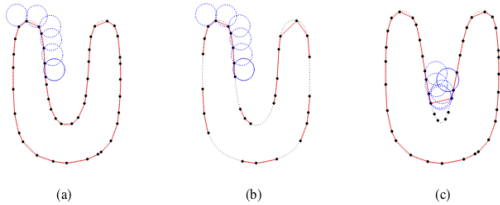

Fig. 2.4.The Ball Pivoting Algorithm in 2D: (a) a circle of radius ρ pivots from sample point to sample point, connecting them with edges; (b) when the sampling density is too low, some of the edges will not be created, leaving holes; (c) when the curvature of the manifold is larger than 1/ ρ, some of the sample points will not be reached by the pivoting ball, and features will be missed [4].

Let the manifold M be the surface of a three-dimensional object and S be a point-sampling of M. Let us assume for now that S is dense enough that a ball (a ball of radiusρ) cannot pass through the surface without touching sample points (Figure 1.4). We start by placing a ball in contact with three sample points. Keeping the ball in contact with two of these initial

points, we pivot the ball until it touches another point, as illustrated in Figure 1.4. We pivot around each edge of the current mesh boundary. Triplets of points that the ball contact, form new triangles. The set of triangles formed while the ball walks on the surface constitutes the interpolating mesh.

The algorithm can be explained as follows: The BPA follows the advancing-front paradigm to incrementally build an interpolating triangulation. BPA takes as input a list of surface-sample data points σ_i, each associated with a normal n_i (and other optional attributes, such as texture coordinates), and a ball radius ρ. The basic algorithm works by finding a seed triangle (i.e., three data points σ_i, σ_j and σ_k such that a ball of radius ρ touching them contains no other data point), and adding one triangle at a time by performing the ball pivoting operation. The front F is represented as a collection of linked lists of edges, and is initially composed of a single loop containing the three edges defined by the first seed triangle. Each edge $e_{(i, j)}$ of the front, is represented by its two endpoints (σ_i, σ_j), the opposite vertex o, the centre c_{ijo} of the ball that touches all three points, and links to the previous and next edge along in the same loop of the front. An edge can be active, boundary or frozen. An active edge is one that will be used for pivoting. If it is not possible to pivot from an edge, it is marked as boundary. Keeping all this information with each edge makes it simpler to pivot the ball around it. The reason the front is a collection of linked lists, instead of a single one, is that as the ball pivots along an edge, depending on whether it touches a newly encountered data point or a previously used one, the front changes topology. BPA handles all cases with two simple topological operators, join and glue, which ensure that at any time the front is a collection of linked lists.

Algorithm BPA(s,ρ):
1. while(true)
2.   while($e_{(i,j)} = get\_active\_edge$(F))
3.   if($\sigma_k = ball\_pivot(e_{(i,j)})$ && ($not\_used(\sigma_k)$ || $on\_front(\sigma_k)$))
4. $output\_triangle(\sigma_i, \sigma_j, \sigma_k)$
5. $join(e_{(i,j)}, \sigma_k, F)$
6. $if(e_{(i,j)} \in F) glue(e_{(i,j)}, e_{(k,j)}, F)$
7. $if(e_{(j,k)} \in F) glue(e_{(k,j)}, e_{(j,k)}, F)$
8. $else$
9. $mark\_as\_boundary(e_{(i,j)})$
10. $if(\sigma_i, \sigma_j, \sigma_k) = find\_seed\_triangle(())$
11.   output_triangle($\sigma_i, \sigma_j, \sigma_k$)
12. $insert\_edge(e_{(i,j)}, F)$
13. $insert\_edge(e_{(j,k)}, F)$

14. $insert\_edge(e_{(k,i)}, F)$
15.   else
16. return

2.8 Accelerometer :

Accelerometer is a sensor that is used to measure the acceleration of a given body including the force of gravity acting on it. Accelerometers can also be used to calculate the tilt angle in a given direction. They can only do this accurately when they are static and not moving. For precise measurement of tilt angle, the data obtained from Accelerometer and Gyro sensor are combined using appropriate and feasible mathematical models such as Kalman filters, Complementary filters etc. Accelerometer data from digital accelerometers can be accessed by using serial protocols like I2C, SPI, USART or can also be done, in our case, by implementation of android programming android cell phones that have Accelerometer embedded to it.

2.9 Gyro Sensor :

Gyro sensors are used to measure the angular rotation. Unlike accelerometers, output of gyro sensors output is linear to the rate of rotation measured with respect to time. Each Gyro channel measures rotation about an axis. It is common to have single axis and dual axis gyro sensors which measure rotation around the x and y axis (i.e. roll and pitch). It is also common to have separate single axis gyros which measure rotation around the y axis (yaw).

2.10   Sockets :

Sockets are the endpoints of a bidirectional communication line. A socket, which is a combination of an IP address with its associated port number, is the entry point for communication for any application that uses IP service. A port number differentiates the packets coming in for multiple applications that use the IP service simultaneously.

2.11   Static IP Address :

A static IP address is an IP address that is manually configured for a device as compared to one that is assigned via a DHCP server.

2.12   Ad-Hoc Networks :

An ad hoc network is a network that is composed of individual devices communicating with each other directly. The term implies spontaneous or impromptu construction because these networks often bypass the gate keeping hardware or central access point such as a router.

3.   METHODOLOGY
3.1 Input Images and sensor Data

Initially, multiple images of the desired object are captured from different viewing angles. These images will be used to produce the desired 3D model. A user mobile phone consisting of accelerometer and gyro sensor is used for taking images.

Every time there is change in the gyro sensor and accelerometer sensor, data is process to update the orientation of device and its position. The data obtained is used to name the corresponding image file and is saved with the name consisting of this data.
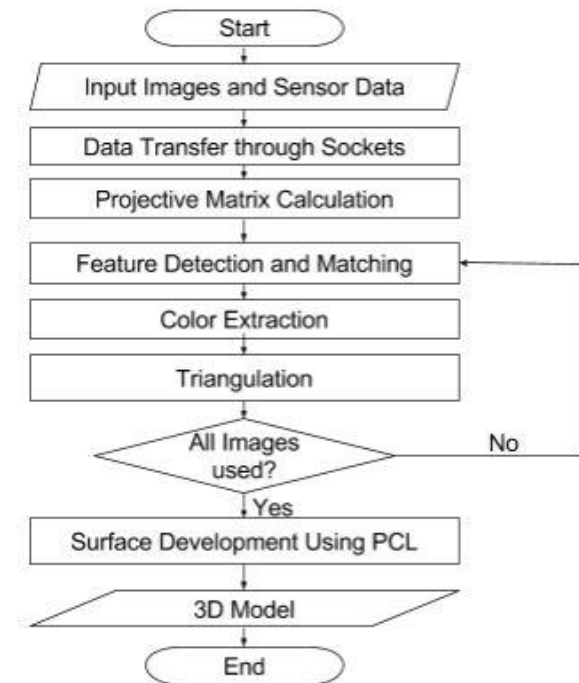

Fig. 3.1.System block diagram implemented on our design

3.2 Data Transfer through Sockets

The image obtained with the corresponding sensor data is sent to the computer for further processing. This is done by making sockets program in our android device and our pc. The pc and android devices are connected to a network. With the known static IP of the pc, we can send data from our android device to the pc for further processing. The program in android device compresses multiple data and image to zip format, converts the zip file to binary format and puts data into out stream buffer which is sent from sockets to pc where it is read and stored.

3.3 Projective Matrix Calculation

The sensor data of the device is continuously read and then tagged as soon as an image is captured. The tagged data from sensor are written as name of the image. In other words, sensor data are embedded into the image. From the sensor data embedded in the filename of our image, we compute the projective matrix by parsing filename. From the gyro sensor data, we get the orientation of device and from accelerometer we get the translation parameters. Thus, from these values, we calculate the projective matrix for each image.

3.4 Feature Detection and Matching

Then the images are loaded in a program in PC. Here SURF detectors are used to identify the features in images. The first two images are taken, with the features detected using SURF detector; we then match the features between the images. Then, for better feature points detection, we use Lowe's Ratio Test. Then, we go on to the next pair of consecutive images until all the images are read.

3.5 Colour Extraction

After we know the position of the feature points in the images, the colour for that point is taken as average from the colour of the 2D matched points from both images. The colour for each vertex is then stored in a numpy array.

3.6 Triangulation

With the known matched points and the respective perspective matrix for images we can use triangulation to get 3D points. Triangulation is done for 2 images at a time and SVD algorithm is used to generate depth value from matched key points with known x and y coordinates. After getting the required 3D points or vertices, and the corresponding colour of the vertices, we can write it to PCD file. We can visualize this point clouds using PCL viewer. The PCD file is made so as to assist in creating the surface from point clouds. The PCD file is easy to use with PCL library as well.

3.7 Surface Development using PCL

If all the images are used for the steps mentioned above, the point clouds are imported into our program using PCL library. The point clouds are used to create triangular meshes which are ideal for creating 3D objects. 3D objects in computer graphics are described by their vertex table and polygon table with additional necessary information. Thus, by using Ball-Pivoting Algorithm we create a triangular mesh which is used as polygon table. The mesh is stored.

3.8 3D Model

The PLY or OFF file represents a 3D model. This file can be opened with Meshlab and with use of Meshlab we can export the file into required format of our choice. Thus we get a 3D model that can be used with popular software like Blender, 3ds Max or SketchUp. In this way we get 3D model of an object with sequence of images of the object separated by some angle.

4. IMPLEMENTATION

The hardware implementation is simplified as much as possible. The features of the robot includes high torque high RPM DC motors connected to PVC tracks which give it the traction that allows mobility in all terrain. The components are placed in a lightweight chassis and powered with a 3 cell Li-Po battery.

The android application is built using android studio. Gyro sensor and accelerometer are must for the smart phone application. Calibrated gyro sensor was used to reduce errors and the data were observed at speed suitable for android UI. The images and data captured were compressed to a zip file before transferring using sockets.

The network system consists of a client-server architecture layout that uses an IPv4 TCP stream for data transfer using a 9000 Kb buffer with a transfer speed of 350Kbps using a Wi-Fi hotspot as a bridge for the devices to communicate.

The feature detection, matching, triangulation and clustering are implemented in Python with use of libraries such as opencv for feature detection and matching; numpy for triangulation and sklearn for clustering. Then C++ along with PCL is used to generate 3D surface. The PCL library was built using CMake.

For 3D reconstruction, the SURF detectors are used and filtered with Lowe's ratio test with value of 0.9 then it is triangulated using SVD. Then the triangulated pats are clustered in such a way that dense points are preserved. Thus, there is a trade off between removal of total outliers and preservation of maximum object points, and values are chosen accordingly as epsilon = 0.015 and minimum points =5. Then, the point cloud is meshed using PCL library where search radius and maximum nearest neighbours are set so that the mesh formed included as much vertices as possible, and faces are compact and smooth.

5. RESULTS AND DISCUSSION

After assembling all the hardware components, our robot i.e. the tread-bot looks as shown in the Figure 5.1. A smart phone has to be clamped on the chassis of the tread-bot for taking the images of the object.

Fig 5.1.The tread-bot designed for taking images by clamping a smart phone to the chassis

The image names are declared according to the

data obtained from the motion sensors (accelerometer and gyro sensor). Multiple images are taken and stored in the smart phone memory. After completion of taking images, the image files are zipped before being sent to the laptop.

Using images taken from various angles of a test object [5], we used our system to generate the 3D model.

Fig. 5.2.Input image of the test object model used in our system [5]. Multiple images such as these were used for the input of the system for testing.

In the server side, SURF feature points were detected, matched then triangulated to give 3D vertices. It was then clustered to remove its outliers. This resulted reduction of number of point clouds from 108,457 to 12,572. The value for epsilon and minimum points for DBSCAN were chosen to be 0.015 and 5 respectively.
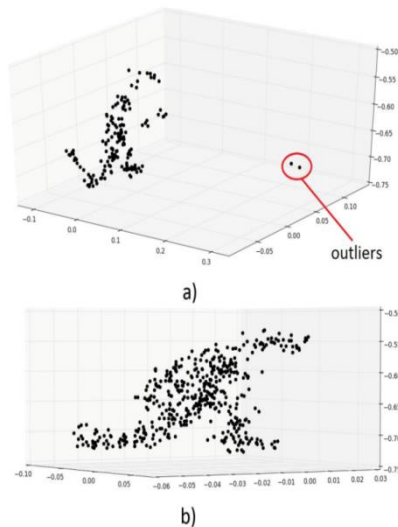

Fig. 5.3.Three dimensional plot of key points obtained from two input images of the test object before clustering (a) and image after removal of outliers after clustering (b).

The above points obtained after clustering were used to generate a three dimensional plot of the object model.

The outputs from various intermediate stages are shown in Figure 5.4 and Figure 5.5. The final output which is the 3D model of the test object is obtained as shown in Figure 5.6.
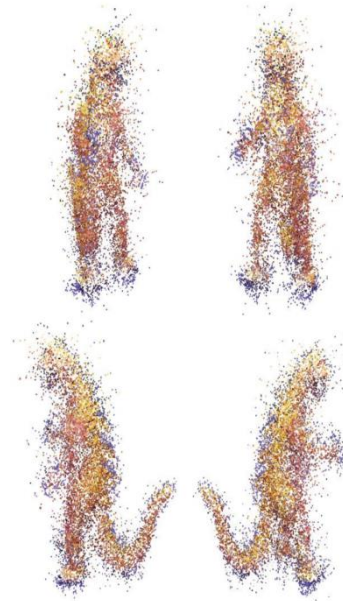

Fig. 5.4.Point clouds of the test object obtained from the points after clustering.

In case of surface reconstruction, the result is as given in the figure below where 15,587 triangular faces were generated from 12,572 vertices with search radius of 0.010, maximum nearest neighbours 10,000 and maximum acceptable distance of 2.5.
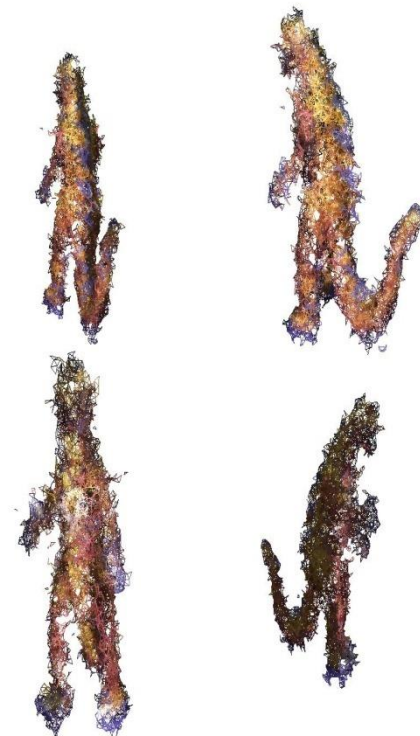

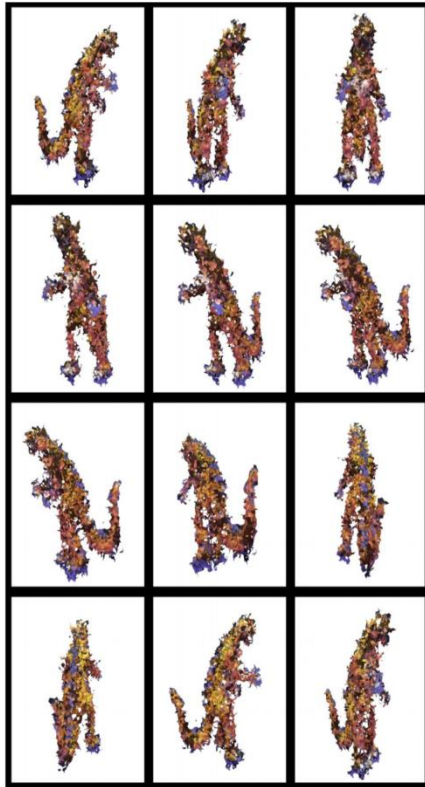Fig. 5.5.Wire frame model of the test object obtained from its respective point cloud in Figure 5.4

Fig. 5.6.Reconstructed surface of the test object obtained from its respective wire frames in Figure 5.5.

6. CONCLUSION

Our proposed system of "3D Modelling with uncalibrated images" allows users to make a robust 3D model using their smart phones and computers without the need of calibrated images as input to the modelling system. This also eases the layman users intending to create a 3D Model who do not want to dive into the technical complexity of the system for the modelling simply with the help of a user friendly application on their smart phones.

However, there are cases of occlusion of foreign objects to the foreground, uneven lighting conditions, uneven background conditions and texture mapping which can cause inaccuracy in the output 3D-model.

These conditions have to be at least considered, if not completely eradicated, in order to get a precise and optimum output. Superior mathematical models can be used for more precise results. And, for further enhancement, 3D modelling can be done in the server where users send the images and data captured by their smart phone and then in turn receive the 3D model. This will allow general public to use it more easily.

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A Comparative Study of Stemming Algorithms for Nepali Language

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Abstract— **Stemming helps in mapping all inflected and derived variants of words to their respective stems. It is an important pre-requisite in Text Mining, Natural Language Processing and Information Retrieval systems. This paper presents a comparative study and an overview of existing stemming algorithms for Nepali Language. The existing stemming algorithms for Nepali language are compared on the basis of their f-measure values.**

Keywords—Stemming; Nepali language; Inflections; Derivations;

I. INTRODUCTION

Stemming is the process of mapping inflected words to their respective stems. The basic concept of stemming is to reduce different grammatical forms / word forms to its root, stem or base form [1]. Stemming is significant in spell checking, machine translation, natural language processing and information retrieval.

Nepali is an Indo-Aryan Language written in Devnagari script. Nepali word construction/formation can be of two types and they are:
- Inflectional and
- Derivational

Inflectional word construction involves attaching inflectional suffixes to the root/stem. Inflection is regular and transparent in its function and they do not change the lexical category and meaning of the root/stem. In Nepali, there is no inflectional prefix i.e. only suffixes are responsible for inflections in Nepali.

Some of the inflectional suffixes in Nepali are listed below:
- एको (eko)
- लाई (lai:)
- हरु (haru)
- को (ko)

Derivation usually changes the lexical category and meaning of the root/stem. Derivational word construction can be further divided into four categories and they are:

1. Affixation (सर्ग प्रक्रिया)
        Stem + Affix = Word Forms
   For example:
        गफ़ + आडी = गफाडी
        बे + इज्जत = बेइज्जत

   In Nepali, there are two categories of affixes and they are prefix(उपसर्ग) and suffix(प्रत्यय). Prefixes append to the beginning of the root and suffixes append to the end. In the above examples, आडी is a suffix, बे is a prefix and गफ़ and इज्जत are root words. Nepali word construction does not involve infix and circumfix.
2. Compounding of two free roots (समास प्रक्रिया)
3. Repetition of word or part of word (द्वित्व प्रक्रिया)
4. Phonetic Similarities (सन्धि प्रक्रिया)

Derivations are morphologically more complex and difficult to handle compared to inflections. Existing works, handles all words that are formed due to affixation, both inflectional and derivational, i.e. the stemming algorithms being compared are all of affix stripping type.

The rest of the paper is organized as: The Section II is discusses in details the types of stemming algorithms. In Section III, study and overview of the existing stemming algorithms for texts in Nepali Language is presented. Section IV discusses the methodology used for the comparative analysis. Section V includes the results of the comparison and section VI concludes the study and the final section includes the possible future enhancements.

II. APPROACHES TO STEMMING

The commonly used approaches to stemming are:

A. Brute Force Approach:

Brute force approach to stemming is also known as lookup table approach. In this approach a lookup table that contains all the index terms and their stems is used. Terms that are to be stemmed are conflated using the entries of the lookup table. Using a lookup table for stemming would be time efficient but it would increase the storage overhead.

B. Statistical Approach:

Statistical approach to stemming uses statistical analysis and techniques to conflate inflectional and derivational endings from words to get to their respective stems. Some of the statistical approach towards stemming is discussed below.

N-Gram String Similarity Stemmer

Adamson and Boreham proposed N-Gram stemmer in 1974. N-Gram stemmer is based on the concept of n-grams and string comparison. An n-gram is a string of n, usually adjacent, characters extracted from a section of continuous text [2]. Conflation is done on the basis of the common n-grams shared by the terms that are subjected to conflation.

N-Gram stemmer is great because it is language independent. However, it isn't very practical, as it requires large storage.

HMM Stemmer

HMM stemmer is based on the Hidden Markov Model(HMMs). Stemmer based on HMMs was proposed by Melucci and Orio[3]. This stemmer does not need a prior knowledge of the language and dataset as it is based on unsupervised learning. This implementation of HMM stemmer can be a little complex and may cause errors due to over stemming.

Successor Variety Stemmer

Successor variety stemmer by Hafer and Weiss is based on the structural linguistics. It identifies the word and morpheme boundaries based on distribution of phonemes. Successor variety of a string is the number of characters that follow it in words in some body of text [4].

C. Affix Removal Stemmers:

Affix removal stemmers conflates affixes from words to get the stems. Affixes can be prefix, suffix, infix or circumfix. Some of the popular affix removal stemmers are discussed below.

Lovins Stemmer

The first published stemmer for English was Lovins Stemmer[5]. Julie Beth Lovins developed it in 1968. It is a context sensitive stemmer that strips endings based on the longest-match principle. It consists of 294 endings, 29 conditions and 35 transformation rules. Each ending is associated with one of the conditions. The algorithm has two steps. In the first step, the longest ending is found which satisfies its associated condition, and is removed. In the second step, the 35 rules are applied to transform the ending. The second step is done whether or not an ending is removed in the first step [6].

Porters Stemmer

Martin Porter developed Porter stemmer in 1980. It is a context-sensitive affix removal algorithm. Porter stemming algorithm [7] is a five steps process based on different types of affixes. The first step handled the inflectional affixes and derivational suffixes were handled in the next three steps. The final step recorded the results of the stemmer.

Paice/Husk Stemmer

Chris Paice and Gareth Husk developed Paice/Husk stemmer [8] in 1990. This stemmer conflates the affixes in an iterative manner. It uses a rule-base with a set of 120 rules, each of which may specify the removal or replacement of an ending. Replacement is done to avoid the problem of spelling exceptions by replacing endings. Using rule-base for both removal and replacement, without further analysis and processing helps to maintain the efficiency of the algorithm.

D. Hybrid Approach:

Hybrid approaches to stemming uses a combination of two of more of the approaches discussed above. MAULIK[9] is a hybrid stemmer for Hindi Language. It uses a combination of brute force and suffix removal approach for stemming. It is based on Devanagari script.

III. Existing Stemmers for Nepali Language

There has been a lot of work in the field of stemming. However, most of them are for English. In fact, NLP research in Nepali started only in the year 2005, with the release of the first Spell Checker for Nepali and the "Dobhase" English to Nepali machine translation project, respectively developed by Madan Puraskar Pustakalaya and with the Kathmandu University in collaboration. In the same year, further works on language engineering like corpus building and annotation for Nepali, Text-To-Speech System for Nepali, digitized Nepali dictionary also got started under the NeLRaLEC (Nepali Language resources and Localization for Education and Communication) Project, also known as the Bhasha Sanchar Project and currently being run at Madan Puraskar Pustakalaya, Nepal [10]. [11] presents different implementation, design and linguistic aspects of a Nepali morphological analyzer and stemmer. The idea looks promising as it considers grammatical rules of word breaking, POS tagset and morpheme-based lexicon for stemming. However, there is no update on the implementation of the idea, which is why the efficiency of the stemmer proposed and practicality of the idea cannot be ensured.

Chiranjibi Sitaula proposed a hybrid algorithm for stemming Nepali text [12], which is a combination of traditional rule based affix removal and string similarity approach. It is a context-free stemmer, which handles both inflectional and derivational words. Incremental stripping is done only for the suffixes and longest-length suffix stripping is done for prefixes only. The work also discusses the performance of the traditional rule-based stemmer is also discussed in the paper. The hybrid-stemming algorithm is summarized in the table 1 below.

Table 1: Summary of the Traditional rule-based and Hybrid stemming algorithm for Nepali text

Paper: A Hybrid Algorithm for Stemming of Nepali Text [12]	
Approach Used	Traditional affix removal rule based approach String similarity approach
Reported Accuracy	68.43%(Traditional rule-based algorithm) and 70.10%(Hybrid algorithm)
Total Rules	150 suffix rules 35 prefix rules
Data Size	1200
Longest affix stripping rule?	Yes, but only for prefix
Incremental affix	Yes, but only for suffix
stripping rule?	
Advantages	1. The algorithm is computationally inexpensive. 2. The hybrid algorithm is better compared to the traditional rule-based algorithm. 3. It is a light stemmer.
Limitations	1. Only few rules are applied. 2. Lots of error due to under-stemming.

An affix removal stemmer for natural language text in Nepali[13], is a Nepali stemmer developed by Abhijit Paul, Arindam Dey and Bipul Syam Purkayastha. It uses an affix lexicon along with a database of root words to find the root of the given word. The affix removal stemmer is summarized in Table 2 below.

Table 2: Summary of the affix removal stemmer for natural language text in Nepali

Paper: An Affix Removal Stemmer for Natural Language Text in Nepali [13]	
Approach Used	Affix removal approach
Reported Accuracy	90.48%
Total Rules	120 suffix rules 25 prefix rules
Data Size	1800
Longest affix stripping rule?	No
Incremental affix stripping rule?	Yes
Advantages	1. Has a high recall value. 2. The words contained in the root lexicon are stemmed correctly. 3. The accuracy of the system is highest among the existing stemmers for Nepali language.
Limitations	1. More rules can be added to rule-list. 2. It uses a root lexicon whose size would increase with the increasing dataset, this would increase the memory overhead.

IV. Methodology and Implementation

Since the stemmers are not available for public use as of yet, a careful study of the algorithms described for

each system was done and personal versions of each stemmer were developed. The same number of rules, same size of the root lexicons and the same size of test data were considered in developing the stemmers. The test data for each algorithm was different from the other. However, many of the rules were same for the three systems. The rules were refined until accuracy similar to that of the actual algorithms was achieved. The accuracy of our version of the systems and that of the actual systems is given in Table 3.

Table 3: Accuracy of our version of the systems and that of the actual systems

Algorithm	Our Version	Actual
Traditional rule-based	70.40%	68.43%
Hybrid	71.64%	70.10%
Affix Removal	85.20%	90.48%

After each version of the stemmers was developed, all the algorithms were tested on common datasets. Figure 1 shows a flow diagram of the methodology used for the comparative study.
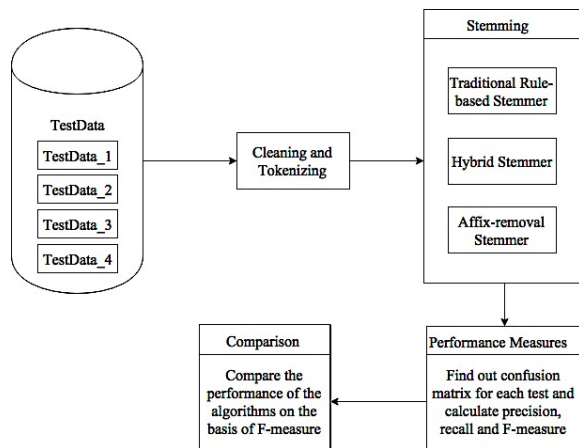

Figure 1: Flow diagram of the comparison methodology

The datasets were first cleaned and tokenized. 4 different datasets: TestData_1, TestData_2, TestData_3 and TestData_4 with 200, 400, 600 and 800 words, respectively, were used for the comparative study of the stemmers. Then, a confusion matrix for each test was written. The confusion matrix is given in Table 4.

Table 4: Confusion matrix for stemmer performance

	Conflated	Not Conflated
Inflections/derivations	TP	FN
Non-Variants	FP	TN

Here, TP, True Positive, stands for number of actual inflections/derivations conflated to get the root word.

TN, True Negative, stands for number of non-variants that were not conflated.

FP, False Positive, stands for the number of non-variants that were conflated and,

FN, False Negative, stands for the number of inflections/derivations that were not conflated.

FP and FN are the errors that arise due to over-stemming and under-stemming respectively.

Finally, the precision, recall and F-measure were calculated for each test. The values of precision, recall and F-measure were calculated using the formulas represented by equation 1, 2 and 3 respectively.

$$p = \frac{TP}{TP+FP} \dots\dots\dots\dots\dots \textit{(1)}$$

$$r = \frac{TP}{TP+FN} \dots\dots\dots\dots\dots \textit{(2)}$$

$$F-measure = \frac{2*p*r}{p+r} \dots\dots\dots\dots\dots \textit{(3)}$$

The F-measure calculated was the balanced F-measure. The result of the analysis in discussed in the next section.

V. RESULTS OF THE STUDY

The performance measures for each test of the traditional rule-based algorithm described in [12] are given in Table 5.

Table 5: Performance measures of the traditional rule based stemmer

Dataset ID	Precision	Recall	F-measure
TestData_1	77.78%	70.0%	73.69%
TestData_2	72.43%	71.76%	72.08%
TestData_3	74.17%	69.30%	71.68%
TestData_4	68.89%	73.63%	71.18%

The performance measures for each test of the hybrid algorithm described in [12] are given in Table 6.

Table 6: Performance measures of the hybrid stemmer

Dataset ID	Precision	Recall	F-measure
TestData_1	75.0%	73.64%	74.31%
TestData_2	74.65%	75.0%	74.82%
TestData_3	75.40%	73.06%	74.21%
TestData_4	68.35%	76.96%	69.13%

The performance measures for each test of the affix removal algorithm described in [13] are given in Table 7.

Table 7: Performance measures of the affix removal stemmer

Dataset ID	Precision	Recall	F-measure
TestData_1	91.58%	79.09%	84.88%
TestData_2	93.05%	80.56%	86.25%
TestData_3	89.90%	79.88%	84.59%
TestData_4	90.50%	81.47%	85.75%

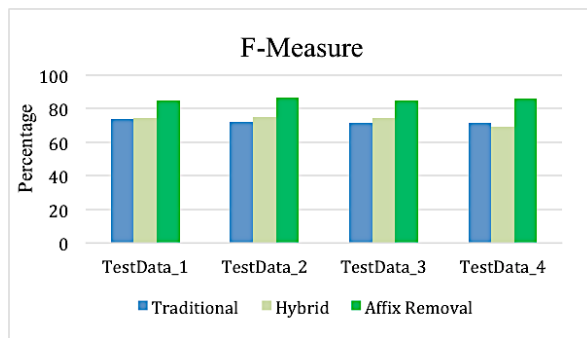The graph showing the F-Measures for each test of the algorithms is shown in Figure 2.

Figure 2: F-Measures for each test of the algorithms

VI. CONCLUSION

As it can clearly be seen that a limited work has been done in terms of stemming for Nepali language. In fact, not much approaches to stemming for Nepali has been explored. Among the three existing systems the system described in [13] performed better that those described in [12]. Both of the systems described in [12], traditional rule-based system and hybrid system, have the fairly same results.

Although the performance measures for the affix removal algorithm is better than those of the other two algorithms, with the increasing number of test data, the size of root lexicon also increases. This can increase the memory overhead in the system and hence, can be computationally expensive.

VII. FUTURE ENHANCEMENTS

Although a lot of work has been done in developing stemmers, most of the works are for English language. Clearly, very limited work has been done in terms of Nepali stemming. This comparative study uses the various statistical performance measure values to compare the algorithms. In future, multiple dimensions, like memory usage, time required, can be compared. This would provide a more effective analysis of the stemmer's efficiency and performance.

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Analysis of Document Clustering Using K-means Algorithm with Cosine Similarity for Large Scale Text Documents With and Without Hadoop

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Abstract—**With the advancement in technology there has been continuous increment in the datasets produced in unstructured format. The datasets are the documents consisting of the information in the different formats like text, portable document format (pdf), Extensible markup language (xml), audio, video etc. There is need of organization of such datasets into semantic group for the information retrieval in optimized way. Hadoop is popular open source software framework which support data intensive distributed applications and Map Reduce is parallel programming technique and runtime support for scalable data processing on Hadoop.**

This paper is the analysis of performance of Hadoop for Document Clustering in the distributed system for large datasets. This is implemented using K-means clustering algorithm with cosine similarity for feature extraction.

Keywords-**Distributed System, Document Clustering, Hadoop, Map Reduce, Cosine Similarity clude at least 5 keywords or phrases**

I. INTRODUCTION

The data and information has always been the major source of the information retrieval in any field like education, scientific researches, business, medical research, management, economics, data management, human resource management, images processing and so on. Each day numerous data are generated and processed for the accomplishment of different activities throughout the world. This information is the vital from which intensive knowledge can be retrieved. The process of obtaining the knowledge from the mass of data and information is called as information retrieval.

Organizing the unstructured documents into the meaningful group is the sub problem of information retrieval in which there is need to learn about the general content of data [1].

Unstructured data are non-database data that includes text-based documents like word processing, presentations, emails, blogs, wikis, tweets, web pages, web components (read/write) web and video/audio files. Unstructured data are found in office productivity suites, Content management systems, digital asset management systems, web content management systems like wikis, blogs, comment, discussion boards and social networking tools like twitter, instant messengers, Facebook etc.

Data mining is the process of extracting the implicit, previously unknown and potentially useful information from data. Document clustering, subset of data clustering, is the technique of data mining which includes concepts from the fields of information retrieval, natural language processing, and machine learning. Document clustering organizes documents into different groups called as clusters, where the documents in each cluster share some common properties according to defined similarity measure. The fast and high quality document clustering algorithms play an important role in helping users to effectively navigate, summarize, and organize the information.

Hadoop is the most effective analytic tool used for processing large sets of data. It is designed to process, store and analyse petabytes and Exabyte of distributed, unstructured and structured data. Hadoop works in the nutshell. It breaks data into pieces and stored them into Hadoop distributed file system [HDFS] which can scale to hundreds of nodes on a single cluster and analyses and process millions of files in a single instance improving efficiency. It is cost effective and scalable method of storing, manipulating and querying data.

Data increasing trend is growing exponentially at an unprecedented space. These volume of data are of great essence with meaningful conclusions. These data are can be used to obtain essential information regarding geographical analysis, health status, education system, social causes and problems, cybercrime and internet threats, fraud and malicious intent and many more. In order to retrieve valuable information these data are needed to be processed.

Data are processed using various analytic tool and methods one of which includes text mining. Text mining is part of information retrieval and is used to retrieve information. In text mining the data are processed using the different techniques and one of them is clustering. Among clustering k means clustering is used with cosine similarity for feature extraction.

II. METHODOLOGY

This research will be focused on determining the feature extraction of the document on the basis of cosine similarity, implementation of vector space model (VSM) for pre-processing of the documents, applying the clustering algorithm and applying the Hadoop with MapReduce.

A. Methodology Adapted

 i. The documents required are indexed using apache Lucene.
 ii. Pre-processing is carried on, which includes the different methods to reduce the document size. It includes:
  a. Extraction of words.
  b. Removing stop words using Key Phrase Extraction Algorithm.
  c. Applying stemming using Porter Algorithm.
 iii. Frequency matrix is generated using vector space model.
 iv. Cosine similarity is applied for distance measure.
 v. K-means clustering algorithm is applied.
 vi. Then each job is submitted and processed using Hadoop platform.
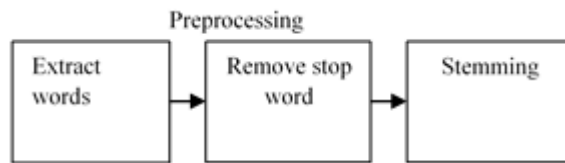 vii. The performance measurement is done on k-means clustering.
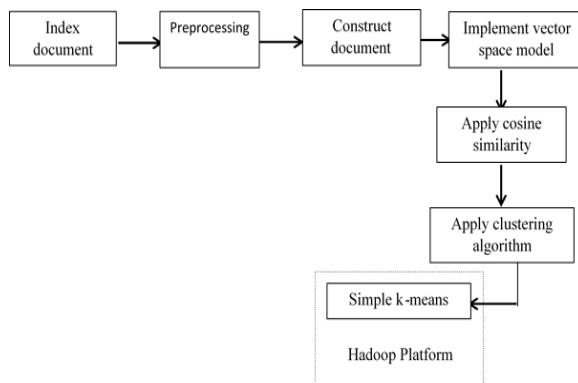
B. Block Diagram

Fig. 1.1 Preprocessing

Fig. 1.2 Methodology

Fig. 1 Diagram of Proposed Methodology

The process starts with the indexing. Here all the files within the folders are checked and listed. And for further processing for the contents, the pre-processing phase is carried out. This is the next consecutive stage where all the unique terms that are listed are processed. Here processing refers to the methods like removal of stop words and stemming which helps to reduce the dimension of the contents, that is the document size drastically.

This phase consists of three further process. They are extracting the words, stop words removal and stemming. After pre-processing phase, the actual document is constructed. This document consists of the required unique terms after the removal of the stop words and stemming.

Vector Space Model

The vector space model (VSM) represents the derived terms as vectors providing the easy way for implantation for the desired work. Vector space model is an algebraic model for representing text documents as vectors of identifiers such as index term. It is used in information filtering, information retrieval, indexing and relevancy rankings [2]. This model focuses on the retrieval of the terms on the basis of the presence of each unique term present in given document.

In VSM, a collection of d documents described by t terms can be represented as a txd matrix 'A', commonly called term-document matrix. The column vectors are called document vector representing the documents in the collection and the row vectors are called term vectors representing the indexed terms from the documents.

Table 1. Term-Document Matrix

Term vectors	Document 1	Document 2	Document 3
Term 1			
Term 2			
Term 3			

Binary Weighting

The term occurrence im VSM refers to binary weighting method where if $a_{ij}=i$ means term i occurs in document j, $a_{ij}=0$ meaning that the term 'i' doesn't occur in document 'j'. The binary weighting informs about the fact that a term is somehow related to a document but carries no information on the strength of the relationship.

Term Frequency

Term Frequency(tf) Weighting measures how frequently a term occurs in a document. It refers to the number of occurrences of the word in the document which represents the value of the vector dimension for the word. Thus the term frequency is often divided by the document length(i.e the total number of terms in the document) as a way of normalization.In this scheme $a_{ij} = tf_{ij}$ where tf_{ij} denotes how many times term 'i' occurs in document 'j'. This frequency for each term in the document is also called as local weight.

Mathematically,
$$tf_{ij} = \frac{\text{number of times term 'i' appears in document 'j'}}{\text{total number of term'i's in document 'j'}} \quad (1)$$

Inverse Document Frequency

Inverse Document Frequency (idf) measures how important is the term is. While computing term frequency (tf), all terms are considered equally important. This scheme represents the scaling factor, or the importance of term 'i. The obtained value decreases as the number of document containing the term increases. The frequency obtained for each term is called global weight.

Mathematically,

$$idf_t = log \frac{total\ number\ of\ documents\ 'n'}{number\ of\ doucments\ with\ term\ 'i'} \qquad (2)$$

Term Frequency- Inverse Document Frequency

Term Frequency- Inverse Document Frequency (tfidf) weighting is the statistical measure used to evaluate how important a word is to the document in a collection or corpus. The importance increases proportionally to the number of times a word appears in the document. This scheme aims at balancing the local and the global term occurrences in the documents.

Mathematically,

tfidf=tf_{ij}*idf_t ……………………………...eqn(3)
where, tf_{ij} and idf_{ij} can be obtained from eqn(1) and eqn(2).

Cosine Similarity

Cosine Similarity is the common measure of similarity between two vectors which measures the cosine of the angle between them. In a (t*d) term-document matrix A, the cosine between document vectors d_i and d_j where $d_i=\{x_1, x_2, x_3,……, x_n\}$ and $d_j = \{y_1,y_2, y_3,……, y_n\}$ can be computed according to the cosine distance formula as mentioned in eqn (4).

$$cos\theta_{i,j} = \frac{d_i d_j}{|d_i||d_j|} = \frac{\sum_{k=1}^{n} x_k y_k}{|\sqrt{\sum_{k=1}^{n} x_k^2 \sum_{k=1}^{n} y_k^2}|} \qquad (4)$$

where d_i and d_j are the ith and j^{th} document vector, $|d_i|$ and $|d_j|$ and denotes the euclidean length (L2) of vector d_i and d_j respectively.

K-means Algorithm

K-means is one of the most efficient methods for clustering. It is the centroid based technique where from the given set of n data, k different clusters; each cluster characterized with a unique centroid (mean) is partitioned using the K-means algorithm. The elements belonging to one cluster are close to the centroid of that particular cluster and dissimilar to the elements belonging to the other cluster.
1. Identifying unique words form the given input documents.
2. Generation of input vectors.
   a.Term Frequency (tf)
   b.Inverse Document Frequency(idf)
   c.Term Frequency Inverse Document Frequency(Tfidf)
3. Selection of similarity measure for generating similarity matrix.
   i. Cosine similarity
4. Specifying the value of k i.e. number of clusters
5. Randomly select k documents and place one of k selected documents in each cluster.
6. Place the remaining documents in the clusters based on similarity between documents and the documents present in the clusters.
7. Compute centroid of each k clusters
8. Again by using similarity measure, find the similarity between the centroids and the input documents i.e. generate similarity vector.
9. Now place the documents in the clusters based on similarity between documents and the centroids of clusters.

10. After placing all the documents in the clusters compare the previous iteration clusters with current iteration clusters.
11. If all the clusters contains same documents in previous and current iteration then terminate the algorithm here and we will be obtaining the final clusters.
12. Else repeat through step-7

MapReduce

MapReduce is a software framework introduced by Google to computer large scale data. It's based on functional programming paradigm with map and reduce functions. The map functions processes the input set of data and generates a set of intermediate key/value pairs. The reduce function merges the intermediate pairs with the same key. Multiple map and/or reduce tasks are run in parallel over disjoint portions of the input or intermediate data, thus parallelizing the computation. It has been hugely used inside Google for parallel-programming over clusters of computers that have unreliable communication.

Hadoop

Hadoop is a distributed file system written in Java with an additional implementation of Google's MapReduce framework [3] that enables application based on map-reduce paradigm to run over the file system. It provides high throughput access to data and is suited for working with large scale data (typical block size is 64 Mb)[1].

Hadoop is an Apache software framework that analyzes petabytes of unstructured data and transforms it into a more manageable form for applications to work on. Based on Google's MapReduce and distributed file system work, Hadoop is designed specifically to be deployed on commonly available, general-purpose network and server hardware. It is available in both open source and commercial packages [4].

III.   EXPERIMENT

For the purpose of experimentation, Clustering was done using the above data sets. For these datasets, stop-list was used to remove common words, and the words were stemmed using Porters stemming algorithm to generate unique term for clustering. Then the terms were extracted. After extracting the terms, the term frequency was generated and inverse document frequency was generated. Finally the term frequency and inverse document frequency (tfidf) was calculated which was the required term vector for calculation for cosine similarity.

After the calculation of tfidf, the k-means clustering was applied where the centroid was chosen randomly. And finally Clustering results were noted for two cases, with and without using Hadoop.

The K-means algorithm is applied on Hadoop and map reduce environment and the time utilized for the generation of various clusters size for different data sets are obtained for both environment using Hadoop and without using Hadoop.

A. Data sets

The datasets used are priorly the sample text files where the few sample text were created manually for the test. As well the datasets which are extensively used for clustering was used [5] for the work. They are heterogeneous in terms of document size, cluster size, number of classes, and document distribution. Below is the topics of the newsgroups arranged by Jason Renn[7].

Table 2. List of Topics of 20 Newsgroups

comp.graphics	rec.autos	sci.crypt
comp.os.ms-windows.misc	rec.motorcycles	sci.electronics
comp.sys.ibm.pc .hardware	rec.sport.baseball	sci.med
comp.sys.mac.hardware	rec.sport.hockey	sci.space
comp.windows.x	talk.politics.misc	talk.religion.misc
misc.forsale	talk.politics.guns	alt.atheism
talk.politics.mideast	soc.religion.christian	

B. Tools

The experiment was performed under the system consisting of following hardware configuration and software system.

i. *Hardware Configuration*

The hardware configuration used for the experiment are RAM:4GB, Processor: Intel® Core(TM) i7-2670QM CPU@2.20 GHz, System type:64 bit operating system/Linux(UBUNTU 12.04).

ii. *Software*

The software used for the experiment are as follows:

TABLE 3. LIST OF SOFTWARES

S.N	Software	Version
1	Operating Sytem (OS)	3.2.0-23-generic
2	Java platform	Intellij IDEA 12.0
3	Apache Hadoop	1.2.1
4	Apache Mahout	0.9
5	Apache Maven	3.0.5
6	Apache Lucene	2.4.0

IV. RESULT AND ANALYSIS

In order to know the performance for k-means clusters generated with and without using Hadoop, the time taken was observed and compared. Similarly the distributed system over centralized system was also analysed on the basis of time utilized during the execution of program for obtaining output with Hadoop and without Hadoop.

For the performance evaluation, the time used by the datasets while generating clusters 2,3,4,5,6,7,8,9,10,20,40 and 60 were observed. The time was observed each time for the mentioned datasets 100, 500, 1000, 1500, 2000, 2500, 3500 and 20000 for the case with Hadoop and without Hadoop while generating different clusters ranging from 2,3,4,5,6,7,8,9,10,20,40 and 60. The data sets are the size of 244.8 KB, 1 MB,2.9 MB,3.9 MB,4MB,5.1 MB,5.4 MB,6.4 MB,46.4 MB respectively for the datasets 100, 500, 1000, 1500, 2000, 2500, 3000, 3500 and 20000. The time was observed in seconds. The obtained values for time for each datasets with Hadoop and without Hadoop are used for evaluation of the performance. So obtained time is compared for the clusters 2,3,4,5,6,7,8,9,10,20,40 and 60 for each datasets.

The value observed for time for the cases with and without Hadoop are listed in the table 4 for all the datasets 100, 500, 1000, 1500, 2000, 2500, 3000, 3500 and 20000 generating clusters 2,3,4,5,6,7,8,9,10,20,40 and 60 using Hadoop and without using Hadoop. The radar chart are obtained for all mentioned clusters and datasets. But here radar chart for clusters 2, 8, 20 and 60 are shown in the figures 2,3,4 and 5.

The time chart obtained for clusters 2, 3, 4, 5, 6, 7, 8, 9, 10 and 20, 40 and 60 showing time for the different datasets having different data size with and without Hadoop are shown in table no 4. For all clusters obtained it can be seen that time taken with Hadoop is comparatively less than without using Hadoop which can be clearly seen in figure no 2,3,4 and 5.

Viewing with respective to the datasets of different size without Hadoop it is clearly seen that as the size of data increases the time utilization also increases. The greater the size of data the more time it takes to execute that is to generate the cluster which can be seen in figure no 2,3, 4 and 5.

For the 100 datasets of size 244.8 KB the time taken for generating clusters 2 to 10 without Hadoop is comparatively less than with using Hadoop.. As the data size increases, for generating clusters without Hadoop the time taken increases gradually whereas with Hadoop time taken almost remain constant. While generating clusters 2 to 10 for 1500 datasets of size 3.9 MB and 3500 datasets of size 6.4 MB without Hadoop time taken increases in comparison to 100 datasets whereas with Hadoop time remains almost constant for the datasets 100, 1500 and 3500. But as the size of data increases time utilization is higher without Hadoop for the generation of clusters than with Hadoop which is clearly shown in radar chart 2,3,4,5. For the dataset 20000 of size 46.6 MB without using Hadoop, during generation of clusters the time cannot be observed due to the memory error. But with Hadoop time observed for the 20000 datasets is shown in figure 2,3,4,5. This clearly shows that the time taken to obtain clusters for large datasets with Hadoop is far more less than without Hadoop.

Without using Hadoop for dataset 100 of size 233.4 KB it takes lesser time to execute that is about 2 sec. As the size of data increases the time consumption also

increases gradually. For the datasets 3500 of size 6.4 MB it takes more time in comparison to other datasets. It is similar to all other clusters obtained from 2 to 10 and is for the clusters obtained for 20,40 and 60. So as the number of datasets increases that is size of data increases the time taken also increases that is data size is directly proportional to the time. That is why for the dataset 20000 of size 46.4 MB the time couldn't be measure due memory error which is shown in figure no 2,3,4 and 5. Using Hadoop the time for clusters 2 to 10 are almost same. In this case for small datasets the time is almost same but for the dataset 20000 of size 46.4 MB it is comparatively Hence through radar chart it is seen that for k-means algorithm the time taken to generate clusters without Hadoop is more with Hadoop.

It can be summarized that with the increment in the size of data , Without using Hadoop, the time utilization rises as well whereas with using Hadoop, time taken for all datasets used is almost same.

For number of documents greater than 3500, without using Hadoop, while generating clusters 2-10, out of memory error is displayed. Hence time and memory couldn't be observed for those cases. But when using Hadoop, clustering can be easily generated within the available system resources.

The time taken for the execution of clusters without using Hadoop for small scale documents is low in comparison to the time taken in Hadoop.

Table 4 Tabular chart for time analysis observed for different datasets with and without Hadoop.

No of Clusters	Hadoop	Datasets								
		100 (244.8 KB)	500(1 MB)	1000(2.9 MB)	1500(3.9 MB)	2000(4 MB)	2500(5.1 MB)	3000(5.4 MB)	3500(6.4 MB)	20000(46.4 MB)
2	Without Hadoop	3	5	28	47	43	52	43	62.4	Out of memory
	With Hadoop	76.8	76.2	140.4	120	82.8	84.6	88.8	93.6	149.4
3	Without Hadoop	3	4	27	43	40	54	46	70.8	Out of memory
	With Hadoop	73.2	76.2	144	82.2	88.8	82.8	82.8	85.2	**148.4**
4	Without Hadoop	3	6	29	68.4	47	66.6	59	77.4	Out of memory
	With Hadoop	73.2	75	141	85.2	89.4	83.4	95.4	88.2	143.4
5	Without Hadoop	2	6	70.2	51	50	64.2	57	82.2	Out of memory
	With Hadoop	73.2	76.2	125.4	85.2	94.8	84.6	87	94.2	141.6
6	Without Hadoop	2	5	34	57	52	75	67.2	85.2	Out of memory
	With Hadoop	73.2	78	127.2	88.8	94.8	84	82.8	87.6	144
7	Without Hadoop	2	6	37	63.6	56	71.4	67.8	89.4	Out of memory
	With Hadoop	75.6	79.2	122.4	123	94.2	83.4	83.4	87	143.4
8	Without Hadoop	2	6	38	64.8	54	74.4	69	93.6	Out of memory
	With Hadoop	74.4	82.2	133.2	125.4	90	84.6	82.2	87	145.2
9	Without Hadoop	2	6	44	64.2	65.4	75	69	123.6	Out of memory
	With Hadoop	73.2	82.2	134.4	136.8	91.2	82.8	83.4	91.2	147
10	Without Hadoop	2	6	42	62.4	59	86.4	75	131.4	Out of memory
	With Hadoop	74.4	87	132	121.8	94.8	82.6	85.8	87.6	142.8
20	Without Hadoop	3	5	70	116	171	296	128	563	Out of memory
	With Hadoop	51	109	80	298	310	50	138	98	241
40	Without Hadoop	3	5	112	196	179	310	226	671	Out of memory

		Datasets								
No of Clust ers	Hadoop	100 (244.8 KB)	500(1 MB)	1000(2.9 MB)	1500(3.9 MB)	2000(4 MB)	2500(5.1 MB)	3000(5.4 MB)	3500(6.4 MB)	20000(4 6.4 MB)
	With Hadoop	66	128	81	301	312	87	141	123	204
60	Without Hadoop	2	5	157	277	208	436	315	Out of memory	Out of memory
	With Hadoop	69	158	89	339	311	98	134	131	143.4
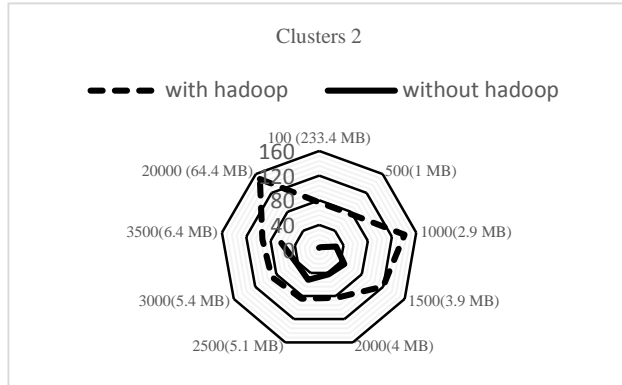
Figure 2. Radar chart showing time obtained for the different datasets for cluster 2 with and without using Hadoop
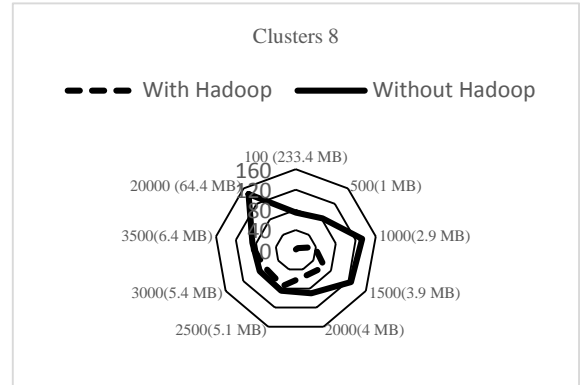
Figure 3. Radar chart showing time obtained for different datasets for cluster 8 with and without using Hadoop
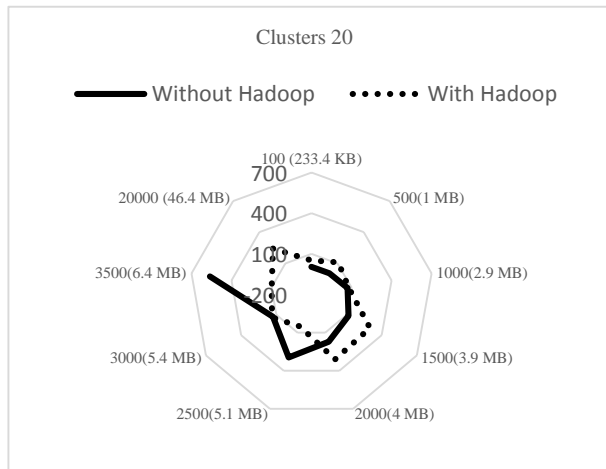
Figure 4. Radar chart showing time obtained for different datasets including 20000 datasets for cluster 20 with and without using Hadoop.
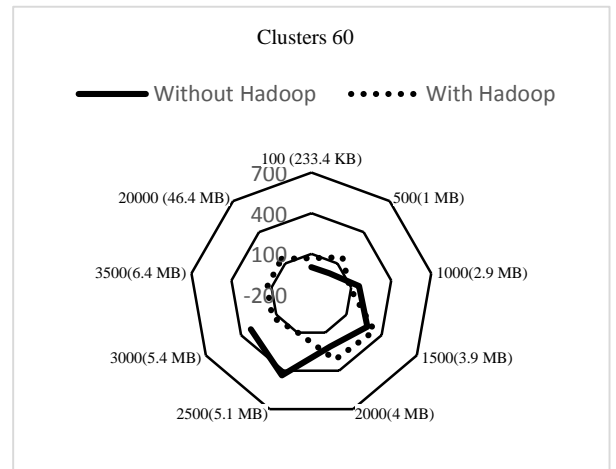

Figure 5. Radar chart showing time obtained for the datasets including 20000 datasets for cluster 60 with and without using Hadoop.

As the data size increases the time utilization also increases gradually and it becomes infinite for the data sets 3500 and above for the case without using Hadoop. But with using Hadoop the time taken is comparatively less than that of without using Hadoop for the data sets 3500 and above. Here using Hadoop for data sets 1500 and 2000 time taken is slightly more than the case without using Hadoop.

But It was also notice that in the used experiment environment with the increase in number of datasets and the cluster results in increase of the execution time both with and without using Hadoop.

V. CONCLUSIONS AND FUTURE WORK

In this work, new model for document clustering was given which can be used to organize In this work, new model for document clustering was given which can be used to organize documents into sub-folders without having to know about the contents of the documents.

This improves the performance of information retrieval in any scenario. To scale the document clustering the proposed model uses the MapReduce implementation of k-means from Apache Hadoop Project.

Hadoop shows the high performance for document clustering using k-means algorithm. Hadoop works with large datasets making efficient utilization of time, memory and processor. Without Hadoop the size of data is directly proportional to the time, memory and processor utilization. As the size of data increases the utilization in time, memory and processor increases leading to the excessive use of system resources resulting low performance and inefficiency to the system.

Hadoop works with the MapReduce and HDFS architecture which implements the k-means algorithm for large datasets of size 46.4 MB within the defined system resources in comparatively less consumption of time, memory and processor representing the distributed system. In other hand the case without Hadoop resembles the centralized system with higher consumption of system resources.

Since the system configuration used was insufficient for case without Hadoop, the results can be tested on the higher configurable system. The clustering has been done for the files and folders consisting of text files. Similar work can be carried on for the different file format multimedia files, videos, images, audios and so on. The indexing has can be done using apache tikka and other application as solitary. Since the term vector can generate sparse matrix that decreases the efficiency so further enhancement can be done.

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Analysis of Link Popularity among the Nepal Governments' Websites by using HITS Algorithm

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ABSTRACT

*New innovations in science and technology, communication becomes faster and easier. Information dissemination tools become the URLs through internet. Nepal Government has taken major initiatives and has good impact for g-governance. In this context, a close study among the governmental organizations' URLs and their links from one web page to another helps for information dissemination. A web page's link popularity is measured by the number of other web pages that link to it, and links from pages on other web sites. The page popularity is measured by using HITS and PageRank methods. The two main factors **relevance** and **reputation** are considered as major findings during study. **Relevance** is a measure of how easy it is for the search engine to tell that your web page is really about the search term that's been used. It improves relevance with on-page search engine optimization, and talks about that extensively on other pages of our site. **Reputation** is measured by the number of links coming into one web site and the quality of those links. The most common term for that is "link popularity".*

Keyword formulation and link definition in the government web sites is random thus status of link popularity is weak. Out of twenty-nine web sites on five websites have implemented the concept of the inlink and outlink i.e. relevancy is better.

Keyword: *Link analysis, Page popularity, HITS, Page Ranking, Weighted graph, In-degree, Out-degree, link popularity, reputation, relevance, on-page search engine, gov.np, hypertext, hyperlink, tag LL - Link Level.*

INTRODUCTION

Link popularity is the study of total number of web sites that link to defined web page[1]. Webpage link popularity depends on linking from within one web site as well as links from pages on other web sites. Some of the more popular search engines like Google and Yahoo have toolbars which display an indicator of the link popularity of a given page [2].

The link structure of web can be viewed as a graph (link graph) in which each vertex is a web page, and each edge is a hyperlink between two pages. The web graph has some interesting properties, such as power law degree sequence and small diameter [3]. A number of stochastic models for the web graph have been proposed for better understand and predict the statistical properties of the Web [4]. The degree of link popularity refers passing of external links among websites that defines how far a web site gives the related information [5]. Researchers are developing algorithms for, mostly within the scope of single websites such as Wikipedia which may one day be unleashed upon the wider Web without sufficient protection against the creation of hyperlinks that exhibit no useful relevance. To make sure that hyperlink-generating algorithms are up to standard. It needs a way of evaluating hyperlinks that is more subtle than simply comparing the topics of the linked documents [6].

HITS Algorithm

Hyperlink-Induced Topic Search (HITS) algorithm was developed by Jon Kleinberg, a Computer Science Professor at Cornell University. This algorithm calculates the ranking of web pages in an offline mode. It has implemented an online ranking algorithm which approximates HITS [12].

Search engines perform their operations in two phases. In the first phase, this algorithm performs a crawl to gather all the web pages and stores these crawled web pages in the file system. The particular format of storing these web pages

differs from one search engine to another. However, these are stored in a compressed format and are indexed for faster retrieval. The next phase involves parsing the content of the stored web pages. This step is essential in order to determine the relative ranking for each page. Ranking the web pages is a highly complex process [13]. Some of the factors that make this complex are the following: billions of web pages, intricate connections among these web pages, different formats, different languages, etc. Apart from these, different search technologies have their own pros and cons. This in turn complicates the functioning of a particular search engine. The HITS algorithm generates ranking for web pages after they have been crawled and stored in a local database.

This process is depicted more clearly in the below diagram:

Fetcher process requests batch file of urls through a http request process sends from the queue server

Queue Server Process
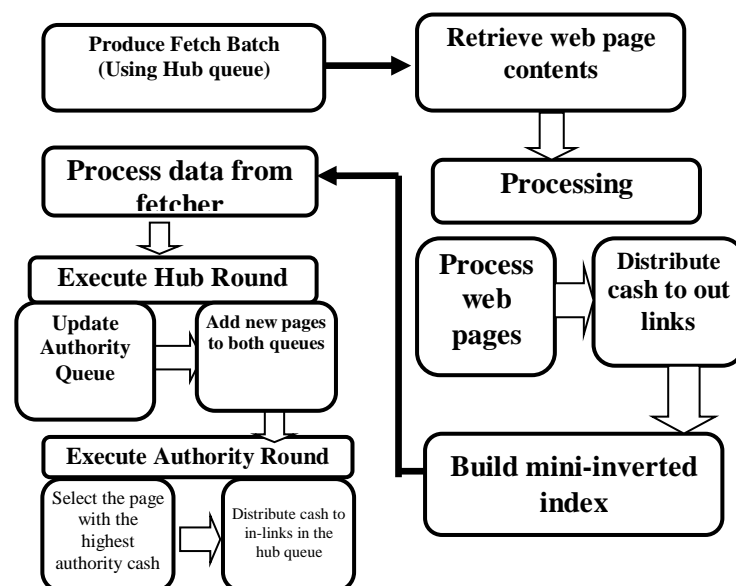**Fetcher Process**

Figure: Overview of Queue Server and Fetcher process

1

This process is repeated continuously until a sufficient number of web pages are crawled or until terminated by the user. Once the data sent the Fetcher(s) is received by the Queue Server, it is processed and the main index and the priority queues are updated accordingly. Queue Server and the Fetcher can be configured to run on a single host or can be executed on distributed systems. Also, multiple Fetchers can be configured to run simultaneously. This speed up the crawling process and increases the overall efficiency of the system. The advantage of this design is that the script running the Fetcher process needs no modification, as the priority queues are maintained in the Queue Server.

Advantages of HITS

1. HITS scores due to its ability to rank pages according to the query string, resulting in relevant authority and hub pages.
2. The ranking is combined with other information retrieval based rankings.
3. HITS is sensitive to user query (as compared to Page Rank).
4. Important pages are obtained on the basis of calculated authority and hubs value.
5. HITS is a general algorithm for calculating authority and hubs in order to rank the retrieved data.
6. HITS induces Web graph by finding set of pages with a search on a given query string.
7. Results demonstrate that HITS calculates authority nodes and hubness correctly.

Drawbacks of HITS algorithm
   Query Time cost, irrelevant authorities and Hubs, Mutually reinforcing relationships between hosts, Topic Drift, Less Feasibility.

METHODOLOGY

Web page contains so many information and citation. It is tedious task to filter the links of the webpage in terms of its domain information. So it is propose a model that is used to do the above task automatically. The model contains 7 steps and finally gives the link popularity of the web page.
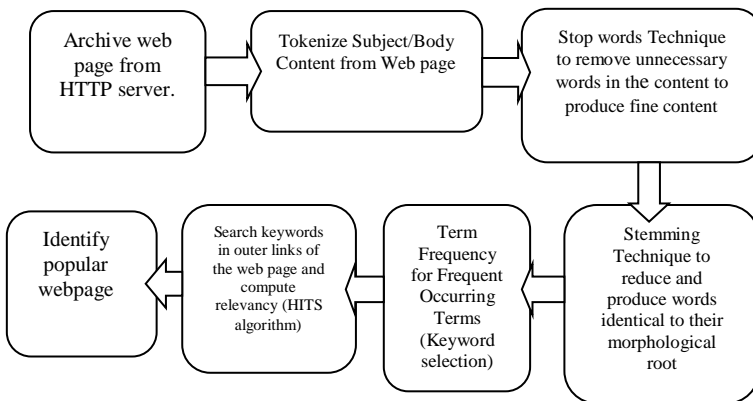
Process Model

Figure: Process flow in the system model

In the first step of the HITS algorithm the root set (most relevant pages to the query) can be obtained by taking the top n pages returned by a text-based search algorithm. A base set is generated by augmenting the root set with all the web pages that are linked from it and some of the pages that link to it. The web pages in the base set and all hyperlinks among those pages form a focused subgraph. The HITS

computation is performed only on this focused subgraph [24]. According to Kleinberg [25], the reason for constructing a base set is to ensure that most (or many) of the strongest authorities are included. The Hub score and Authority score for a node is calculated with the following algorithm [11]:

```
Pseudo code of HITS algorithm
1 Let G be set of pages
2  for each page pg in G do
3       pg.auth = 1
4       pg.hub = 1
5  function Calc_Hubs_Authorities(G)
6    for step from 1 to i do
7         norm = 0
8         for each page pg in G do
9             pg.auth = 0
10          for each page qg in p.inNeighbors do
11              pg.auth += qg.hub
12           norm += square(pg.auth)
13          norm = sqrt(normal)
14          for each page pg in G do
15              pg.auth = pg.auth / normal
16           norm = 0
17          for each page pg in G do
18              pg.hub = 0
19          for each page rg in pg.outNeighbors do
20              pg.hub += rg.auth
21              norm += square(pg.hub)
22          norm = sqrt(normal)
23          for each page pg in G do
24       pg.hub = pg.hub / normal
```

IMPLEMENTTION AND RESULTS

The HITS algorithm is a very popular and effective algorithm to rank documents based on the link information among a set of websites. However, it assigns every link with the same weight which results in topic drift. This paper generalizes the similarity of web pages and proposes a query-induced similarity describing how a webpage is similar to another on a query topic. Then, it also analyzed a new improved weighted hits-based (HITS) algorithm by assigning appropriate weights to link with the similarity and popularity of web pages. Experiment results indicate that the improved HITS algorithm can find more relevant pages than HITS, ARC, SALSA and improve the relevance by 30%-50%.

Tools: The user interface of the thesis was built using jsp with spring framework. The whole system was built in eclipse with jdk 1.6. It has used the open source MySql server as our database.

J2EE: Java two enterprise editions is one of the platforms apart from other two platforms J2SE and J2ME that covers many areas of enterprise and distributed development. The J2EE platform offers a multitier distributed application model, reusable components, a unified security model, flexible transaction control, and web services support through integrated data interchange on Extensible Markup Language (XML)-based open standards and protocols.

Data Samples: The goal of the paper is to rank the Nepal government's web pages on the basis of computing domain relevancy in the outer links of the web pages. There are about fifty governmental web sites and   have taken only 29 ministry web sites for the experiment and among them have

taken five web sites and their outer links (v1,v2,v3,v4,v5,v6) sample data in the form of adjacent matrices is given as:

Keyword/webpage	v1	v2	v3	v4	v5	v6
Education	1	0	1	1	1	0
Implement	1	1	1	0	1	1
Monitoring	1	0	1	1	0	1
Responsible	0	1	0	0	1	1
Manage	0	1	1	0	1	0
Autonomous	1	0	0	1	1	1

Table: Adjacent Matrix of moe.gov.np web page.

Of

keyword/webpage	v1	v2	v3	v4	v5	v6
Prevail	1	0	1	1	1	1
Law	1	0	1	1	1	0
Commission	1	1	1	1	1	1
Justice	0	1	1	0	1	1
Prevention	1	0	1	1	1	1
Policy	1	1	1	0	1	1

Table: Adjacent Matrix of lawcommission.gov.np web page.

Steps to run Application software

For the detail implementation of the weighted HITS algorithm to compute the link degree among the selected Nepal government web sites, simple application is developed. For the computation, first of all adjacency matrix is computed through the in-degree and out-degree. Each web site is considered as vertex or node. Here, maximum 10 nodes are considered in implementation as below.

Figure: Authority and hub score of moe

Comparative Study of link levels with associated keywords

		LL_1	LL_2	LL_3	LL_4	LL_5	LL_6
Mohp	Authority	0.66	0.77	0.44	0.22	1.00	0.33
	Scores	0.44	0.44	0.33	0.77	0.00	0.00
Moe	Authority	0.54	0.71	0.41	0.12	1.00	0.30
	Scores	0.39	0.39	0.24	0.77	0.00	1.00
Moic	Authority	0.80	0.92	0.80	1.00	0.92	0.92
	Scores	1.00	0.95	1.00	0.62	0.95	0.95
Mofa	Authority	0.05	1.00	0.44	0.50	1.00	0.66
	Scores	1.00	0.95	1.00	0.62	0.95	0.95
Law-commission	Authority	0.81	0.63	0.95	0.77	0.81	1.00
	Scores	0.86	0.86	0.95	0.77	0.81	1.00

Figure: Comparative Study of link with associated keywords

Study of websites with their authority score by using keywords

	Authority

3

Keywords	Mohp	moe	moic	mofa	lawcommission
Link_level_1	0.66	0.54	0.80	0.05	0.81
Link_level_2	0.77	0.71	0.92	1.00	0.63
Link_level_3	0.44	0.41	0.80	0.44	0.95
Link_level_4	0.22	0.12	1.00	0.50	0.77
Link_level_5	1.00	1.00	0.92	0.45	0.81
Link_level_6	0.33	0.30	0.92	0.66	1.00

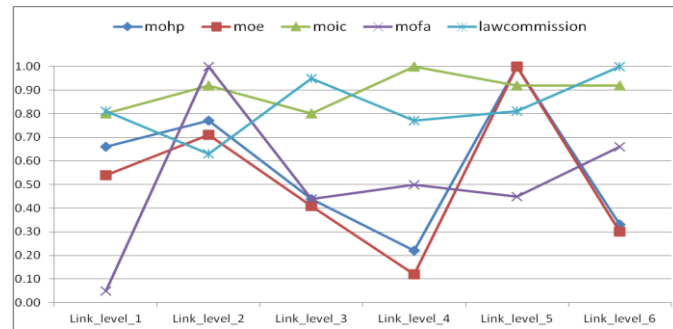*Figure: Measured Authority Score of web sites.*

Figure: Measured Authority of different web sites.

From the above line graph analysis, the ministry of information and Communication has the highest authoritative index because all the 6 keywords are ranged within the index value of .80 to 1.00. It means website is well designed with necessary study of the indegree, outdegree, link analysis by *relevance* and *reputation.*

Study of websites with Hub Scores of keywords

	Scores(Hub)				
Keywords	Mohp	moe	Moic	Mofa	Lawcommission
Link_level_1	0.44	0.39	1.00	1.00	0.86
Link_level_2	0.44	0.39	0.95	0.95	0.86
Link_level_3	0.33	0.24	1.00	1.00	0.95
Link_level_4	0.77	0.77	0.62	0.62	0.77
Link_level_5	0.00	0.00	0.95	0.95	0.81
Link_level_6	0.00	1.00	0.95	0.95	1.00

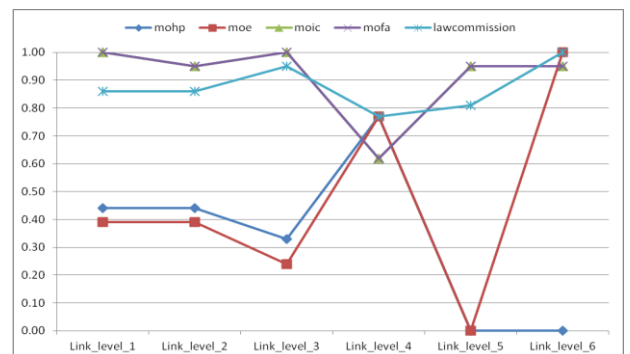*Figure: Measured Hub score of different web sites.*

Figure: Measured Hub score of different web sites.

From the above line graph analysis, the ministry of law has the highest score index because all the 6 keywords scores are ranged within the index value of about .70 to 1.00. It means website is well organised from the view of user accessibility.

Hence, contents and its links are well managed in ministiry of law and commission.

Study of websites with their Authority and hub Scores generated by HITS algorithm

	mohp	Moe	Moic	mofa	lawcommission
Hub	0.30	0.43	0.84	0.84	0.81
Autority	0.35	0.50	0.97	0.97	0.93
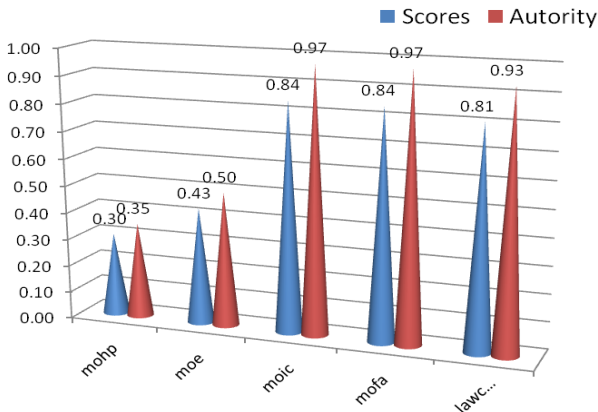
Figure: Histogram measuring authorith and hub score of diffent web sites

From the overall index of authoritative scores analysis of existing status of 5 most common Nepal Government websites, ministry of information and communication and ministry of foreign affairs observed good status on link popularity. The ministry of law also seems to be well organised but needs some improvements. But majority of other ministries websites need more structural, security and link level study and implementation to proper dissipation of the electronic information in the globally competent world.

CONCLUSIONS

This study included twenty nine Nepal governments' ministry web sites for the experiment but only five web sites have their relevancy value well. Among five web sites the best relevancy score has been found in web site Ministry of Information and Communication (www.moic.gov.np) and other have slight variation in relevancy score. The relevancy score of the web sites shows that only few governmental web sites have their domain related information i.e. the outer links of the web site give the domain related information.

From the overall index of authoritative scores analysis of existing status of 5 most common Nepal Government websites, ministry of information and communiation and ministry of foreign affairs observed good status on link popularity. The ministry of law also seems to be well organised but needs some improvements. But majority of other ministries websites need more structural, security and link level study and implementation to proper dissipation of the electronic information in the globally competent world.

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Anomaly Detection from System Logs based on Spectral Method

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Abstract—This research provides a statistical method for detecting anomaly using multivariate data from system metrics. The spectral anomaly detection technique has been implemented using PCA (Principal Component Analysis) as unsupervised method to detect anomaly from data consisting of both normal and abnormal events. A comparison has been done with another unsupervised algorithms namely K-means which shows PCA outperformed K-means by 30% when F-measure is used to evaluate for probe attacks for standard DARPA (Defense Advanced Research Projects Agency) dataset. The real data of the system has been collected and analyzed using unsupervised approaches for detecting anomalies. Also, the results of real data have been validated with visual plots. The result shows PCA as a better way to find the anomalous events and detect them precisely.

Keywords—System, multivariate data, DARPA, Anomaly Detection, K-means, PCC, CART.

I. INTRODUCTION

The term anomaly-based intrusion detection in networks refers to the problem of finding exceptional patterns in network traffic that does not conform to the expected normal behavior. These non-conforming patterns are often referred to as anomalies, outliers, exceptions, aberrations, surprises, peculiarities or discordant observations in various application domains. In anomaly detection, the normal behavior of the system is modeled. Incoming patterns that deviate substantially from normal behavior are labeled as attacks.[1] The increase in number of networked machines has lead to an increase in unauthorized activity; not only from external attackers, but also from internal attackers, such as disgruntled employee and people abusing their privilege for personal gain.[2] Anomaly detection attempts to recognize behavior that does not conform to normal behavior. This technique is based on the detection of traffic anomalies. The anomaly detection systems are adaptive in nature; they can deal with new attack but they cannot identify the specific type of attack. An ideal IDS does not produce false or inappropriate alarms. In practice, signature based IDS is found to produce more false alarms than expected. This is due to the very general signatures and poor built in verification tool to authenticate the success of the attack. The large amount of false positives in the alert logs generates the course of taking corrective action for the true positives, i.e. delayed, successful attacks, and labor intensive.There are basically four types of remotely launched attacks: denial of service (DOS), U2R, R2L, and Probes.A probing is an attack

in which the hacker scans a machine or a networking device in order to determine weaknesses or vulnerabilities that may later be exploited so as to negotiate the system. This practice is commonly used in data mining e.g. portsweep, nmap, imap, satan etc.[4]

Several research works have already been done and many research papers have been published regarding anomaly detection techniques. The research work done by Sami et. al [2] focuses on the analysis of server log data and the detection and potential prediction of anomalies related to the monitored servers . Chen et. al. [5] investigates a multivariate control technique to detect intrusions by building a long-term profile of normal activities in information systems and using the norm profile to detect anomalies. Syarif et. al.[11] described about misuse detection techniques and anomaly detection techniques. In case of misused detection techniques, the research implemented naive bayes, decision tree and nearest neighbor methods. For anomaly detection techniques, different clustering algorithms K-Means, K-Medoids, EM Clustering and distance-based outlier detection algorithm have been implemented [11]. Bentley [13] used nearest neighbors approach KDtree and mention about the structures attempt to reduce the required number of distance calculations by efficiently encoding aggregate distance information for the sample.

Even-though there are more works on anomaly detection and some research also talk about multivariate analysis with different approaches for process control, there is hardly any research, which properly use the statistical-based multivariate method for System. Survey has been done in different areas of log data but implementation is not done except basic attributes like packets in, packets out etc. Only attributes like CPU, memory and processes have been analyzed. Other attributes have not been considered, which could have significant impact on anomaly consideration. And, most of the researches done have used popular datasets like DARPA and KDDcup99 [14]. Research using real dataset is very less heard due to complexity attached. With these motivations the authors have implemented both supervised and unsupervised statistical methods for anomaly detection with large no of attributes as features and performance assessment has been done .
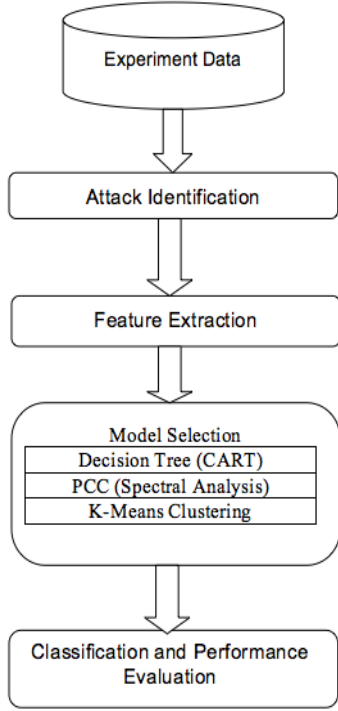
Fig. 1. Flowchart for Implementation Model

II. METHODOLOGY

Anomaly Detection method detect anomalous events that occurs across data across network and system. It takes data as input and with that processes it and generates anomalous events from data, which also consists of normal data. Unsupervised method of anomaly detection has been used. So, this research classified events as anomaly with proper model selection and its performance assessment has been done.

A. Implementation Model

Logs are collected from variety of sources and analyzed. The collection of data that has been considered for research is standard dataset that is DARPA and real dataset. In case of real dataset, a standard toolset, sar is used which serves to log and evaluate a variety of information regarding system activity. With performance problems, sar also permits retroactive analysis of the load values for various sub-systems (CPUs, memory, disks, interrupts, network interfaces,commits, faults etc). A linux server has been used to collect data where sar tool has been installed. In case of DARPA standard set, the first step i.e attack identification is to first determine the types of attacks e.g. Probe attacks(i.e.portsweep, ipsweep,nmap and satan). Model selection describes about model and the algorithm implemented for the research. The algorithm 1 has been described in detail in next section. For model, Spectral anomaly detection techniques using PCA and KMeans clustering has been used and analysed.

B. Feature Extraction

Feature Extraction is finding or processing the overall attributes and only extracting the important attributes out of them. E.g. for standard dataset; src_bytes, dst_bytes sport, dport, source ip, destination ip etc. Contents in the packets logged_in, su etc. Connection errors based on time same_source_ports probe attacks, rerror etc. E.g. For real dataset;memory used, CPU util, commit,faults etc.

C. Algorithm

For this research, using unsupervised model, two methods have been evaluated: K-means clustering and Spectral Anomaly detection.
Let $\mathbf{X} \in \mathbb{R}^{\mathbf{m*n}}$ denotes train dataset, where $\mathbf{m}$ is number of train-data and $\mathbf{n}$ is dimension of train data.
Notation $\mathbf{X_j^{(i)}}$ denotes $\mathbf{j^{th}}$ feature of the $\mathbf{i^{th}}$ example in our dataset.

K-Means Clustering: K-means clustering is very simple to implement yet effective in performance. Clustering is a form of unsupervised learning whereby a set of observations is partitioned into natural groupings or clusters of patterns in such a way that the measure of similarity between any pair of observations assigned to each cluster minimizes a specified cost function. K-means partition m observations into k clusters in which each observation belongs to the cluster with the nearest mean. Every learning problem is an optimization problem; there is the need to search for values of parameters in parameter space that minimizes some defined cost function. The distance used for K-means is Euclidean distance.
For given input dataset, encoder C is found that assigns observations in training set to the K clusters in such a way that, within each cluster, the average measure of dissimilarity of the assigned observations from the cluster centroidmean is minimized.

$$J(C) = \sum_{k=1}^{K} \sum_{C(i)==k} \|X^{(i)} - \mu_k\|_2$$

Algorithm 1 k -means

Input: X: train-dataset and K:Number of clusters
Initialize Randomly pick K datapoints and assign them to k-centroids $\mu_k \in \mathbb{R}^n$. i.e.

$$\mu_1, \mu_2, ..., \mu_K \leftarrow sample(X, K)$$

   repeat
      Cluster assignment

$$C(i) \leftarrow k : \arg\min_k \|X^{(i)} - \mu_k\|_2$$

      Move Centroid

$$\mu_k \leftarrow \mu_k : \arg\min_{\mu_k} J(C), \ k = 1..K$$

      i.e. $\mu_k \leftarrow \frac{1}{\sum_i C(i)==k} \sum_{C(i)==k} X^{(i)}, \ k = 1..K$
   until convergence

Spectral Anomaly detection: Spectral anomaly detection uses the principal component analysis as in algorithm 2 results to check outlierness of datapoints. The most naive version of spectral anomaly detection is to χ^2 test the sum of normalized projection error on all dimensions with significance α and degree of freedom equals to number of dimensions. The intuition behind this is that the normal data will conform with the correlation within the variables, and outlier will not. This method is described in algorithm 3.

The more improved version of this approach is to break

Algorithm 2 Principal Component Analysis

$\Sigma \leftarrow \mathbf{X^\mathsf{T} X}$
$\mathbf{Q}, \mathbf{\Lambda}, \mathbf{Q^{-1}} \leftarrow \mathbf{EigenValDecompose(\Sigma)}$
$\mathbf{Y} \leftarrow \mathbf{XQ}$, i.e. PCA without reducing dimensions.
where $\mathbf{Y} = [\mathbf{Y_1}, \mathbf{Y_2}, ..., \mathbf{Y_n}], \forall_\mathbf{j} \mathbf{Y_j} \in \mathbb{R^m}$ representing the projections of $\mathbf{X}$ on eigen vectors $\mathbf{Q}$
and $\mathbf{\Lambda}$ is diagonal matrix of eigenvalues $\lambda_\mathbf{1}, \lambda_\mathbf{2}, ..., \lambda_\mathbf{n}$

Algorithm 3 Chi-Squared Test Based Classifier

for all $\mathbf{Y^{(i)}} \in \mathbf{Y}$ **do**
    $\mathbf{NormalizedProjError(i)} = \sum_{\mathbf{j=1}}^{\mathbf{n}} \frac{[\mathbf{Y_j^{(i)}}]^\mathbf{2}}{\lambda_\mathbf{j}}$
    if $\mathbf{NormalizedProjError(i)} > \chi_{\mathbf{n},\alpha}^\mathbf{2}$ **then**
        $\mathbf{anomaly(i) \leftarrow TRUE}$
    else
        $\mathbf{anomaly(i) \leftarrow FALSE}$
    end if
end for

Algorithm 4 Principal Component Classifier

Let $\mathbf{q}$ be number of components such that 50% variance is retained, and $\mathbf{r}$ be number of components that retains last 20% variance.

    for all $\mathbf{Y_{(i)}} \in \mathbf{Y}$ **do**
        $\mathbf{major(i)} = \sum_{\mathbf{j=1}}^{\mathbf{q}} \frac{[\mathbf{Y_j^{(i)}}]^\mathbf{2}}{\lambda_\mathbf{j}}$
        $\mathbf{minor(i)} = \sum_{\mathbf{j=n-r+1}}^{\mathbf{n}} \frac{[\mathbf{Y_j^{(i)}}]^\mathbf{2}}{\lambda_\mathbf{j}}$
    end for
Let $\mathbf{c_1}$ & $\mathbf{c_2}$ be the $\mathbf{k}$ quantile of distributions of variables *major* & *minor*.

    for all $\mathbf{Y^{(i)}} \in \mathbf{Y}$ **do**
        if $\mathbf{major(i)} > \mathbf{c_1}$ & $\mathbf{minor(i)} > \mathbf{c_2}$ **then**
            $\mathbf{anomaly(i) \leftarrow TRUE}$
        else
            $\mathbf{anomaly(i) \leftarrow FALSE}$
        end if
    end for

---

the dimensional spaces into major and minor dimensions subjective to dataset[15]. The major dimensional subspace will consist of axes which cumulatively retains first 50% variance, and minor retains last 20% variance. Even in this approach, we will check normalized projection error, but separately along major and minor dimensions. A data-point is an outlier if the normalized projection error along both dimensional sub-spaces are extreme, which is determined by

quantile method. This method is formally given in algorithm 4. Both Principal Component Classifier and χ^2 test based anomaly detection were tested on same set of significance, i.e α for χ^2 test, and $\mathbf{k}$ quantile for PCC.

D. Perfomance Evaluation

For performance evaluation, following measures are taken into consideration:

$$Precision(P) = \frac{TP}{TP + FP} \tag{1}$$

$$Recall(R) = \frac{TP}{TP + FN} \tag{2}$$

$$F - 1Measure(F_1) = \frac{2 * P * R}{P + R} \tag{3}$$

where, TP = True Positive, FP = False Positive, TN = True Negative, FN = False Negative

III. EXPERIMENTS AND DISCUSSIONS

R language is used as an experimentation tool. R provides a wide variety of statistical and graphical techniques, including linear and nonlinear modeling, classical statistical tests, time-series analysis, clustering and others. Along with R, python language is also used. Experiments have been conducted for both standard dataset and real dataset.

A. Standard Dataset Results

Under the sponsorship of Defense Advanced Research Projects Agency (DARPA) and Air Force Research Laboratory (AFRL), the MIT Lincoln laboratory has established network and captured the packets of different attack types and distributed the data sets for the evaluation of researches in computer network intrusion detection systems. The KDDCup99 data set is a subset of the DARPA benchmark data set. Each KDDCup99 training connection record contains 41 features and is labeled as either normal or an attack, with exactly one specific attack type. This Dataset has been taken as testing data for validation of the research work with different classifiers and methods.

1) Attack Identification: From KDD dataset, following probe attacks are considered for research:

- ipsweep: An Ipsweep attack is a surveillance sweep to determine which hosts are listening on a network..

- portsweep: Surveillance sweep through many ports to determine which services are supported on a single host.

- satan: Network probing tool, which looks for well-known weaknesses. Operates at three different levels. Level 0 is light

- nmap: Network mapping using the nmap tool. Mode of exploring network will varyoptions include SYN.
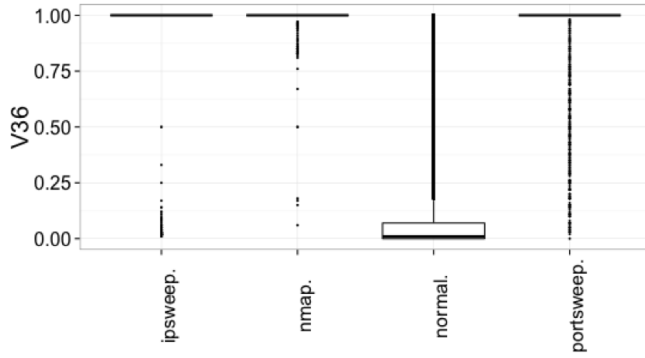
Fig. 2. Probe attacks with respect to dst_host_same_source_port

2) Feature Extraction (Attributes): Based on the attack requirement, following feature were extracted:

- Basic features: This group summarizes all the features that can be extracted from a TCP/IP connection. Feature used for research is src_bytes.

- Content features: These features are purely based on the contents in the data portion of the data packet. Feature used for research is logged_in.

- Traffic features: This group comprises features that are computed with respect to a 2 Sec. time window and it is divided into two groups: same host features and it service features. Some of the traffic features used in research are count, error_rate, diff_serv_rate,srv_count, and srv_rerror rate.

For different attacks, the attribute in consideration might be different. These variables are considered based on the distribution that were plotted using boxplot command provided by R. A plot for this is drawn in Figure 2 using boxplot was made with variable dst_host_same_source_port (V36) for probe attacks ipsweep,nmap,portsweep & satan.The outliers and the plot characteristics showed that all three probe attacks showed different characteristics than for normal. This means, this variable could be one of the attribute for anomaly in case of these attacks.

3) Classification and Performance Evaluation : Only probe attacks category has been analysed for research. A total of 14 attributes has been extracted out of 41 attributes for probe attacks. Results have been analysed using supervised approach Decision tree. Also unsupervised approaches-K-means and PCC have been used.

Using PCC,q(quantile value) and all evaluation measures were calculated. When the quantile value was increased,it was observed that precision was also increasing while recall was decreasing. The quantile value was tuned with values starting from 0.9 to 1 with quantile values varying to three decimal values. The optimal value was set where F-measure showed the best result. The choice of features was very dependent for unsupervised method; hence a lot of effort was required to tune the parameters. In this case there were 97278 normal data and 1040 anomalous data. There, α (significance value),
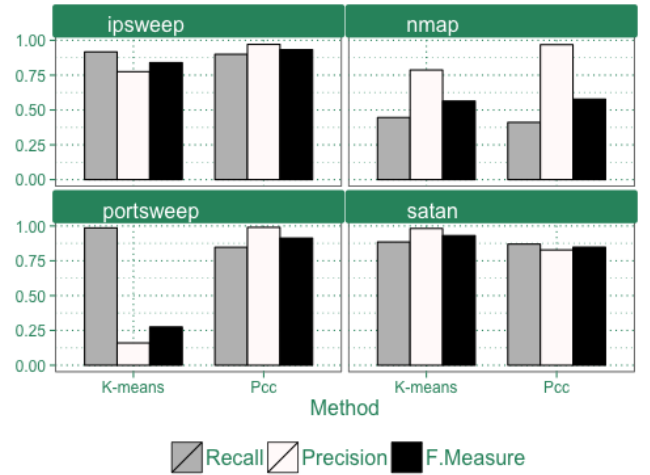

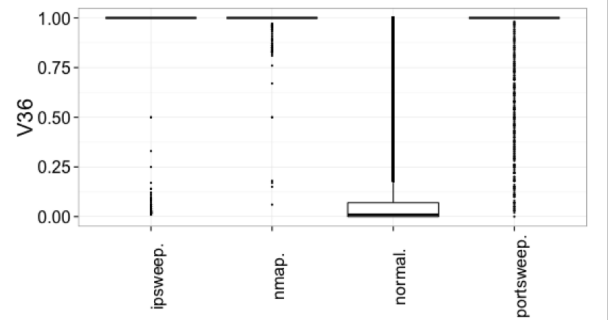Fig. 3. Comparison Plot for probe attacks

Fig. 4. Comparison Plot for combined probe attacks using different methods

q(number of major components) and r(number of minor components) were considered. When attacks were classified based on these parameters, we saw following result with the model. Significance value α=0.985 and q and r set as 0.5 and 0.8 respectively were used for the classification. After classification, results obtained:

Using K-means, the feature sets were extracted from KDD99 dataset. Based on number of principal components k, precision, recall and F-measure were computed. Using R language, subset of probe attacks from KDD99 dataset were defined. Subset were a collection of extracted features for research. From total dataset of KDD99, sampling was done and a total of 5000 data was analyzed. After classification, results obtained:

A comparison plot of probe attacks using K-means and PCC has been drawn as in Figure 3. For each attack type, all the evaluation measures i.e. Recall, Precision and F-measure were calculated. Only the optimum values of each attacks were considered.The obtained optimal values were 0.931, 0,933, 0,578 and 0.913 for satan, ipsweep, nmap and portsweep respectively. Along with individual probe attacks, a combined result of all probe attacks was considered for research as shown

in Figure 4. The statistical plots of probe attacks were created using K-means, chisq and PCC. The optimal values for all the three methods were 0.835, 0.575 and 0.569 for PCC, Chisq and K-means respectively.

B. Real Dataset Results

For real data, the collection was done for different attributes of the system. A development server with 24/7 operation and activities was monitored and data was collected. System Activity Report (SAR) was used as one of the tool for data collection.

1) Attack Identification: Identifying attack means finding anomaly in system, and confirming those anomaly as attacks based on the multivariables considered, and also the expected behavior of system. The target has been to find the anomaly from the data of system where there were normal and anomaly both events.

2) Feature Extraction (Attributes): This part was the most challenging part for a real data. With tools, they provide almost all the attributes of system. The task was to extract the useful attributes for further analysis. Total of 24 system attributes were considered. These values were extracted from SAR events and activity file with past one month data in live development server. Altogether around 4000 activities and events of system were collected. Attributes chosen covered paging faults, I/O read writes and utilization, network interface error, socket, queue length and load averages, memory utilization, cpu utilization, number of files handled and number of tasks created.

3) Classification and Performance Evaluation : For different load, memory and cpu utilization and other network attributes, the collection model was implemented with the system tool. The server where data was collected was 247 and there we had the possibility to stress the machine, generate out of memory exceptions, disk space full issues and other file system issues. Also, it had applications running resource intensive jobs. The server machine was running in a production environment. When events were classified following results were obtained:

Total Events: 3885
Normal Events: 3854
Anomaly Events: 31

Since, unlabeled dataset was used, comparison between two unsupervised methods was done for validation of algorithm. The distance measurement used was Euclidean distance. It was based on the assumption that anomaly data must have higher distance. Nearest neighbor has been used to visualize events as anomaly or normal and for validation.

For validation, KD-tree algorithm has been used with nearest neighbor for detecting anomaly. Based on that, PCC and K-Means algorithm have been implemented to label them as anomaly or normal. A visual representation of that has been the validation of this research.

In the Figure 5, the distributions of events that are of same nature were always in cluster. Circles showed the anomalous
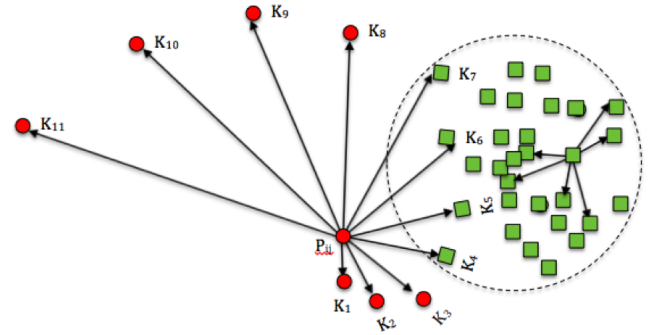

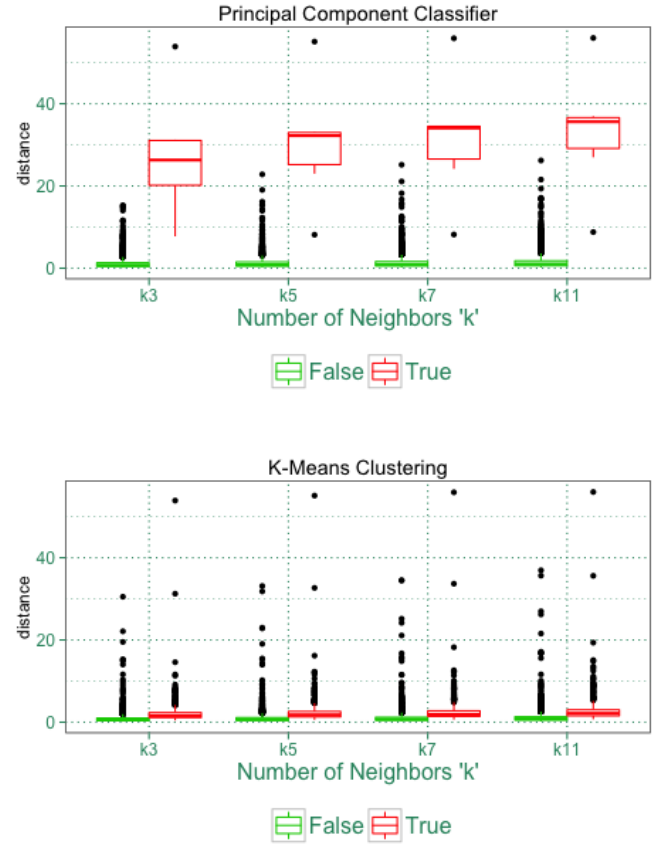Fig. 5. Distribution of normal and anomaly events and neighbor distance

Fig. 6. Anomalies in real data using K-means and PCC

events while square represented the normal events and Pij as an anomalous event. It has been well verified with nearest neighbor. The square boxes termed as normal were in near distance with each other, whereas anomalous events were far from each other or normal event. Ki represented the distance from anomalous event to other anomalous or normal event.
As shown from the Figure 6, it can be clearly seen that PCC outperformed K-Means clustering in determining the anomalous events. Based on the number of neighbor k, it can be clearly seen that PCC anomalous events were distinct as opposed to K-Means, where distinction of anomalous events
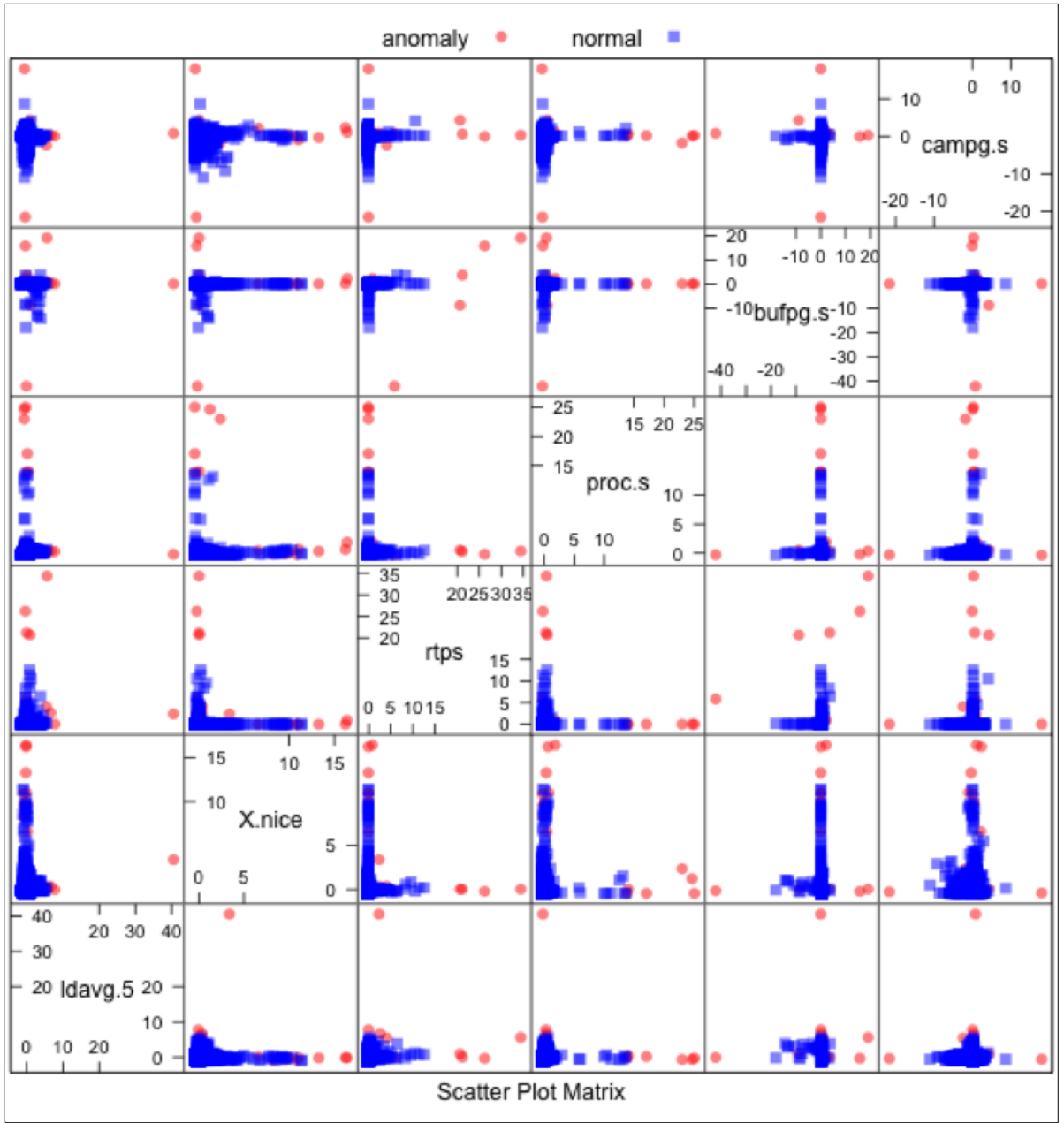
Fig. 7. Features Plot for real data showing normal/abnormal events

were rather in lower side. The plot had two components in X-axis, False and True. False represented the normal events whereas true represented the anomalous events. Y- axis represented the distance. The validation of unlabeled real data of system had been done visually. A feature plot using R where only important features were drawn. The reason for using only selected features or attributes was due to difficult it generated in visualization.Following features; ldavg.5, %nice,rtps,procs , bufpgs, camps were chosen as important features.

Features plot as in Figure 7 implemented the classified anomalous and normal events and plotted accordingly. With the defined attributes in X-labels and Y-labels, features plot was drawn where circles represented the anomalous events and square represented the normal events. Events at the extremes

were anomalous as they were far from the normal events and were rarely in clusters. Some of the circles were seen also near normal events. The reason for this was due to limited attributes considered for plot and possible effect of other attributes. And, comparison was done based on any two attributes of interest. So, this also provided research with another validation of real data set that algorithm used to extract anomaly from normal and abnormal events.

IV. CONCLUSION

In this research, unsupervised method for anomaly detection has been used. For unsupervised method, a spectral anomaly detection technique has been used using PCC. In

case of PCC, parameters (significance value), q (number of major components) and r (number of minor components) has been tuned to provide the best result. Our experiment was done for unsupervised approach and it showed that algorithm P outperformed other algorithms with an F-measure of 84% for probe attacks, which has been tested with standard DARPA dataset. In case of K-means result has been around 57%.

The Model has been tested with real dataset. For this, system events with SAR as one of the tool from live server have been collected for month. For real dataset, there is no labeling of anomaly or attack. PCC algorithm and K-means have been used to find the outlier or classify the events as anomalous or normal. At first, these real data are analyzed to detect anomaly using nearest neighbor approach and then visualization is done. The result shows that this method has potential to be applied to real-time logs.

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Automatic Vehicular License Trial Monitoring System

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Abstract—The monitoring process for getting a driving license for vehicles in Nepal is done manually. As a result, the system is prone to errors and biasness of the involved inspector. Also the task of monitoring is repetitive and lacks much creativity on inspector's behalf, automation would allow utilization of involved human resources on much mentally demanding fields. In this regard, to make the procedure fair and transparent, a fully automated monitoring system is being proposed. The concepts of computer vision, image processing and electronics are utilized to automate the system.

A set of camera (four, for now), each giving a unique view of the field, is arranged in such a way that it would be possible to roughly reconstruct the field. Each view is mapped to the top-view of the field using 2D-homography. Each of the projected top-views of the field is then used to create approximate top-view of the field, that is more accurate than each of the individual views. The actual contour of the vehicles footprint when it enters the field is then tracked to know the actual position of the vehicle in the field. Further, the side lights and the back lights of the vehicle is tracked using the light detection technique, with reference to vehicles position in the field. Finally, the decision of the test is made using the developed software based on the accepted rules of the test. The results show that system can track the path and lights of the vehicle with acceptable accuracy.

Keywords—License trial, Image processing, Homography, Projective mapping, Multiple camera, Top-view reconstruction

1.　INTRODUCTION

The development in the field of Science and Technology has made our life very easy. Automation is one of the things technology has brought to us. Automation is simply defined as performing a task or solving a problem, mainly repeative and routine without any manual assistance. Considering all the benefits, efficiency and precision automation brings, we tried to use the concept of automation in one of the most popular field, Vehicular Trial Examination for License used in our country. Automation in this field will not only make the test transparent and fair but will also remove some inherent errors caused due to manual monitoring, biasness, bribery and many more. Automation can be easily implemented in License Trial Examination because monitoring in license trial examination is usually repeative task and it does not need significant amount of creativity. It might need some intelligence but it can be predicted and expressed algorithmically.

Getting a driving license require some kind of test to be performed. In our country, recent upgrade to new system of vehicular trial tests for license is believed to systematic and scientific and very close to real scenarios. The new vehicular trial exam has brought some positive changes in both the system and the result. However, the monitoring is still manual, which means it is not error free and sometimes it is even unfair. Until the monitoring is manual, the various problems persist in the procedure even if it is scientific. One of the problem seen in manual monitoring is context dependency, that is, each of the test depends on the context such as time, nature, mood of the test inspector (biasness). One of the simplest solution to all of these problems is automation. Automating the the trial test will not only solve the above mentioned problem but will also provide other opportunities such as proper human resource management. Also the test, after being automatic, will be transparent, fair and context independent.

Before the current system was adopted the test procedure for both two-wheelers and four-wheelers were very simple. For two-wheeler, the test involved moving the vehicle through a series of vertical poles, alternating the path between the consecutive poles, without touching them. And the test was complete. For four-wheelers, the test was little different, but the difficulty was not very much. Due to these reasons, a new system was adopted with advanced procedures that are believed to be much more scientific than previous one. With the revised procedures, newer problems came into play. The older system was more transparent because of its simplicity. But, the new system despite being scientific has not much scientific monitoring process. This causes reduced transparency that leads to various other problems mentioned ahead.

Our solution to the problem involves the use of concepts of computer vision and electronics for making the system automated, self-relient, and after all, transparent. Not much work had been done in fields identical to our problem. But independent partial works and researches could be used to build a solution. Various techniques and concepts from image processing [1], multi-view 3D reconstructions [2], multi-view image fusions, synchronous image acquisition [8], parallel processing [11], [12], are used for basic monitoring task. And for precision, low level sensor networks are placed in vehicles for precise data. As the test field is relatively small, low range wireless communication is

feasible for synchronous transmission of sensor data to the monitoring server.

Most of the theoretical works from Richard Hartley and Andrew Zisserman [2] on multiview geometry were enough to understand the concept and to deduce ideal solutions. Their work involved multiple camera calibration, homography, and 2D and 3D reconstruction. Various computer vision libraries, openCV [3] in particular, already provided the tools such as direct implementations and documentation of many of the algorithms required for image processing [1] and machine learning. For hardware implementation [4] of sensor networks various pre-built devices could be used. Also, various secure wireless communication devices are available.

2. THEORETICAL BACKGROUND

2.1. Image Processing and Computer Vision

1. Computer Vision : Computer vision is the science that aims to give a capability of interpration of visual perceptions (image or video) to machine. It is concerned with the automatic extraction, analysis and understanding of useful information from those perceptions. It involves the development of a theoritical and algorithmic basis to achieve automatic visual understanding.

2. Image Processing : Image processing is a set of techniques applied to digital images in order to get an enhanced image or to extract some useful information. Usually Image Processing techniques includes different sets of algorithms that treat images as two dimensional signals, i.e. $f(x,y)$. Image processing basically includes the following three steps.

1) Acquiring the image with optical sensor.
2) Analyzing and manipulating the image which includes data compression and image enhancement, filtering and spotting patterns.
3) Result can be an altered image or report that is based on image analysis.

2.2. Camera Model and Calibration

1. Camera Calibration : Camera Calibration is the process of finding the parameters internal to the camera that affect the imaging process. Factors such as image center, focal length of lens, scaing factor, skew factor and lens distortion considered in camera calibration. The various types of distortions in camera are constant and can be corrected. These distortions can be corrected some standard calibration procedures. Camera calibration is an important step towards getting a highly accurate representation of the real world in the captured images. Camera calibration can actually refer to two things: geometric calibration and color calibration.

Geometric Calibration :
When the image is captured, the 3D scene is mapped to the 2D image, that is, every point in the 3D world gets mapped to the 2D plane on our image. This is called pinhole camera model and is shown in Fig 1. This, of course, is the ideal case where there is absolutely no distortion of any kind. Every camera is modeled based on this, and every camera aspires to simulate this as close as possible.
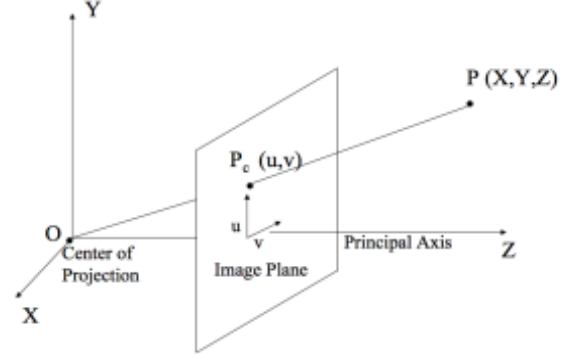

Fig. 1: Pinhole camera model

In Fig 1, the camera is placed at the origin O. The point P represents a point in the real world which needs to be mapped onto a 2D plane (image plane). The distance between the origin O and the image plane is called the focal length of the camera.

Intrinsic and Extrinsic Parameters :
From figure 1, to estimate (u,v) from (X,Y,Z).
The two triangles formed using the origin$/P_c/Z-axis$ and the origin$/P/Z-axis$ are similar triangles. This means the u depends on the f, X and Z. Similarly, v depends on f, Y and Z.

$$u = fX/Z \tag{1}$$
$$v = fY/Z \tag{2}$$

Now to make the origin of the image coordinate system coincide with point where the Z axis intersects the image plane, P_c needs to be translated to the desired origin. Let this translation be dened by (t_u,t_v). So now, u and v are given by:

$$u = fX/Z + t_u \tag{3}$$
$$v = fY/Z + t_y \tag{4}$$

Let matrix M denote the translation of point (X,Y,Z) to (u,v).

$$p_c = MP \tag{5}$$

To measure the P_c in pixels, the u and v coordinates should be multiplied by m_u and m_v respectively. Now the new transformation matrix depends on f, X, Y, Z, t_u, t_v, m_u, and m_v. Lets denote this by:

$$P_c = KP \tag{6}$$

where K is the intrinsic parameter matrix for the camera. Now if the camera doesnot have its center of projection at (0,0,0) and is oriented in arbitrary fashion, then

rotation and translation operation needs to be done to make the camera coordinate system coincide with the configuration in that pinhole camera figure. Let the camera translation to origin of the XYZ coordinate be given by $T(T_x, T_y, T_z)$. Let the the rotation applied to coincide the principal axis with Z axis be given by a 3X3 rotation matrix R. Then the matrix formed by first applying the translation followed by the rotation is given by the 3X4 matrix:

$$E = (R|RT) \qquad (7)$$

This is called the extrinsic parameter matrix for the camera. Here, the symbol | refers to just concatenating two matrices with the same number of rows.

So, the complete camera transformation can be represented as:

$$K(R|RT) = (KR|KRT) = KR(I|T) \qquad (8)$$

Hence P_c, the projection of P is given by:

$$P_c = KR(I|T)P = CP \qquad (9)$$

C is a 3X4 matrix usually called the complete camera calibration matrix. So basically, camera calibration matrix is used to transform a 3D point in the real world to a 2D point on the image plane considering all the things like focal length of the camera, distortion, resolution, shifting of origin, etc. This matrix consists of parameters that are intrinsic as well as extrinsic to the camera.

2. Geometric Transformation of Images: A Geometric transformations permit the elimination of the geometric distortion that occurs when an image is captured. Geometric distortion arise because of the lens or camera orientation.

Suppose that the true position of the pixel is (x, y) and the distorted position is (x', y'). Then a geometric transformation is a vector T that maps pixel (x, y) to a new position (x', y') as $(T_x(x, y), T_y(x, y))$. The transformation equations T_x and T_y are known in advance in case of rotation, translation, scaling or can be determined from known original and transformed images.

Affine Transformation :
An Affine transformation is an important class of linear 2D geometric trnsformations which maps variable into new variables by applying linear combination of translation, rotation, scaling or shearing operations. The T_x and T_y can be expressed as polynomials in x and y. If they are linear mapping function in x and y, then applying affine transfomation.

$$x' = a_0 x + a_1 y + a_2 \qquad (10)$$
$$y' = b_0 x + b_1 y + b_2 \qquad (11)$$

In matrix form, we get

$$\begin{bmatrix} x' & y' & 1 \end{bmatrix} = \begin{bmatrix} a_0 & b_0 & 0 \\ a_1 & b_1 & 0 \\ a_2 & b_2 & 1 \end{bmatrix} \begin{bmatrix} x & y & 1 \end{bmatrix} \qquad (12)$$

Homography :
A homography is a non-singular, line preserving, projective mapping $h : P^n \to P^n$. It is represented by a square(n+1) dimension matrix with $(n+1)^2 - 1$ degree of freedom(DOF). The figure 2 represents the projective transformation by rotating and translating the camera. The planar surface in the world is viewed with
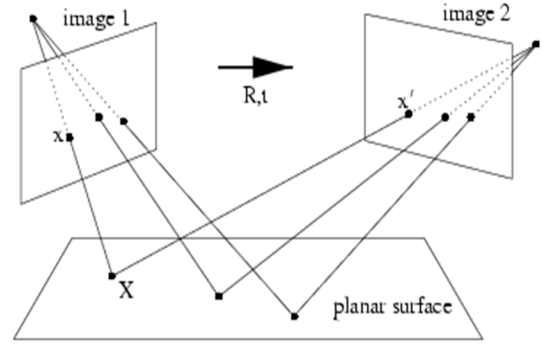

Fig. 2:   Projective transformation

a camera with a projection matrix **P**. Let (s, t) be the coordinate of the planar surface. Points on the plane are situated in the 3D world and their 3D positions can be expressed in XYZ camera coordinates. The planar surface coordinate (s, t) can be transformed to camera coordinates XYZ by multiplying (s, t, 1) by a 4X3 matrix, as follows:

$$\begin{bmatrix} X \\ Y \\ Z \\ 1 \end{bmatrix} = \begin{bmatrix} a_x & b_x & X_0 \\ a_y & b_y & Y_0 \\ a_z & b_z & z_0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} s \\ t \\ 1 \end{bmatrix} \qquad (13)$$

The image pixel (x, y) corresponding to a point (s, t) in the scene plane is obtained by

$$\begin{bmatrix} w_x \\ w_y \\ w \end{bmatrix} = \mathbf{P} \begin{bmatrix} X \\ Y \\ Z \\ 1 \end{bmatrix} \qquad (14)$$

The above two mappings together define 3X3 matrix **H** mapping $(s, t, 1)$ to (w_x, w_y, w) as

$$\begin{bmatrix} w_x \\ w_y \\ w \end{bmatrix} = \mathbf{H} \begin{bmatrix} s \\ t \\ 1 \end{bmatrix} \qquad (15)$$

The matrix H is called Homography.

Similary if the same scene plane is viewed by a second camera(which would have a different XYZ coordinate system), then there would have been two homographies H_1 and H_2, defined by two cameras. This implies that the composite mapping $H_2 H_1^{-1}$ maps pixels in first camera to the pixels in second camera. That is, each camera defines a homography of the form

$$H^{-1} \begin{bmatrix} w_x \\ w_y \\ w \end{bmatrix} = \begin{bmatrix} s \\ t \\ 1 \end{bmatrix} \qquad (16)$$

Since the product of two 3X3 invertible matrices is itself an invertible matrix, so the mapping from pixels of the first camera to pixels of the second camera is a homography.

3. Image Processing techniques: Image preprocessing involves many methods that is used to prepare the images for further analysis, including interest point and feature extraction. Some of the techniques used frequently in this project are listed as below.

Changing Colorspaces: The conversion from one colorspace to another colorspace is important image processing technique. There are more than 150 colorspace conversion such as $BGR \leftrightarrow Gray$, $BGR \leftrightarrow HSV$, $BGRA \leftrightarrow BGR$ and many more. Among these conversions, the conversion from colorspace $BGR \leftrightarrow HSV$ is most commonly used conversion.

Noise and Artifact Filtering: Noise is usually an artifact of the image sensor but there are several additional artifacts that may be present in the image. The goal of the noise removal is to remove the noise without distorting the underlying image. Depending on the type of the noise or artifact, different methods may be employed for pre-processing. The first step is to classify the noise or artifact, and then to devise the right pre-processing strategy. Some of the techniques used for noise filtering [10] are : Average Filtering, Median Filtering, Gaussian Filtering, etc.

Thresholding: In thresholding, the color-image or gray-scale image is reduced to a binary image. Usually, a grayscale image is converted to a bi-level image using an optimal threshold value.
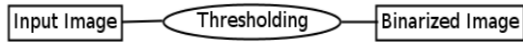

Fig. 3: Process of thresholding

There are two types of thresholding techniques,

Global Thresholding : A single threshold value is used for all the image pixels.
Local or Adaptive Thresholding : Different threshold values for different local areas are used.

Morphological Transformation: Morphological transformations are some simple operations based on the image shape. It is normally performed on binary images. It needs two inputs, one is our original image, second on is the structuring element or kernel which decides the nature of operation. Two basic morphological operations are *Erosion* and *Dialation*, and other variant forms are *Opening* and *Closing*.

Canny Edge Detection: Canny operator was designed to be an optimal edge detector. It takes as input a gray scale image, and produces as output an image showing the positions of tracked intensity discontuinities.

Corner Detection: Harris Corner Detection

3. METHODOLOGY

The overall system has very large domain but to reduce the overall system complexity and to keep the implementation as simple as possible, we have reduced our domain of interest to few things considered important in trial examination. For this the common rules of the trial test are used, that is, for deciding whether the vehicle has crossed the lines, bottom portion of the vehicle is tracked instead of modeling and tracking the whole object. As both traffic lights and vehicle lights (backlight and sidelights) are of specific color, so for tracking light a simple technique of object localization and color extraction is used. For the same purpose, synchronous sensor networks using switches are used for all the lighting informations and state of the vehicle.

The working of the system can be divided into two parts. The first part involves frame synchronization of multiple cameras (four), each giving a unique view of the field. The cameras are arranged in such a way that a rough reconstruction of the field is possible. Each view is used to map the perspectively distorted rectangular field to a rectangular image with dimension proportional to the field. Each of the perspectively warped (projected) top-views of the field is then used to create approximate bird-eye view of the field, that doesn't have all the errors in individual views. When the vehicle enters the field, the actual contour of the vehicles footprint is tracked to know the actual position of the vehicle in the field. Further, the side lights and the backlights of the vehicle and the traffic lights is tracked using the light detection technique, with reference to vehicles position in the field. All the necessary preprocessing are done as required. The second part is about building a Decision Framework. For now, simple comparisions are used to make inferences based on the information obtained from the first part. But for accurate and more precise results, statistical models could be used.

3.1. System Architecture

The simplified system design is shown in the block diagram in Fig 4

Each of the component blocks are explained below :

1. Camera Calibration : The basics of camera calibration are covered in section 3. As mentioned before, camera need to be calibrated because all the following stages depend on the image acquired using these cameras. By calibration, we mean that we need to find parameters of camera that could be used to undistort the distorted images taken using the camera. There are basically two parts of camera calibration :
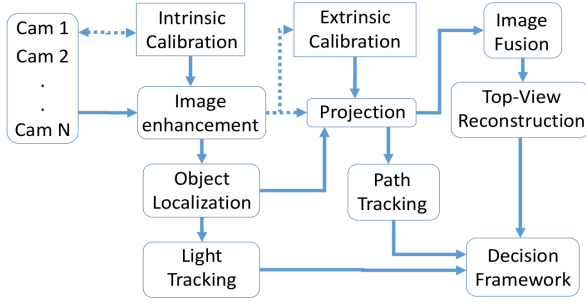
Fig. 4:   System Architecture

Intrinsic Calibration: A camera usually has two kinds of distortion, namely, radial and tangential distortion. Radial distortion causes the bulging of image and tangential distortion brings non uniform scaling in image. So, to remove these kinds of intrinsic distortions, Zhang's method [6] of camera calibration is used. This method uses a standard chessboard pattern to calibrate and find the distortion parameters of the camera. Intrinsic calibration is required only one time. After that, the parameters can be stored and reused.

Extrinsic Calibration: Methods of extrinsic calibration vary with requirement. Usually, the rotation and translation vectors are calculated using extrinsic calibration. But in our case, we calculate only the perspective projection matrix that could be used to map the rectangular field to a 2D image. For this, dense perspective warping technique is used.

For this, in each view, a perspective rectangular field is spotted. After that the boundaries are found. Best straight line fit is then used to calculate its corners with good precision (using RANSAC). After it, a perspective transformation matrix is calculated, that transforms each view into rectangular homographic projection that maps to approximate top-view of the field. For this mapping, dense perspective warping is used, that fills the missing pixels using standard spline interpolation. This is done for each camera. After that, One of the views is chosen as reference view, and rotations for all other views are calculated such that the all views map to the same top-view of the field. After it, the rotation matrices are combined with previously calculated projective transformation matrices for each view, so that they could be used directly used to for mapping to required top-view from each view.

2. Image Enhancement and Preprocessing : At every stage, we get images that are full of noise and are not in directly usable form. So, to make those images usable for subsequent stages, various noise filtering techniques are used. The filtering should be both fast and good. It should be fast to reduce overhead and keep the process realtime. So, there is an obvious compromise between speed and quality of processing.

3. Projection : The projection or homography matrices calculated during calibration are used to transform each view directly into the approximate top view of the field. As the camera are static, the projection matrices do not change with time. The projection is done both during calibration and path tracking of the vehicle.

4. Image Fusion and Top-View Reconstruction : All the projected top views inherently have some error. As they are perspectively warped images, the near portion of the field for each view will be more precise that the farther view. So, to remove the errors brought along with perspective warping, we merge different images of top views from different cameras so that the result would be much more accurate image. Every image has accurate information for some portion of the field. So, each image is given weight to pixels that is proportional to the its accuracy. After that, the images are merged together using weighted averaging. The result is the accurate top view of the field.

5. Object Localization : All the stages explained ahead are mainly concerned with the reconstruction of the 2D field. The top view of the field is calculated with acceptable precision. Then comes the actual task of localization of vehicle in the field. The procedure is similar upto projection stage. All the camera take the images synchronously. Each image is pre-processed independently. Then, in each view the actual vehiche is spotted using background subtraction [5], [9]. After that, each of the resultant image is projected to corresponding top view. In each of the projected views, There is a warped shape of vehicle. Though these images would not make much sense separately, there is a typical feature of these images when combined. When we find the intersection of these images, the result would be the actual footprint of the vehiche. That footprint would allow us to track the vehicle in the field.

6. Path Tracking : For a two-wheeler, the footprint is usually two dots, corresponding to each wheel, separated by some distance. And for four-wheeler, the footprint is almost a rectangular area. Whatever be the case, we could track the footprints in the series of frames. For demonstration, for a two-wheeler, two dots are joined using a line. After it, that line is tracked in each frame to find the position of vehicle at different instant of time. The direction of motion of that line gives the direction of motion of the vehicle.

7. Light Tracking : The vehicle has sidelights and backlight. For accurate monitoring, lights should also be tracked along with the vehicle. As the lights are usually coloured, we just need to track the region of vehicle that might glow. We could track the light by locating its associated colour [7] for brightness. If this method fails, we could send the state of corresponding lights from vehicle using local sensors. Beside the vehicle lights, traffic lights should be tracked too. For this, the region of interest for the location of traffic light in the image is found. Then this region is continuously

monitored for the brightness of specific colour of light. Timing of these events could be found using the position of the frame in long sequence of image frames since the start, along with the frame input rate.

8.   Decision Framework : Decision of the test is what actually matters in the whole procedure. The decisions should be correct. There are a lots of things that could go wrong during monitoring process. There are few assumptions about the synchronization of frames. The whole system requires the frames to be synchronized for correct results. But sometimes, even if few frames are not in synchronizations, the results could be predicted with high accuracy using stastical techniques such as correlation analysis because neighbouring frames are highly correlated. The rules of the test demand that the vehicle remain inside the tracks on the ground. So as a basic implementation, whenever the footprint crosses the track, it should indicate a mistake on driver's behalf. Similarly, timing and position for vehicle should be noted carefully, as the sidelights and backlights should be continuously monitored. Anyway, the actual decision always depends on the accepted rule.

3.2. Implementation

As the system involves multi-view image acquisition and processing, it is really useful if the system is designed to operate parallelly. Also at each stage, there is high rate of image acquistion (about 25-30 fps). Due to this reason we have implemented the system using a cluster having four nodes, each node dedicated to take images at fixed rate, do the stand-alone processing and forward the necessary data to the main node for the decision making. This way, the system is more flexible to addition of new nodes with additional camera. It would increase system performance without any increase in latency.

For prototyping, we have formed a beowulf cluster using four linux based machines. We've shared all the resources, even the camera of individual machines. For the implementation of parallel processing architecture, we've used MPI (Message Passing Interface) standard. Prototype is developed using python along with 'mpi4py' package.

Beowulf is a multi-computer architecture used for parallel computation. It usually operates with one server node, and one or more client nodes connected using LAN or other network. Beowulf cluster are usually made with hardware components that are capable of running any linux or unix like operating system, having standard Ethernet adapters, and switches. It does not contain any custom hardware components. Beowulf also uses commodity software like the FreeBSD, Linux or Solaris operating system, Parallel Virtual Machine (PVM) and Message Passing Interface (MPI). The server node controls the whole cluster and serves files to the client nodes. It is also the cluster's console and gateway to the outside world. Large Beowulf machines might have more than one server node, and possibly other nodes dedicated to particular tasks, for example consoles or monitoring stations. Nodes are configured and controlled by the server node, and do only what they are told to do. Sharing the required files and programs between nodes using a Network File System is a better way to run a cluster.

Most of the image processing algorithms are used from free OpenCV (Open Computer Vision) library. A python wrapper for OpenCV is used for python implementation. Whatever is built inside the library is used that way, and what we needed to build, were built using those elementary features provided by the library. Much effort was not spent on reinventing the wheel, rather it was used on how to utilize prebuilt features to solve the problem at hand.

4.   RESULTS AND DISCUSSION

Most of the images we used for the analysis and testing are taken under uniform lighting conditions. So the results are better than what could be expected. Still, for practical case, a little more pre-processing would give similar results. Different views of the field taken using four cameras are shown in Fig 5.

After mapping each camera view in Fig 5 to their corresponding top view using perspective warping, the results were as shown in Fig 6. The farther portion of the field in each view after perspective warping seems much distorted and blurred as shown in Fig 6, whereas the nearer portion seem to have mapped much accurately. This is because tof the perspective distortion introduced by camera. Then all of these projected images were merged properly weighting each image with each pixel weighted according to its distance from camera, the reconstructed top view of the field was as shown in Fig 7.

After the top view of field is reconstructed, the actual task of tracking of vehicle in the field is started. For that we need to get the vehicle's footprint for each synchronous set of frames. The footprint of the vehicle was obtained as mentioned in the methodology section. The image in Fig 8 shows the top view of the field along with the footprints of a 2-wheeler at various places in the field. The white dots close to each other are the actual footprints. Along with path tracking, lights of the vehicle are continuously monitored as explained in the methodology section.

5.   CONCLUSION

The implementation of this automated procedure to the license trial monitoring would greatly reduce the problems with the current system. Also it would motivate similar kinds of fields to apply automated techniques whenever and wherever possible. Beside this, the obtained results might look promising, but there are some problems with practical implementation. All the assumptions made during the tests are not tolerable in practice. The usual lighting conditions are very unstable. If the system is implemented in outdoor conditions, much more effort should be spent on making the system dynamically stable. For outdoor system, the simple background subtraction wouldn't
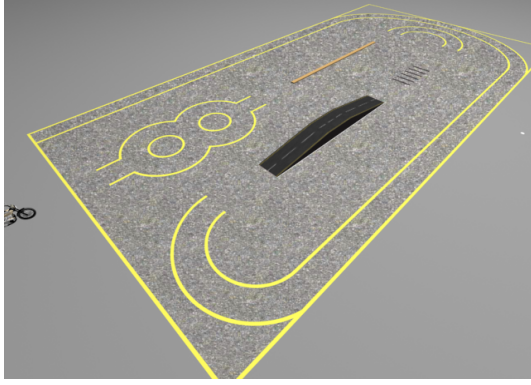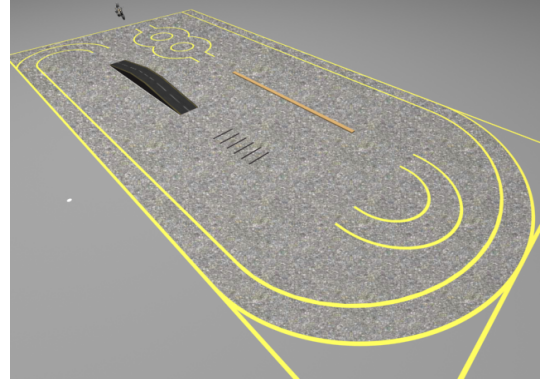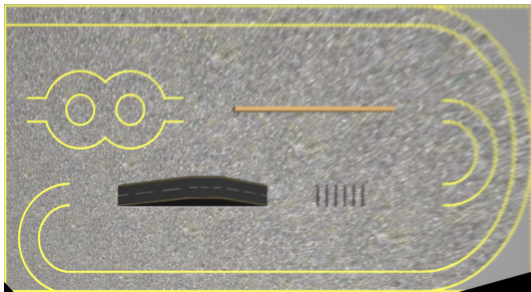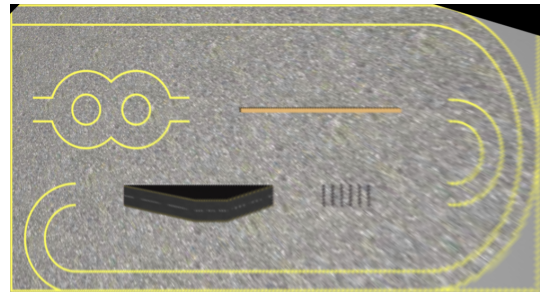
(a) View 1
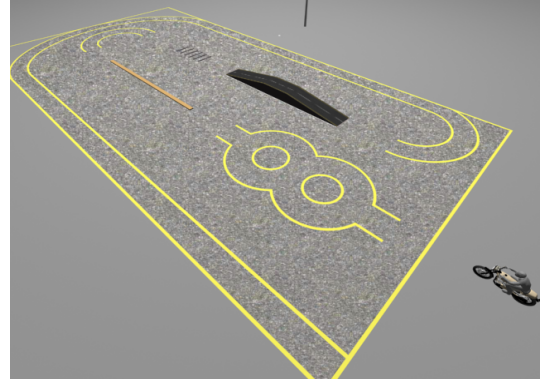
(b) View 2
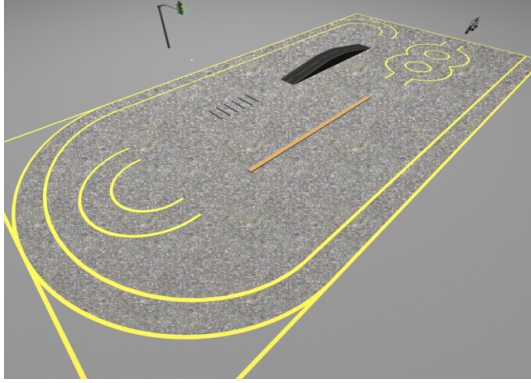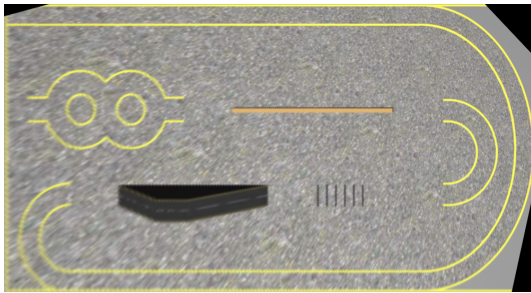
(c) View 3

(d) View 4

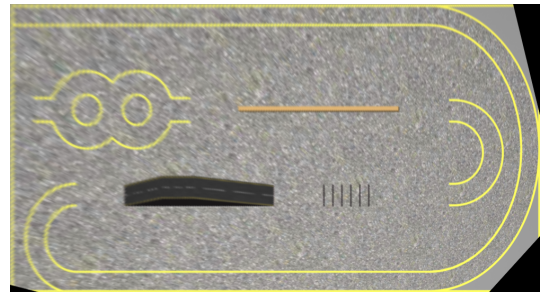Fig. 5: Camera Views for corresponding camera

(a) Projected View 1

(b) Projected View 2

(c) Projected View 3

(d) Projected View 4

Fig. 6: Projected top views of the field

work. Instead, the background should be learned dynam- ically and statistical frame subtraction methods should
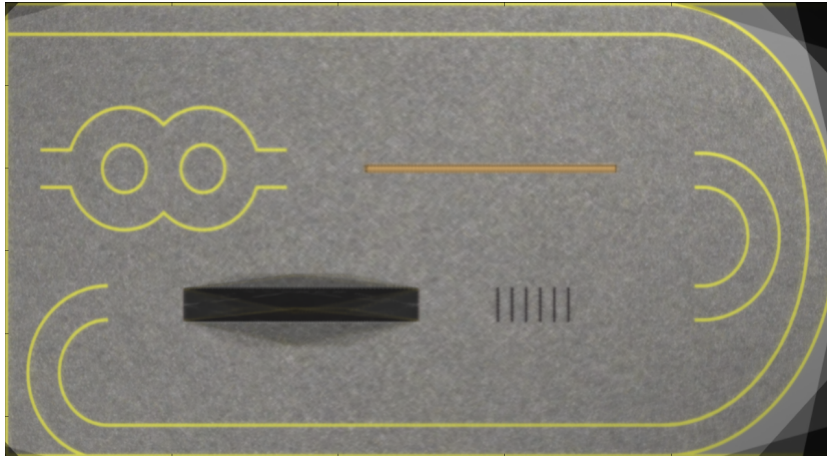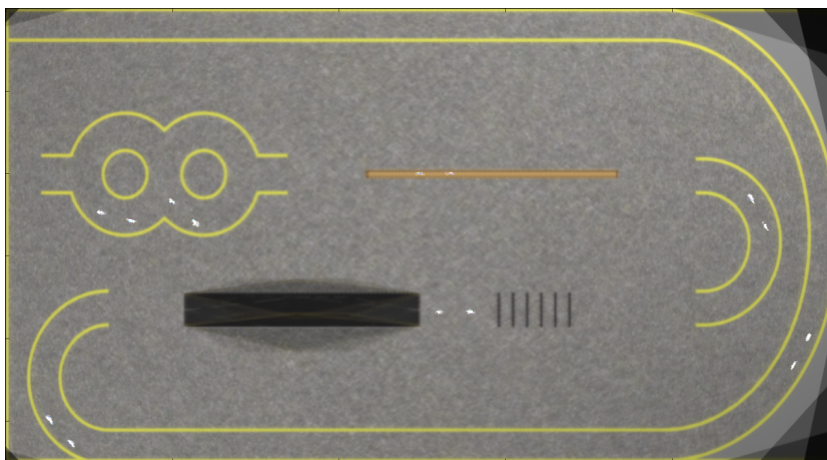
Fig. 7: Reconstructed top view of the field

Fig. 8: Footprints of vehicle in the field

be used for foreground object localization. Due to frequent variation in environment, appropriate feature extraction and matching should be used to find the position of vehicle instead of finding footprint using simple overlapping. Despite these problems, the actual design of the system is feasible because all of the above mentioned problems could be handled by using precise implementation method at each stage. All the processes following calibration stage depend of the accuracy of calibration process. So the calibration should be as accurate as possible. Also the accuracy of prediction and decision making could be increased by using higher resolution images. But this would increase the cost of computation. Using more than four camera would also increase the accuracy.

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Backpropagation Algorithm based DIDS for Distributed Attack

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Abstract—**As technology has become more advanced and sophisticated, the system complexities are also increasing. Due to which, the end users are not much aware with system's internal design and architecture, and has created more opportunities for the hackers and crackers to play with the loopholes in the system. They try to find the loopholes by scanning existing vulnerabilities of the system, and later attack the system at once, in some planned way, to turn it down to the dysfunctional state to steal some vital information. Signature based IDS can only detect predefined bunch of attacks, but it cannot detect rare and new attacks. Its time complexity also increases with the increasing number of signature in the database. So, we require a system which can detect not only those predefined bunch of attacks, but also rare and new attacks called anomaly based attacks in distributed system. So, the research objective was to develop a model for detecting intrusion in the system with high accuracy and low false positive rate. This research was experimental and quantitative in nature, and has used 10 percent version of KDDCup99 dataset for training and testing the model. The model was developed, based on backpropagation algorithm of Artificial Neural Network, and the features were selected based on the information gain of these features. The model was able to generate 99 percent accuracy with zero false positive rate, when the attack is categorized into two, either attack or normal. However, when the model is deployed to detect more than two categories, the accuracy was found to be decreased.**

Keywords—Signature IDS; Anomaly IDS; Distributed System; Intrusion Detection System; Backpropagation Neural Network; KDDCup99; Entropy; Information Gain

I. INTRODUCTION

With the rise of the easiness of the system , there comes system complexities too, going behind the curtain , with which users are not aware and it creates opportunities for the hackers to play with the loopholes in the system. They try to find the loopholes by scanning vulnerabilities of the system and later attack the system to turn it down to the dysfunctional state. Therefore, the security comes as major issues in each and every field of our life especially in IT field .The security of the information of, either people, organizations and of the country is very crucial. If the intruders breach their privacy, then it becomes very essential to detect the intrusion, and to protect the system before it paralyzes the system and makes it dysfunctional. Signature based IDS which means it can only detect known attacks, and contains predefined bunch of rules generally stored in some database or file system. Therefore for every packet it has to compare with whole signature rules, that means if there are more than 50,000 rules, then the system requires huge computing capacity and the system becomes much slow. If there is distributed attack in the same node, the system almost paralyses and could not respond properly, and cannot detect rare or new attacks. Also, those signatures based IDS are not able to share the newly learned attacks to other IDS in distributed system. BP actually computes the difference between the actual and desired outputs in output layer which is called errors. The main target is to minimize the value of errors, and this error is minimized by adjusting the value of weights that is used to connect the neurons among the input, hidden and outer layer. The way the error is propagated from output to input is called back propagation. The errors are propagated backwards to each neurons involved. New errors are calculated based on the previous errors calculated. The main advantage of using this BP algorithm is that the computational time required at the neuron of the last layer is equal to the computational time required at the first layer.

II. RELATED WORKS

R.S Naoum et al. proposed a model [1], that the enhanced resilient backpropagation was able to classify the records into 5 classes with a reasonable good detection rate about 94.7 % and with a false positive rate of 15.7 %. In this paper a multilayer perceptron is trained using an enhanced resilient backpropagation training algorithm for intrusion detection. The performance and evaluations were performed using the NSLKDD anomaly intrusion detection dataset. R Chang, et al. introduced a new method of learning intrusion detection [2], using Sample-Query and Attribute-Query to reduce training cost. In the KDD dataset, each sample has 41 attributes where some attributes may be more useful in distinguishing normal connection from attacks. R Gaidhane et al. [3] classified intrusion into 23 attack types using KDDCup'99 dataset. Back propagation neural network classifier is built for classification with the help of "Waikato Environment for Knowledge Analysis (WEKA)" library and evaluated by observing detection rate. Results showed that it classifies instances into several attack types with low detection rate. Ahmed H. Fares*

and Mohamed I. Sharawy [4] paper focuses on two classification types: a single class (normal, or attack), and a multi class (normal, DoS, PRB, R2L, U2R), where the category of attack is also detected by the NN. Extensive analysis is conducted in order to assess the translation of symbolic data, partitioning of the training data and the complexity of the architecture. V. Dao et al. [5] demonstrated that neural network (NN) techniques can be used in detecting intruders logging onto a computer network when computer users are profiled accurately. The five NN techniques used are the gradient descent back propagation (BP), the gradient descent BP with momentum, the variable learning rate gradient descent BP, the conjugate gradient BP, and the quasi-Newton method. The IDS-NNM – Intrusion Detection System using Neural Network based Modeling, is presented in this paper[6] by O Linda et al. Back Propagation and LevenbergMarquardt, for normal behavior modeling. The presented algorithm was evaluated on previously unseen network data. The IDS-NNM algorithm proved to be capable of capturing all intrusion attempts presented in the network communication while not generating any false alerts. Z Shuang-can et al. [7] proposed a multi-agent distributed IDS (DIDS) model based on BP neural network. This model adopted the modes of distributed detection and distributed response. Each Agent was independence relatively. And this model analyzed the functional design of each agent and central console. Rudolk Jaksa, et al. proposed[8] Neural Network Model of the Backpropagation Algorithm. In this paper the authors apply a neural network to model neural network learning algorithm itself. A. T. Shah [9], et al. did research on A Real-Time Intrusion Detection System using Artificial Neural Networks (ANN). The attributes of packets that are stored in the dataset are labeled as 0, 1, etc. A neural network consists of three layers, viz, input layer, hidden layer and the output layer. Such labeled attributes are given as input to the neural network via input layer. G. Kayacik, et al. [10] proposed a feature relevance analysis is performed on KDD 99 training set, which is widely used by machine learning researchers. Feature relevance is expressed in terms of information gain, which gets higher as the feature gets more discriminative. In order to get feature relevance measure for all classes in training set, information gain is calculated on binary classification, for each feature resulting in a separate information gain per class. M. Bahrololum et al. Vrushali D. Mane and S. N Pawar [11] paper introduces the Anomaly Intrusion Detection System that can detect various network attacks.The aim of this work is to identify those attacks with the support of supervised neural network, i.e. backpropagation artificial neural network algorithm and make complete data safe. In this paper, system comprises experimenting neural networks that use only the (17 of 41) most significant features of the KDD 99 dataset. [12] paper proposed a new approach to design the system using a hybrid of misuse and anomaly detection for training of normal and attack packets respectively. The utilized method for attack training is the combination of unsupervised and supervised Neural Network (NN) for Intrusion Detection System. By the unsupervised NN based on Self Organizing Map (SOM), attacks will be classified into smaller categories considering their similar features, and then unsupervised NN based on backpropagation will be used for clustering. By misuse approach, known packets would be

identified fast and unknown attacks will be able to detect by this method. In this research [13], Rough Set Theory (RST) and Support Vector Machine (SVM) to detect network intrusions is used.. First, packets are captured from the network; RST is used to pre-process the data and reduce the dimensions. The features selected by RST will be sent to SVM model to learn and test respectively. The method is effective to decrease the space density of data. The experiments compare the results with Principal Component Analysis (PCA) and show RST and SVM. Schema could reduce the false positive rate and increase the accuracy. In this paper [14] an ensemble approach for feature selection of KDDCUP99 dataset is used, which consist of two techniques of feature selection that are filter and wrapper. The filter phase calculates the information gain of each feature and ranks them and gives input to wrapper phase. Wrapper phase searches for the final best subset of feature.

III. PROPOSED SYSTEM

The conceptual model for distributed IDS using backpropagation is shown in Figure 1. It consists of one central node and distributed nodes. The central node is used for model generation whereas distributed nodes are used to detect real-time traffic for intrusion detection. The model generated should be highly accurate and low false positive rate. The newly detected intrusion is sent to central node for retraining and redistribution. The different phases of DIDS using backpropagation neural network are as following:
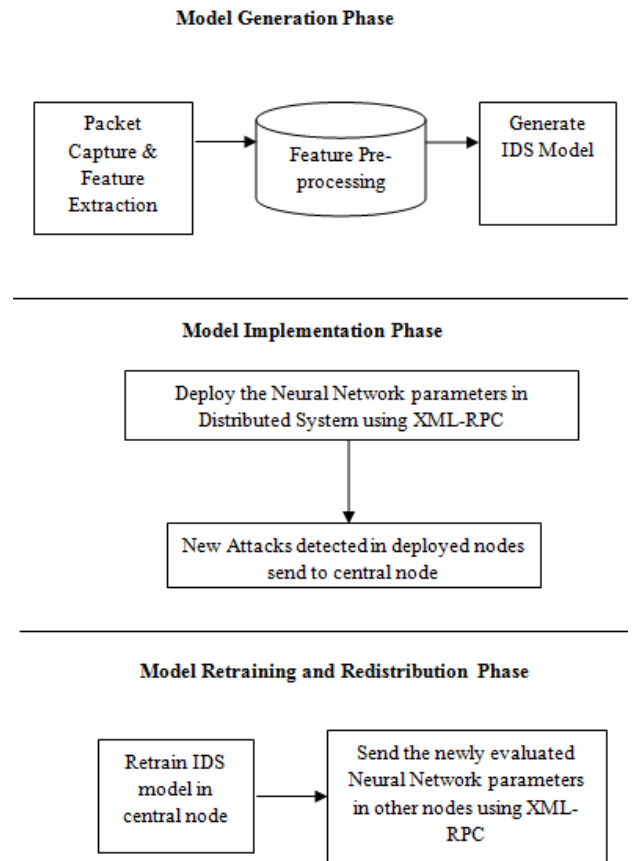

Fig. 1 Conceptual Model for DIDS using BPNN

A. Model Generation Phase

In this phase, packets are captured through sensors. Sensor is the module to capture the packet using libpcap or other library, and extract the features from it. In this research, KDDCup99 dataset was used which is the dataset of already captured packet and labeled. Then, the features go through a series of pre-processing. Pre-processing consists of data encoding, normalization and feature selection. The selected features instances are then fed to the IDS model for training and testing with KDDCup99 dataset. And, finally the model is generated with acceptable level of error.

B. Model Imlementation Phase

In this phase, the neural network parameters generated from above phase like dimensions and connection weights between the neurons are then passed through into other nodes using XML-RPC and are subjected to real time traffic for intrusion detection. If the detection is new attack types, then the nodes sends those information to central node.

C. Model Retraining and Redistribution Phase

In this phase, the newly detected attacks are received and are used to retrain the IDS model in central node. After, retraining the model, the neural network parameters are again passed to other nodes using XML-RPC in distributed system.

Using this system architecture, the model will be only trained at central node, which would be of high capacity server, and other nodes in the distributed system need not to have high computing processors. The minimum required parameters i.e. dimensions and weights of neural network are passed to other nodes using standard communication protocol like XML-RPC, due to which the bandwidth will be saved instead of sending the network traffic to central node for detection. And, the other nodes in the distributed system only require to have feed-forward propagation to detect the intrusion.
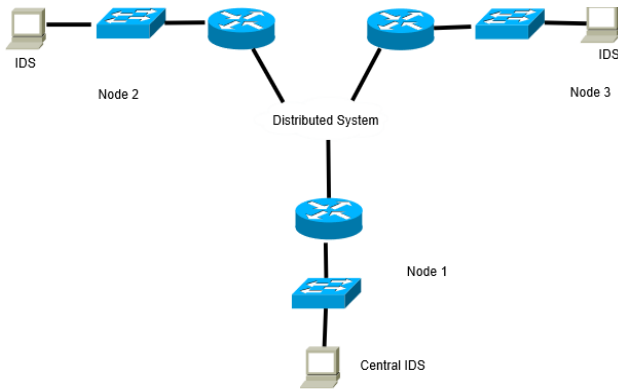

Fig. 2 System Architecture for DIDS using BPNN

The actual system model for DIDS looks like as shown in Figure 2. The model generation is done in central IDS of node 1. The IDS at node 2and node 3 runs the instance of IDS model which are connected through routers and switches. Packets passing through the node are captured by port-mirroring the uplink port of main switch connected to the gateway and features will be extracted. Central IDS sends the parameters to other nodes which consist of selected feature vectors, neuron number of all layers, categorization type and the connection weight vectors. The node can be extended as per the requirement, but it must have connectivity with the central node.

IV. EXPERIMENTS AND RESULTS

This research was experimental and quantitative in nature. The model was developed using C++ programming language, MySQL for data encoding, Linux shell scripts for data filtering and D3js for data visualization. The experiment consists of following steps for model generation which are as follows:

A. Data Encoding and Normalization

The experiment was started with processing the 10 percent of KDDCup99 training and testing dataset. Out of 41 features, first 9 features were basic features, next 13 features were content features and last 19 features were traffic features. Among 9 basic features, 3 features were found to have value in textual format namely protocol types, services and flags of feature number 2, 3 and 4 respectively. Data were encoded after combining the feature value of training and testing dataset. Protocol types were encoded from $0 - 2$, services from $0 - 66$ and flags from $0 - 20$. Combining both from training and testing dataset contains total 40 attack types. Training dataset contains only 23 attack types and rest 17 attack types only appeared in testing dataset. The attack types encoding starts from 0 to 39 in alphabetical order. In two category system, the attack types was categorized as attack or normal whereas in four category system, the attack types are categorized into dos, probe, u2r, r2l and unknown. Unknown value was assigned to depict that this attack was only appeared in testing dataset. After the accomplishment of data encoding part, all the features values were normalized to bring all the features to common scale 0 to 1. So, the feature having high value would not affect the contribution of another feature for detection during training and testing of the IDS model. Every value of each feature column was normalized using equation 1 to bring all features to the common scale.

$$\frac{x - x_{min}}{x_{max} - x_{min}} \qquad (1)$$

Here, x denotes the each feature vector value

B. Entropy and Information Gain

After the computation of data encoding and normalization, entropy and information gain of each feature column were calculated. The entropy was calculated using equation 2.

$$-\sum p_i log_2 p_i \qquad (2)$$

Here, p denotes the probability of each feature vector value. First, entropy of attack type column was calculated. Then, the entropy of each feature column was calculated with respect to the output attack type column. The difference of the change in the entropy gave the information gain.

C. Feature Selection

After information gain were calculated, the features having the highest gain were selected starting from first 2 features consecutively increasing by one feature up to total 41 features. Following data shows the order of feature selection based on two categories, distinct two categories, four categories and distinct four categorized attacks information gain. Category 2 means the attack types is categorized into either attack or normal and category 4 means the attack types is categorized into dos, probe, r2l, u2r including unknown attack type to signify rare and new attacks. So, the model was trained with categorized training dataset without and with distinct records. The order of features after training as follows:

1) Category 2 Feature order : 5, 23, 3, 6, 36, 12, 24, 2, 32, 37, 33, 35, 31, 34, 29, 30, 39, 38, 26, 25, 4, 1, 41, 40, 10, 16, 28, 19, 13, 27, 17, 8, 22, 18, 15, 11, 14, 9, 7, 20, 21

2) Distinct Category 2 Feature order : 5, 3, 29, 30, 23, 4, 6, 34, 33, 35, 38, 25, 39, 26, 12, 36, 37, 32, 31, 24, 41, 1, 40, 27, 28, 2, 10, 8, 13, 16, 19, 17, 11, 7, 18, 22, 14, 15, 9, 21, 20

3) Category 4 Feature order : 5, 23, 3, 6, 24, 12, 36, 32, 2, 37, 33, 35, 34, 31, 30, 29, 38, 39, 25, 4, 26, 1, 40, 41, 27, 28, 10, 22, 16, 19, 13, 17, 11, 8, 14, 18, 9, 15, 7, 20, 21

4) Distinct Category 4 Feature order : 5, 3, 30, 29, 23, 4, 35, 34, 33, 6, 38, 25, 39, 26, 12, 36, 37, 32, 31, 24, 41, 40, 27, 1, 2, 28, 10, 22, 8, 13, 16, 17, 11, 19, 14, 18, 9, 7, 15, 21, 20

D. Model Generation

The developed model was then trained with the training dataset with learning rate set to 0.3 and momentum set to 0.5. The number of neurons selected was half of the sum of input neurons and output neurons. Then, the test was conducted with testing dataset containing total 311029 records which was 10 percent of KDDCup99 testing dataset. The connection weight after backpropagation was calculated using equation 3:

$$w^+ = w + \eta * \delta * out + \alpha * \Delta \qquad (3)$$

Here, w denotes the connection weight between neurons
w^+ , denotes the new connection weight
η , denotes learning rate
δ, denotes error
out, denotes input from previous neuron
α, denotes momentum rate
Δ, change in previous iteration

Fig. 3 Accuracy of testing dataset while training with non-distinct category 2 training dataset with increasing number of features

Figure 3 shows that accuracy of detection was high on number of feature selected was 10 and then after 23, it has sharply increased.

Fig. 4 Accuracy of testing dataset while training with distinct category 2 training dataset with increasing number of features

Figure 4 shows that accuracy of detection was high on number of feature selected was 10 and then after 21, it has sharply increased. But, accuracy is at peak 99 percent when feature selected were 21.
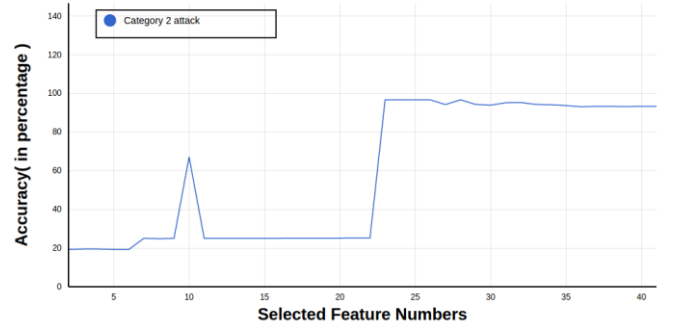

Fig. 5 Accuracy of testing dataset while training with non-distinct category 4 training dataset with increasing number of features

Figure 5 shows that accuracy of detection was high on number of feature selected was 28, but it has average performance compared to training the model with category 2 attack types.
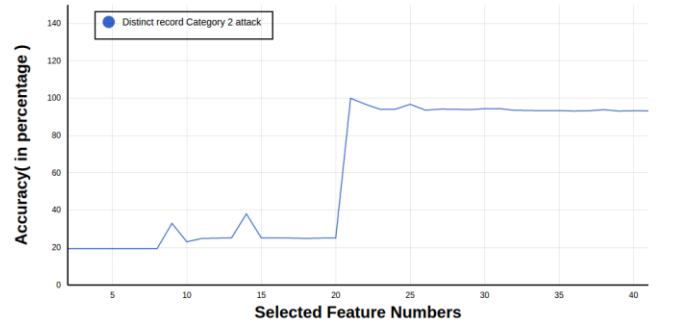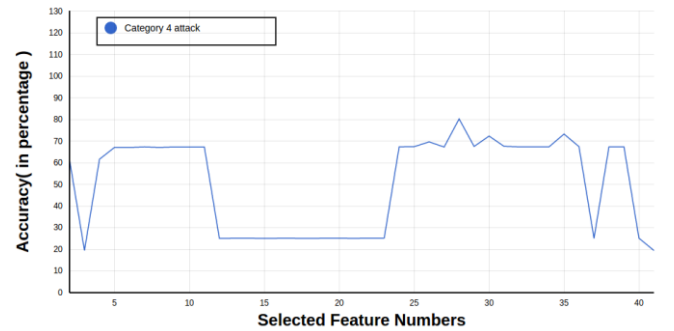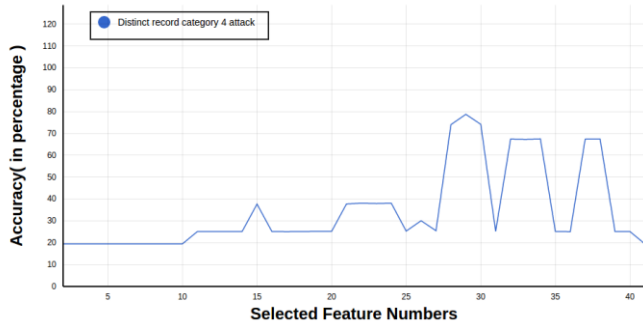
Fig. 6 Accuracy of testing dataset while training with distinct category 4 training dataset with increasing number of features

Figure 6 shows that accuracy of detection was high on number of feature selected was 29, but it also has average performance compared to training the model with category 2 attack types.

E. Model Validation

The performance of the developed model for IDS using back propagation neural network after model generation were measured using the accuracy and false positive rate. To calculate these values and to check the validation of the model, we used the confusion matrix as shown in table I. The data were recorded for error difference of less than 0.1 in category 2 attack type's classification. Likewise, the error difference for category 4 attack types classification was recorded for less than 0.4.

1) True Positive (TP): Actual Attack and Predicted also as Attack

2) True Negative (TN): Actual Normal and predicted also as Normal

3) False Positive (FP): Actual Normal, but predicted it as Attack

4) False Negative (FN): Actual Attack, but predicted it as Normal

TABLE I. CONFUSION MATRIX FOR MODEL VALIDATION

N = Total		Predicted		
		Normal	*Attack*	
Actual	*Normal*	TN	FP	TN + FP
	Attack	FN	TP	FN + TP
		TN + FN	FP + TP	

The equations 4 and 5 were used to calculate detection rate and FPR using confusion matrix.

$$\text{Detection Rate} = \frac{TP+TN}{Total} \qquad (4)$$

$$\text{FP Rate} = \frac{FP}{Actual\ Normal} \qquad (5)$$

TABLE II. CATEGORY 2 SELECTED FEATURE 25

N = 311029		Predicted		
		Normal	*Attack*	
Actual	*Normal*	60593	0	60593
	Attack	10070	240366	250436
		70663	240366	

Table II shows for category 2 while choosing the selected features up to 25, the developed IDS model was able to detect 60593 normal connections as normal and out of 250436 attacks, only 240366 were detected as attacks and 10070 attacks were detected as normal. The accuracy was found to be 0.967623598 and false positive rate was found to be 0.

TABLE III. DISTINCT CATEGORY 2 SELECTED FEATURE 21

N = 311029		Predicted		
		Normal	*Attack*	
Actual	*Normal*	60593	0	60593
	Attack	92	250344	250436
		60685	250344	

Similarly, Table III shows while training IDS model with distinct category 2, when choosing the selected features up to 21, the developed IDS model was also able to detect 60593 normal connections as normal and out of 250436 attacks, only 250436 were detected as attacks and 92 attacks were detected as normal. The accuracy was found to be 0.999704208 and false positive rate was found to be 0.

TABLE IV. CATEGORY 4 SELECTED FEATURE 28

N = 311029		Predicted		
		Normal	*Attack*	
Actual	*Normal*	60591	2	60593
	Attack	61286	189150	250436
		121877	189152	

Table IV shows for category 4 while choosing the selected features up to 28, the developed IDS model was able to detect 60591 normal connection as normal and 2 as attack for normal connection. Out of 250436 attacks, only 189150 were detected as attacks and 61286 attacks were detected as normal. The accuracy was found to be 0.80295085 and false positive rate was found to be 0.000033007.

TABLE V.   DISTINCT CATEGORY 4 SELECTED FEATURE 29

N = 311029	Predicted		
		Normal	*Attack*	
Actual	*Normal*	60592	1	60593
	Attack	66062	184374	250436
		126654	184375	

Similarly, Table V shows while training IDS model with distinct category 4, when choosing the selected features up to 29, the developed IDS model was also able to detect 60592 normal connections as normal and out of 250436 attacks, only 184374 were detected as attacks and 66062 attacks were detected as normal. The accuracy was found to be 0.787598584 and false positive rate was found to be 0.000016504.

V. CONCLUSION

The developed IDS model using back-propagation neural network was found to be accuracy of 99.9704208 percent and false positive rate to be zero, when the model was trained with only two classification either normal or attack consisting of no duplicate records in 10 percent KDDCup99 training dataset for selected features 21. Without removing duplicates records, the accuracy was only found to be 96.7623598 percent and false positive rate to be zero for selected features 25. The IDS model trained with distinct records for two classification attack types gave better accuracy and low false positive rate using back-propagation neural network. However, the accuracy was found to be decreased while classifying into dos, probe, r2l, u2r and unknown attacks. So, the model giving the highest accuracy and low false positive rate parameters can be distributed to other nodes of the computer network and subject to real-time traffic to detect intrusion. The newly detected intrusion can then be transferred to central node for retraining the node and redistribute accordingly. This will save the network bandwidth and processing cost, as well as detect intrusion with high accuracy and low false positive rate.

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Big Data and Google File System

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ABSTRACT

Today data is the most valuable and precious object. To handle, store, and manipulate data-it's a kind of challenge. This is the age of computer and using computer application (web and desktop application) is very common. During each and every use of computer application data is collected, stored and reused. We simply use hard disks to store data. But a normal computer owns about 500GB storage only. Does this much of data is enough for a person? The age of physical storage is wage out. It's time for cloud storage. Let us think what volume of data may be at google, facebook, twitter etc? How they may be stored, processed and available at real time system when needed? Google holds around 15 exabytes of data. About 90 percent of whole volume of data of the world is equivalent to data being accumulated in 2 years. So it's a matter of study. This paper explains about big data, google's technology of handling data and google file system.

KEYWORDS

Big Data, map reduce, google file system, hadoop ,NoSQL, data mining, machine learning.

CATEGORIES AND SUBJECT DESCRIPTIONS

Big Data, Database

GEBERAL TERMS

Theory, Design

1. INTRODUCTION

Use of internet and computer application collects monstrous amount of data daily. These data are stored in either physical device or in cloud. This is the age of cloud computing. Thus its more feasible to store big amount of data in cloud rather than locally available hard drives and other storing devices. According to Statista, there are 2082.7 millions of smart phone users in the world in 2016 and this is increasing day by day[1]. There are 3,424,971,237 active internet users till June,2016[2]. Likewise user of social sites and other web application is increasing day by day resulting into the collection of data. Google has around 15 exabytes of data. Also facebook and twitter collects a huge amount of data. Data sets grow in size because they are collected rampantly from various devices like smart phones, web applications, mobile devices, sensing devices, web and CC cameras, cameras, radio-frequency devices, sensor networks etc. Since 1980s, technological per-capita capacity of world to store information is approximately doubled in every 40 months. As of 2012, every day 2.5 quintillion (2.5×1018) bytes of data were created. This voluminous data cannot be handled by traditional Database Management process. So, we use another technology to receive, process, collect and handle this huge amount of data, this new technology is called as big data technology.

The term 'Big Data' is first used by John Mashey in 1998 in Silicon Graphics (SGI) presentation slide with title of "Big Data and the NextWave of InfraStress". But, for the first time, 'Big Data' is used in a Data Mining book in 1998 by Weiss and Indrukya . However, in academic paper this term is used by Diebold in

2000. The origin of the term 'Big Data' is due to the reason that we are producing a huge amount of data every day[3]. Big data are those data sets which cannot be handled by common and simpler software and hardware tools efficiently and accurately. Big data is the term for a collection of data sets so large and complex that it becomes difficult to process using database management tools or traditional data processing applications. The process of extracting valuable information from the big data is called as "Data Mining". Handling data properly also means mining of important information from monstrous data sets. These mined or extracted data are used for training or learning for the system and makes the system intelligent which is called "machine learning". Google uses big data technologies for maintaining its file system.

1.1 Current trends

Relational Database Management System cannot handle large chunks of data. As data is collected from everywhere, an efficient handling with proper security should be maintained. Big Data is treated as an efficient tools for business analysis, society administration and scientific research. It is common belief that the effective use of Big Data has the significant benefits to transform economies, and also data is being created or produced in new ways day by day. With contrast to opportunities with Big Data, it is even considered as big challenge in adequate handling. For increasing amount of data, new technology that is to say big data has emerged from current prospective that traditional system is unable to handle.

2. Characteristics of big data

Characteristics of big data can be explained in terms of V^3, Volume, Variety, and Velocity [4].
Volume: As mentioned earlier big data is huge collection of data sets. Volume here refers these large sets of data which is the first and basic characteristic of big data. Data volumes continue to increase at an unprecedented rate.
Variety: Data is collected and stored from different sources. Variety is about managing the versatile collection of multiple data types, data sets may be structured, semi-structured and unstructured data. Organizations need to integrate and analyze data from an aberrant or meander collection of information sources or data from within and outside the enterprise. With variety of data generating sources, data are also with variable size, format and property. Variety of data is the characteristic of big data.
Velocity: Velocity simply says the motion of data sets. As the generated data is collected, handled and processed, the speed of processing must be faster as possible. Now these large chunks of big data are processed and available to user in real time system in a relevant way.
Now –a-days extra 2V are also added to define the big data characteristics. They are
Variability: The structure of data changes as per the operations. Unstructured data sets during collection may changes to structured at he end. Manipulation of data occurs with variability.
Value: Business value of data is increasing. Data is the most precious item. On the basis of data sets and data items numerous significant process is performed. Analysis of data gives whole analysis of system. Data analysis is core part of most types of social researches. For example census of population is all about data analysis. Thus data has a special and significant value.
Now characteristics of big data is V^5.

3. ROLE OF DISTRIBUTED SYSTEM IN BIG DATA

A distributed system is a network of interconnected network of computers or servers where each and every computer in a preferred network can communicate each other through message passing. In distributed approach, all computers connected each other is also taken as single unit of computers. Distributed system plays significant role in managing the big data problems that exist in

today's world. In the distributed approach, data are placed in multiple machines and are made available to the user as if they are in a single system. If data or other information is to be accessed by a computer connected in a system via a certain path which is malfunction then the data information can be available to the end user computer from different or alternative path in a tolerable time slot. By this way big data processing is easier and systematic using distributed system.

4. APACHE HADOOP AND MAP REDUCE

Apache Hadoop is one of the most popular and well established software based on open source framework used for distributed storage and distributed processing of big data sets. Hadoop is designed in such a way that it can easily cope up with hardware failure and if hardware failure occurs it can be handled by framework itself. Storage part in hadoop is provided by a part called Hadoop Distributed File System while processing of these data chunks is called MapReduce technique. MapReduce is a programming model of data processing in distributed manner by dividing data sets in smaller data chunks , processing each smaller data chunks in different machine or servers called parallel processing. MapReduce programs are written in a functional programming style or paradigm but the purpose and idea is not functional. This module explains the nature of this programming model and how it can be used to write programs which run in the Hadoop environment. The basic operation of MapReduce is like "divide and rule". First map method is operated which does classifying, filtering, shorting of data on the certain basis. Second part is summary operation like counting or frequency calculation of different data.

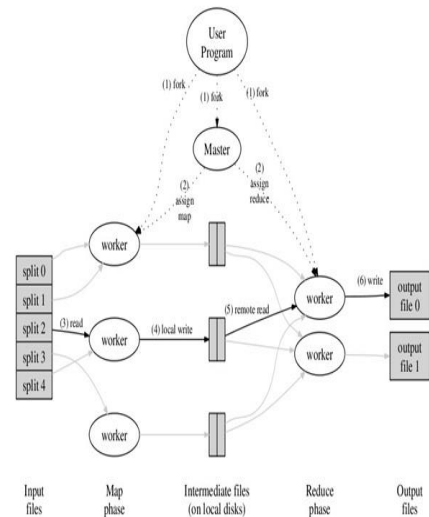The following is the basic outline diagram of map reduce execution environment.

Figure 1: Map Reduce

In a basic MapReduce job, contains input, mapper, reduce and output phase. The input data is usually large and the computations have to be distributed across hundreds or thousands of machines in order to finish in a reasonable amount of time. Input data are divided into various parts generally the size of each part is 16 to 64 MB. These divided smaller data parts are now assigned to process in individual machine or servers which is parallel processing. This gives key-value pair of intermediate data values. The reducer component merges all the intermediate values associated with the same intermediate key and provided as output files. The input and the output of the job are stored in a file-system. In a MapReduce job, a special program called master assigns mapper or reducer tasks to rest of the idle workers.

5. NOSQL

The term means Not Only SQL It's not SQL and it's not relational. NoSQL is designed for distributed data stores for very large scale data needs. In a NoSQL database, there is no fixed schema and no joins. Scaling out refers to spreading the load over many commodity systems. This is the reason why NoSQL is

better and economical solution of big data. NoSQL is faster than relational database system because it uses key -value pair, wide column, graph or document as database. It uses a low level of query language which doesn't contain join across the tables . Application needs are also changing as time changes which is favorable for NoSQL rather than relational database because this is the age of large volume of data to be processed in greater speed. Also it is the age of virtualization and cloud computing. For these type of trend relational database cannot handle for the desired output. NoSQL technology is rising rapidly among Internet companies and the enterprise because it offers data management capabilities that meet the needs of modern application. It is an improved performance to satisfy expectations of users wanting highly responsive applications and to allow more complex processing of data. NoSQL is increasingly considered available alternative to relational databases, and should be considered particularly for interactive web and mobile applications.

5.1 Cap theorem

CAP theorem says it is impossible for a distributed computer system to provide all guarantee Consistency, Availability and Partition Tolerance at a same time.

Consistency in CAP is not the same as consistency in ACID (that would be too easy). According to CAP, consistency in a database means that whenever data is written, everyone who reads from the database will always see the latest version of the data. A database without strong consistency means that when the data is written, not everyone who reads from the database will see the new data right away; this is usually called eventual-consistency or weak consistency.

Availability in a database according to CAP means you always can expect the database to be there and respond whenever you query it for information. High availability usually is accomplished through large numbers of physical servers acting as a single database through sharing (splitting the data between various database nodes) and replication (storing multiple copies of each piece of data on different nodes).

Partition tolerance in a database means that the database still can be read from and written to when parts of it are completely inaccessible. Situations that would cause this include things like when the network link between a significant numbers of database nodes is interrupted. Partition tolerance can be achieved through some sort of mechanism whereby writes destined for unreachable nodes are sent to nodes that are still accessible. Then, when the failed nodes come back, they receive the writes they missed

6. DATA MINING IN BIG DATA

Data mining is a popular and significant technique of extracting of valuable information which is called patterns from the warehouse of data or large collection of data. It uses various techniques like clustering, classification, regression, and association. It involves the methods from machine learning and statistics. Data mining from big data is more difficult and challenging as compared to mining from traditional data. Clustering and other techniques of data mining is to be improved and extended to cope up with huge data collection [5]. These sorts of clustering algorithms [6] include CLARA (Clustering LARge Applications) algorithm, CLARANS (Clustering Large Applications based upon RANdomized Search), BIRCH (Balanced Iterative Reducing using Cluster Hierarchies) algorithm etc. Genetic algorithms are also used in clustering as optimization criterion to get better result, Clustering Big Data is also developing to distributed and parallel implementation [7]. Developing an effective algorithm for large-scale discriminant analysis is going on by researchers [8,9] for reduction of computational complexity. Bio informatics is also shifting from traditional method to combine integrative database analysis and data mining[10]. This new paradigm results in the synthesis of large-scale genome function which is also a collection of data and mining or

finding a logical portraits of patterns form these genome is another job.

7. GOOGLE FILE SYSTEM(GFS) ARCHITECTURE

The above figure 2 is the architecture of google file system (GFS)[11]. Google organizes the GFS into several groups of computers or to say networks of computers. Each group or cluster may have thousands or more machines. Within GFS clusters there are three kinds of entities: clients, master servers and chunkservers.

In GFS client is nothing its simply a entity that produces requests. Requests may be retrieving and manipulating existing files or creating new files on the system. Clients may be other computer or device or computer like architecture device. We can say that client is customer of Google File System. The master server is the coordinator for the cluster. The functions of master are maintaining an operation log, which keeps track of the activities of the master's cluster. The operation log helps to keep service interruptions. If master server crashes or malfunctions then another server replaces the old server. The new server was not other it is one it has monitored operation log. Metadata is the information that describes chunks. The metadata tells the master server to which files the chunks belong and where they fit within the overall file. Master's job is also to track metadata. During starting, the master analyses all the chunkservers in its cluster. During analysis, chunkservers replies to the master with its findings. Now, the master server keeps track of the location of chunks within the cluster. If there is hardware failure GFS maintains backup of master server to overcome such failure. So at a time, the number of active master server per cluster is only one. GFS gets in tortuous position as master server sends and receives messages but in small numbers. Chunkservers are actual working clusters. Chunkservers handles all file data and these store 64 MB files. Chunkserver sends requested chunks to the client directly which decreases processing time. The GFS

Figure 2. GFS Architecture
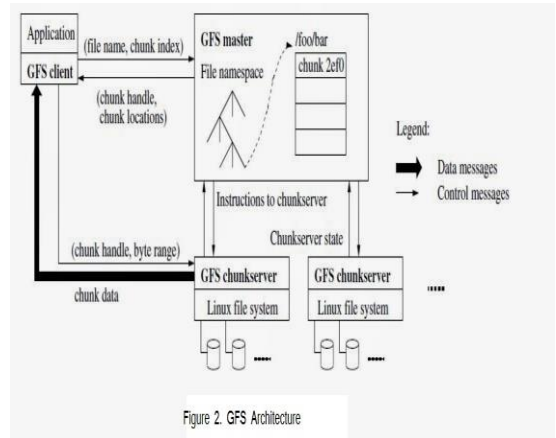
copies every chunk multiple times and stores it on different chunkservers. Each copy is called a replica. By default, the GFS makes three replicas per chunk, but users can change the setting and make more or fewer replicas if desired. This is all about Google File System. ..

8. CONCLUSION

Here we can conclude the term 'Big Data' as a huge collection of data. Data is collected from everywhere and large voluminous data cannot be handled by traditional relational database management system which is the gist reason to apply big data technologies. From these monstrous collection of data useful information is extracted via process called 'Data Mining' .. Google file system is simple look-up of the data and files which gives the result in small moment of time.

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Blue Brain

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*Abstract---***Human brain is the most valuable creation of God. The man is intelligent because of the brain. "Blue brain" is the name of the world's first virtual brain. That means a machine can function as human brain. Today scientists are in research to create an artificial brain that can think, response, take decision, and keep anything in memor. The main aim is to upload human brain into machine. So that man can think, take decision without any effort. After the death of the body, the virtual brain will act as the man .So, even after the death of a person we will not lose the knowledge, intelligence, personalities, feelings and memories of that man that can be used for the development of the human society.**

Keywords-- **Nanobotes, Neurons, Sensory System**

1. INTRODUCTION

Human brain is the most valuable creation of God. The man is called intelligent because of the brain. The brain translates the information delivered by the impulses, which then enables the person to react. But we lose the knowledge of a brain when the body is destroyed after the death of man. That knowledge might have been used for the development of the human society. What happen if we create a brain and upload the contents of natural brain into it? This BLUE BRAIN project was founded in May 2005 by Henry Markram at the EPFL in Lausanne, Switzerland. Goals of the project are to gain a complete understanding of the brain and to enable better and faster development of brain disease treatments. The research involves studying slices of living brain tissue using microscopes and patch clamp electrodes. Data is collected about all the many different neuron types. This data is used to
build biologically realistic models of neurons and networks of neurons in the cerebral cortex. The simulations are carried out on a Blue Gene supercomputer built by IBM, hence the name "Blue Brain". The simulation software is based on Michael Hines's NEURON, together with other custom-built components.

2. BLUE BRAIN

2.1 Definition

The blue brain is an attempt to create a systhetic brain by reverse engineering human brain. It would be the world's first virtual brain. The IBM is now developing a virtual brain known as the Blue brain. Within 30 years, we will be able to scan ourselves into the computers. We can say it as Virtual Brain i.e. an artificial brain which is not actually a natural brain, but can act as a brain. It can think like brain, take decisions based on the past experience, and respond as a natural brain. It is possible by using a super computer, with a huge amount of storage capacity, processing power and an interface between the human brain and artificial one. Through this interface the data stored in the natural brain can be up loaded into the computer. So the brain and the knowledge, intelligence of anyone can be kept and used for ever, even after the death of the person

2.2. Need Of Blue Brain

Human society is always in need of such intelligence and such an intelligent brain to have with. But the intelligence is lost along with the body after the death. The virtual brain is a solution to it. The brain and intelligence will be alive even after the death. We often face difficulties in remembering things such as people names, their birthdays, and the spellings of words, proper grammar, important dates. Virtual brain may be a better solution for it.

2.3. Possibility

Really this concept appears to be very difficult and complex. First, it is helpful to describe the basic manners in which a person may be uploaded into a computer. The most promising is the use of very small robots, or nanobots. These robots will be small enough to travel throughout our circulatory systems. Traveling into the spine and brain, they will be able to monitor the activity and structure of our central nervous system. They will be able to provide an interface with computers that is as close as our mind can be while we still reside in our biological form. Nanobots could also carefully scan the structure of our brain, providing a complete readout of the connections between each neuron. They would also record the current state of the brain. This information, when entered into a computer, could then continue to function like us. All that is required is a computer with large enough storage space and processing power.
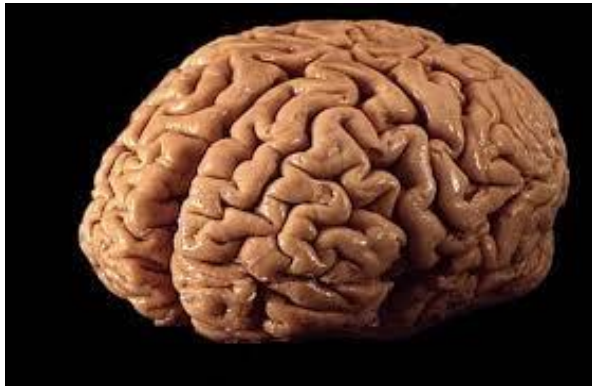
2.4 Natural Brain

Fig: Natural Human Brain

The brain essentially serves as the body's information processing centre. It receives signals from sensory neurons (nerve cell bodies and their axons and dendrites) in the central and peripheral nervous system, and in response it generates and sends new signals that instruct the corresponding parts of the body to move or react in some way. It also integrates signals received with signals from adjacent areas of the brain, giving rise perception and consciousness. The brain weighs about 1500 grams (3 pounds) and constitutes about 2% of total body weight.

3. WORKING OF NATURAL HUMAN BRAIN

The human ability to feel, interpret and even see is controlled, in computer like calculations, by the magical nervous system. The nervous system is quite like magic because we can't see it, but its working through electric impulses through the body. One of the world's most "intricately organized" electron mechanisms is the nervous system. Not even engineers have come close for making circuit boards and computers as delicate and precise as the nervous system. The three simple functions that it puts into action: sensory input, integration, motor output.

3.1 *Sensory input*

When our eyes see something or our hands touch a warm surface, the sensory cells, also known as neurons, send a message straight to your brain. This action of getting information from your surrounding environment is called sensory input because we are putting things in your brain by way of your senses.

3.2 *Integration*

Integration is best known as the interpretation of things we have felt, tasted, and touched withour sensory cells, also known as neurons, into responses that the body recognizes. This process is all accomplished in the brain where many neurons work together to understand the environment.

3.3 *Motor Output:*

Once our brain has interpreted all that we have learned, either by touching, tasting, or using any other sense, then our brain sends a message through neurons to effecter cells, muscle or gland cells, which actually work to perform our requests and act upon the environment.

4. COMPARISION BETWEEN NATURAL AND SIMULATED BRAIN

By comparing the functions of natural brain with the simulation of electrodes it will be easy to build the bluebrain.

Natural Brain	Simulated Brain
INPUT In the nervous system in our body the neurons are responsible for the message passing. The body receives the input by sensory cells. This sensory cell produces electric impulses which are received by neurons. The neurons transfer these electric impulses to the brain.	INPUT In a similar way the artificial nervous system can be created. The scientist has created artificial neurons by replacing them with the silicon chip. It has also been tested that these neurons can receive the input from the sensory cells. So, the electric impulses from the sensory cells can be received through these artificial neurons.
INTERPRETATION The electric impulses received by the brain from neurons are interpreted in the brain. The interpretation in the brain isaccomplished by means of certain states of many neurons.	INTERPRETATION The interpretation of the electric impulses received by the artificial neuron can be done by means of registers. The different values in these register will represent different states of brain.
OUTPUT Based on the states of the neurons the brain sends the electric impulses representing the responses which are further received by sensory cell of our body to respond neurons in the brain at that time.	OUTPUT Similarly based on the states of the register the output signal can be given to the artificial neurons in the body which will be received by the sensory cell.
MEM ORY There are certain neurons in our brain which represent certain states permanently. When required, this state is represented by our brain and we can remember the past things. To	MEMORY It is not impossible to store the data permanently by using the secondary memory. In the similar way the required states of the registers can be stored permanently and when

remember things we force the neurons to represent certain states of the brain permanently or for any interesting or serious matter this is happened implicitly.	required these information can be received and used.
PROCESSING When we take decision, think about something, or make any computation, logical and arithmetic computations are done in our neural circuitry. The past experience stored and the current inputs received are used and the states of certain neurons are changed to give the output	PROCESSING In the similar way the decision making can be done by the computer by using some stored states and the received input and the performing some arithmetic and logical calculations.:

5. COMPUTER HARDWARE

The primary machine used by the Blue Brain Project is a Blue Gene supercomputer built by IBM. This is where the name "Blue Brain" originates from. IBM agreed in June 2005 to supply EPFL with a Blue Gene/L as a "technology demonstrator" In June 2010 this machine was upgraded to a Blue Gene/P. The machine is installed on the EPFL campus in Lausanne (Google map) and is managed by CADMOS (Centre for Advanced Modelling Science). The computer is used by a number of different research groups, not exclusively by the Blue Brain Project. In mid-2012 the BBP was consuming about 20% of the compute time. The brain simulations generally run all day, and one day per week. The rest of the week is used to prepare simulations and to analyse the resulting data.

Blue Gene/P technical specifications:

- 4,096 quad-core nodes (16,384 cores in total)
- Each core is a powerpc 450, 850 MHz
- Total: 56 teraflops, 16 terabytes of memory
- 4 racks, one row, wired as a 16x16x16 3D torus
- 1 PB of disk space.

Operating system: Linux SuSE SLES 10

Fig: Blue Gene/ P

5.1 *JuQUEEN*

JuQUEEN is an IBM Blue Gene/Q supercomputer that was installed at the Jülich Research Center in Germany in May 2012. It currently performs at 1.6 peta flops and was ranked the world's 8th fastest supercomputer in June 2012. It's likely that this machine will be used for BBP simulations starting in 2013, provided funding is granted via the Human Brain Project. In October 2012 the supercomputer is due to be expanded with additional racks. It is not known exactly how many racks or what the final processing speed will be. The JuQUEEN machine is also to be used by the research initiative. This aims to develop a threedimensional, realistic model of the human brain.

Fig: JuQUEEN Supercomputers

6. UPLOADING A HUMAN BRAIN

The uploading is possible by the use of small robots known as the Nanobots. These robots are small enough to travel throughout our circulatory system. Traveling into the spine and brain, they will be able to monitor the activity and structure of our central nervous system. They will be able to provide an interface with computers that is as close as our mind can be while we still reside in our biological form. Nanobots could also carefully scan the structure of our brain, providing a complete readout of the connections. This information, when entered into a computer, could then continue to function as us. Thus the data stored in the entire brain will be uploaded into the computer.
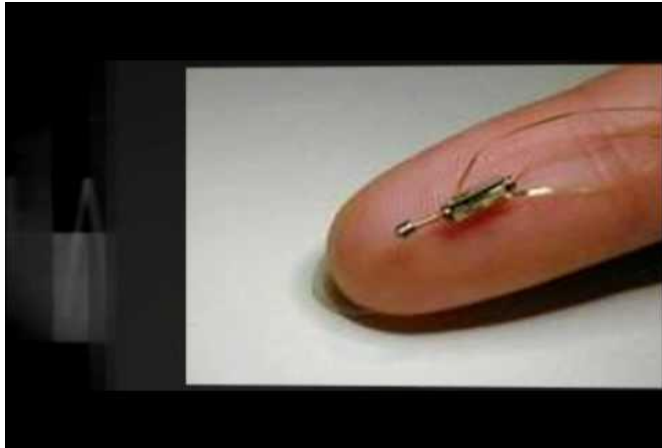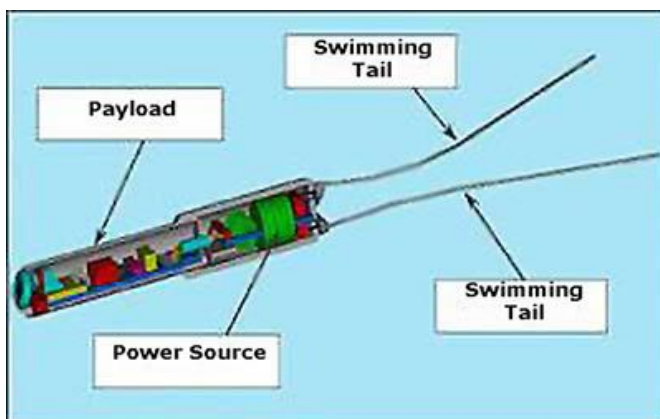

Fig: Nanobot

Fig : Nanobot(Internal Structure)

7. ADVANTAGES

1. We can remember things without any effort.
2. Decision can be made without the presence of a person.
3. Even after the death of a man his intelligence can beused.
4. The activity of different animals can be understood i.e. by interpretation of the electric impulses from the brain of animals, their thinking can be understood easily.
5. It would allow the deaf to hear via direct nerve stimulation, and also be helpful for many psychological diseases. By downloading the contents of the brain that was uploaded into the computer, the man can get rid of from the madness.

8. LIMITATIONS

1.We become dependent upon the computer systems.
2.Others may use technical knowledge against us.
3.Computer viruses will pose an increasingly critical threat.

9. CONCLUSION

In conclusion, we will be able to transfer ourselves into computers at some point. They are either simple minded, or simply require further time for technology to increase. The only serious threats raised are also overcome as we note the combination of biological and digital technologies. While the road ahead is long, already researches have been gaining great insights from their model. Using the Blue Gene supercomputers, up to 100 cortical columns, 1 million neurons, and 1 billion synapses can be simulated at once. This is roughly equivalent to the brain power of a honey bee. Humans, by contrast, have about 2 million columns in their cortices. Despite the sheer complexity of such an endeavour, it is predicted that the project will be capable of this by the year 2023.

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Blue Eyes Technology

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ABSTRACT
In today's world, technology has reached to new level unfolding its limitations and improving at a tremendous pace. How would our life be if our computer could interact like our friends, feel our physical presence, appreciate our happiness and cheer us up in our despair? Imagine, a wonderful world where the computers that humans have built can interact with them just like their colleagues. We now have reached the technology known as "BLUE EYES" technology that can sense and control human emotions and feelings through various gadgets by providing computer with human power. We all have some perceptual abilities i.e. we can perceive each other's emotional state by analyzing facial expressions. The eyes, fingers, speech are the elements which helps to sense the emotion level of human body. Its main objective is to create the machine that doesn't only compute but can perceive and sense the things as we humans do. By analyzing person's physical state and emotions, the computational machines can simply understand what user desires and where his eye is focusing at. In this technology, after capturing the image it compares eye portion of the captured image to the stored images in the database and can finally perceive the emotions of a person like happy, sad, excited, surprised and so on. This paper is about hardware, software, applications and future prospects of "BLUE EYES" technology.

Keywords
CSU (Central System Unit), DAU (Data Acquisition Unit), Emotion Mouse, MAGIC (Manual and Gaze Input Cascaded), SUITOR (Simple User Interest Tracker)

1. INTRODUCTION
At present, technology has become the part and parcel of human life. With each day, it offers new layers to unfold. It is undeniable how technology has simplified our life and multiplied our progress. It is an era of artificial intelligence and machine learning. "Blue eyes" technology is one of such technology that enables a machine to think and feel emotions like a man.

A technology conducted by the research team of IBM at it research Centre in California since 1997, "BLUE EYES" technology gives the computer an ability of having cognitive skills and emotional characteristics like that of a human being. [6] This technology incorporates the perceptual ability and emotional gesture in a computer so that those computer could sense the emotional levels that a normal human beings go through. Imagine walking to your home all tired and depressed one day, as you open your room the computer senses your presence, greets you a "Hello!" ,understands how you are feeling and cheers you up as your friends would do to

you. This all can be possible with this technology which has a phenomenal future prospect.

With this technology, the computers could use facial recognition and speech recognition system to collect the information from human beings and react accordingly. The main aim of "Blue Eyes" technology is creating powerful computers that have sensory and perceptual abilities like that of a human being. This technology uses a camera and microphone to identify user actions and emotions. Blue Eyes uses a sensing technology to identify a user's action and gather information. The information thus obtained are analyzed and the emotional state of the user is determined. It consists of both software and hardware systems which facilitates a stress free environment where humans and machine can collaborate and work together.

2. SYSTEM OVERVIEW
"BLUE EYES" system monitors the status of operator's visual attention through the measurement of saccadic activity. Two major system units are used:
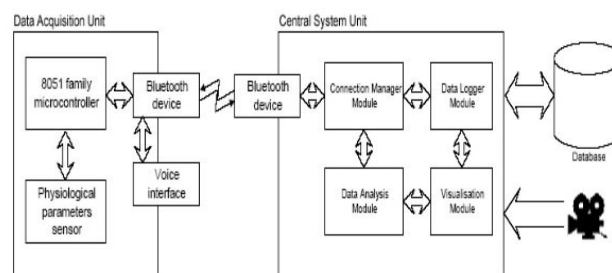

Figure 1: System Overview [1]

2.1 Data Acquisition Unit (DAU)
"BLUE EYES" technology uses a mobile device known as DAU. This unit collects the physiological information coming from the sensors and for verification and processing purposes it further sends that information to the CSU.

The wireless interface between user with sensors and CSU is provided by a Bluetooth module that is incorporated with mobile device. PIN codes and ID cards are assigned to the entire operator's for authentication purposes. The device uses the hardware such as system-core Bluetooth section, Jazz Multisensor, Atmel 89C52 microcontroller, EEPROM, Beeper, LCD display (HD44780), LED indicator, voltage level monitors and 6 AA batteries. It runs on batteries that is why it requires less power, is lightweight and easy to use. [2]

2.2 Central System Unit (CSU)

This unit is incorporated to a personal computer using USB, serial and parallel cable. [2] It is mainly composed of four components:

- ❖ Connection Manager -> Its main task is to perform low level Bluetooth communication.
- ❖ Data Analysis Module -> For obtaining the information about the physiological state of an operator, this module analyzes the raw sensor data. Some analyzers used are:
  - Saccade detector: It monitors eye movement to determine level of operator's visual attention.
  - Pulse rate analyzer: It uses blood oxygenation signal to compute operator's pulse rate.
  - Custom analyzers: It recognizes other behaviours than those which are built in the system. The new modules are created using C4.5 decision tree induction algorithm.

Algorithm step	Original C 4.5	Proposed modification
Entropy calculation	$E(S) = -\sum_{j=1}^{k} \frac{f(C_j,S)}{|S|} * \log\left(\frac{f(C_j,S)}{|S|}\right)$ where $f(x,y)$ denotes the frequency of decision class x in set y	Decision not based on entropy. "Common sense" rules for splitting input set.
Choosing best division	Minimization of weighted entropy sum of subsets	Additional factor that markedly favors balanced divisions
Division condition	Condition attribute $a_i < v$	Additional condition attribute $a_i \in (a,b)$
Tree pruning	Prune the tree to maximize the test set hit ratio	Stop splitting input set when it is too small (much faster than the other method). No tree modifications after testing.

Table 1: Algorithm steps with its modification

- ❖ Data Logger Module-> This module provides assistance in order to store the monitored data.
- ❖ Visualization Module -> This module provides supervisors with user interface.
  Some of its features are connection management, data processing, data recording, access verification and system maintenance.

3. TECHNOLOGIES USED
3.1 Emotional Computing

In 1997, Rosalind Picard describes why emotions are necessary to computing community. There are basically two aspects of affective computing i.e. the computer are given the ability to detect emotions and the ability to express emotions. So, emotion is an important element which can be used into computing for productivity for computer user. A study (Dryer & Horowitz, 1997) has shown that people with personalities that are similar or complement each other collaborate well. In today's world it is very necessary to develop the computers that can understand our emotions and interact with us.

3.1.1 Theory

Based on Paul Ekman's facial expression work, there is a correlation between human emotions and human psychological measurements. His experiments consist of participants attached to devices that can record certain measurements like temperature, galvanic skin response (GSR), pulse, blood pressure and somatic movement. Then, he allowed the participants to mimic the different facial expressions and measured psychological measurement. He has basically given the six basic emotions to mimic such as anger, fear, sadness, disgust, joy and surprise.

3.1.2 Result

The result consists of data scores for four physiological measurement i.e. GSA, GSR, pulse, and skin temperature, for each of the six emotions anger, disgust, fear, happiness, sadness, and surprise within the five minute baseline and test sessions. In a second GSA data was sampled 80 times. GSR and temperature were sampled approximately 3-4 times per second and pulse was sampled approximately 1 time per second. In order to measure the difference of psychological measure of human, we find the difference between the baseline and test scores. If the difference is more than one and half standard deviation from mean was considered as missing. This obtained results gives the theory of working of the emotion mouse. [3]

3.2 Classification of Emotion Sensors

- ➢ For Hand

3.2.1 Emotion Mouse

The main goal of human computer interaction (HCI) is to make the computers smart by analyzing the facial expressions of the human beings. This can analyze the facial expression, speech recognition, eye tracking and gesture recognition.

Figure 2: Emotion Mouse [3]

In this the people touch the mouse and all the psychological parameters are measured. People use their computers to obtain, store and manipulate data using their computer." Emotion Mouse" can measure person's heart rate, temperature, galvanic skin response and body movements and pair them with six emotional states: happiness, surprise, anger, fear, sadness and disgust that are stored in the database. As a result, we obtain the psychological data which can be used to determine the six basic emotion of the user i.e. the task the

user is currently doing on the computer. So in the near future the computer can sense the human emotions perfectly and can help human for various purposes.

➢ For Eye

3.2.2 Manual and Gaze Input Cascaded (Magic) Pointing

In the past, Gaze tracking was considered as the superior computer input. But as the time passes the people came to know that there are various limitations with the gaze pointing. So, they developed the alternative approach i.e. Manual and Gaze Input Cascaded pointing (Magic). So, with magic pointing we can perform the manual task in order to manipulate and select the particular target. The manual task cannot be performed in gaze tracking as in the magic pointing. In this magic pointing, the cursor is warped to the eye gaze area i.e. towards the target. There are basically two approaches on the basis of cursor placement and target identification. They are Liberal approach and Conservative approach.

Liberal Approach

In liberal approach, the user can control the cursor on or near the target by the hand .There is 120 pixel threshold so, the cursor cannot move to particular target until the threshold is met. The liberal is "pro-active," since the cursor waits readily in the anticipated target or on every potential target. The user can make the manual movement to the cursor by hand where he /she is actually looking at in order to get the actual targeted object. The cursor is overactive when the user looks at the same position for the long time when the user does not intend to look at that position.
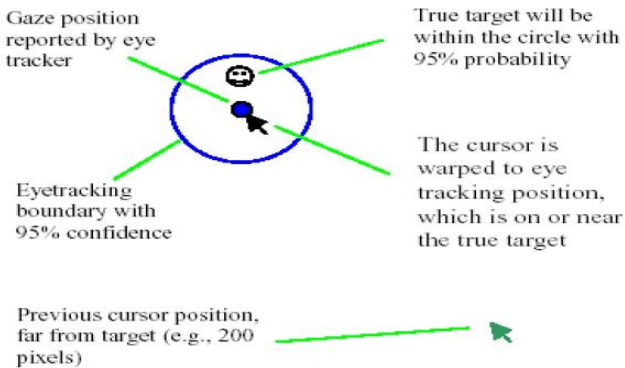

Figure 3: Liberal Approach [3]

Conservative Approach

In conservative approach, the manual input device should be used in order to move the cursor to a target. Until the manual input device is not activated, the cursor does not warp to the particular area or the particular target. In this approach, the cursor is on the boundary of the gaze area and it requires the manual input by the hand to move the cursor to the particular target. When the user looks at a target and moves the input device by the manual input device, the cursor will appear "out of the blue" while moving towards the particular target, on the side of the target opposite to the initial actuation vector.
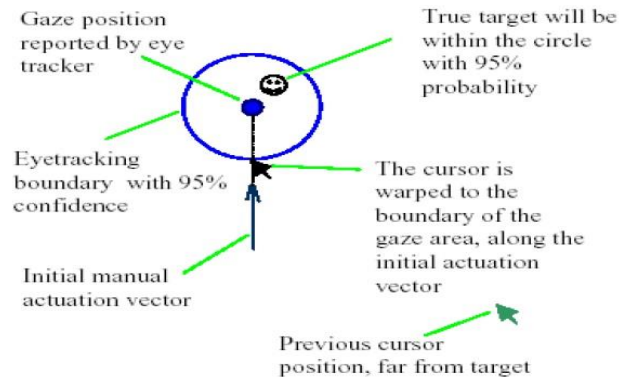

Figure 4: Conservative approach [3]

Both the conservative and the liberal has the following advantages:
1. They help in the reduction of the fatigue and the mental stress.
2. It increases the accuracy.
3. It is a natural model for the user.
4. It help in increasing the speed as manual modifications can be done.
5. It is simple, so it is easy to use.
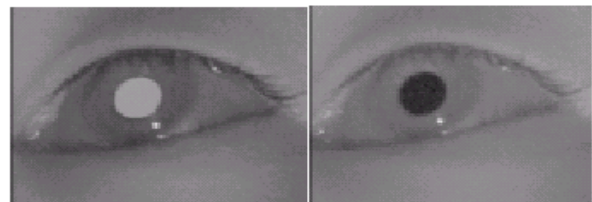
3.2.3 Eye Tracker

Figure 5: Bright (left) and dark (right) pupil images resulting from on- and off-axis illumination. The glints, or corneal reflections, from the on- and off- axis light sources can be easily identified as the bright points in the iris. [3]

The light source and the camera optical axis are placed on the axis. After they are placed on the axis, then the light is reflected from the interior portion of the eye and this is detected by the camera. In this condition the image of the pupil appears bright. This effect is often can be compared to the red-eye in flash photographs when the flash is close to the camera lens. So, the Bright (left) and dark (right) pupil images resulting from on- and off-axis illumination is shown in the figure above. The glints, or corneal reflections, from the on- and off-axis light sources can be easily identified as the bright points in the iris. The Almaden system uses two near infrared (IR) time multiplexed light sources, composed of two sets of IR LED's, which were synchronized with the camera frame rate. One light source is placed very close to the camera's optical axis and is synchronized with the even frames. Odd frames are synchronized with the second light source, positioned off axis. The two light sources are calibrated to provide approximately equivalent whole-scene illumination. [4]

➢ For Voice

3.2.4 ARTIFICIAL INTELLIGENCE SPEECH RECOGNITION (AISR)

For the Artificial Intelligence Speech Recognition system to be implemented effectively, it is necessary to consider the grammar used by the speaker and accepted by the system, noise level, noise type, position of the microphone, and speed and manner of the user's speech are some factors that may affect the quality of speech recognition. Siri (Apple), Google Now (Android) and Cortana (Windows) which all serves as intelligent personal virtual assistants on different platforms are relevant example of an artificial intelligence. These platforms deploys the action and information when user asks "Where is the nearest station?' or "Call the person ABC". [1]

Artificial Intelligence is based on two basic features. The first one is it determines the behavior pattern and thinking process of the human beings and implements these process through the machines. Intelligence is more to do with a 'situated', 'interactive' and 'real time' concern. With the use of artificial intelligence, machines become smarter and less expensive than natural intelligence. Natural language processing (NLP) refers to artificial intelligence methods of communicating with a computer in a natural language like English. In NLP, the input words are scanned and matched with internally stored word in the database.

Speech Recognition

The user speaks to the computer through a microphone which contains three filters. The more number of filters denotes probability of accurate recognition. At present, due to the custom built in integrated circuit, switched capacitor digital circuits are mostly in use. The filter output is passed to ADC to convert analog signal to digital word. Each second, ADC samples the filter output many times. Each of these sample represents different amplitude of the signal. Each value is then converted to a binary number proportional to the amplitude of the sample. These digital values are stores in a buffer area in a large RAM and central processor unit (CPU) controls the input circuits that are fed by the ADCS. This digital information which represents the spoken word, is now accessed by the CPU to process it further.

The binary representation of each of these words are considered as a standard template, against which the future words are compared. These templates reside in the memory. After the completion of the process, the system becomes active and is capable of identifying spoken word the computer starts to search and compares the binary input pattern with the templates. [It is to be noted that even if the same speaker talks the same text, there are always slight variations in amplitude or loudness of the signal, pitch, frequency difference, time gap, etc.] Due to this difference, the template and binary input word never match perfectly. The pattern matching process designs the best fit through statistical technique.

The values of binary input words are subtracted from the corresponding values in the templates. If both the values are same, the difference is zero and there is perfect match. If not, the subtraction produces some difference or error. The smaller the error, the better the match. In case of best match, the word is identified and displayed on the screen. As the CPU has to make many comparisons before recognition occurs, it may take time. This requires a large processor and large RAM. This process of matching the word and template correctly is known as dynamic time warping. It recognizes that different speakers pronounce the same words at different speeds as well as elongate different parts of the same word. [1]

3.3 The Simple User Interest Tracker (SUITOR)

SUITOR is an advanced approach which tracks the area of the computer screen where the user's eye is focusing. It helps to determine the topic of interest of a user through such tracking and delivers the information to the hand held devices. It fills a scrolling ticker on the computer screen with the information related to the user's task. SUITOR knows where you are looking, what applications are you running and which web pages you are browsing. [1]

Suppose if I am reading a web page about Apple, the system will display the stock price and news stories that could affect apple. Similarly, if I am going through the headline of any news, this system will pop up the news story in the browser window. SUITOR is an attentive system which is attentive to user's actions and supplies the information resources as per the user's interest.

4. APPLICATIONS

- Security and control systems can be controlled using this technology. The surveillance cameras not only capture image but they do have a vision. They can recognize the emotions of the user and assist security to focus on the persons whose emotional conditions are abnormal and seemingly dangerous.
- Assisting Human Operator by monitoring and recording the operator's physical condition.
- Driving systems can be controlled by blue eye technology which in turn can be helpful in reducing the number of accidents happening in the world.
- Medical supervision is also possible by letting the doctors to go through data of number of patients and make related notes. Detection of physiological situation of patient like blood pressure, oxygenation, pulse rate and so on.
- It can be used in lie detectors in smart cameras, processing of emotional speech, analyzing the customer movements to detect their intentions.
- In automobile industry, power stations and video games.
- Military, flight control centers, operating theatres, oven and refrigerators can also use this technology.
- To create "Face Responsive Display" and "Perceptive Environment" Generic Control Rooms. [5]

5. FUTURE PROSPECTS

In future "BLUE EYES" technology can be implemented for leading human life in much more simpler way. For example; one can switch on or off Television, music player, a/c, fan, washing machine, oven, coffee machine etc. by just having one look at them or by instructing them through voice commands. Imagine that technical world where computers can display happy or funny pictures and mails in the morning to cheer you up when you are in despair. [5]

The hardware used can be further improved by using the smaller and less intrusive units in future such as small CMOS camera to monitor operator's point of gaze, low voltage ICs, use of data mining algorithms for advanced encryption of database and so on. That day

is not too far when this technology will push its way to the hand held mobile devices making the humans more dependent in this technology, Therefore, despite of increase in comfortability, this technology might have some of its negative sides that can have bad impact on the mankind.

6. CHALLENGES

"BLUE EYES" technology can face both technological and implementation challenges:

- The implementation of gaze tracking method is not so accurate which might annoy the users.
- Tracking and implementation of speech recognition for languages with local dialect variations for the same becomes very tedious as it needs to have grammatically correct language having neutral dialect to convert the recognized words into an action.
- Single gesture might have multiple interpretations. So, the information obtained from a gesture might not be the correct one.
- Distance might affect the accuracy of the information obtained and results produced.
- Climate can have effect on the implementation of "Blue Eyes" technology such as in case of electrodes implantation in order to translate under rain or snow. [5]

7. CONCLUSION

The "BLUE EYES" technology makes computation devices more user friendly and also makes human life much more comfortable. It is developed to fulfill the need of human operator for the system monitored in real time. It is helpful in reducing the gap between humans and machines they use as it makes machine to interact with us like our peers. Further research is going on in order to take this technology to next level overcoming all the challenges to make our world of imagination come true.

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Comparative Analysis of ERP Systems:

Microsoft Dynamics NAV vs. OpenERP

Raksha Roy[1], Umesh Upadhyaya[2], Sanjay Poudel[2]

Abstract—**This paper concerns the comparative implementation of Microsoft Dynamics NAV and OpenERP at ICIMOD and Possible Health respectively. Organization can get optimum level of benefit in terms of ERP performance and result as per the implementation of its requirement. The goal of this paper is to help organizations select ERP system cost effectively to attain better efficiency in various organizational processes.**

Keywords—Microsoft Dynamics NAV, OpenERP

I. INTRODUCTION

Addressing the information needs of all the functional departments across the organization without a single unified system is inefficient. Enterprise Resource Planning (ERP) systems are both commercial and non-commercial software that optimize, automate and integrate most of the business processes and transactions in an organization. ERP systems promise integration of organizational processes and access to integrated data across the entire enterprise. Moving to being a paperless organization, ICIMOD and Possible Health adopted extensive integration of all the subunits of the organization since 2009 and 2015 respectively. Before ERP, different programs and subunits carried out their day to day activities either in a tedious paper based manner or by some separate application for different modules.

II. ERP ARCHITECTURE

A. Microsoft Dynamics NAV

- ➢ RoleTailored Architecture (3 tier architecture)
  - • Presentation level (RoleTailored client)
  - • Business logic and communication level (Microsoft Dynamics NAV Server)
  - • Data level (SQL Server database)

Fig 1: RoleTailored Architecture (K. Dhinsdsa et. al, 2013)

- ➢ Web Client Network Architecture (4 tier architecture)
  - • Presentation level (Web Browser)
  - • Web server (Microsoft Dynamics NAV web server components)
  - • Business logic and communication level (Microsoft Dynamics NAV Server)
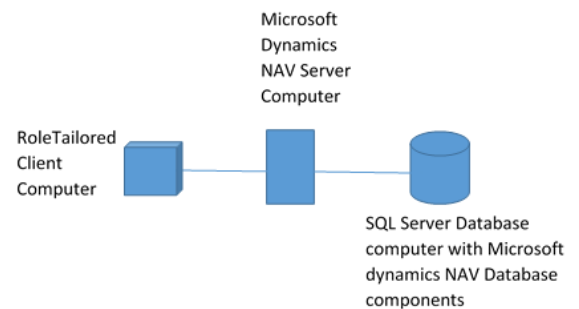 - • Data level (SQL Server database)

Fig 2: Web Client Network Architecture (K. Dhinsdsa et. al, 2013)

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1 Author

2 Co-Author

B. Openerp

An Open ERP system is formed from 3 main components:

➢ Database Layer (PostgreSQL)

Open ERP uses PostgreSQL as the default database for all its functionality. The PostgreSQL database server

contains all of the databases that contain all data and most elements of the Open ERP system configuration.

➢ Open ERP application server (Middle Layer)

The Open ERP application server contains all of the enterprise logic and ensures that Open ERP runs optimally. The Server itself is written in Python language. Open ERP application server is released under Aeffro GPL License.

➢ Client Layer

The web server, a separate application called the Open Object client-web, which enables connecting to Open ERP from standard web browsers and is not needed when system is connect using a GTK client. The client-web component can be thought of as a server or a client depending on the user's viewpoint. It acts as a web server to an end user connecting from a web browser, but it also acts as a client to the Open ERP application server just as a GTK application client does.

III. REAL TIME IMPLICATION OF ERP

Major Modules of ERP Software used at ICIMOD and Possible Health:

A. Major Modules of ERP Software – ICIMOD
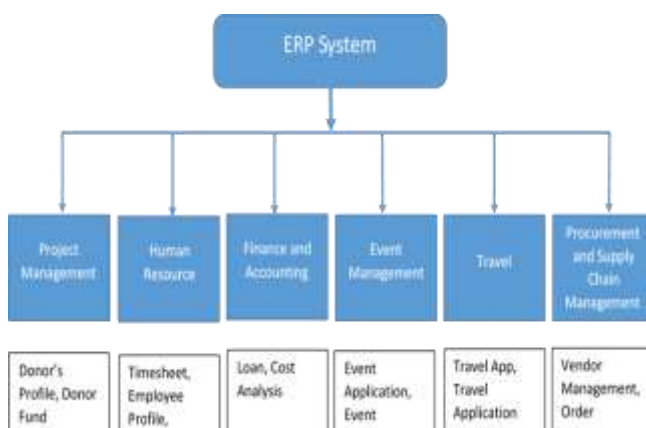
- Human Resources Module

Human resource management module capability will keep employee data in a secure manner, track timesheet, leave balance, process contract and also provide quick access to the employee's complete employment information.

- Finance and Accounting Module

A quality Enterprise Resource Planning software solution will include strong financial management module that is fully integrated with the organization's core functional areas of manufacturing and sales order management. In robust Enterprise Resource Planning systems, the transactional data generated from these departments will be available for immediate review. These capabilities offer full financial visibility into the organization's payables and receivables with up-to-date access to inventory level. This transparency will provide accounting personnel and the executive staff with real-time financial data that helps facilitate quick, yet highly informed organizational decisions.

- Event Management Module

Event management module keeps the tracking of in-house/out-house as well as in-country/out-country event details as well as facilitates staffs to claim the event expense form.

- Travel Application Module

Travel application module enables staffs to post their travel application as well as claim travel expense if needed through a managed integrated system.

- Procurement and Logistic Module

Procurement and Logistic Module smoothens the processing of order. The module is highly applicable in tracking vendor information, process purchase request and goods receipt note.

- Project Management Module

This module basically deals with donor's profile, funding and other activities related to corresponding cost centers.

B. Major Module of ERP Software – Possible Health
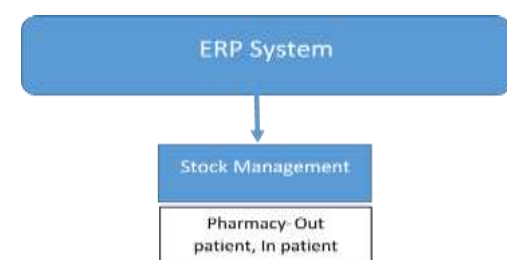
- Stock Management Module

  Central stocks are managed by the Openerp. When clinician prescribe medicine from Electronic health record system that request is parsed to the atom feed management and gets synced with the current stock available at the warehouse.

IV. COMPARATIVE ANALYSIS OF MICROSOFT DYNAMICS NAV AND OPENERP

A. NAV at ICIMOD

Broader Modules are available in NAV as per the organizational requirement. NAV is proprietary software of Microsoft which implies that Microsoft is liable for all the maintenances and the vendors are available for support, as per the current scenario in Nepal. ICIMOD users are more aware of Microsoft products and its technologies. NAV being windows OS dependent, implementation of it takes into account the dependencies with OS as well as other implications like users integration with active directory, etc. This also makes Microsoft Outlook integration, Jet Reports addition, SharePoint implementation possible with ERP system in the organization. Professional software support provides stronger documentation which is one of the major requirement at ICIMOD.

B. OpenERP at Possible Health

Single ERP modules along with supporting apps for different functions are used at Possible Health. Extension of the existing standard module is not of much importance of the organization. OpenERP is a community owned software and there's no partners working currently for OpenERP in Nepal which increases the dependencies for support. The implementation of ERP at Possible is so that not much of configuration as well as module enhancement is required to perform on daily basis. The organization uses Open Source technologies and the System Integrators/CTOs as well as the users are well aware of open source technologies like CentOS, etc., thus making OpenERP optimum in the current scenario

V. RESULTS AND DISCUSSION

OpenERP being platform independent software and Possible Health opting for open source software for the operations in the organization, this ERP solution has been able to perform to the optimum level since its implementations. It has so far been able to maintain the transparency and ease-of-use amongst around 50 ERP users. ICIMOD on the other hand where the users are well acquainted to windows operating system since the beginning, uses Microsoft Dynamics NAV for enterprise

resource planning purposes. The ease-of-configuration is higher with the frequent configuration requirement of the organization. Local Partner support and strong documentation makes NAV the best choice for ICIMOD where the number of user exceeds over 300 on a daily basis.

VI. CONCLUSION

Medium-sized companies like ICIMOD and Possible Health typically gain the optimum advantages with the implementation of ERP software as per the organizational needs. Whether we use open source development tools or proprietary tools, it requires custom development at some level. In order to implement ERP cost effectively and attain better efficiency in organizational processes, organization should study *the must have capabilities* and that *would be nice to have features*. Depending upon the cost implications, in-house efforts (availability of resources; both human and technological) and the ability to customize the product for streamlining the processes, an organization can opt for OpenERP or proprietary software.

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DNS DDoS Detection using Traffic analysis

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Abstract—**Denial of Service(DoS) is an eminent security threat to today's network infrastructure.With the advent of more and more network centric applications and our lives being more and more dependent on it for education, information, healthcare and others. With the advent of fastest networking services and high speed internet at the customer end as well as the presence of tools and information online, user with malicious intent or a group of computers controlled by such users are potential enough to launch denial of service attacks causing massive utilization of network bandwidth and computing resource on the path to the victim of the attack. Major trends seen in the DNS DDoS attacks is the flooding attack where a host is flooded with large amount of DNS replies which it never requested courtesy of the UDP protocol which supports the source address spoofing. Major part of the is attack is the amplification of the 512 byte packet size to a packet way much more larger than the requesting packet being delivered to the victim using the open resolver as an amplifier.The paper tries to predict the attack projection based on parameters collected from the data of such attacks and tries to devise the parameters which can predict the DNS DDoS attacks at an early stage. This approach will be able to detect DNS amplification attacks earlier so that the mitigation measures can be in place for the proper defence of these attacks.**

I. INTRODUCTION

DNS Distributed Denial of Service(DDoS) is an eminent security threat to today's network infrastructure where name resolution is an essential part of looking up resources in the internet.With the advent of more and more network centric applications and services and our lives being more and more dependent on it for education, information, healthcare, safety, surveillance and others. With the advent of fastest networking services and high speed internet at the customer end as well as the presence of tools and information online users with malicious intents, group of hackers who own a zombie network and some experimentalists working with pre written code are potential enough to launch denial of service attacks. with the presence of the networks more and more users and misconfigured devices or device configured poorly form the security perspective being connected to the internet can cause a collaborative effort to launch distributed denial of service attacks, which is basically a form of attack where the victim is flooded with a huge number of requests targeted towards it. DNS (Domain Name Server) is a crucial hierarchical network infrastructure translating the domain names into IP address and vice versa. With people being more and more used devices and services being usable as a part of our normal lives it is becoming more easy and comfortable to remember the names

rather than remembering numbers. DNS is a major crucial infrastructure that can be targeted to be used towards the users by the people having malicious intent in the internet.Hackers or collective group of individuals for social, economic and other reasons can target the end user(victim) using the essential infrastructure i.e DNS it uses to communicate with the rest of the world with large amount of requests which wastes the effective network bandwidth in the path as well as the processing resources.

Major trends seen in the DNS DDoS attacks is the flooding attack where a host is flooded with large amount of dns requests which it never requested courtesy of the UDP protocol which supports the source address spoofing. Major part of the is attack is the amplification of the 512 byte packet size to a packet way much more larger than the requesting packet which is achieved using the open resolver as the amplifier to increase the amount of impact that can be created on the targeted victim. As DNS is hierarchical infrastructure with supports name to ip address lookup for clients. A DNS servers that looks up for names on to the higher level of hierarchy on behalf of its client is called a resolver. A resolver may perform iterative as well as recursive lookups. An open resolver is a DNS server which does recursive lookup to clients outside of its domain, which pose a significant form of threats to the global network infrastructure by answering recursive queries to hosts outside of its domain.DNS DDoS attacks upon SpamHaus [1] and Cloudflare [2] are the attacks where the form of attack has shown their powers.

With human life being more and more attached to internet for home safety,safety of lives,health care and others management the internet infrastructure cannot afford to have the downtime which may cause loss of lives as well so the protection of the crucial infrastructure against these attacks is a major research challenge these days. The detection mechanism can also be deployed at sources, intermediate networks destination or a combination of them [3]. This papers tries to detect the DNS amplification attacks at the destination with the analysis of traffic which triggers alarm to work on the preventive measures to mitigate these attacks.

The paper tries to predict the attack projection based on parameters collected from the previous data namely inter arrival time of packets, amplification factor and the rate of arrival of these packets. This approach will be able to detect dns amplification attacks earlier so that the mitigation measures can be in place

for the proper defense of these attacks.

The mitigation mechanism at the host end can be packet marking and filtering [3] and History-based IP filtering [3].

II. Proposed Approach

DNS DDoS Detection is very important in order to detect the attacks and make the defensive mechanism available on the appropriate time so as to stop escalating of the unwanted traffic processing at the victim and the clogging of the bandwidth in the path to the victim.The approach tries to detect DNS DDoS looking into the responses that is the attack traffic targeted towards the victim. The request traffic is not taken into the consideration and because the approach looks into detection form the victim's end. The source spoofed traffic is the only traffic available at the victim end along with the legitimate traffic asking for other resources at the victim end. The target of the approach is the detection of the anomalous flows and the defense mechanism in place to stop the anomalous traffic and service the legitimate traffic separating them from the anomalous traffic.

The processing starts with the detection of the traffic flows targeted towards the victim basically DNS traffic. A network flow is defined as an unidirectional sequence of packets with some common properties that pass through a network device, i.e IP addresses, protocols and ports [4].The malicious traffic are grouped using the traffic flow looking into the source port of the response that are targeted towards the victim which are being fed from the open resolver as a spoofed traffic that are forged to be requested from the victim. The criteria for the classification into flows can be classified on the basis of source address and source port hitting into the victim and the type of the response being received ANY,MX,TXT,AAAA or other records. A one level of classification is done based on the source port of the response i.e 53 UDP port and the type of response being received.

In the second the arrival times of the responses is being looked into. The inter arrival times of the responses i.e the consecutive time difference between the arrival times of the packets is analysed to detect that either is a slow version the DNS DDoS attacks or a faster or flash forms of attacks requiring immediate attention.For attacks representing the flash form immediate attention is required and for the slow forms of attacks the time difference between the arrival of packets needs to be considered in order to find the correlation between the packets of the flows and declare it DNS DDoS flows and to trigger alarms to stop processing of the packets.

Thirdly for the flash flows the rate of arrival of the packets is checked. The arrival of the packets in the flow per minute or the sampling time is calculated to determine and declare it as DNS DDoS and trigger defensive mechanism at place to to stop the anomalous flows.In case of slow DNS DDoS attacks the standard deviation of the packet of

these flows could provide an indication either these flows are abusing the victim resources with lesser amount of DNS DDoS traffic.

A. Thresholds

One of the important aspect of the detection mechanism is the development of the Thresholds used to
1) classify the traffic into the anomalous flow and differentiate it from the legitimate traffic.
2) set a limit into number of queries into then as to classify it as anomalous flows and create different groups of anomalous traffic
3) devise threshold for the time difference between the consecutive packets to differentiate between them as slow and fast form of DNS DDoS Attacks
4) The rate of arrival threshold is used to declare the flash form of DNS DDoS and to trigger the alarm for defense mechanism in palace.
5) The threshold standard deviation to look into the slow DNS DDoS attacks and trigger alarms for the defense mechanism.

III. Validation

The validation can be done testing using the developed threshold against realtime data feed and comparing the DNS DDoS detected against the intrusion detection system. The detection rates can be compared against the intrusion detection and insight into the developed threshold can be determined.

IV. Acknowledgements

I would like to thank everyone who helped to conceive the idea of DNS DDoS Amplification Detection using traffic analysis.

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Edulaya: ICT for Knowledge Sharing and Management to Uplift the Educational Status in Rural Areas of Nepal

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ABSTRACT

Education is the process of acquiring knowledge and skills that can develop the power of reasoning and judgment. Information and Communication Technology (ICT) can be used as a technique for knowledge sharing and management by empowering teachers and students to communicate differently from the conventional classrooms that required physical presence of both the parties. Development in technology has brought changes to the traditional approach of teaching-learning and contributed to a wider reach of educational infrastructures. It certainly can be used improve the quality of education especially in a geographically challenged country like Nepal. Students all over the world have had sheer benefit with the dynamic leap in educational methods through the introduction of ICT. Contradicting the fact, it is a different case in most of the rural areas of Nepal where students are still struggling to get adequately qualified teachers. It is because in most cases, skilled and adequate human resource tends to hesitate to work in such places because of the challenges such places offer. Thus, the students living there are obviously lagging behind in comparison to the ones in urban areas. It is one of the primary reasons why educational field in Nepal requires a bold platform to minimize this gap.

The recent development in the field of communication infrastructures has given a mere hope to uplift the educational status of Nepal. Edulaya, therefore aims to bridge between the students with skilled teachers especially in rural areas. Besides, it is also applicable in whichever field possible.

Keywords: Edulaya, distance education, information and communication technology, ICT, education in Nepal, interactive learning, knowledge sharing.

I. INTRODUCTION

Imagine the smiles in the faces of students of Jumla, when they can get to interact with one of the best-in-class teachers from Kathmandu at real time. Imagine the differences that can be made if students of such geographically challenged area receive a daily session like that for at least an hour a day. And, imagine the growth and the overall prosperity in the educational field of Nepal. Well, Edulaya can be possible platform which can really make this happen.

BACKGROUND

Nepal has a lot more to develop even in basic infrastructures like electricity, roadways and telecommunication. Development in the field of education requires sheer development in infrastructures as well. Considering the fact that most of other countries have already implemented internet based teaching-learning strategies, Nepal still lags behind. Nepal's educational system is primarily based on the conventional chalkboard method where both students and teachers require being physically present.

A popular definition of distance education from back to 1990 says it makes the use of two-way electronic communication as a central tenant. It can also be said that most of all current distance courses, those are being extended to the world's remote areas, make the use of information and communications technology into their implementation. Therefore, it is now a common platform for college students to interact with their professors via email or internet-based course management software from the outside of the campus. Students who attended university in the last ten years are likely to have received a CD-ROM accompaniment to at least one of their text books [1].

Although it has been some time that the Government of Nepal realized the importance of ICT and therefore has prioritized "Development of ICT". Nepal wants to implement knowledge sharing for the production of good human resource as well as in building knowledge-based society. This can be as a tool to bridge the gap between the people living in remote areas and major cities [2].

EDUCATIONAL STATUS OF NEPAL

According to a recent census of 2011 A.D, around 57.4% of the total population of Nepal is literate and the rate is ever growing. But according to UNESCO, the condition in rural areas is different than expected. Statistically, urban areas have recorded a literacy rate of 73 per cent, but only reaching 43 per cent on average in rural areas [3]. From the numbers, it can clearly be judged how students of remote places are being educated and hence the disparities. Therefore, together with the cooperation from every possible group and individual, the goal set by Nepalese Government to decentralize educational infrastructures and differences by using ICT can be achieved.

EXISTING DISTANCE EDUCATION PROJECTS IN THE WORLD

Distance learning solutions and online educational tools are rapidly growing in popularity and effectiveness with teachers, colleges and university-level programs worldwide. One recent survey estimated that at least one in five undergraduates has participated in at least one "distance education" course as part of their studies, and many middle, high and even elementary school teachers have begun using some form of distance learning in the classroom. Some of the most popular distant learning applications prevailing are Adobe Connect, Blackboard, Canvas, Coursera, edX and Schoology [4].

Today the concept of distance education is fairly well-understood, and the potential importance of distance education in the future of education is also generally acknowledged. There are a number of virtual universities. The University of Phoenix (http://www.phoenix.edu) and Athabasca University (http://www.athabascau.ca) are two of the largest virtual universities in the USA and Canada, respectively. Athabasca University is supported by the Canadian government. More than 77,000 students are enrolled in 2003. Virtual universities allow students to take advantage of the flexibility in time and location. Students who are employed on a full-time basis are able to complete higher level education without jeopardizing their jobs. Software systems and student evaluation methods in virtual universities are similar to those used in traditional universities [5].

USE OF ICT IN EDUCATION OF NEPAL

Nepal can currently be placed among countries like Liberia, Ethiopia, Somalia, etc. in terms of technology. The major force holding Nepal down is the lack of electricity, followed by unstable government, lack of exposure, awareness and simply ignorance. Even though the current state of ICT in Nepal isn't acceptable, there have been some promises for the bright future [6].

The first ever use of ICT in teacher training and distance education in Nepal was initiated with radio based distance education in 1980. Its focus was to enhance the professional capabilities of under SLC in service teachers. Later on, in 1993, as per the Government policy, every primary was supposed to undergo 10 month training. When Teacher Training Project was implemented in 2002 multimedia centers were constructed in Educational Training Centers with a focus on based teacher education system [7].

Some of the pioneer organizations have surely tried to implement ICT in the field of education in Nepal. Most of them being educational organizations such as Kathmandu University, projects including UNESCO CD-ROM resources, Computer Assisted Language Learning (CALL), Computer Applications in Mathematics Teaching (CAMT) and some of the M.Phil and M.Ed courses have been enrolled in the earliest of this decade. Ministry of Education, Nepal had proposed a 5 year master plan to improve classroom delivery, access to learning materials and improve effectiveness and efficiency of overall educational governance and management. However, the progress of the plan hasn't yet been published [8].

National projects related to ICT and education is very hard to see in Nepal. However, some of the projects that were launched as an initiation from non-governmental organizations are Open Learning Exchange (OLE – Nepal), OLPC (One Laptop per Child), Nepal Wireless Networking Project (NWNP).

Considering all these facts, ICT in knowledge sharing

and distance education hasn't really prospered in Nepal while the country is still dealing with improving infrastructures development for ICT.

II. PROPOSED SOLUTION

Geographical barrier is one of the prime reasons for the imbalance in educational status of people living in different parts of Nepal. This imbalance has also negative effect in the development progress of the country as education is a vital infrastructure for development. The easiest solution to address this problem is the use of ICT in education to ensure that all students have access to good educational resources like well-qualified teachers, interactive learning process and books.
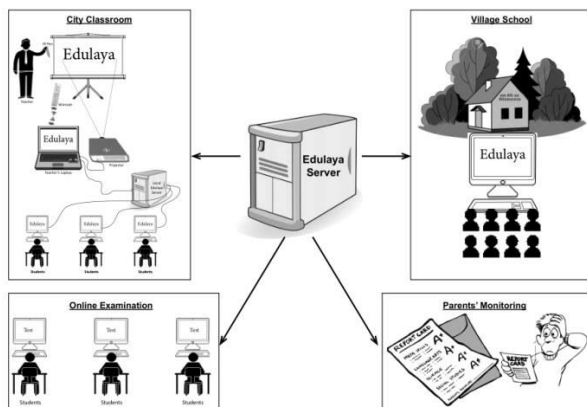

Figure 1: Proposed implementation model for Edulaya

USING ICT AS A SOLUTION IN NEPAL

ICT is a key to better education. It is indeed a powerful tool to sabotage the geographical barriers that exists in developing countries like Nepal. Increasing competition in the world and declining educational status in rural areas of developing countries is creating a larger gap every day and the best way to deal it with it is the use of ICT in education. The system therefore requires ICT as a backbone as it can connect the teachers and interested students of different locations to a same platform where they can freely share knowledge and information regardless of their geographical regions. Virtual classrooms can be created with the use of ICT to carry out distance education to associate the well-qualified teachers to a common educational platform which can be accessed by all students. Students can then be able to receive more information and have vast knowledge on many subjects which might not be available in their regular classes at school.

REAL-TIME DISTANCE LEARNING

This is an unfamiliar term in the context of Nepal as there are hardly few projects which are being run using this technology. Real-time distance learning allows the virtual classes to be run at real time. In most cases, a teacher creates a video and puts it on internet with few assignments which are viewed by the students. However, in this system, the teacher and student can actually communicate in real-time as if they are attending a same physical classroom. It does not involve the complete video of a teacher delivering the lecture as it requires more bandwidth which is not feasible in Nepal. It therefore streams the content of the whiteboard on which the teacher is writing to all the computers connected to it at real time. In addition, it also streams the audio of the teacher so that it gives the classroom effect where a teacher is teaching by writing on the board. The audio streaming and whiteboard streaming should be enabled in teachers' accounts only in order to avoid confusions among students. To make the real time distance learning cost-effective, technologies like Wii mote whiteboard should be integrated. Since only teachers audio is streamed, there should be some way where the student can interact with the teacher to put forward queries and have intense discussions. The system should thus include a chat system as well so that the student can interact with the teacher and ask him questions. The teacher can furthermore save the content of the whiteboard in the gallery as an image which will act as class notes to the students who might need them for future references.

ONLINE EXAMINATIONS AND PROGRESS REPORTS

Education is never complete with just a teacher imparting knowledge from one side. It is a two-way process and students should be able to acquire the imparted knowledge and try to implement them in their lives. The easiest way to ensure that the students have actually understood what has been taught is taking examinations. Holding examinations is quite easy if it is in physical classrooms but it is different in the case of virtual classrooms. Another important aspect of Edulaya would therefore be some practical approach of online examinations. On the basis of what was taught, students can be examined in between class periods to better understand their progress. It is quite understood how online examinations are difficult to implement in

comparison to the conventional examinations. Thus, this feature can be implemented in a very basic way at first for the convenience of system stakeholders.

The teachers can keep assignments and set questions for tests while the students can submit their assignments and take online examinations. The assignments and examinations is cheked by the teacher and progress report can be created on the basis of the assignments that has been submitted and the score of the students in the tests. The system should send progress reports of the students to the parents as well so that they are updated about their child's progress. The primary motive of the application here is to monitor the progress of students. It can also be possible to involve respective parents thereafter.

III. PROPOSED METHODS FOR SYSTEM IMPLEMENTATION

Higher education institutions offering distance education programs have increased significantly in the last two decades. Thus, most countries have experienced a growth in distance education for the purpose of knowledge sharing and management. The rapid growth of technology in the field of education has also outpaced the research on practice and designs. One established distance education researcher noted that "Because technologies as delivery systems have been so crucial to the growth of distance education, research has reflected rather than driven practice." This form of teaching has evolved from a specialized form of education to "an important concept in mainstream education [1]."

Edulaya can be a system that comprises of a set of processes or collection of systems that have been designed earlier so that the cost for using the system remains minimal. This system basically requires four main users: teachers, students, parents and educational institute. However, it is not just limited to teaching-learning process at educational institutes only. It can also be extensively used in other fields like medicine and business to share information and discuss various issues in a group even if the team members are not physically present in the same room. The educational institutes incorporate all the required infrastructures, the teacher delivers lecture while the students living in absolutely different geographical regions attend the lectures at real time through this system and the parents have the privilege to monitor
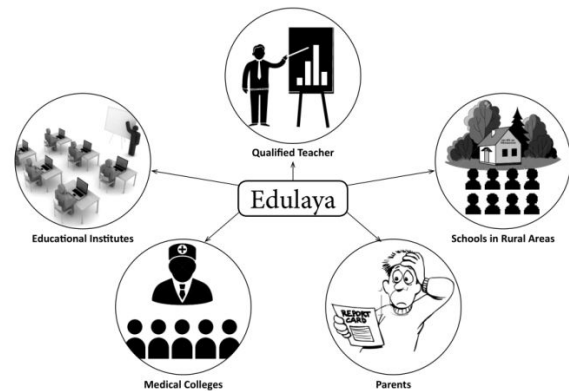
their child's overall progress.

Figure 2: Stakeholders of Edulaya

Based on the experiment results, a low cost interactive whiteboard along with the capabilities of the Wii mote is feasible for development and can provide a practical solution in terms of usage in a classroom setting. The Low Cost Interactive Whiteboard software can be utilized using the two interaction methods which can be done using an IR Pen: pointing and pressing [9]. According to the cognitive theory of multimedia learning, learning is an active process of filtering, selection, organization and integration of information. The processing of information can take place in two separate channels: the auditory and visual channels, both with limited capacity. If information is presented in both auditory and visual form, the capacities can be used most effectively, which leads to deeper learning [10].

WII MOTE WHITEBOARD

The first component of Edulaya would be an interactive whiteboard system, which is made by arranging the devices like an Infrared LED marker, a projector which projects the full-option canvas for the teacher on a whiteboard and a Wii-mote, which is a wireless game console device from Nintendo Wii. It is also popular as Nintendo Wii-Remote and has been implemented in many parts of the world due to its easy availability and cost-effectiveness. It basically focuses on making use of Wii-mote, or Wii-remote and IR LED pens in order to support teaching-learning process more interactive. The IR LEDs array radiates an IR field in front of the setup, while the IR sensor of the Wii-moteis placed behind the array. This enables the sensing area of Wii-mote's sensor to be more enhanced by the strength of the emitter diodes in the IR LED array [11]. The main objective

of designing an interactive whiteboard application is to apply more multimedia concept to support effective learning environment in classroom.

The teacher would be allowed to write, draw, erase, highlight, draw shapes, record audio and video, take snapshots, change the text color and brush sizes as well as save the canvas as an image in the gallery so that the students can view it for future purposes. These types of system are a cheaper alternative for interactive teaching and learning process. This system can actually replace the function of ink-marker. In addition, image capturing and video recording can help students to review teaching materials at home or after-class session [12].

LIVE WHITEBOARD STREAMING

Considering teachers as the only user in the uppermost hierarchy, whatever the teachers write onto the whiteboard canvas should be streamed to all online students. The other users of the system, students of the same classroom or in completely different geographical region can view the content of the whiteboard at real time. The content of the whiteboard as well as the audio is sent to the Edulaya server from where they are broadcasted at real time to all the students who are logged into the system.
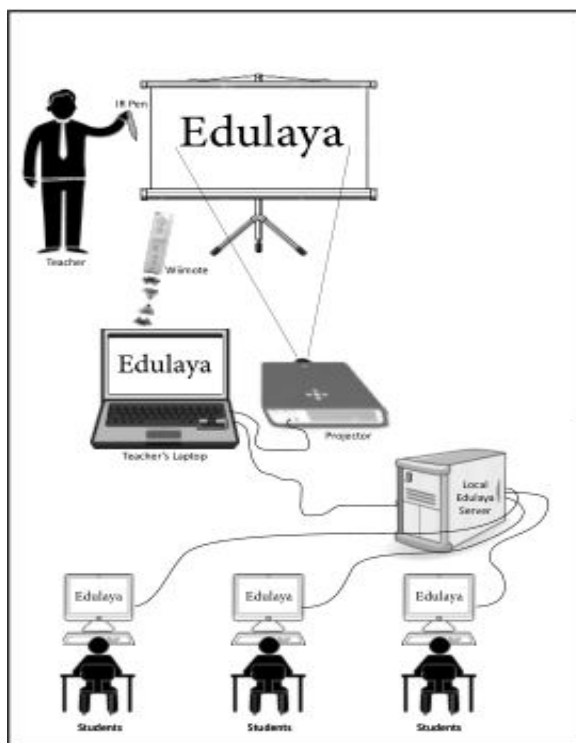

Figure 3: Proposed working model of Edulaya

IV. APPLICATION MANAGEMENT

The ability to allow real-time communication only isn't enough to implement any kind of application similar to Edulaya in a practical scale. Efficient data management is very essential as well to support the core functioning of the application.

Any classroom where students cannot take notes is worth nothing. It is obvious that students will compulsorily refer to notes and resources at various stages. Therefore, Edulaya can pack a bunch of gallery resources that can store multiple screen shots of the white board content throughout the class period. The platform can also be programmed to store sequence of videos depicting the activities that took place in the canvas (white board). A teacher can store important canvas content in the form of image which can be reviewed later by the students. Similarly students can also experience a playback of a live classroom session synchronized with fluent audio clips. Besides all the white board content and synchronized audio, other resources such as digital documents, audio-video clips, images and links can be appended accordingly. These additional resources tend to complete the classroom activities after a regular session of knowledge sharing is completed. The concept here is to make such resources available in many different types for the convenience of the students. The students will be able to effortlessly download such content whenever required.

A web application generally needs typical administrator who handles all the management of content, users and policies. An administrator in Edulaya can manage users, gallery content and authenticate new sign ups. The administrator maintains a close relationship with the system by sending and receiving notifications from various means. The methods that an administrator can interact with Edulaya can be periodically updated throughout the life of the application upon requirements.

V. CONCLUSION

ICT at current scenario is a strong tool to uplift the educational status of Nepal. With the use ICT in education, it not only improves the quality of education but also sows and nourishes the interest in technology in the minds of young students. This paper has been made as a proposal to solve the educational barriers in the rural areas of Nepal. It addresses those problems by implementing distance

learning from which well-skilled teachers of urban areas can teach the children in the rural areas so that the students of rural areas get equal opportunity to quality education as those of the cities. It involves an interactive whiteboard that does not need board markers, duster and ink refills and its feature can be extended by live streaming its data to all the computers of the students. It can provide a panel large touch screen that can be served as a regular whiteboard which can be controlled by touching the surface panel by using an IR pen. This technology therefore allows the users to write or draw directly on the surface and save it to the computer. The main motive is to make a cost effective educational medium so that more educational institutes adopt it and implement it.

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e-Education: Components and Models of ICT in Education in Nepal with Knowledge Management

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ABSTRACT

Education is one of the prerequisites of development. It is the basis for the development in the modern world. Information and Communication Technologies (ICT) has an important role in formal and non-formal settings, in programs provided by governmental agencies, public and private educational institutions. The extent of such programs is not impactful in the context of Nepal, mainly because technology has not been able to penetrate the geographic rurality. Compared to the rest of the world, Nepal still faces the lack of proper tools and technologies that could help the education sector prosper. This problem is more prevalent in the rural areas of Nepal where the digital divide is highly noticeable.

Developing a better educational ecosystem using available technology is the challenge that we face today. One of the many ways to tackle this obstacle is to design a rigid internetwork of computer networks for educational institutions in a way that can allow bigger institutions to help smaller ones. For doing so, existing technologies and networks are to be studied and better alternatives are to be chosen. With such internetwork as the base for the ecosystem, digital knowledge management systems are to be implemented by educational institutions in collaboration with the government and non-government agencies for the ecosystem of ICT-based education to be impactful. Such an ecosystem will allow course materials to be easily disseminated throughout the country thus improving the teaching and learning experience.

This study gives two models of ICT-based education that can be implemented in the context of Nepal. The models describe the various components of ICT-based education, stakeholders and the interaction between them.

Keywords: Network Connectivity, Digital Ecosystem, Interworking, Educational Networks, Knowledge Sharing Systems.

1. INTRODUCTION

Providing citizens with quality education is becoming more and more important with globalization. Along with it has increased the dominance of information, knowledge, and digital technologies in all economies [1]. Like any other field, the field of education is not spared by the effects of ICT. This is evident from the changing practices in the process of teaching, learning and research [2]. The incorporation of ICT in education is justifiable because of the continuous transformations brought upon by the digital era [3]. ICT's have the capability to increase the quality of education by providing curricular support to the students and teachers [2]. Use of ICT in education not only increases the quality of education, it also makes the students skilled in ICT, which in today's world is a must for almost any kind of employment.

Like any other economy in the world, the effects of ICT has also affected Nepal. Nepal is one of the developing economies in Southeast Asia. The changes brought upon by ICT in the global context has also influenced the education system of Nepal. According to the "ICT in Education Master Plan 2011-2017" ICT has been introduced as a subject and as a tool for instruction in school education by the Government of Nepal, Ministry of Education, through National Curriculum Framework (NFC) [4]. Although, plans and policies have been made, there seems to be an increasing gap between the haves and have not's which has created the need for the education systems to focus on enforcing rural education with ICT. There is an equally strong agreement that unequal access to such knowledge sharing infrastructures is dangerous, and the increment in the gap is accelerating [1].

Nepal is among the developing nations of Asia where the effect of digital divide seems significant. While the densely populated Kathmandu Valley and few other cities around the country enjoy the ICT infrastructures, there are still places which is almost cut off from all kinds of development infrastructures. Even the most required infrastructures of transportation, education and

health remain distant from these places [5]. Hence, the issue of connectivity is one of the main concern when it comes to implementing ICT-based Education in Nepal.

2. PRESENT SCENARIO OF ICT IN EDUCATION

There has be an exponential growth of ICT & ITES industry worldwide in the recent times. The ICT industry of the developing nations is a fast growing industry. The annual growth in production, offshore outsourcing, domestic market share, export and investment clearly approve of this [7]. As a result, the ICT industry requires a large number of well-qualified and well-trained ICT professionals of all categories. However, there has been an increasing gap between the demand and supply of such manpower that currently exists. In order to narrow down such a gap, ICT education & training system needs to play a crucial role [6]. Though initiations have been made by both governmental stakeholders and non-governmental agencies, such a system suffers from many issues such as insufficient investment by the concerned stakeholders and shortage of competent manpower. Little collaboration between academics and user-industries, infrequent up-gradation of course-curriculum, focus on mass higher education with less consideration to quality are some other reasons for the increasing gap [7]. Any plans and projects that have been created and put forward seem to have mostly remained on papers only and not implemented.

In policy making, the Government of Nepal has issued an ICT in Education Master Plan (2011-2017) [4] which strategizes the use of Information and Communication Technologies (ICT) in education to achieve the broader goals of education. The other polices such as the IT Policy (2067), SRRP (2009-2015) and Three Year Plan (2011-1013) of the Government have included some policies and strategies to integrate ICT in education as a tool. The master plan solidifies these older policies.

Besides the efforts of the government, there are other stakeholders (individuals and organizations) whose endeavors have induced the growth of ICT implementation for education. Efforts by NREN [8], OLE Nepal [9], Mahabir Pun and other researchers have helped in the actualization of ICT-based education in Nepal. NREN is a non-profit organization which is active in building research and education networks [8]. OLE Nepal is another such organization which has been dedicated to enhancing the quality of education and its access via ICT [9]. OLE Nepal is also involved in creating E-learning systems such as E-Paath and E-Pustakalaya [9], thus contributing in development and curation of digital content. Mahabir Pun through his initiative of Wireless Nepal, has been connecting rural Nepal to the global network and has made a considerable contribution to rural telecommunication [10].

3. THE COMPONENTS AND STAKEHOLDERS OF ICT-BASED EDUCATION

Connectivity to the global network brings the rural community nearer towards prosperity. But, just connectivity is not sufficient because there is always a need of some way to channelize the right information for the right audience. One of such ways to channelize the information is through Knowledge Management Systems.

This study aims at finding the possible models of ICT-based education in the context of Nepal, of which the network infrastructures and knowledge management systems are two integral components. A Web-based platform for the digital aspects of courses of study, usually within educational institutions, normally known as E-learning system [11] can be taken as an instance of a Knowledge Management System. Such a system can be used to disseminate study materials (Digital Content) which is another important component of ICT-based Education. Educating the people, especially in the rural areas of Nepal, faces the problem of tedious geography as well lack of trained manpower. Thus, teacher training becomes another important part of ICT-based Education.

Investments for connecting the rural areas of Nepal to the global network, implementing Knowledge Management Systems for education with the collaboration to the government or non-government agencies will not only increase the quality of education but also the standard of living. Local people with general education can be trained to operate these systems and thus educate the younger ones while the experts can send information and teach them through the E-Learning Systems. This implies that local community and its direct and indirect involvement also plays a huge role in the implementation of ICT-based Education.

The basic components of ICT-based Education that can be derived from the above discussion are:

    a. ICT and Network Infrastructures
    b. Digital Content and Knowledge Management Systems
    c. Local Community
    d. Skilled Human Resource

These components and their interaction can be shown diagrammatically as follows:
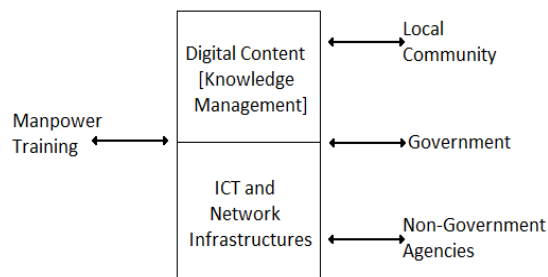
Figure 1: Components of ICT based Education

4. ICT AND NETWORK INFRASTRUCTURES IN NEPAL

The infrastructure is the base for the actualization of ICT-based education. The infrastructures include computers, software and most importantly the network infrastructures. Schools in Nepal are not ready for achieving ICT-based education. Schools in most of the rural areas of the country hardly even have one computer. Infrastructures such as display devices, IP telephony, mobile devices (laptops, tablets, notebooks, etc.), servers, printers, and so on are hardly used in schools of the rural areas of the country. There are projects that are penetrating these untouched areas and supplying ICT infrastructures, building computer labs, and providing digital learning materials.

In the context of Nepal, due to the tedious geographic conditions and the increasing digital divide, connectivity has been a huge issue in implementing ICT in education. There are many different kinds of network structures that are implemented around the world specifically for the purpose of education.

Many educational institutions around the world implement various kinds of networks. For instance, BYOD (Bring your own device) [12] is a popular concept in developed countries where students and teachers go to school with their own devices. The students can connect to the school or teachers and vice versa via the internet. Such a concept for implementation in Nepal would require a lot of funds and practically not possible as students can afford devices on their own. Another core network concept that educational institutions use is the Unified School Network Infrastructure [13] which implements concepts such as modularity, hierarchy, resiliency and flexibility. This is based upon Cisco's Schools Service Ready Architecture. Such networks are also too expensive for most of the schools throughout the country.

A possible solution would be to connect schools in such a way that they can be supported (in terms of network infrastructures) by other schools or agencies. For example, a schools can be connected to a central district network through which the school is given access to the internet.

5. DIGITAL CONTENT AND KNOWLEDGE MANAGEMENT SYSTEMS

Digital content is an important component of ICT-based Education. The study materials are digitized in order to disseminate to the students. The whole concept of ICT-based education, in a way, revolved around digital content. When we talk about digital content, the study materials are not just text and pictures but include audio, visuals, and other forms of multimedia on an interactive platform. Such platforms are basically known as E-Learning systems. E-learning systems are in some ways a form of Knowledge Management System. However, by the definition of Knowledge Management Systems, "Knowledge management systems refer to any kind of IT system that stores and retrieves knowledge, improves collaboration, locates knowledge sources, mines repositories for hidden knowledge, captures and uses knowledge, or in some other way enhances the process of Knowledge Management [14]." E-learning systems can integrate these concepts in order to deliver a more sophisticated functionality.

E-Learning Systems are a new concept in most parts of the country. E-Learning systems use technology as the mediating interface between the learner, the content and the instructor or teacher where technology refers to a combination of hardware and software [11]. But with concepts of these systems, comes the requirements of good network connectivity and internet. The digital divide that is prevalent in most rural areas of Nepal will be a factor of hindrance to the digital age of learning.

There are many different types of open source knowledge management systems that can be used for the process of teaching and learning. Learning Management systems can be considered to be a Knowledge Management Systems to some extent. Some popular Learning Management Systems are Moodle, Sakai, aTutor, eFront, OLAT, etc [15]. The main goal of these systems is to disseminate the digital content to the students and provide a platform of interaction between teachers and students.

6. LOCAL STAKEHOLDERS AND SKILLED HUMAN RESOURCE

Local stakeholders in ICT-based education include the local community that is directly or indirectly affected by it [9]. The community around schools and institutions implementing ICT in education, the parents of the

students, support staff, technical staff and so on are some instances of local stakeholders. When ICT is implemented in education, the process of implementation brings about the need for investment, both financial and non-financial [4]. This creates job opportunities as well which benefits the local community. For example, local people can be trained to become technical staff in the schools that use ICT in education. Local community is also responsible to a great extent for the sustainability of the implemented systems [4]. Thus, involvement of the local community and its support is necessary for sustainable implementation of ICT-based education.

One of the many important steps in the implementation of ICT in education is to produce skilled human resources to run the systems. Skilled human resources are required so that the systems can be used properly and can be used in the most effective ways. The process of producing skilled human resources does not end with just training the technical staff. Teachers must also be trained. The teachers who are been used to the traditional method of teaching in the classroom need to be given training so that they can use the ICT tools that have been set up in their teaching process [16]. A further step of training the teachers would be to teach them to produce digital teaching materials and to share among themselves through the knowledge management systems. Training teachers and a set of technical staff, thus make an integral part of ICT-based education.

7. PROPOSED MODELS FOR ICT-BASED EDUCATION

Based on the above discussion, it can be deduced that the model for ICT-based Education needs to incorporate the fundamental components and the stakeholders and bind them using ICT. In the context of Nepal, a single institution or a single organization is not capable of implementing ICT-based education throughout the country. Institutions, organizations and agencies must team up and collaborate with each other to be able to gain the best out of ICT's implementation in the field of education. The concept of collaboration and support should be the integral part of the models.

Two models are proposed in this study that explain how ICT-based education can be implemented and actualized in Nepal with collaboration between institutions, organizations, agencies and stakeholders. The two models have been differentiated with respect to the direct involvement of the agencies of the Government of Nepal. The two models have been described as follows.
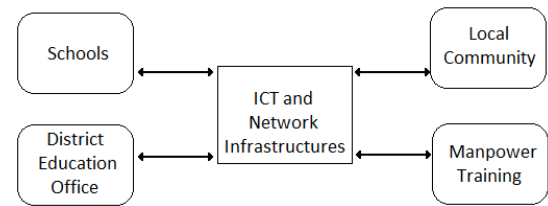
1. Government supported ICT-Based Education

Figure 2: Model 1 for ICT-Based Education

The first model as shown in figure 2, shows the direct involved of the Government. Here, the District Education Office (DEO) is part of the model. According to this model, schools and educational institutions (represented by Schools in the figure) are connected in a network with the DEO. The DEO acts as the resource center for the schools. The DEO provides both infrastructural resources and digital content to the schools connected to the network. This framework allows schools access internet via the DEO. In this framework, the digital content is disseminated to the schools via a central location which is the DEO itself.

The model also show local community as stakeholders who will be directly and indirectly affected by the implementation of ICT in education. Manpower training is another aspect depicted in the figure. The teachers and local manpower need to be trained in order to achieve the best out of ICT-based education.

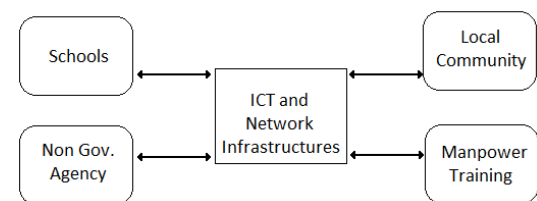2. Non-Government Agencies supported ICT-Based Education

Figure 3: Model 2 for ICT-Based Education

The second model as shown in figure 3 depicts the direct involvement of non-government agencies. Non-government agencies could be International Non-Government Organizations (INGOs), Non-Government Organizations (NGOs), Schools or other agencies. For instance, the role played by the DEO in model 1 can be replaced by a University or an INGO. Model 2 maintains the concepts of collaboration and support and at the same time makes ICT-based education independent of Government interference. This model also incorporates manpower training and local community support which is similar to the first model.

8. CONCLUSION

The learning revolution is still in its infancy. Right now, organizations have to create everything from scratch when it comes to using technology in education. In the future, they will be able to buy generic or pre-packaged software for the process of teaching and learning. The world is seeing a drastic change in the matter of ICT-use in Education. Implementation of ICT in education seems to be making progress in Nepal as well. There are multiple ways in which the implementation and actualization of ICT in education can be approached. The core concept brought about in this study reveals the need of collaborative effort among institutions and agencies to support each other in the process of implementation of ICT. The involvement of local stakeholders and training of manpower, involvement of government or non-government agencies are also very important in the implementation of ICT in education. Finally, it can be concluded that ICT in education needs both infrastructures wise and content wise improvement which can be achieved in a collaborative effort among the institutions and agencies.

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"Flipped Classes: New e-learning Object in Nepal and Perspective of Teachers."

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Abstract

Flipped classroom is a new teaching method for traditional classes which makes the instructional materials available online to the students. Flipped classroom model is gaining popularity among K to 12 schools of various developed countries and is also rapidly drawing attention of teachers, students, parents and school administrations. This is also known as an inverted classroom or reverse instructions, a simple method to flip the things done inside classroom with the things done at home, by incorporating technology. In this flipped model of teaching, teachers prepare video lectures for various lessons and deliver it among their group of students through internet or other modes of delivery, outside the class. This methodology frees up classroom time and has been abundantly practiced in developed countries. In face of this situation, and being a new practice in Nepal, there are obvious challenges and different perceptions of teachers on it. The purpose of this study was to examine the perception of teachers on using flipped course delivery method, using internet technology as a supporting tool, in addition to the traditional method. For this, a survey was conducted among teachers of a school who are preparing flipped class videos. Teachers were found to be highly motivated toward the flipped class model. Despite of different challenges such as using new technology, camera phobia and others, teachers were seen ready to face the challenges and adopt new teaching methodology. They also percept that the students will be benefitted by the practice.

Keywords: Flipped class, e-learning objects, internet, and perspective of teachers.

1. Introduction

Flipped class is a new approach to learning today where a classroom is not teacher centric. In flipped model, a typical classroom lecture setting is replaced with the homework setting and vice versa. Flipped class basically implies a method of distributing pre-class materials to students, using available technology, such that students have insight of what the following day's lecture or class will be about. The materials provided may include lecture videos, case studies or others. The following classes would then be discussion oriented and problem solving based. Many educational institutions have started using and preferring flipped class method over the traditional teaching method.

The four basic pillars of flipped learning model [F-L-I-P] are namely; flexible environment, learning culture, intentional content and professional educators [1]. Flexible environment refers to an environment that adjusts lesson or unit according to the need. Learning culture is a model which shifts the teacher centered traditional model with the student centered model, where students are provided opportunities to explore, learn and evaluate. Intentional content is a method used by the educators to maximally utilize the classroom time using active learning strategies, peer instruction, problem based learning, and case based learning and others. Professional Educators are reflective in their practice, accept constructive criticism and tolerate controlled classroom chaos.

This method of learning not only allows teachers to provide attention to as many students as possible inside the classroom, but also, promotes understanding, improves learning environment and improves overall performance of students as well. However, this method may be difficult to adapt as the replacement of traditional model, may not be properly coped up by the students as well as teachers. Teachers should be trained and shown ways to search and produce materials for their classes.

Improper preparation may lead transition into a disastrous dimension, which may directly affect the classroom environment. Flipped classes do not have a fixed model of implementation, with research and advancement this approach is continuously changing with the notion of improvement the existing classes.

2. Literature Review

There have been many research learning design and technology, concerning the flipped classroom model. According to the research, students spend the majority of

the day using some sort of technology. This has caused students to become more active as learners and to be less tolerant of passive learning situations towards lectures. Youth today are proactive and learning differently than previous generations. Gamers have become very good at multitasking [2]. Flipped classes not only provide platform for creating opportunities but also aids to view a clear picture of what and how their students are thinking and learning, providing them necessary support and encouragement [3]. A research on evaluating the effectiveness of flipped classroom for teaching CS1 concluded that after the implementation of the flipped model, students showed progressive improvements in their scores [4].

Video lectures provides a mechanism of enjoyment and fun with learning, but in fact this method can dangerously reduce anxiety as expectations increases. Fun factor is focused more which can decrease the learning outcome of the students. Another fear of some educators includes the increasing use of computers in the classroom threatens to decrease the intimacy between students and teachers, and with it, teacher morale [5]. Flipped learning adds up to the fact that its implementation makes teachers much less important. Teachers may encounter a wide array of questions that they normally do not expect in the traditional classroom. There also lies difficulty in judging what appropriate questions needs to be addressed to the students [3]. The other challenge is that the excitement and interaction environment that is addressed in the traditional class are difficult to replace with static lectures. Next challenge is that not all students are able to access materials online, such as in context of developing countries like Nepal this is a greater challenge. There is no way to verify whether the students are actually learning and engaging themselves with the provided materials at home. Also, there lies a greater challenge in providing expertise and skills to the teachers in order to produce teaching materials [6].

The most common external barrier, access to resources, is a huge impediment to technology implementation. This is most likely because, unfortunately, educational settings typically do not have access to the latest technology [7]. Shifting from existing methods of teaching and adapting new technology is not a one day task. Technology is continuously changing and learning how to adapt, collect resources and shape lesson plan accordingly requires time. Not only this, teachers are hesitant in implementing this new technology due to several reasons such as lack of adequate technical support, lack of confidence in using and developing the materials and so on. Continuous change in beliefs and practices must be made according to the changing technology, experience and teaching-learning pattern [6].

Inverting the classroom means that events that have traditionally taken place inside the classroom now take place outside the classroom [8]. The researchers have given a possible explanation for the increase in motivation being that this type of classroom demanded the students take ownership for their learning [8]. The instructors noted that students were generally more comfortable asking questions in class, possibly because of the increased opportunities for one-on-one interaction with the instructor [8]. According to Marco Ronchetti, student knowledge is divided into three phases; knowledge acquisition [KA], deeper understanding [DU], and knowledge consolidation [KC]. He mentions that the main goal is to get more teacher involvement during DU phase due to unavailability of time and cost factors. A study by Byron High School, Minnesota on flipped learning concluded that the flipped learning was preferred among 87% of parents, 95% of students. The research also concluded that the flipped learning method not only improved one's understanding skill but also promoted peer instruction [9].

3. Research Methodology

According to google search, YouTube has about 5 billion viewers a day standing second most visited website after google.com. This technology can be used to create positive impact on overall education system, if academic institutions are able to use the power and popularity of video for sharing the learning materials. In 2000, Lage, Platt & Treglia came up with an idea of using technology in teaching, popularly known as, flipped classroom model. Instead of having students listen to a lecture during class hours and making them complete their assignments at home, students watch video lectures at home and complete their assignment under the guidance of their teachers inside the classroom. Currently, the flipped classroom method is popular among the K-12 sector. Researchers have admitted that the way today's generation are learning is different than the previous generation, due to the advancement in technology. Their practice with technology has huge impact on the way they prefer to learn. As a result, a serious concern has been raised on how to successfully engage youth in learning with the aid of technology. This advancement in technology is making the role of a teacher increasingly more difficult. Teachers are not only struggling to gain students' interest but they are also struggling to make students active in the learning process. Advancement in education requires overcoming these challenges.

This study attempts to discover teachers' perceptions on using the flipped classroom in comparison to traditional instructional methods. To identify if schools in Nepal have idea about the flipped class model, a primary survey was

done among few top schools of Kathmandu valley. These schools were picked in accordance to their popularity on the basis of quality education and fee charges high. This survey was done assuming that these schools might have introduced flipped class model for delivering quality education. They were asked over the phone whether they had any idea about the flipped class model but only one among the top listed schools had been aware of flipped class model. The teachers of that particular school were also found to be preparing the flipped class materials as well. The survey on flipped class model was conducted among the teachers who were preparing flipped classes. The survey also examined the underlying challenges on preparing flipped classes and technology integration. All the survey questions were close ended and teachers were provided with flexibility in answering, either yes/ no or scaling on likert scale ranging from 1 to 5. The survey questions were designed and divided into three parts. First section of the questionnaire was about collecting personal and academic information. Second section was about the teaching methodology that they currently have been practicing. Third section was the major section of the questionnaire, which had four different sub sections namely; opinion, influence, benefits and challenges section. Received responses were listed in the excel sheet and further analyzed for finding and concluding results.

4. Findings and Discussion

Data from the survey showed that despite of few underlying challenges the teachers were found to have positive perception towards the flipped class learning methodology. Both male and female teachers were found to be equally motivated. Majority of the surveyed teachers were 25 to 35 years of age and were found to be familiar with new technology. These teachers were curious and positive to adopt new method of teaching as well.
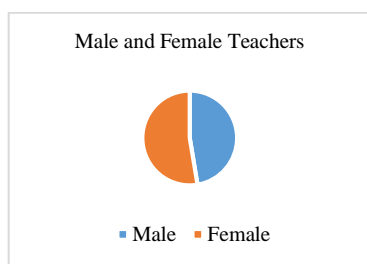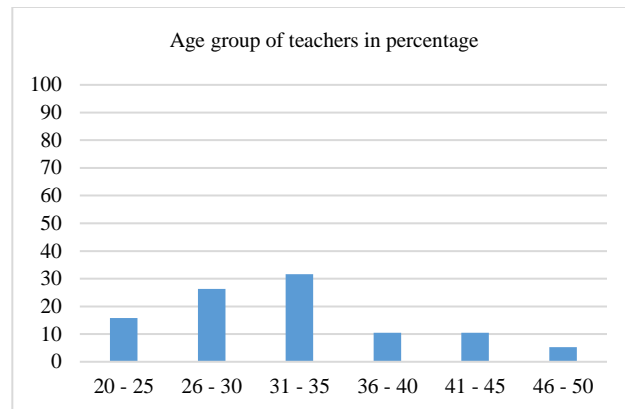

Figure 1- Ratio of Male and Female teachers

Figure 2-Age group of surveyed teachers

4.1 Teaching methodology

Table 1- Questioner for teaching methodology

Questions	Index
Do you use video lecture as instruction tools?	A
If Yes, do you record videos yourself?	B
If No, do you have objection on using it?	C
Does your organization encourage the use of video lecture?	D
Have you prepared the flipped class materials?	E
Have you heard of Bloom's taxonomy?	F
Have you heard of "higher order thinking skills"?	G

Though all the teachers do not have any objections on using videos in their class, agree that their organization encourage in preparing flipped materials and have prepared, but only 31.58% teachers among the surveyed have been found using videos in their classes as an additional teaching tool. It was found that there was shortage in availability of videos for subjects other than science, mathematics and computer, which matched Nepali government school curriculum. Survey also showed that 68.42 % teachers were aware about terms such as, Bloom's taxonomy and higher order thinking skills, even though their university academic background was not education as major. Majority of the teachers had idea on how to perform the knowledge, understanding, skill testing of the students.
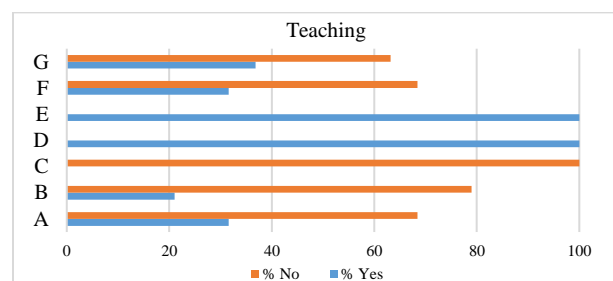

Figure 3-Teaching methodology percentage distribution

4.2 Opinion of teachers

Table 2-Questioner for teacher's opinion

Questions	Index
Flipped class model will give more time for discussion in the class.	A
Flipped approach will help student learn more than traditional approach.	B
I prefer teaching class with flip model than with traditional model.	C
I like preparing the video for the flipped.	D
Flipped class videos give me opportunity to become the public figure.	E
I am motivated to the flipped class model and recommend.	F

All the teachers were well aware of flipped class methodology and its major principles. Before directly engaging teachers into preparation of flipped class materials, school had provided several training sessions regarding the flipped classes and basic technology. Teachers were provided opportunity to record video on any section of the subject they were most confident about. With couple of rounds of reviews on the recorded videos, feedback was provided to the teachers and currently the school has set a recording studio where teachers can record their classes during off hours from school. They have completed recording almost 150 video lectures and now are in production phase. The recorded raw audios and videos are provided to in-house DigitalLab team provided with highly configured machines, who are responsible for editing and releasing the final product. The members of DigitalLab team are from Information Technology background.
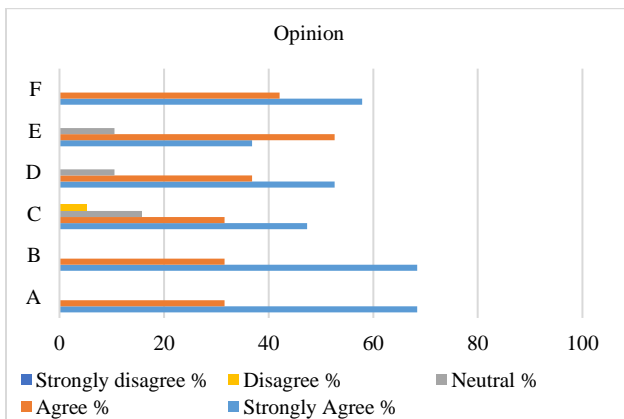

Figure 4-Opinion on flipped class

All the teachers have positive opinion towards the usage of flipped class method. However, their preference on teaching with flipped class methodology varies where 16% of the teachers have neutral opinion and 5% disagree on

using flipped classes. The teacher who fell under the minority i.e. 5% has agreed on the rest of the categories, in support of the flipped classroom method. The teacher also uses videos as instructional tool in the class, has prepared flipped class videos and also falls under appropriate age group 25 – 35. The reason behind the disagreement to usage of flipped class may be cultural influences and ego problems.

4.3 Influences of flipped class

Table 3-Questioner for influences of flipped class

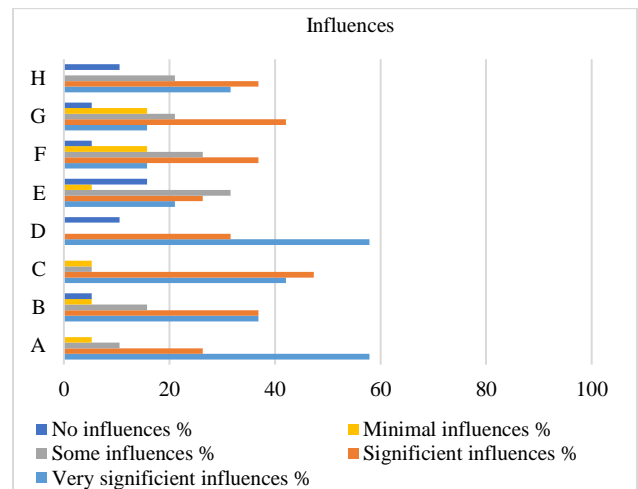| Questions	Index
Better learning experience for students.	A
Availability of technology to support.	B
Competition with other institutions.	C
Opportunity to be the institution adopting new pedagogies.	D
Financial incentives.	E
Demand of the student.	F
Demand of the parents.	G
Demand of the teachers.	H

Figure 5-Influences of flipped class

The above result shows that 84.21% teachers think that the flipped classes will give better learning experience to the students, while 10.52 % of teachers think there is no influences on the opportunity to be the institution adopting new pedagogies. 68.42 % teachers agree that flipped classes will have significant influences on the demand of teachers, but 10.52 % teachers disagree. Majority of the teachers have demanded use of flipped classroom which shows a positive sign that the flipped classroom will be successful. Demand of flipped classes by students and parents shown in the survey result are based on the teacher's perspective. Demand category shows that demand of teachers will have more influence for taking the flipped class initiative by the school rather than demand of the student and parents. Most of the teachers showed their

neutral opinion regarding the financial influences. However, teachers are well aware about the royalty system. This data only shows, what teachers think about influences of initiative on flipped class method taken by the school.

4.4 Benefits to the students

Table 4-Questioner for benefits to the students

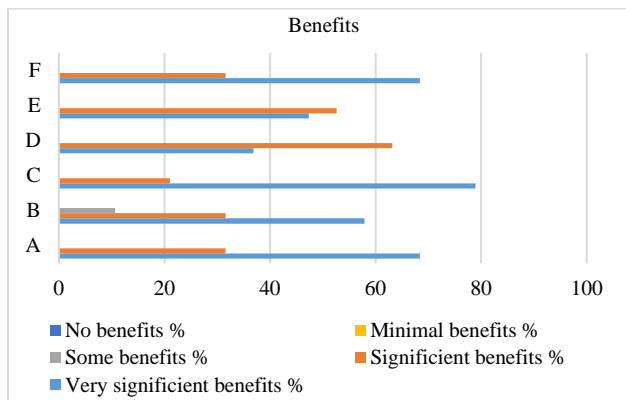| Questions	Index
Improvement in self learning habit.	A
Improvement on using technology.	S
Student will have time to catch missed class.	V
Improvement on class performance and participation.	D
Improvement in understanding the lesson.	E
Improvement in exam result.	F

Figure 6-Benefits to the students

Almost 100% teachers are very positive that students will be benefited from the flipped class model which is a positive sign. Improvement in understanding of the lesson, class performance and exam results are interrelated to each other. Since teachers are providing the class lecture materials to the students prior to the class, students will have opportunity to study the materials time and again until they clearly understand it. When they come to the class, they can participate in open discussion with friends in the presence of teachers which improves the class performance. Improvement on these two factors will have direct impact on the examination result so expected to be improved.

4.5 Challenges

Table 5-Questioner for challenges

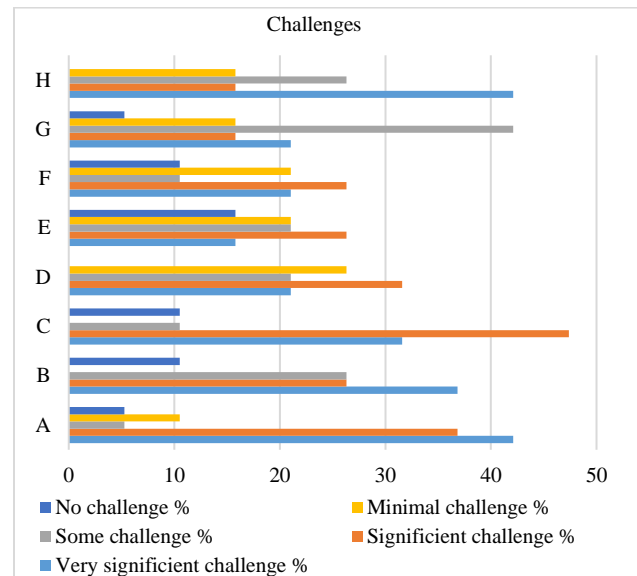| Questions	Index
Changing teaching methodology.	A
Time required to prepare the course material.	B
Learning new technology for making videos.	C
Lack of connectivity or technology to the student.	D
Chances of watching the videos before the class by students.	E
Attendance of student in the class.	F
Camera phobia to teachers.	G
Fluency in recording the class.	H

Figure 7-Challenges

The survey result shows that there is significant challenges in changing the teaching methodology, where 78.95 % teachers consider it as a challenge. Confidence level might a factor for occurrence of such result but it cannot be concluded to be the true reason behind. School should provide additional trainings on flipped class recording and motivational seminars should be conducted. However, 5 % teachers do not consider this as challenge. This strength can be a good resource for the school. Also, 68.42 % teachers find time required to prepare the course material as a challenge. This challenge will be overcome once the teachers get used to recording the flipped classes. Similarly, 26.32 % teachers have neutral opinion on it and 10.52 % do not take it as challenge. Learning new technology seems to be a significant challenge from the above data. School should provide video editing, movie making and other necessary trainings to the teachers. Data on lack of connectivity or technology to students, students watching the videos before class, attendance of student in the class are only the mere guesses and opinion of teachers. These factors do not play significant role in drawing the conclusion. However, almost 50% teachers have taken these factors as a challenge. The result also showed that all teachers are not camera friendly, 36.84% of the teachers

see facing the camera as challenge, but majority of the teachers have neutral opinion on it. To build the confidence on this factor, school should provide workshops on facing camera to the teachers. School should create a forum where some media personals can be invited to interact and share their experiences with camera with the teachers. Fluency in recording the class is seen as a huge challenge and will have significant impact on preparation of flipped classes. The associated school is preparing flipped classes for Nepali government curriculum and according to the survey, it was concluded that teachers had difficulty in writing and pronouncing Nepali sentences, resulting structure and grammatical errors.

5.   Limitations and Conclusion

Flipped class method being a new practice in Nepal, the survey was conducted only in one school of Kathmandu district with limited number of teachers. The generalization of the result to the entire nation is difficult to be made. This research studied the perspective of the teachers who are preparing flipped class videos, but not of the teachers and schools who have had implemented the method. The impact factor of the flipped classes has not been analyzed. Perspective of the students and parents has not been studied in this survey.

The result also showed that the teachers were highly motivated to use flipped model. They are preparing the video lectures and the data of the survey shows that the method has been initiated by demand of teachers. The survey shows that teachers have positive opinion on flipped classes and are confident that students will be benefitted by the practice. Similarly, teachers are also well aware about the challenges on its implementation. Despite of having known the challenges, teachers are willing to record flipped classes.

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Hand Gesture Recognition Using sEMG

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ABSTRACT

This paper presents the development of hand gesture recognition system for Human Computer/ Machine Interaction using surface Electromyography (sEMG). The principal aim of this paper is to recognize the predefined user's hand movements using single channel EMG. The EMG signals from the skeletal muscles of forearm were taken using surface electrodes. To identify the exact gesture different EMG features like RMS Value, Mean Value, Variance, Standard Deviation, Median, Max Power & Min power were extracted and classification is done using K-Nearest Neighbors (K-NN) Algorithm. Based on the experimental result, the proposed system could recognize the hand gestures up to 90% accurately.

KEYWORDS

Surface Electromygraphy, sEMG, Human Computer/Machine Interaction, Pattern Recognition, Gesture Recognition, Machine Learning, KNN Algorithm, Bio- Signal

1. INTRODUCTION

From the very young stage of child pointing an object with a finger to the manipulation of modern smart phone, gestures are everywhere and we use them to communicate specific messages. Gestures are the movement of hand, head, face or other part of body that allow us to connect a variety of feelings, expressions, commands and thoughts to others. In other words, gesture is a form of non-verbal communication and is often used as assistance for our vocal communication; nonetheless they can be used as an exclusive and effective way of communication. In our daily life, we use mouse, keyboard, joystick, etc. to communicate with our computer/other device. Although these interaction tools have provided ease to communicate with machines, they lack in user friendly and natural interface. So, there is a growing interest on HCI (Human Computer Interaction) field to make innovative interface by the proper use of voice, vision, gesture, etc. Unlike typing with fingers on keyboard, touching on screen and moving mouse with hand, just a simple gesture can be enough to act as an input to the computer. Gesture performed by the user can be recognized by the computer vision but the author presents the system that employs human bio-signal to communicate with computer or other devices. Because of easy recording and non-invasive process, among various bio-signals, surface EMG signal generated from the human forearm is employed as an input [1]. These EMG signals can be used to control the prosthetic limb, exoskeleton, robots, computer video game, home appliances, smartphones and other devices and it can also be used as an input signal for disabled people to interact with computer and act as an interface between deaf and hearer to interpret sign language.

2. RELATED WORK

This section describes the related methods of obtaining gesture from user to perform specific task.

A computer vision based approach has been widely embraced to identify the user's gesture or movement to interact with the system or device. Authors in [2] implemented real-time tracking algorithms to detect and track a hand, analyzed the motion of the hand using a Fourier descriptor (FD), and used Hidden Markov Models (HMMs) to train a model and recognize gestures. This system relies on a camera that is capable of observing a user that performs various gestures. More recently, author in [3] proposed a similar concept using video camera and Kinect sensor, commercialized Microsoft product for gaming, to recognize the gesture. This system enabled users to do arithmetic calculation and even allowed to play rock-paper-scissors.

Even recently, a Camera Mouse [4] named product is available in the market which works as a mouse replacement system for Windows computers so it

worked with just about any application program. For example people use Camera Mouse with entertainment programs, education programs, communication programs, web browsers, and so on. Camera Mouse works best with application programs that require only a mouse and a left click and that do not have tiny targets.

Although these vision based methods provide natural way to interact with computer they are also disadvantageous in some ways like the user has to in sight of camera and they may suffer in complex background and poor lighting condition. To overcome the problem associated with the detection of gesture accurately, some researchers proposed the idea of specialized globe that can be worn on the hand [5] This increases the system complexity by introducing more components which is not an ideal to the gesture recognition system.

Besides vision based system wearable sensor based gesture technology has become widely explored and used due to the proliferation of consumer electronics that contain sensors such as accelerometers, gyroscopes, and so forth. Fitbit [6] is a simple health-tracking device that uses a three-axis accelerometer to detect user activity. The wearable smartwatches; Pebble Smartwatch [7], Apple Watch [8], Moto 360 [9] and Gear S [10] which are equipped with an accelerometer, gyroscope, barometer, heart rate sensor and light sensor, give them a wealth of sensing possibilities thus enabling developers to create application that sense all sorts of user activity and interaction via gesture recognition.

In the field of gesture recognition or human computer communication, unlike conventional methods (audio-visual, mechanical etc.), biosignal offers brand new possibilities. With the help of biosignals, it is possible to detect emotions [11], make music [12] or develop smart clothes [13].Basically EMG is widely adopted to make interface between human and device/machine. We can see it in exoskeleton system as in [14] where actuator provides extra support to human hand as per the EMG signal received from hand. For disabled people the development of a new generation of biosignal controlled prostheses [15] offers the possibility of making their life much easier. More recently, EMG is being used to interpret sign language [16] which can create new possibility to make communication between deaf and hearer. Author in [17] proposed a system that allows user to control the mouse and type letter on the computer screen.

It is seen that most of the research has been done with multichannel EMG. Although it offers better accuracy, handling of large data set of features becomes complicated after the numbers of channels more than four[18]

Multichannel system of EMG is advantageous for classification but it makes system complex and bulky. A novel technique of identifying the gesture using a single channel sEMG is a need to minimize the complexity and cost of the system while maintaining the accuracy. In doing so, author has made an attempt to recognize gesture using single channel EMG in this research.

3. METHODOLOGY

The functional block of this system is shown in Fig-1. Single channel EMG signal is acquired from the subject's forearm using surface electrodes and the hardware designed to make amplification, filtering and processing send the signal to the computer via bluetooh communication. In computer, using Matlab, features are extracted and employing these features of EMG signal classification is done to identify the performed gesture.
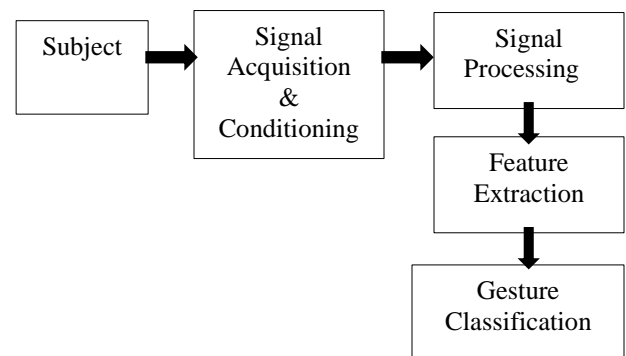
Fig 1: Functional Block Diagram

To make specific hand gesture for this system author describes the gesture selection prior to the system description.

3.1 Gesture Selection

Two different hand gestures are selected as shown in Fig-2.

3.2 Electrode Placement

Electrodes are placed in such a way that a good signal can be achieved for specific gesture. Based on the muscles involvement on such gesture active electrodes are placed at Flexor Carpi Ulnaris and Palmiris Longus as shown in Fig-4. As depicted in Fig-3, the two active electrodes are placed 20cm apart at forearm and the reference electrode is placed on bone surface i.e. elbow.

3.3 Signal Acquisition, Conditioning and Processing

The surface EMG signals are acquired for various hand movements using AD8232 Heart Rate Monitor Module from Sparkfun electronics [19]. This module comes to pass the ECG signal having band frequency of 0.5 Hz to 40Hz. As the EMG signal has the frequency range upto 500Hz, this module is not suitable in a direct way. So, the author had redesigned the filter with frequency range 20Hz to 400Hz of this module and let the EMG signal passed through it. Due to EMG signal's sensitive nature it is contaminated by external noise sources and artifacts. Using the noise signals gives very poor result which is not desirable. The noises can be classified as motion artifacts, power line noise, electrode noise, ambient noise, and inherent noise electrode noise, motion artifacts can be removed by placing the electrodes in proper position and using good quality equipment. The band pass filter with frequency range of 20-500Hz is used to eliminate the motion artifacts, electrode noise and power line noise.

The analog output signal from AD8232 is converted into digital and transmitted it to the computer via bluetooth module using microcontroller for further processing where some post processing is done before extracting features.

3.4 Feature Extraction

Due to complex nature of EMG the proper selection of features are essential for classification. EMG classification is one of the most difficult pattern recognition problems because there exists large variations in EMG features. Especially, it is difficult to extract useful features from the residual muscle of an amputee. So far, many researches proposed many kinds of EMG feature to classify posture and they showed good performance. However, how to select a feature subset with the best discrimination ability from those features is still an issue for classifying EMG signals. [20]

The success of any pattern classification system depends almost entirely on the choice of features used to represent the raw signals. It is desirable to use multiple feature parameters for EMG pattern classification since it is very difficult to extract a feature parameter which reflects the unique feature of the measured signals to a motion command perfectly.

But the inclusion of an additional feature parameter with a small separability may degrade overall pattern recognition performance.

Based on [21], features; Integrated EMG (Mean Value), Mean Absolute Value and Variance of EMG are implemented in this proposed model.
In addition, Median Frequency, Maximum Power, Minimum Power and Standard Deviation are also extracted.

3.5 Gesture Classification

Classification of EMG signal pattern is implemented by one of the Machine Learning Algorithm, K-Nearest Neighbor (KNN) Algorithm [22]. The K-nearest neighbor (KNN) classification rule is one of the most well-known and widely used nonparametric pattern classification methods. It was originally suggested by Cover and Hart [23]. Its simplicity and effectiveness have led it to be widely used in a large number of classification problems. [24] A typical K-NN algorithm flowchart used in this system is shown in following figure.
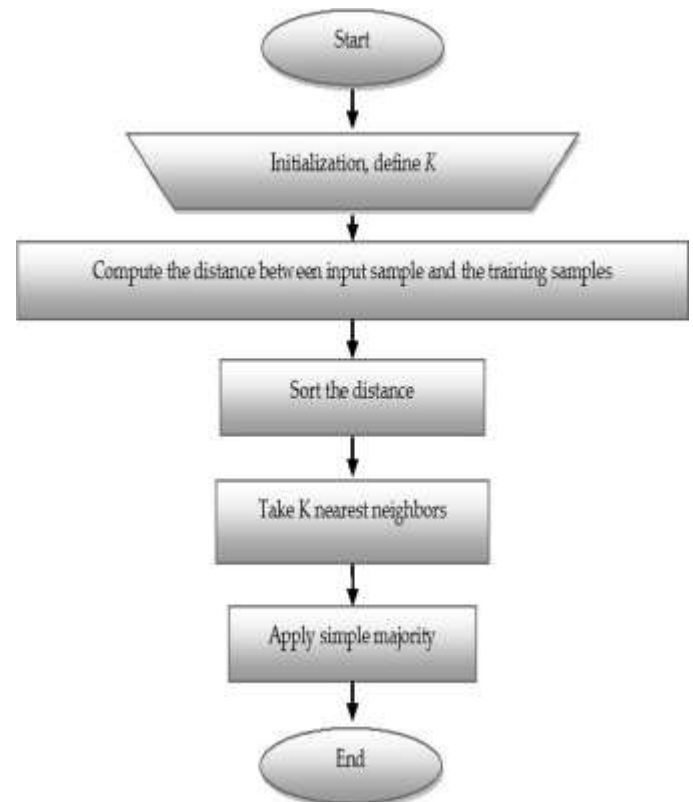

Fig-5: K-NN Algorithm Flowchart

4. RESULT AND DISCUSSION

4.1 Experimental Setup

To collect the data required for the system, an experiment was conducted with 10 different subjects. From each subject 8 training data and 2 test data for offline test were recorded for each gesture. Altogether, 200 different set of data were recorded from this experiment where each subject contributed 20 different data.

4.2 Database of Training Data

Based on the data acquired from the experiment, training database was made by extracting eight different features:- Integrated EMG (Mean Value), Mean Absolute Value, Variance of EMG, Standard Deviation, Root Mean Square, Median Frequency, Maximum Power & Minimum Power for different gesture. This database consists of 200 different data.

4.3 Testing and Evaluation

The system was tested for offline and online based from the test data recorded in the experiment. Altogether, there were 20 different test data for the testing .Based on the result obtained from the test data, system performance was evaluated. Fig-6 and Fig-7 are the raw EMG signals generated while performing gestures pinch and wrist flexion respectively.

4.3.1   Offline Testing

Table-1 depicted the result of offline testing with K=1 using Euclidean distance.

4.3.2   Online Testing

In online testing, 3 different subjects were involved. Each performed 10-10 different set of gesture for pinch and wrist flexion. Table-2 represents the online testing with K=1 using Euclidean distance.

4.4 Discussion

As seen from Table-1 and Table-2, it is observed that the accuracy of the system performance during the offline testing is more accurate than the online testing. Accuracy in the performance of the system is related with the environment and the connections of experiment setup, placement of electrodes, quality of probes, training dataset, how accurately user performed the gesture, delay in response by the system/algorithm and classifier used.

To improve the system performance two more testing was carried out with the same three subjects. This time the k-parameter of the K-NN algorithm has changed to

3 and the distance for nearest neighbor is considered as Euclidean and Cosine for 2nd and 3rd test respectively. In the second test, the accuracy of the overall system performance is improved from 83.33% to 90% for wrist flexion whereas 73.33% to 83.33% for pinch gesture. Whereas the third test didn't gave the result better than the second one. The result of the improvement in system performance is given in Table-3.

Generally, it is found that separate EMG channel is used to recognize EMG pattern responsible for different wrist movement/finger movement/hand movement by placing multiple electrode-pair on different muscles responsible for specified movement of hand/wrist/finger. [25, 26 & 27]

Since, the system employed only one channel to recognize different EMG patterns responsible for specific gesture, system accuracy was not achieved about to 100%. Besides this several parameters like electrode placement, quality of electrodes and probes, training data, features extracted, no. of test performed & classification algorithm affect the overall performance of the system to achieve higher accuracy. However, all these parameters influenced the accuracy of the system, using of multiple channels could give higher precision to recognize correct pattern thereby making the system more accurate to achieve desired operation. But the author emphasizes on using of single channel rather than multiple to make cost effective solution in gesture recognition or HCI field.

Another approach to improve the system performance that can be applied to single channel is allowing the subject to practice of each gesture in a constant manner. In addition to this, system performance might be improved by an EMG specific analysis for extracting more relevant features.

5. CONCLUSION AND FUTURE WORK

Developing of gesture recognition system for HCI using different bio-signals could open the alternative approach to computer input devices like mouse and keyboard. This approach is basically useful to those who have severe motor disabilities and is physically disabled to operate normal computer input devices. Another possibility of using biosignal (like EMG) is the control of prosthetic limbs, exoskeleton, computer game and home appliances. Even further, it can be used to for silent communication and sign language interpretation.

Hand Gesture Recognition using sEMG system has successfully tested with an accuracy upto 90%. Thus, it can be concluded that the human bio-signal (surface

EMG signal) could be used to make interface between the human and computer so as to provide alternative means to communicate with computer or other devices.

Because of complexity and cost of multiple EMG channel based gesture recognition, author thought that such system should be cheap and wearable. In an attempt to make efficient single channel gesture recognition system author has achieved accuracy up to 90%, which is a great motivation to work in such field in the future. Although the system is capable to detect two different gestures, which could be useful in place where two distinguish gesture is needed, like in household appliances to turn on and off and in simple video game for example racing or flight, author has put his interest forward to develop a system to recognize as many patterns as possible with higher accuracy using different machine learning algorithms (like support vector machine, artificial neural network etc.), EMG specific features, and good hardware and better electrodes and its right placement on right muscles.

Fig-2(a): Pinch   Fig-2(b): Wrist Flexion

Table-1: Offline Testing

Gesture	Repetition	Hit	Accuracy
Wrist Flexion	20	19	95%
Pinch	20	17	85%

Table-2: Online Testing (for K=1, Euclidean distance)

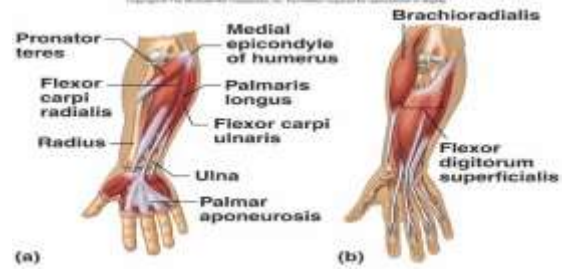| Gesture	Repetition	Hit	Accuracy
Wrist Flexion	30	25	83.33%
Pinch	30	22	73.33%

Fig-4: Forearm muscles

Fig -3 (a): Electrode placement (b): User performing gesture during the testing
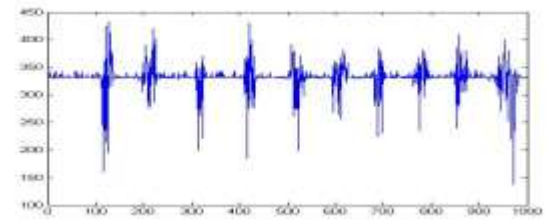

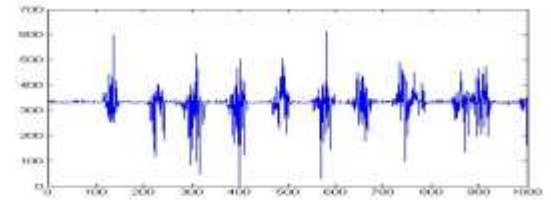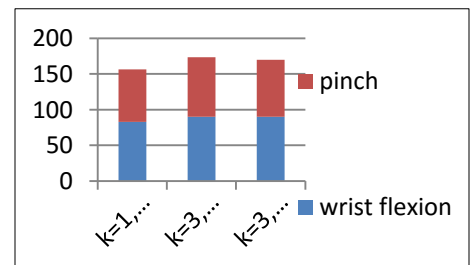Fig-6: EMG signal while pinching

Fig-7: EMG signal while flexion of wrist

Table-3: Performance Improvement in Online Testing

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ICT Enhancing Embedded System for Water Level Monitoring of Household Tanks in Nepal

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ABSTRACT

Manual monitoring of water level in overhead tanks is a traditional process. In context of Nepal, it becomes even harder since the overhead tanks are placed at extreme positions on the rooftops. The task of monitoring the water level time and again is time consuming. The situation gets worsened when water has to be monitored during night. Overflow of water during its scarcity is also an issue. Apparently, there is no early warning system to monitor the tank water level when it has reached a critical situation. **"ICT for Enhancing Embedded System for Water Level Monitoring of Household Tanks in Nepal"** is a system that measures the level of water in the household tanks in real time. The system uses a water level sensor to measure the level of water, Arduino board to read inputs from the sensors and manipulate the inputs by sending a set of instructions. Wi-Fi Module is used to access wireless network. The water level is monitored in real time and its data is send to the web server through Wi-Fi Module. The system also notifies the person when the water reaches the specified level. The system is proposed realizing the limited availability of water and electricity under the conditions of ever-increasing population growth. Thus the system is most applicable in daily use as it helps to monitor water levels of the household tanks under the constraints of water shortage.

Keywords: Manual monitoring of water, ICT, Wi-Fi Module, Arduino, embedded system.

I. INTRODUCTION

Technology has made life more efficient and comfortable in a way that it has enabled devices to be controlled from anywhere at any time. Same way, water level monitoring is a system introduced with the help of these technologies to measure the level of water in overhead tanks.

The day to day use of water contributes to its storage. Storage of water in overhead tanks has become a necessity to the people especially for the residents of Kathmandu Valley. Every house in the valley has overhead tanks for the purpose of storing water. Low voltage also serves as a major issue for the shortage of water at a household level. Due to the irregular timing of electricity in Nepal, water has to be drawn and monitored at any time. Monitoring the level of water manually during night time can be a risky task. Failure in monitoring and drawing of water at night may lead to the unexpected shortage at a household level. Therefore a system that notifies the level of water at real time is a necessity.

This paper presents an embedded system which monitors the level of water in overhead tanks of the houses. The system is the integration of embedded system along a website and an android application.

The system integrates ICT and IoT in advancing the feature of embedded system. The system aims to provide a monitoring system that notifies the user the current water level anytime, anywhere. It reduces the time and effort of an individual as compared to the manual monitoring of the water level.

The system provides monitoring application for both the user as well as the admin. It provides user with an android application to ease the monitoring of water level. The user is notified by the system if the water level reaches the specified critical level.

ICT and IoT for WATER LEVEL MONITORING

Information and communication technology (ICT) and water efficiency is a new research area. ICT integrates the information gathered regarding water driven issues with technology to innovate solutions [1]. The increasing use of ICT has enabled various means to manage and preserve the water resources

and has led to developments of smart water management (SWM). The SWM approach integrates ICT systems and solution in order to maintain the consumption of water [2]. SWM contributes towards multiple sectors such as agriculture, industry, urban environment. Basically, SWM introduces smart way of managing water especially for daily life [3].

The Internet of Things (IoT) is to enable devices to be connected anytime, anyplace ideally to the internet using any network or services. With IoT, the systems capability could be extended. Internet of Things can be integrated with the water level management process to contribute to the solution for the water level monitoring remotely.

I. RELATED WORKS

Some papers regarding the advancements in water level monitoring are:

TANK WATER LEVEL MONITORING SYSTEM USING GSM NETWORK

This paper proposes the design and implementation of microcontroller based tank water monitoring system. It introduces the development of water level monitoring system with an integration of GSM module to alert the user through Short Message Service (SMS). The monitored data sent through SMS to the intended technician mobile's phone upon reaching the critical level [4].

AUTOMATED WATER LEVEL MONITORING SYSTEM

The paper presents a system working on the design and construction of an automated water level management system with SMS and buzzer system. The paper is proposed for an enhanced water sensing and control mechanism that alert by triggering communication link via GSM modem. There are buzzers and SMS are present to alert user on critical water level.

The paper reports on development of a microcontroller-based system to monitor the water level. On reaching the critical state, the system also top-ups the water from reserve tank when the water level in main tank falls below half of the tank depth. The monitored data and information is sent through SMS on reaching critical states and a buzzer activates to warn the user. Water pump is controlled and switching on / off in tandem with the water levels in the main and reserve tanks. The sensors constantly sense the water level in both the main and reserve tank for microcontroller to response accordingly [5].

WIRELESS AUTOMATIC WATER LEVEL CONTROL USING RADIO FREQUENCY COMMUNICATION

The paper describes a system working on the design and construction of a wireless automatic control system with radio frequency communication. The paper discusses about automatic water level sensing and controlling with wireless communication. The tank and sump contains radio frequency transceivers along with a controller installed. Radio Frequency transceivers are used for wireless communication that is completely automated by a micro controller. Installation cost is reduced since the system is wireless and is reliable [6].
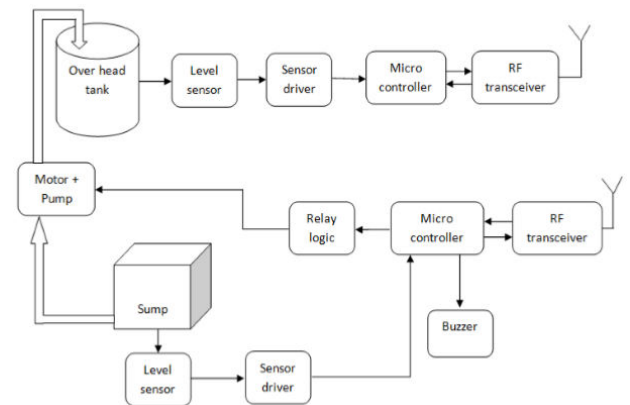
Fig 1: Block diagram of wireless water level control system [6]

WIRELESS HOME AUTOMATION TECHNOLOGY (WHAT) USING INTERNET OF THINGS

This paper represents an affordable and flexible automatic home control system. The system integrated Arduino, web server with IP connectivity for interaction among devices and appliances remotely using Android app [7]. The usefulness of the system is demonstrated using devices such as light switches, temperature sensors, and water-level sensors. A remote controlled system provides reminders, voice commands functionality. The system is very useful for people with physical disability. It plays a vital role in maintaining living

standards and provide secure and flexible environment.

Fig 2: Overview of Concept [7]

II. PROPOSED SYSTEM

The paper presents a system that aims at integrating ICT and IoT for monitoring the level of water in overhead tanks of the houses in Nepal. The overall architecture of the system is shown in figure:
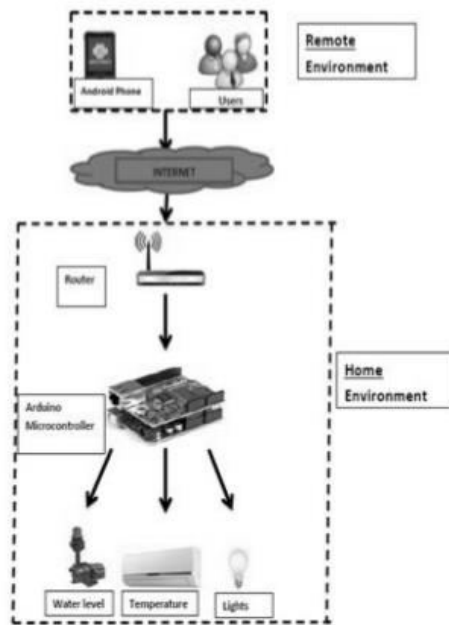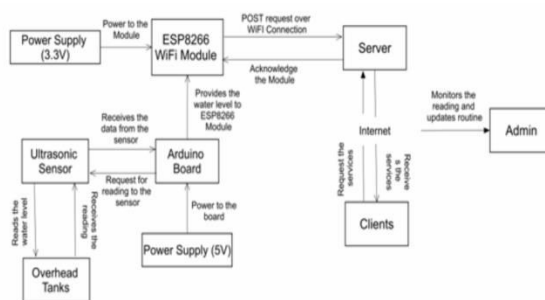

Figure 3: Proposed system architecture of Water Level Monitoring

The main objective of the paper is to develop and deploy an embedded system for monitoring water level of overhead tanks. The paper also aims at monitoring the level of water in real time through the use of internet technology to create a user friendly and easy to use android application.

The proposed architecture of the system consists of four basic building blocks. They are an embedded system, a web server, an android application and administrator's website.

EMBEDDED SYSTEM

The embedded system proposed in the system consists of the setup based on Arduino UNO, ultrasonic sensor, voltage regulator and an Wi-Fi module. It is placed at the top of household tanks.
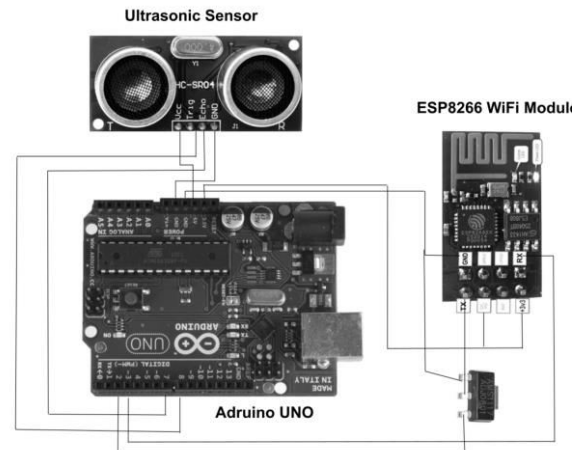
Fig 4: Circuit diagram of the system

Arduino UNO is an open source single-board microcontroller which is based on ATmega328. The system proposed uses an ultrasonic sensor to measure the level of water. Ultrasonic sensor generates the measurement by evaluating the time taken for the sound to travel between the transmission and the reception. The time taken is then converted into meter or inches respectively. Voltage regulator is used to convert the 5V output of the Arduino into 3.3V. Wi-Fi module is used to give wireless internet access to the system because the system has to be planted at the top of the tanks. It would be inconvenient to use Ethernet to give internet access to the system. In the proposed system the ultrasonic sensor and the Wi-Fi module is connected to the Arduino UNO. The ultrasonic sensor measures the level of water in the household tanks and sends it to the web server via Wi-Fi module. The ultrasonic sensor reads the reading in the form of meter. The reading is sent to the web server as a parameter of the POST request. The sensor and the Wi-Fi module is controlled by the Arduino UNO.

WEB SERVER

Web server manages to become a communication hub between the embedded system and the client's application as well as the administrator's website. It receives the reading from the embedded system and inserts into the database. Another important work of the web server is to notify the client if the level of water reaches the critical level or the level as specified by the clients. The main reason of having the web server in the system is to access the level of water remotely over the internet.

CLIENT AND ADMINISTRATOR

The clients system could be any devices running on the android Operating System. Client with the help of an android application requests the server for the level of water. The server responds to the client by sending the level of water. Every client is provided with a unique username and password so as to view the reading of their own tanks. The android application consists of a user log in page where the user has to login with the correct username and password. Another feature of the android application is that the clients could specify the level on which they wanted to be notified. The administrator in the proposed system has the privilege of monitoring the reading of all the clients using the system. The privilege includes the adding and deleting of clients and also maintaining the username and passwords of the clients.

IV. CONCLUSION

There are many issues regarding the storage and monitoring of water in the household tanks. The system has a wide range of application. It can be implemented in all types of tanks provided the height of the tank is known already. As obvious, this system will prove to be very beneficial in all aspects.

Thus, the paper presents Water Level monitoring system capable of solving the issues regarding the water level monitoring in household tanks.

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ICT for Disaster Management

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ABSTRACT

Disaster is sudden event may be accident or natural catastrophe that causes huge loss to every aspect of the subject. Future is uncertain so do is disaster; it can happen anywhere and anytime bearing huge loss that may be recoverable or not. All catastrophe can't be known but some catastrophe can be controlled and managed someway. With the huge development in ICT in this 21st century, ICT can provide aid or role for those disasters including proactive solutions of the disaster management. This paper will discuss on theoretical and practiced examples which can aid to minimize the loss of disaster. For instance, after the major earthquake of 2015, the rehabilitation was aided by huge self-mobilized volunteers acted in common ground through ICT technologies like web app and mobile app. It clarifies on how modern ICT tools can be used for minimizing natural calamities. For the every projects, may be its developmental or project level, there will be certain percent of chances on catastrophe to be caused. In this scenario, this paper will discuss the different aspects that are affected in the project. The ICT management tools for rescue and rehabilitation which are utmost part after tragedy will also be discussed through this paper.

Keywords

Disaster, ICT tools, management

1. Introduction

According to Cambridge Dictionary, disaster is an event that results in great harm, damage, death or serious difficulty. Disaster is French aka Italian word where Des means bad and Astre means star [1]. It is defined as a sudden event may be accident or natural catastrophe that causes great damage to resources, property and human value. The United Nations International Strategy for Disaster Reduction (UNISDR) defines disaster as "a serious disruption of the functioning of a community or a society involving wide spread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources". [2]

Disaster are of primarily two types called natural and manmade disaster. Natural disasters are disaster caused by the event of the nature itself and manmade disaster are sudden accidents that are caused and effected by manmade process. Manmade disaster include warfare, collapse of building, vehicle accidents, etc.

ICT means the one term for combination of Information, Communication and Technology for the various services and application associated with it. [3] ICT includes different tools like cell broadcasting, radio, television that helps in accessing applications areas related to management, learning, etc. Information always goes in parallel with communication hence the term ICT always stays inbound. [4]

ICT has great role in disaster management. Management includes the process of identification, preparedness, prediction, prevention and mitigation roles which can be aided with ICT. ICT itself contains different approaches and tools for the rescue, relief and rehabilitation that is associated with disaster management.

2. Analysis of Disaster

Occurrence of Disaster is always inevitable. No one can predict about the future and so do is the disaster. Disaster can happen at any moment and time. With its uncertainty, the loss associated with also becomes uncertain. The ecological to human resource damage including loss of life is the biggest impact it can to in individual level, while the loss at development or society level still counts big. Disasters can be of two types [5]:

1. Natural disasters: Natural disasters are the nature occurring phenomena caused either by rapid or slow events which can be geophysical, hydrological, climatological, meteorological or biological. These natural disasters are of danger in nature causing huge loss to physical property. This may results in change the natural structure and shape of the earth physical nature and biological systems in case of long run and soft run. Example include: earthquake, tsunamis, avalanches, drought, strong waves, and disease epidemics.

Earthquake at Nepal in 2015 is a strong hit making casualties of 8000+ and 20000+ injured which is a type of natural disaster. Approximately 8m people are affected by this earthquake. [6]

2. Man Made disasters: The disasters caused the humans results of work including human settlements, environment pollution, and accidents are manmade disasters. Any task that is related to development also leads to disasters. Urbanization, pollution, deforestation, research on topics, etc. may lead to Man Made disasters with its destruction same or equivalent to Man Made disasters.

The Union Carbide Gas Leak was one of the worst manmade disaster occurred in Bhopal India after gas leaks killing 3000+ peoples and many injuries. [7]

Disasters whether manmade or natural has always been disastrous to human kind life which can be mitigated as well as prevented with proper management including the role of ICT in it.

3. Disaster Management

The task of handling the pre and post condition before/after disaster to reduce the effects caused by it to the minimal point is called disaster management. Disaster can happen at anywhere at any time. Disaster is inevitable. The best way to manage disaster is to identify the potential risks of disaster, analyses the future disaster risk from each and every corner point of the view, analyses the pros and cons associated with the disaster and analyses the cost and value associated with the disaster and make forward for the step actions

associated to it.. Further disaster management can be done with well preparedness, prevention and mitigation theories and philosophies.

Further disaster management can be associated with rescue, relief and rehabilitation process which are of primarily post disastrous works.

It can be handled well in association and collaboration with local bodies, governments, NGO/INGO's, etc. The occurrence of hazard may not result to disaster but early warning leads to hazards not to become disaster. The main role that include well managed disaster is in collaboration with regional bodies, private sector, the media house, etc.

Disaster preparedness is continuous process of risk reducing activities with coordinated planning, that improve risk reduction measures saving maximum lives and livelihoods enabling the affected population to return back to normal times [8]. Instances of preparedness includes animations and videos details about earthquake in Nepal. [9]

Disaster mitigation helps to reduce the risks of disaster through proactive measures before disaster occurs. Karnali River which after implementation has drastically reduced the casualties associated with flood.[10] Other different types of disaster mitigation includes disaster management public awareness, insurance programs, implementing and enforcing building codes, hazard map, etc. [11]

4. Role of ICT in disaster management

ICT has always helped in the identification of risk areas, vulnerabilities zone, and potentially affected risk areas through different tools like hazard mapping and graphical analysis. Information Communication technology can play a significant role in detecting potential risk areas. This primer outlines the importance of ICT in managing disasters.

Mitigation can be done with the help of ICT through timely disaster warning. Although the damage can't be avoided, with effective implementation of ICT for early precaution as well as evacuation, the damage has been highly reduced. The successful warning is determined by role of ICT played and successful programs that take afterward to minimize loss. For instance, Use of community radio for early warning in drought in Kenya and soon help to undertake development programs coordination. [12]

ICT also plays significant role in preparedness and prevention which are the part of disaster management. It should be noted that preparedness. The measures taken for preparing and reducing the effects of disasters is called preparedness where ICT helps in producing platform for effective and coordinated planning, with risk reduction methods to result in saving maximum lives and return to normal after it. ICT provides the efficient handler in such case.

With the successful prevention methods ICT helps in reduction to damage to property and human sufferings. The prevention tools for ICT for the post disaster response includes process of initiating, mobilization, and stand-down. ICT may help in management of Information, facilitate task management, planning and decision making. These all process in prevention can be undertaken with the help of ICT.

5. Tools of ICT

ICT consists of different tools that helps to facilitate in the process of risk management associated with disaster. For the analysis, preparedness, prevention and mitigation of disaster and its risk, the proactive and post active measures can be associated with ICT tools. There are different ICT channel tools which can be considered as:

-Radio/TV
-Internet
-Telephone
-Cell Broadcast
-Community Radio
-Short Message Service
-Geographical Information System
-Sirens
-Remote Sensing

The tools of ICT helps in identification, prediction, preparedness, prevention, mitigation and prediction of the disasters that may occur. The important process of collecting analyzing and disseminating information in accordance to local bodies and situation is only effective through tools of ICT

Radio/TV: One of the traditional method used for conveying messages to huge population at a time. The possible drawback seems is that when they are switched off, the message conveyed is equal to zero. Early warning system can be associated with ICT for the disaster management.

Internet: Internet is huge connection of network. The pre and post disaster management can be useful with the help of Internet. The funding after post disaster can be successful due to use of internet application. Huge money was collected as donation from worldwide after major Earthquake in Nepal. [13] Pre disaster management includes awareness program associated with Internet applications.

Telephone: Telephone is used as end to end communication that is used for disaster management especially for alerting and relief and rehabilitation process. The special hotline numbers can be used by the officials to provide the information services.

Cell Broadcast: Cell broadcast is an integrated open system that allows emergency officials one touch notification to cell phones with covering all carriers regardless of the size and carrier. [14] Cell broadcast is a more effective system than SMS as no additional cost is required and not affected by traffic load.

Geographic Information System (GIS): A geographic information system is a computer system for capturing, storing and disseminating data to easily see, analyses and understand patterns in maps. GIS can use location, longitude, latitude, and different information real data and helps simultaneously to compare them.[15] A geographic information system (GIS) lets us visualize, question, analyze, and interpret data to understand relationships, patterns, and trends. In regards with disaster management, the process of understanding of mitigation and prevention helps with high decision making, cost saving, improved communication, better record keeping and managing geographically located data in organized manner makes GIS one of the important thing. [16]

Remote Sensing: Remote sensing is the acquisition of information about particular place or object with the help of satellite and other high flying air-crafts. It is used to collect the information for further

research purposes about the place and object, by scanning them. It is used in variety of fields ranging from geology, ecology, and glaciology. It is of most effective way to get the information about the geography of the place. It can be used to get know about the place, what sort of disaster is more likely to hit the place. Like collecting the record of earthquake, and observing how much it has effect on the nearby regions. The data is collected from a higher view, with the help of satellite and aircraft to get a large view of the affected area and its nearby region.

6. Effectiveness/Benefits of ICT

The sadness and grieves that follows after the disaster is more troublesome just as the disaster itself. It profoundly impacts the victims physically and psychologically and the impact can change the social lives too.

- The GIS tools can record the previous statistics about the disasters that hit or are likely to hit the place any time soon. Like, it can have a record of when the Earthquake hit Kathmandu valley, and how much hard it can do. Such statistics can be helpful for future references.
- The communication media like radio, TV and Internet can be a important resources in order to inform majority of the public before the disaster i.e. sending the emergency and they can also help for post-disaster relief programs.
- The media can also be used to teach and inform the public about the basic preparation habits, like first aid services, and how to be safe from earthquake, what to do during those occurrences.

7. Risks of ICT

Despite ICT seeming a great tool for disaster management, it comes with its bad side to. Because there's always two side to a tool. And ICT is no different. ICT provides a strong means of communication. But not all the users are the same.

- Some people just put out false information regarding the disaster, affecting other people by surprise. The wrong use of media is disastrous.
- Some even get down to making prank/fake events, just to collect money and misuse it. Especially after the time of disaster, when everyone started collecting money to help the victims but not all the collectors were with that motive.
- ICT can make a large reach, but it still won't reach all the users, because, there are people who do not own mobile phones, and don't use the internet. The old people mostly, they are out of reach of technology.

8. How to be more effective?

There will always be a space for improvement. To improve ICT for disaster management, the following things might be done.

- The government should put of awareness program about disaster and teach about the safety measures to be followed during that time.
- The literacy class should be held, and also the citizens must be taught on how to use the basic communication media.
- There should be improvement on the quality of network too. The congestion on the network after the disaster is troubling.

- The cost of basic communication services should be made suitable with the daily living cost of the common citizens. Technology should be affordable.

9. Conclusion

So, technology is a great tool, and gives a communicating medium for most of the population, but still it should be bettered. There is space for further improvement, and it should be advanced to that level. And of all it should be made affordable for the common public. The technological resources should be fully exploited, to serve the common needs and help the people making their lives better and safer. After all that's the point of this whole advancement of civilization to make human lives better.

It's not only the job of the government but the aware people also. They should share the knowledge. The citizens must share a bond with the society with social values and norms. They should learn to peacefully co-exists and help each other in the time of need.

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ICT for Environment: Environmental Information System for alternative energy and environment to promote its sustainability in Nepal

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ABSTRACT

Information and Communication Technology (ICT) and its relationship with environment is controversial. ICT is used extensively, especially by developed nations to fight climate change, pollution and energy crisis and other environmental issues. At the same time ICT also contributes around 2% of global greenhouse gas (GHG) emission and is growing at very fast rate. GHG is a major cause to climate change. Despite Nepal's emission of GHG is one of the lowest in the entire world, it is the fourth most vulnerable country to climate change. However, addressing environmental issues is in the lowest priority of government of Nepal. Currently majority of population of Nepal has access to telephone and internet connection. Availability of a reliable and interactive Environmental Information System (EIS) can empower citizens and managements with the environmental information of the nation and bring out positive changes through effective decision making. Unfortunately, apart from dull tabular data and occasional environmental awareness projects no robust means of EIS is available.

EIS using Geographical Information System (GIS) has been implemented and proved effective in many countries. Nepal can take advantage of its growing ICT market to implement such EIS to address its growing energy crisis and other environment problem mainly through promotion of alternative energy and its sustainability.

Keywords: Information and Communication Technology (ICT), Environmental Information System (EIS), Geographical Information System (GIS), Global Greenhouse Gas (GHG), Energy

I. INTRODUCTION

Information and Communication Technology (ICT) and environment is intertwined with each other in many ways. Environment is affected by human actions such as how they use its resources and replenishes them. ICT on the other hand have day to day involvement in individual lives of human. At such, ICT and environment cannot be unrelated and in fact, have direct correspondence to each other. According to calculations by consultants A.T. Kearney, ICT industry accounts for around 600 million metric tons of CO_2 emission every year which is equivalent to 2% of global GHG emission and increasing at very fast rate [1]. However, ICT-induced energy efficiency is estimated to save several times more energy than the energy consumed by ICT itself [2].

Energy crisis is one of the major problems in Nepal. Urban population is facing power outage as a result of more power demand than supply can meet. Commercial cooking fuels like LPG and petrol are scarcely available at remote population. Around 75 percent of total population still depends on firewood as main source of cooking. According to WHO, "4 million out of 3 billion people die prematurely from illness relevant to the indoor household air pollution from cooking with solid fuels" [3]. There is no official statistics of such deaths in Nepal but it is sure that large population is exposed to such vulnerabilities. Energy can be linked to other issues such as deforestation, sanitation, fertility, erosion.

The growing ICT market in Nepal can be used to implement energy efficiency and solve environmental problem while checking on negative impact of ICT on

environment. Use of Environmental Information System (EIS) has prospect of being the most practical and valuable solution to address environmental issue of Nepal.

ENVIRONMENTAL INFORMATION SYSTEM (EIS) IN ENVIRONMENTAL MANAGEMENT

Environmental Information System is a combination of geographical information system (GIS) that collects, stores, analyses and provides information crucial to environmental management. Environmental Management consists of stakeholders including general public, environmentalist and government that makes decisions to draw practical, effective and sustainable plans [4]. EIS is basically an application with integrated features of data visualization through maps, charts and other GIS features. Data involving environment generally consists of location details. So it is logical to represent environmental data in maps as they are mostly stored as geographical data. EIS lets users to access data on wide range of environmental components through queries and provides data managements tools for their analysis [5]. Environmental data from government offices, INGOs and input from civil society can readily be combined with existing or newly created map to construct GIS system. It can be mined for new data, to visualize data in more informed way or solve real world problems.

ROLE OF GIS IN ENVIRONMENTAL INFORMATION SYSTEM

Modern GIS has evolved into a powerful technology that can represent exact geographical location with many layers of information associated with it. Information of a location is represented as a layer in corresponding GIS application location including environmental measurements. This allows multiple application to be created from same GIS based on specific issue being inspected. For instance, GIS application of Nepal may show usage of fossil fuels throughout the country and the same application may be modified with layers to show prospects of alternative energy in those areas. GIS supports and delivers decision making information to environmentalist or awareness and guidelines to general public.

GIS can organize existing information or create new information from existing one through analysis and transfer that information throughout their organizations. GIS can automate processes, alter environmental management operations by gaining new knowledge, and support decisions that have environmental impact [6]. Unlike paper maps or tabular data that dominates information system of Nepal, a GIS is an interactive and dynamic and may be updated continuously to accommodate most recent information. GIS system can be as small as a personal endeavor or be a national level asset. GIS is extended to EIS creating often complex body that supports planning, analysis decision making through use of environmental information [4].

II. BACKGROUND

It is not true that the concern for the environment is total sanctuary of environmentalist only. Today, environmental responsibility is a critical issue for governments and citizens forming civil society. Many countries are already introducing ICT tools to protect environment and fight environmental issues. According to Dr. Hamadoun I. Touré, Secretary-General of the International Telecommunication Union (ITU) "ICTs are cross-cutting technologies that can drive the deep transformation needed in the global effort to combat climate change. This is all about opportunity: forward-thinking leaders already recognize the need to move forward and look to ICTs as a key enabler of a new model of social and economic development."

Significance of EIS has been widely recognized by many countries to dispatch environmental information. In 2010, ITU approved a Resolution to protect environment and battle climate change issue by highlighting the role of telecommunication and ICTs at Plenipotentiary Conference in Guadalajara, Mexico. For that reason, ITU is committed to aid developing nations use ICTs with stakeholders and develop tools to support this objective. In the Plurinational State of Bolivia, the EIS of the National Chamber of Industry contains alphanumeric and cartographical contents about the country in a single system. Chile has a National Environmental Information System (SINIA) web portal, managed by the Ministry of Environment, which manage information on the country's environment and natural resources in a comprehensive

and interpretable manner. This portal gives access to the various information systems that make up SINIA [7].

The ICIMOD (International Centre for Integrated Mountain Development) is a regional intergovernmental centre with south Asian countries of Hindu Kush Himalayas - Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan. The main objective of ICIMOD is to assist mountain people to understand the Globalization and climate changes, to adapt and make the most of new opportunities, while addressing upstream-downstream issues [8]. Alternative Energy Promotion Centre (AEPC) is another government body under the Ministry of Science and Technology that promotes renewable energy as mainstream resource and thereby, protect environment and raise living standard of people in rural area [9].

Most of the environmental information and few GIS application of Nepal are created with support from donor-funded organization like UNEP and ICIMOD. Central Bureau of Statistics (CBS) is a national body under the National Planning Commission Secretariat (NPCS) of Nepal and serves as a national statistical organization of Government of Nepal. CBS now provides national statistics in form of maps and tabular data that can be publicly accessed. CBS uses ArcGIS, a GIS based software to create static maps [10]. Based on this, it can be seen that the basic foundation for establishment of intermediate level EIS is present in Nepal.

Nepal is the fourth most vulnerable country to climate change despite its contribution to GHG emission is only 0.04% which is one of the lowest in the world. Global warming is an alarming issue caused primarily due to Green House Gas (GHG) emission and production of carbon dioxide gas attributed mostly to human activities that involves burning of fossil fuel, deforestation and pollution. Nepal is a small and simple country at the very beginning stage of globalization. It is therefore, necessary for Nepal to participate with global nations in campaign to preserve environments for their own sake at the very least. EIS system can analyze tabular national statistics into information repository that provides environmental information for awareness. However, primary obstacle for implementation of EIS

is indifference of government followed by technological and institutional constraints.

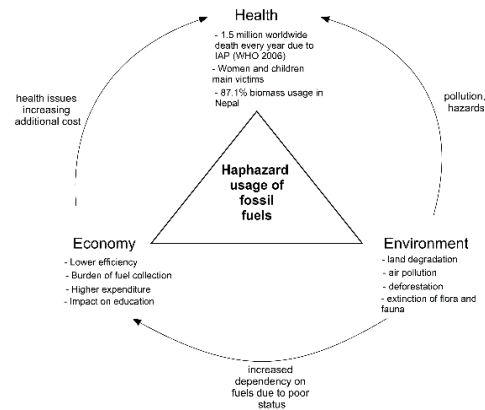## III. NEED FOR SUSTAINABILITY OF ALTERNATIVE ENERGY

Figure 1: Impacts of overutilization of traditional fuels

Nepal may be poor economically but is rich in natural resources. Energy demand is increasing exponentially with modernization. There is huge prospect for generation of alternative energy in Nepal [11]. This can decrease dependency on traditional energy sources. Haphazard use of traditional energy sources is responsible for most of the threats and pollution. For instance, over usage of firewood cause deforestation which in turn create soil erosion and therefore increase risk of landslide. Furthermore, it endangers life and property. Ecosystem comprises of many such chain reactions and how energy is utilized is one of its biggest player. Alternative sources of energy are mainly inexhaustible source of energy like wind, water and solar energy. They are environmental friendly and are as efficient as its traditional energy counterpart. It minimizes burden on environment by reducing emission of greenhouse gases. This in turn acts as a catalyst to sustainable development, regional balance and economic activities. It will ultimately result in improvement in health, economy and education [11].

Traditional sources involving firewood, dung, crop residues share 87.1%, petroleum products, coal and electricity shares 12.2% and renewable source contribute only 0.7% to total energy consumption. Population in urban areas relies mostly on commercial fuel like petrol, electricity and LPG [12]. Due to high

population density, it is often difficult to meet up with demand of energy in these areas. Shortage of petroleum fuels, LPG, and power outage for hours are common problem. Other than few overcrowded cities, Nepal is mostly rural. As a result, dependency on traditional energy such as firewood is natural as they are readily and in many cases freely available. Women and children are mostly exposed to respiratory disease as a result of inhaling poisonous smoke from burning biomass in poorly ventilated room. In addition, it is time consuming, often several hours a day and visit considerable distance to collect firewood to meet daily household need. Because of this, women and children may not get appropriate opportunity for proper education or other productive activities. This trend is inefficient in terms of time and cost as well as has negative impact on health, environment and lifestyle of people. Therefore, sustainability of alternative energy offers an effective method to avoid these problems and offer much better and cleaner solution [13].

IV. EIS TO ADDRESS SUSTAINABILITY OF ALTERNATE ENERGY AND ENVIRONMENT
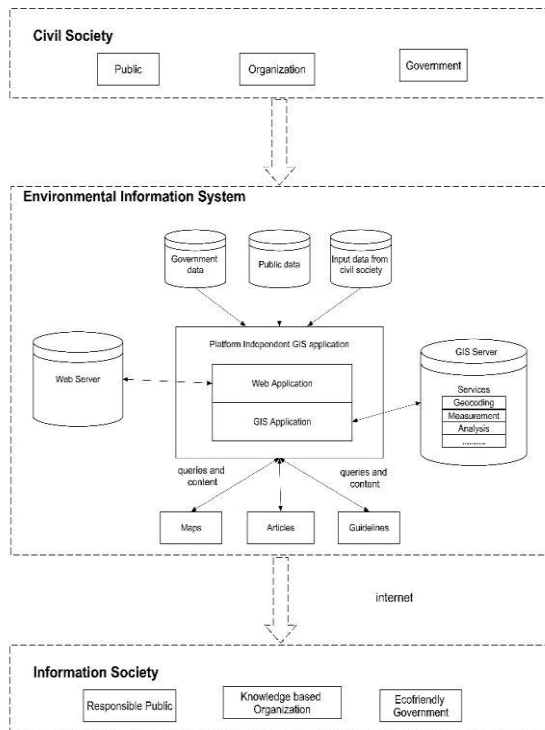

Figure 2: ICT enabled Environmental Information System

The proposed system is an Environmental Information System with one main objective of providing environmental information to anyone at anywhere and thus, bringing behavioral changes among people to form low-carbon society. Most of the changes to a low-carbon society should start from local level where energy is actually consumed. Proper dispatching of information about the range of options aids this process. To do this more effectively, people require the knowledge and information of available range of options such as building efficient cooking stoves, benefits of alternative energy and how to build them. ICT-based information system can readily provide such information on demand where general public should be able to access information easily from anywhere [14]. It consists of mainly two parts: Environmental Information System and its users. The users can be individuals, an organization or even government.

The major content of this EIS will be visual information in form of maps that are both pictorial and interactive. Pictorial maps are preprocessed maps with statistical and analytical information on number of people using firewood as cooking fuel and suffering from its pollutants, environmental resources consumption patterns, pollution index, garbage disposal stations, visualization of various environmental issues and their solution and much more. These maps can be further elaborated into articles that people can read as news. Interactive maps will use GIS technology to display similar information but with much more functionality. Unlike Google maps and Bing maps that provide information on life and style, these maps will provide environmental information localized on Nepal. EIS application is formed up of two parts: Web Application and GIS Application. Articles and pictorial maps are handled by web application while GIS application provides online, dynamic and powerful platform for interactive map.

The fact that one third of population of Nepal has now access to internet makes this system even more practical. The number of internet service subscribers in the country has crossed the 10-million mark. It took around two decades to surpass the milestone and is mainly supported by huge growth in mobile data intake during the last five years. With this, the internet penetration rate has reached 38.09 per cent while that of telecommunication penetration exceeded 100 percent

[15]. This can be used in advantage to disseminate proper information to people through EIS. Information is decisive factor in most cases. People tend to opt the choices that are beneficial to them. EIS can point out perks of healthy environment, use of alternative energy sources, guidelines like use of homemade compost manures in terms of economical, health and social personal gain to bring out behavioral changes in people. By providing information to people they can react accordingly. People with clean and rich environment become aware to protect it. People who are suffering from environmental issues can work on to mitigate and resolve them.

V. CONCLUSION

ICT is ubiquitous and have potential effect and impacts on individuals and environment. ICT have little contribution to global warming but the use of ICT in energy efficiency is much more than it consumes. Nepal is one of the most vulnerable country subject to climate change. ICT have many applications for preserving environment that include prediction and early warning system, energy efficiency application and information education. Among these influential powers of ICT can be used to develop an EIS system that will provide high quality of environmental information about Nepal and promote sustainability of alternative energy. Alternative energy is the key to resolve existing energy crisis in the country and mitigate environmental effects though over usage of traditional source. EIS system can provide general information on environmental status, aware people on harms and benefits or range of choices such as use benefits of alternative energy and harm of traditional energies and bring gradual social change in long term.

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INTEGRATION OF CLOUD COMPUTING AND INTERNET OF THINGS

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ABSTRACT

The Cloud computing and Internet of Things (IoT) are quite distinct from one another. These technologies have already become a part of our everyday life. Their implementation and use are expected to be tireless, making them a major factor in the future of computing. A Paradigm where Cloud and IoT converge is thought to be disruptive but at the same time an enabler for numerous and promising applications in the real world scenarios. In this paper, we will be gathering our attention to the integration of Cloud and IoT, which is termed as "The Cloud-IoT" paradigm. We will provide a detailed nature and implementation of the integration of Cloud and IoT. Starting with the exploration of the basics of both IoT and Cloud Computing, we will discuss the real world issues and the how Cloud-IoT could be implemented on them. We provide an up-to-date picture of Cloud-IoT applications, with a focus on their specific research challenges. Finally, these challenges will be investigated to show where the future of computing in this field is heading, which we expect to play a leading role.
Keywords: Cloud Computing, Internet of Things (IoT), Integration, Cloud-IoT, Application Cloud-IoT, challenges of Cloud-IoT.

INTRODUCTION

Cloud Computing is the new paradigm in the world of computing where we don't have to rely on the memory devices completely, rather we use severs hosted by different Servers Providers and take full leverage of it through the Internet. Cloud computing has virtually unlimited capacity of storage and processing power which is a more mature technology at least to a certain extent to solve the problem of most of the Internet of things. On the other hand Internet of Things (IoT) is a system interrelated computing devices, mechanical and digital machines, animal, humans, or objects provided with unique identities and ability to transfer and process data without requiring human-human or human-machine interaction. Internet of things usually refers to the real world and limited storage and processing ability. The two worlds of Cloud and IoT have been self-regulating evolutions. However, mutual advantages could be derived from their integration. IoT can benefit from the virtually unlimited capabilities and resources of Cloud to compensate its technological constraints (e.g., storage, processing).The Cloud can comprehend an effective solution to implement IoT services and applications that exploits the data produced by them. On the other hand, the Cloud can benefit from IoT by broadening its scope to deal with real world challenges in a more distributed and dynamic manner, and for delivering new services in a large number of real life scenarios. Thus a noble Paradigm where Cloud and IoT converge is thought to be disruptive but at the same time an enabler for numerous and promising applications in the real world scenarios. The Cloud-IoT, a new system considered to be the future of the Internet and computing.

NEED FOR THE INTEGRATION OF CLOUD COMPUTIONG AND INTERNET OF THINGS

In today's world, people want everything to be connected. Regardless of whether if it's a washing machine, an oven, a refrigerator, or a vehicle, and all will communicate with Cloud Servers. But in order for Cloud Servers to gather the data and processing for the machines, it needs the aid of IoT. The Cloud and the IoT are distinct from one another. The features of the cloud computing and Internet of things are distinctive in nature for Cloud-IoT paradigm as shown in Table 1.

Table 1: The Interconnected Characters.

Internet of Things	Cloud
Real world things	*Simulated resources*
Limited calculation	*Unlimited calculation*
Point of conjunction	*Service delivery*
limited storage	*adequate Storage*
Big data	*Process to handle big data*

Basically, the Cloud acts as transitional layer between the things (objects) and the applications, where all the data, processed result, and complex functions necessary to implement are stored.
The following are the major notions for the requirement for the Integration of the Cloud computing and Internet of Things: Repository, Number Crunching, and Collaboration.

1.Repository

Internet of Things produces numerous unstructured or semi-structured data, mainly of three forms volume,

swiftness and variation, meaning the process of collecting, attaining, processing and visualizing, archiving, sharing, and searching large amounts of data. It would need a huge and on-demand storage at a low cost to store analyze and process these data. This could be achieved by Cloud technology. Cloud is the most advantageous and cost efficient solutions to handle the data generated by the Internet of things. Once uploaded to the cloud, data through a typical API, can use the secure, and access directly from anywhere. Collected data are usually assembled and transmitted to a more powerful node processing and storage would be available as per the need.

2. Number Crunching

IoT have very limited processing resources that doesn't allow real-time data processing. Data gathered are usually transferred to powerful nodes where assembly and processing is feasible, but scalability is difficult to achieve without a proper processing setup. The unlimited processing of Cloud and the on-demand system allow IoT to handle needs would be properly satisfied and the analyses of unparalleled complication. Data-driven resolution and prediction algorithms would be possible at a minimum cost and would provide growing profits and condensed risks. Other outlook would be to perform real-time handling, sensor-centric applications, to cope with complex actions, and to implement task for energy saving.

3. Collaboration:

One of the necessities of IoT is to create IP-enabled devices communicate through dedicated hardware, and also the support for such Collaboration is extremely costly. Cloud offers a good and minimum cost to connect, track, and manage everything from anywhere at any time using custom-made portals and in-built apps, due to the provision of high-speed networks, it allows the possibility to manage and control isolated things, their coordination and their Collaboration and real-time implementation to the result.

ADVANTAGES AND DISADVANTAGES OF CLOUD-IOT

1. Advantages

1.1 Cost-efficient and Time saving

The most significant Cloud computing benefit is cost savings. IoT involves in numerous connected computing devices, mechanical and digital machines, animal, humans, or objects handling all of them could be costly and time-consuming. The interconnected computing interaction provides better efficiency, hence; accurate results can be obtained fast. But the computing power required is too costly and maintain will take a lot of attention. With cloud computing, you can save lot of time and significant capital costs with zero domestic server storage and application requirements. Cloud's powerful features could be beneficial for IoT.   The processing power of cloud would substantially reduce the cost required and the save time as everything on Cloud would maintained by the service provider.

1.2 Manageability

Cloud computing delivers simplified data processing organization and maintenance capabilities through central administration of resources, vendor managed infrastructure. IoT can benefit a lot from Cloud. With the systematic, simple web-based user interface to gain access to software, applications and services, managing the Things of the Internet would be very easy and convenient.

Storage recourses:

IoT is defined in the information sources (things), which produce's large amount of data usually of Big Data: data size, data types, data generation occurrence. Thus, it shows gathering, retrieving, handling, visualizing, archiving, allocating, and examining huge data. Giving virtually boundless, cost-saving, and as per needed storage volume, Cloud is the appropriate and affordable key for dealing with the information and data collected by IoT. This integration takes a new joining situation, where new openings arise for information collection, integration, and distribution with third-parties. After the use of Cloud, data could be dealt in a standardized means over regular APIs, and could be secure by installing most powerful security, and easy access and visualize anywhere.

1.3 Computation recourses

IoT devices comprises inadequate processing resources which won't let immediate and data processing. Data collected are generally transferred to higher and powerful nodes where collection and handling is possible, but scalability is challenging to accomplish without an appropriate structure. The boundless processing abilities of Cloud and its on-demand model let's IoT processing requirements to be fulfilled and assist analyses of exceptional complexity. Data-driven decision making and forecast algorithms would be likely at minimum cost and would offer growing incomes and less risks. Other outlooks would be to implement real-time processing to instrument accessible, real-time, shared applications to accomplish complex scenarios, and to implement assignment free from energy saving.

1.4 Communication recourse

Cloud offers a well-organized and economical solution to connect, track, and manage everything from anywhere and anytime using tailored gateways and integrated applications. Because of the use of high speed networks, it empowers the monitoring and maintaining remote things, their management, their infrastructures, and the real-time entry to the formed data.

1.5 New capabilities

IoT is considered to be high diverseness of devices, machineries, and procedures. Therefore, scalability, interoperability, trustworthiness, effectiveness, handiness, and security could be difficult to acquire. The integration with the Cloud resolves these

problems, further features such as ease-of-access, ease-of-operation, and condensed distribution costs.

2. Disadvantages

2.1 Security

In Cloud-IoT system, everything is over the Cloud, the user hardly knows how their data are stored and how much secured is the network. Thus, it is not clear if the data are highly secure and that they are impenetrable. Also, with advancement of IT immense threats are introduced by the growing use of smartphones as well as wearable electronics.

2.2 Consumption of electricity

Cloud-IoT integrates Cloud computing and the Internet of Things, meaning setting up enormous amount of Servers leading to over consumption of electricity. Not just servers but also Internet of Things comes with huge amount of devices such as wearables, smartphone, sensors etc. which also leads to consumption of energy.

APPLICATION OF CLOUD-IOT

Internet of Things (IoT) is one of the utmost dynamic and versatile areas of information technology at the today's time. IoT involves in interconnecting the physical objects ("things") to the IT systems that can extracts information about or from those things which in turn be useful to on a range of applications and services which may be interrelated to the things. IoT handles a wide range of applications, covering enterprises, administrations and consumers and symbolizes the integration of paradigm from conventionally different groups: Information Technology plus Operational Technology. Thus, it is significant for IoT systems to have a structural design, systems principles, and processes that can adapt to the remarkable scale, security, reliability, and discretion requirements.

Here are some of the application of the Cloud-IoT system:
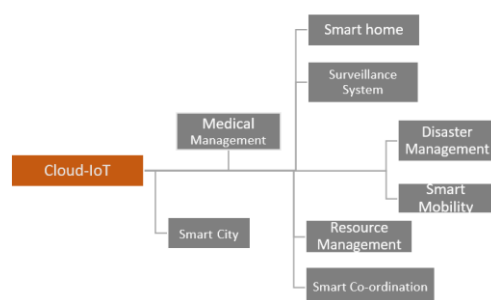
1. Medical Industry

Business models in the Healthcare industry is rapidly being altered after the Arrival of IOT's. The ability of IOT to gather information from anywhere and the cloud's ability to collect record and analyze them has given medical industry an extra power to manage the industry efficiently. Some of the Basic Scenarios are mentioned below:

1.1 Minimization of device maintenance cost and time

Connecting any device with IOT's and cloud could seriously reduce maintenance time and cost. Any connected device that needs constant monitoring and technical assistance could be maintained without being physically present in front of the machine and multiple machines could be targeted at a single time.

1.2 Patient Monitoring

The concept of Patient monitoring remotely using IOT and cloud is pretty simple. Various Different Sensors are used to securely capture public health data and then these data are transferred to Cloud where complex algorithms are run. After this medical Professionals will be able to make proper recommendations.

1.3 Wearables

Smart wearables are widely being developed these days and we can see a huge potential for IOT and clouds involvement in this as well. Heart rate sensors, blood pressure meter, diabetes test everything could be integrated to a single device and whose data could be transferred to the Cloud and further implement Data Analysis algorithms for future purposes.

2. Natural Resource Management

Management of the natural resources is termed to be natural resource management. The natural resource may include land, water, soil, pants and animals and all the elements and things found in nature. In order for the resources to be managed, key components are usually observed: biodiversity, habitats, sustainability, rate of extinction, ecological imbalance etc. Cloud-IoT can play a vital role in managing these resources. With Cloud-IoT intelligent real time system could be developed for monitoring every natural resource in the planet. Special Algorithms would help in collecting, processing, sensing, and networking these data to know the exact rate of the consumption of the resources in both local as well as widespread area. Knowing the exact amount of resources being exploited, we can predict the future of these resources and take complex and comprehensive measures. With Cloud-IoT resources could not just be protected but could be used in systematic form. For instance, a farmer can harvest and produce more crops, if he knew what damages the soil, how can a barren land be made cultivable, resulting in more amount of crops and that could be achieved by Cloud-IoT, by finding out specific relation among different tropical structure

around the globe and knowing why it is barren and what measure could be taken. Similarly, water resources, energy resources and plants could be conserved by gathering data and patterns resulting in a sustainable and long-term resources.

3. Smart Coordination

Logistics is defined as a well-organized and cost-effective managed decisions linked to the plan, develop and control of the resource sequence procedures. Smart Coordination approaches this in a smooth way, meaning planning and arranging, ICT organization, people and administrative strategy planning needs to be efficiently and productively aligned. Smart Coordination mainly includes Design, People, Strategy and Infrastructure and is the coordinated relationship of these four key domain.

4. Disaster Management

Disaster whether natural or human-made, is a problem which results in extensive life damage. It is accompanied by loss of livelihood and possessions affecting shocking impact on socio-economic states. Types of Disasters- There are 2 types of disasters categorized on the basis of origin, namely Natural disaster: earthquakes, flood and landslides, volcanic eruptions and so on. Human induced disasters: Nuclear disasters, bio-hazard disasters, chemical disasters etc. The Cloud-IoT will be a beneficial in this setting. From Clout-IoT technology, we can easily monitor every nook and Connor of the particular or widespread disaster prone areas and with different IoT technologies such as lacing surveillance droids, sensors and other technologies we can immediately know about the disasters occurring and with real-time processing we can determine the exact impact and period it will occur and take major precautions according to it. With future development we can even be well prepared before the disasters occur by pattern matching algorithm of real-time and analyzing the past data collected from IOT and Processed by IOT.

5. Smart Cities and Smart home

IOT-Cloud are making it possible in making cities safer and effective to live. By connecting Vehicles to the cloud via IOT, it will be easier to manage traffic according to the number of vehicles present at a given time in a certain region. Surveillance Cameras connected with IOT and cloud could prove to be a great way for ensuring public safety. The Street Lights, public water consumption etc. could also be managed efficiently. With the involvement of IOT and its implementation in traffic management, Emergency vehicles could see available open routes directly from their hand-held devices and move towards their destination accordingly. IOT and cloud can also be combined used in household systems to make our daily life simpler. Many companies are developing systems which collect data from devices inside of a house, push the data to the Cloud server and then from that to the owner mobile phone. Owners then send control messages from their mobile phone and the devices that are connected to IOT inside their house will respond accordingly. For example a sprinkler system can be scheduled time for it to water the plants whenever needed and this instruction can be sent to it from anywhere around the world if the sprinkler is connected to an IOT-Cloud paradigm. This is a small situation where IOT could be used in a domestic environment, we could basically find additional devices that could be linked to IOT and cloud.

6. Microsoft Azure

Using Microsoft Azure IOT suite IOT is all about making all our data come together in new ways and utilize those data in some manner. Azure's cloud platform helps to make this process easier. With Azure IOT suite's sophisticated easy to use features users are capable of connecting to their IOT remotely and manage, control it from any location in this world. One of its feature is to analyze the data stream in motion and storing and query large data sets. Visualizing real time as well as historical data makes Azure IOT ideal for working with IOT in and with Cloud. Azure IOT Suite also delivers many pre-configured solutions that help to reduce the time it takes to configure IOT solutions. There are other tools as well for working with Cloud-IOT but being a very fast and reliable platform Microsoft Azure IOT seems to be the best platform available for integration of IOT with cloud.

CLOUD-IOT CHALLANGES

1. Huge collection of electronic garbage

With the advancement of Cloud-IoT system, lots of electronic garbage's would be collected. Many IoT devices will be decommissioned after its use or will be faulty resulting to dumping of that IoT device. Thus, causing rapid assortment of the electronic devices know to be electronic garb ages.

2 Over consumption of energy

Since Cloud-IoT paradigm is dependent on the Cloud and IoT devices, over consumption of energy is inevitable. Cloud-IoT requires uninterrupted communication between IoT device and the servers. IoT devices needs continuous transmission of data from and to Servers which means Servers need to be present all the time. Thus, Servers needs to be provided with huge and stable energy causing extensive use of energy. Similarly, IoT devices also need continuous supply of energy.

3 Some other challenges

3.1   Lack of flexibility of IoT devices

3.2   Threats introduced by the growing use of smartphones as well as wearable electronics.

3.3   Challenges related to monitoring are further affected by volume, variety, and velocity characteristics of IoT

CONCLUSION

This paper is focused on the research of the application of the implementation of Cloud computing based on Internet of Things (IoT) methodology as the "Cloud-IOT" paradigm. We have here noted various already implemented and possible application of the Cloud-IOT systems. In the future, we plan to modify our method in the following three aspects: (1) find out more solutions to the scattering and optimization. (2) Conduct more in-depth research on mathematical analysis of our method. Though we have mentioned some noteworthy systems in this paper, we might have missed out on other innovative systems that we could not find during our research period.

ACKNOWLEDGEMENT

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Intelligent RFID Reader Design for Internet of Things Applications – A Review

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Abstract—**Considering the present scenario regarding security, fast operation and easy understanding the role of RFID is increasing day by day. There are various industries which uses RFID to identify the objects with the help of the RFID Reader as well as tag. This paper deals with the designing of the various types of RFID reader as well as understanding their protocol. Based on the protocol designing and algorithms they can be implemented into the real world effectively. RFID reader is designed according to various applications and the most challenging part comes when we consider the performance, evaluation criteria, accuracy and also multiple uses.**

Keywords— RFID Reader, Tag, Toll Tax Management, Attendance Management, Library Management System, Radio Frequency Identification.

I. INTRODUCTION

RFID reader is a network either fixed or movable, capable of reading the tag value wirelessly and according to this unique data process the further processing is carried on. The RFID technology was first introduced in the U.S.A military for tracking the missile location. This paper combinely discuss about the RFID technology, its benefits and also its various applications with Internet of Thing. It also includes different types of RFID reader and their designing concept in context of hardware and algorithm. [2] The tag content the information in the chip attached with the tag. The tags are classified into two category as Active tag and Passive tag. Active tag require power supply and passive tag take the power supply from the reader. The various types of RFID reader is designed with the different features but there is still difficulty in finding the applications considering Internet of Things and its application with enhance features. Hence in todays market it is required to design a RFID reader which is compatible with the application with the internet of thing. Author [3] [4] proposed internet integrated RFID reader which work on IPv6 protocol and can be implemented for the IOT applications. Mandeep [5] et al. discusses the various advantage, limitation and application of the RFID technology. The various advantages of RFID technology are as follows:

1. Reading and writing features are available in RFID technology.
2. Processing time is faster as compared to barcode system.
3. Reduces human effort.
4. Read range is high as compared to barcode (high frequency reader).
5. There is no direct physical contact between tag and reader.
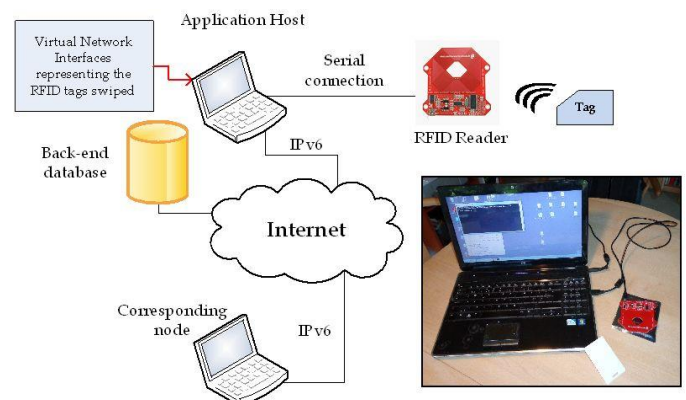6. RFID reader read the tag value so human intervention is not required so that less chances of error.

Fig.1. Setup of RFID tags and reader for virtual identification on the Internet[3]

[1] According to the operating frequency RFID Reader is classified into the following categories:

1. Low Frequency - 125 KHz RFID Reader
2. High Frequency - 13.56 MHz RFID Reader
3. Ultra High Frequency - 865-915 MHz RFID Reader
4. Ultra High Frequency - 2.4 GHz RFID Reader

II. LOW FREQUENCY - 125 KHZ RFID READER

These types of RFID reader works on the 125 KHz cutoff frequency. The antenna is designed with the help of the coil. The cut of frequency is calculated by the given formula.

$$f_{resonant} = \frac{1}{2\pi \sqrt{LC}} \tag{1}$$

The resonance cut off frequency is designed with the help of the coil and capacitor. On the sharp tuning of the resonance frequency reader can read distance increased up to 12". These types of RFID reader is used where the reading distance is required very less. Library management system, attendance management system, toll tax management system etc. is designed with the help of this 125 KHz cut off frequency. In the given figure 125 KHz RFID Reader is design based on the EM4100 protocol and EM4095 protocol, which access the 64

bit data and extract only 32 bit original data. The communication between RFID Reader and tag is in analog mode. These analog data is converted into the digital data and from the 64 bit data stream, 32 bit original data is fetched and these data does the further processing. The hardware section consist of oscillator circuit, Amplitude modulator, Amplitude demodulator, filter circuit, detector circuit (to detect the digital bit stream). Software based on certain algorithm is used in the reader circuit that reads these data and find out the original data.

III. HIGH FREQUENCY - 13.56 MHZ RFID READER

These types of RFID Reader works on 13.56MHz cut off frequency. The patch type antenna could be designed for this type of reader. Reading distance of this type of reader is high and it could be increased upto 24 inches. This type of reader consist oscillation circuit which generates the frequency of 13.56 MHz as cut-off frequency. When the tag is detected, analog signal changes and according to these changes demodulator circuit detect the binary value. The high frequency RFID reader firmware is available in the reader circuit which read the binary information and from this information, the tag value data is extracted.

[1] Author developed the algorithm to test the various types of RFID Reader used for the medical purpose applications. They also developed a separate simulator for the 125 KHz, 13.56 MHz, 915 MHz and 2.4 GHz RFID Readers. They tested the RFID Reader that could be affected from the medical devices so that they performed repeatable test from the antenna and pick the wide variety of the signal. They worked on the electromagnetic compatibility (EMC) issue that interference occurs due to various RFID Readers and proposed algorithm take less time to test.

IV. ULTRA HIGH FREQUENCY - 865-915 MHZ RFID READER

This type of RFID reader are popular for the long distance communication. The data transmission is fast. Author [10] [11] [12] proposed the various type of UHF antenna and used of FR4 substrate to design them. According to the different UHF band frequency used in various countries they test and achieve average 2.49 dBi gain. The reader circuit reads this UHF frequency band signal and sends to the demodulator which divide this signal to the low frequency signal which is suitable for the further processing in the circuit. These circuits extract the signal which is found in decoded format in the tag and extract the original information. This unique code information signal is useful for the further transmission.

V. ULTRA HIGH FREQUENCY - 2.4 GHZ RFID READER

Ultra high frequency is popular for the long distance communication. This type of frequency range RFID reader mostly used due to 2.4GHz frequency is free band frequency and also used for the internet of things application. [9]Author design 2.4 GHz path type antenna for the RFID reader application. The reader circuit first convert high frequency

signal to the low frequency signal so that they can process to the further electronics hardware. According to the protocol used in the tag, program (microcontroller) feed to the electronic hardware to extract the original information. Now these information send serial to the computer or for the further processing applications.

TABLE I. COMPARISON OF DIFFERENT RFID READER

CUT OFF FREQUENCY	125KHz RFID Reader	13.56 MHz RFID Reader	865-915 MHz RFID Reader	2.4 GHz RFID Reader
Read Range	1"-12"	2"-24"	1"-10'	1"-15'
Types of Tags	Passive Tag (Coil)	Passive Tag(Inductive and Capacitive Coupling)	Active and Passive Tag (E-Field Coupling)	Active and Passive Tag (E-Field Coupling)
Data Transmission Speed	Slow	Moderate	Fast	Faster
Application	Access Control Security	Access Control, Library Management	Highway Toll Tax	Highway Toll Tax, Assets Tracking

APPLICATIN OF RFID

There is numerous application of RFID technology, in figure 2 author try to summarize [5] them. The RFID technology is used in the field of manufacturing, transportation, monitoring and tracking, healthcare, human identification, agriculture, finance, government and military etc.
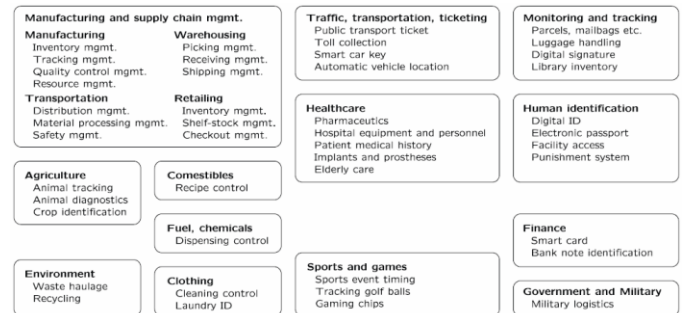

Fig.2. Applicatiion of RFID Technology

Designing of an intelligent RFID reader for the Internet of Things application is emerging field and lots of application could be implement with this technology.

CONCLUSION AND FUTURE SCOPE

The RFID reader is design in the manner that can communicate with the nearest other RFID reader and implement them into the Internet of Things application. The read distance of each type frequency reader could be increased. The software algorithm is designed in the way that they take less processing time. The complexity of hardware could be eliminated which reduce the cost of the reader also. Its designing will be the gift to the technical and detection field as it can be replaced with barcode system with high security, easy communication and accurate result. The various

features could be add with this technology for the different application to enhance the use to RFID.

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Item-Based Collaborative Filtering Based on Popularity of Items Using Hadoop

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ABSTRACT

After the analysis of the traditional item-based collaborative filtering technique, this research focuses on distributing it which is aimed at overcoming the problem of scalability when the number of users and items are large. In the era of Big data, the algorithm will be implemented in Hadoop framework for efficient operation on large amounts of data. More importantly, it also takes into consideration, the popularity of the items for recommendation for improved accuracy and overcoming the problems arising with sparsity such as cold-starting.

Keywords: Hadoop, MapReduce, Item Based Collaborative Filtering, Item Popularity

1. INTRODUCTION

Recommendation Systems are mostly used in e-commerce websites where they use customer's interest to generate a list of recommended items [1]. Content based recommendation systems analyze the description of items to identify items that are of particular interest to the user. Collaborative filtering (CF) is a technique that recommends items based on similarity measures between users or items. The items recommended to a user are those preferred by similar users.

2. RELATED WORK

In [2] L. Fan, L. Hong, and L. Changfeng developed item based collaborative filtering technique using hotweight. In this research, real movies dataset was used and generated recommendation lists for users. The algorithm was evaluated using RMSE and MAE. Finally the result showed that the recommendation system has highest accuracy when the number of neighbours considered was 5. In [3] R. Pagare and S. A. Patil studied about the scalability and challenges in different collaborative filtering methods. The different algorithms studied are cluster based, item based and context based. The paper points out the major challenges such as scalability, sparsity, cold-starting and privacy. In [4] S. Vinodhini, V. Rajalakshmi, B. Govindarajalu developed a recommendation system that recommends books by analyzing the features of books and interest of users. This hybrid recommendation system used rating list and profile of the user. The data set considered was a large set of books which is big data hence, Hadoop was used. In [5] H. Su, X. Lin, B. Yan and H. Zheng developed a collaborative filtering algorithm that considers the

influence of time factor on users' interest. According to the variation of each user's interest, appropriate time decay factor were chosen for each user. The weights of the users' past ratings were decayed to meet the users' interest changes. The algorithm was implemented in MapReduce, implementing distributed computing.

3. ITEM-BASED COLLABORATIVE FILTERING (IBCF)

Item-based collaborative filtering invented by Amazon.com builds an item-item matrix determining relationships between pairs of items, and gives item recommendation to users by examining the relationship matrix and matching that user's previous behaviors. The basic principle of IBCF is that: according to user-item matrix, IBCF will discover similar items for users. There are many kinds of methods to compute similarity between items such as Pearson correlation coefficient, cosine similarity etc. After similarity computations, the most similar items to the test item are found by using the threshold value. The items with the highest similarity values are thus recommended.

4. HADOOP

Apache Hadoop software library allows for distributed storage and processing of large datasets across cluster of computer. It is designed to scale up from a single node to thousands of nodes each offering its own storage and computation[6].

4.1. Hadoop Distributed File System (HDFS)

HDFS which is designed to run on commodity hardware has a master/slave architecture [7]. It consists of a single NameNode, a master server that manages the file system namespace operations. It also determines the mapping of blocks to DataNodes. The DataNodes performs block operations upon instructions from the NameNode and also servers read/write requsts from the file systems client.

4.2. MapReduce

MapReduce is a technique of computation consisting of two function, called Map and Reduce [8]. Map tasks are given chunks from a distributed file system which turns them into sequence of key-value pairs. The key value pairs from each Map tasks are collected by master controller and sorted by keys. The keys are divided among the Reduce tasks so that all key-value pairs with the same key is collected by the same Reduce task. Finally, the Reduce tasks combine all the values associated with that key.
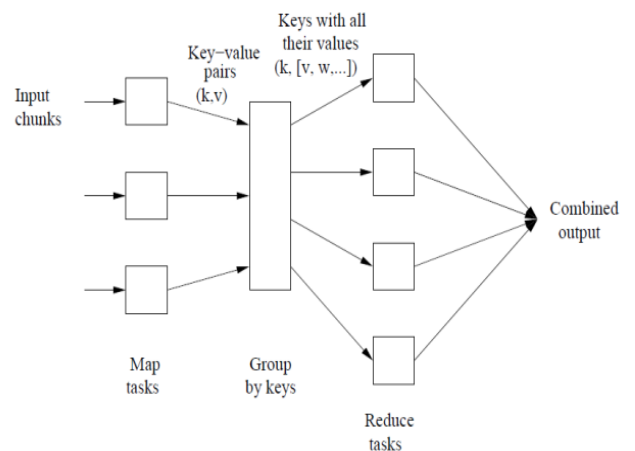
Figure 1. Block diagram of MapReduce computation[8]

5. METHOD

The algorithm consists of following steps: generating user-item preference matrix, generating co-occurrence matrix, generating recommendations, generating popularity scores and combining the recommendations with the popularity score. In this section, we first introduce the traditional IBCF and distributed IBCF, then present how to combine the distributed algorithm with popularity score. We describe the entire process in MapReduce framework.

5.1. Traditional Item-based collaborative filtering

The traditional IBCF computes the similarity between pairs of items then recommends the top items with the highest similarity. The similarity calculation can be done using Cosine similarity, Pearson correlation coefficient etc. For Cosine similarity, the rating vectors of item A and item B are a and b, respectively, dimension of the vectors is the number of users n, user i's rating for item A is R_{iA}. The cosine similarity between item A and item B is

$$similarity_{AB} = \frac{\sum_i^n R_{iA} R_{iB}}{\sqrt{\sum_i^n R_{iA}^2} \ \sqrt{\sum_i^n R_{iB}^2}} \tag{1}$$

When recommending for user u, we check item i which user u haven't rated, then calculate the $similarity_{ij}$ of item i and item j, item j have been rated R_{uj} by user u, if user u has rated item set m, user u's predicted rating for item i is

$$R_{ui=} \frac{\sum_j^m R_{uj} * similarity_{ij}}{\sum_j^m similarity_{ij}} \tag{2}$$

However these systems are unable to recommend items to users that are new to the system due to the lack of historical behavior. This situation is called cold-starting.

5.2. Distributed Item-based Collabortive Filtering

The distributed item based collaborative filtering basically includes the below mentioned steps.

5.2.1. Computing the User-Item Preference Matrix

User-item preference matrix for some user U which represents the rating that user has given to the items. If

the rating is a 0 then it signifies that the user has not rated the item yet.

Table 1. Mapper/Reducer for User-Item Matrix

Task		Key	Value
Mapper	Input	User Id	Item Id | Rating
	Output	User Id	Item Id:Rating
Reducer	Input	User Id	Item Id: Rating
	Output	User Id	Item Id1:Rating1,……..,Item IdN:RatingN

5.2.2. Computing Co-Occurrence Matrix

We obtain similarity by constructing a co-occurrence matrix. Instead of computing the similarity between every pair of items, it'll compute the number of times each pair of items occurs together in some user's list of preferences. For instance, if there are 9 users who express some preference for both items X and Y, then X and Y co-occur 9 times. Two items that never appear together in any user's preferences have a co-occurrence of 0.

Table 2. Mapper/Reducer for Co-occurrence Matrix

Task		Key	Value
Mapper	Input	User Id	Item Id1:Rating1,……..,Item IdN:RatingN
	Output	Item Id1	Item Id2:co-occurrence
Reducer	Input	Item Id1	Item Id2:co-occurrence
	Output	Item Id1	I#Item Id2:co-occurrence,...., Item Id2:co-occurrence

5.2.3. Generating Recommendations

For generating recommendations for a user we multiply the user's user-item vector with the co-occurrence matrix. The product of the co-occurrence matrix and a

user-item vector is itself a vector whose dimension is equal to the number of items. The values in this resulting vector will lead us directly to recommendations; the highest values in recommendation vector correspond to the best recommendations.

Table 3. Mapper/Reducer for Recommendations

Task		Key	Value
Mapper	Input	Item Id	Item Id2:co-occurrence,...., Item Id2:co-occurrence# User Id1:Rating1, ……..,UserIdN:RatingN
	Output	User Id	Item Id:Partial product
Reducer	Input	User Id	Item Id:Partial product
	Output	User Id	Item Id:Recommendation score

5.3. Item Popularity

The popularity value takes an approach of Term Frequency-Inverse Document Frequency (TF-IDF) algorithm. TF-IDF weight is a weight often used in information retrieval and text mining. This weight is a statistical measure used to evaluate how important a word is to a document in a collection or corpus [8], but the IDF becomes less when the word is found in more document, we take document frequency (DF) instead of IDF.

For TF-IDF analogy we consider each item as a term, a row of ratings of each user given to all the items as a document and the whole utility matrix is considered to be a collection of such documents, each rating as the number of occurrence of that word in the document.

Term-frequency (TF): This measures how frequently a term appears in a document. In our research this gives the rating of an item given by a particular user. It can be normalized by dividing by the total number of terms in the document.

Document-frequency (DF): This gives the total number of documents in which a particular term has appeared. In this research, this is a measure of how many users have rated a particular item.

$$\text{Document-frequency (DF)} = \frac{N_t}{N} \quad\quad (3)$$

Where, N_t is the number of documents in which term t has occurred and N is the total number of documents.

Table 4. Mapper/Reducer for Popularity scores

Task		Key	Value
Mapper	Input	User Id	Item Id1:Rating1,……..,Item IdN:RatingN
	Output	Item Id	Rating
Reducer	Input	Item Id	Rating
	Output	Item Id	Popularity score

The result of the multiplication of co-occurrence matrix and user-item vector is multiplied by the popularity weight of each item for the final recommendation vector. In case a new user is added to the system then his user-item vector is full of zeroes. In this case the user is recommended item purely on the basis of popularity value which also helps to eliminate the cold-starting problem due to sparsity.

Table 5. Mapper/Reducer for combining Popularity scores with recommendations

Task		Key	Value
Mapper	Input1	User Id	Item Id:Recommendation score
	Input2	Item Id	Popularity score
	Output	User Id	Item Id:Recommendation score Popularity score

Reducer	Input	Item Id	Item Id:Recommendation score
			Popularity score
	Output	User Id	Item Id: Final Recommendation Score

5.4. Evaluating The Algorithm

Precision, recall and F1 measure is used to calculate accuracy. The recommendation list of N items is topN, while the item list users really interested in is the test. Precision is the proportion of top recommendations that are relevant.

$$\text{Precision} = \frac{|test \cap topN|}{N} \qquad (4)$$

Recall is the proportion of relevant recommendations that are included in the top recommendations.

$$\text{Recall} = \frac{|test \cap topN|}{|test|} \qquad (5)$$

A pictorial illustration of Recall and Precision is given below

It is the ultimate measure which is the combination of precision and recall.

$$\text{F1} = \frac{2*precision*recall}{precision+recall} \qquad (6)$$

6. EXPERIMENT AND ANALYSIS

6.1. Datasets

This research adopts MovieLens stable benchmark datasets of 100K and 1M with ratings 1 to 5 from Grouplens (http://grouplens.org/datasets/movielens/) for experimental analysis. The format of the data is user id | item id | rating | unix timestamp separated by tabs in 100K dataset and double colon (::) in 1M dataset.

6.2. Experimental Design

The experiment was performed in a Hadoop cluster of 1 NameNode and 3 DataNodes. Hadoop 2.7.2 was installed in Ubuntu 15.10. 20 GB of storage and 1GB of RAM was allocated to each node. Hadoop Streaming is used for executing MapReduce taks. Hadoop Streaming is an utility that comes with Hadoop distribution which allows to create and run Map and Reduce tasks with any executable as the mapper and reducer [9].

A sample of 20 users are taken from both the datasets. 80% of their ratings are divided as training set and the remaining 20% as testing set. 5% of total ratings are considered as the top-N recommended items. The comparison of collaborative filtering with collaborative filtering using Popularity iterms of Precision, Recall and F1 is shown in tables below.

Table 6. Precision of CF and CF-Popularity

Algorithm	Precision	
	Dataset 1(100K)	Dataset 2 (1M)
CF	0.4786	0.4249
CF-Item Popularity	0.5524	0.5261

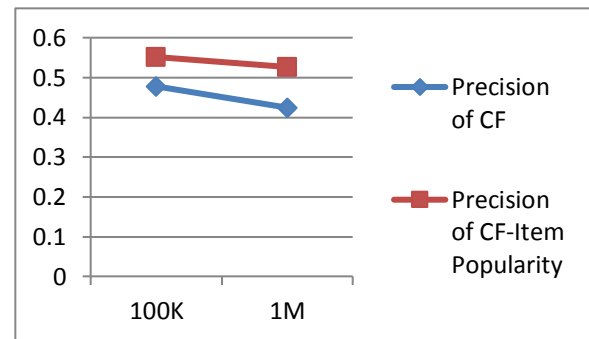
Figure 2. Comparison of Precision

Table 7. Recall of CF and CF-Popularity

Algorithm	Recall	
	Dataset 1(100K)	Dataset 2 (1M)
CF	0.1223	0.1085
CF-Item Popularity	0.1444	0.1343
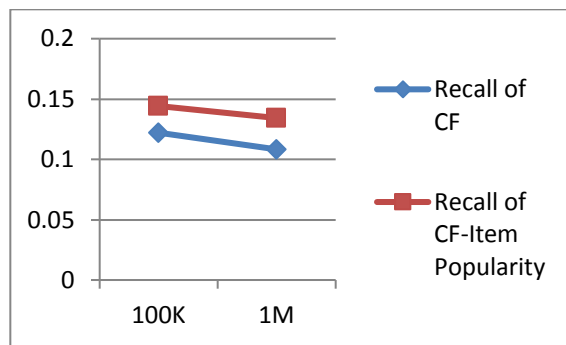
Figure 3. Comparison of Recall

Table 8. F1 of CF and CF-Popularity

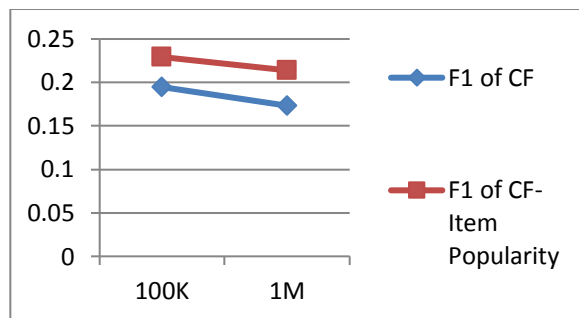| Algorithm	F1	
	Dataset 1(100K)	Dataset 2 (1M)
CF	0.1948	0.1729
CF-Item Popularity	0.2289	0.214

Figure 4. Comparison of F1

7. CONCLUSION

The principle features of item-based collaborative filtering algorithm was analyzed in detail and applied the entire process in distributed platform of Hadoop and utilized the parallel computing mode of MapReduce. On the other hand, this research presented a new Collaborative Filtering method with popularity. According to the occurrences of items in users' preference and the rating given to the item, popularity score was computed. Real movies rating datasets were for the research and the algorithm was evaluated using Precision, Recall and F1 Score.

The evaluation methods showed that the algorithm under research has better accuracy than the one where popularity value was not considered. The algorithm can also successfully overcome the problem of cold-starting when new users are added into the system by recommending the most popular items.

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Machine That Acts Like Human

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ABSTRACT

Recent progress in artificial intelligence (AI) has renewed interest in building systems that learn and think like people. Many advances have come from using deep neural networks trained end-to end in tasks such as object recognition, computer games, achieving performance nearly equal to human. Object recognition systems are pretty good in case of facebook and google but cannot recognize like human. Machines are trained thousands and thousands times but cannot recognize and predict the new or other possible instances of object. Human can recognize the object by looking at the back and side view only but it's difficult in case of machine. Human can recognize and understand situation from speech or voice that he hears. Human can predict and feel various pose and action of an object. Human can recognize the situation by looking face of people. A person with bright face is believed as a happy situation and weeping as sad situation. This paper focuses on how machine also can take right decision based on these image, pose or action, voice and sound like human and other animals does.

KEYWORDS

Artificial Intelligence, natural intelligence, machine learning, deep learning, emotional intelligence, action recognition, Hidden Markov Model (HMM), intuitive machine, Characters Challenge, Image Processing.

CATEGORIES AND SUBJECT DECRIPTIONS

Artificial Intelligence, Machine Learning

GENERAL TERMS

Theory, Design,

1. INTRODUCTION

In general we are least aware of what our minds do best." -Marvin Minsky.

The human visual system represents a very complex and important part of brain activity, occupying about 30% of the cortex resources. It enables us to see colors, detect motion, and perceive dimensions and distance. It enables us to solve a very wide range of problems such as image segmentation, object tracking, as well as object and activity recognition. We can predict the future nature of activity from some pose or action. That is to say human mind is deterministic in character which strengthens capacity of learning supervised or unsupervised with few moment resulting response and take right decision very quickly. For example if someone is carrying a gun pointing to other person, our brain recognizes so quickly that we are in danger and tries to save life by doing certain tasks like hiding, running, counterstriking or other diplomatic activities –apologizing ,surrendering etc. We can take right decision at a right time. Human mind is emotional according to situation. Also human mind has tremendous capacity of image recognizing. We can recognize object by back, side or top view. That is to say if we can see back portion of someone but not the face but also we can recognize that person very accurately. If we know or see that two children are fighting, our brain takes decision much more quickly that we have to stop these children as soon as possible.

Human needs unity among groups to perform a task in easier way. The decision of collectiveness is also taken as per necessary only. Human (we) perform these types of tasks very easily, not knowing the entire complexity what action is responsible in our brain to solve it.

The above paragraph describes about what activities makes human an intelligent and social animal that is natural intelligence. My study and research is about why machine cannot be like human in intelligence.

1.1 Current trends

Although there are transcend improvements and research in Artificial Intelligence. Today machine can recognize face of people, recognize simple pose and actions, building and places, can identify human palm or fingerprints, heart-beat , retina etc. Companies such as Google and Facebook have active research divisions exploring AI technologies, and object and speech recognition systems based on deep learning (A neural network with at least one hidden layer) have been deployed in core products on smart phones and the web. The media has also covered many of the recent achievements of neural networks, often expressing the view that neural networks have achieved this recent success by virtue of their brain-like computation and thus their ability to emulate human learning and human cognition[1]. Google has a driverless car which is also significant achievement in Artificial Intelligence but as of August 28, 2014 the latest prototype has not been tested in heavy rain or snow due to safety concerns. Because the cars rely primarily on pre-programmed route data, they do not obey temporary traffic lights and, in some situations, revert to a slower "extra cautious" mode in complex unmapped intersections. The vehicle has difficulty identifying when objects, such as trash and light debris, are harmless, causing the vehicle to veer unnecessarily. Additionally, the lidar technology cannot spot some potholes or discern when humans, such as a police officer, are signaling the car to stop [2].

To sum up these achievements machine can do everything but cannot take self decisions because taking decision is a product of recognizing the image of an object or action, identifying and prediction of new or possible instances of object recognized as image, think for the possible decision and take right decision. To think possibilities for the right and positive decision machine may have emotion or self thinking capacity which may be based on supervised or unsupervised learning. So, this paper focuses on these topics to make machine intelligent as human and act like human.

2. BASIC DEFINITIONS

- **Machine Learning**- Machine learning is a type of artificial intelligence (AI) that provides computers with the ability to learn without being explicitly programmed. Machine learning focuses on the development of computer programs that can teach themselves to grow and change when exposed to new data.

- **Image Processing**- Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. It is a type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image.

- **Deep Learning**- A neural network with at least one hidden layer (some networks have dozens). Most state-of-the-art deep networks are trained using the backpropagation algorithm to gradually adjust their connection strengths

- **Backpropagation**- Gradient descent applied to training a deep neural network. The gradient of the objective function (e.g., classification error or log-likelihood) with respect to the model parameters (e.g., connection weights) is used to make a series of small adjustments to the parameters in a direction that improves the objective function

- **Convolutional network**- A neural network that uses trainable filters instead of (or in addition to) fully-connected layers with independent weights. The same filter is applied at many locations across an image (or across a time series), leading to neural networks that are effectively larger but with local connectivity and fewer free parameters.

- **Markov Chain**- A Markov chain is a sequence of random variables with the Markov property that the probability of

moving to next state depends only on the present state and not on the previous states.

- **Hidden Markov Model (HMM)-** The Hidden Markov Model is a finite set of states, each of which is associated with a (generally multidimensional) probability distribution. Transitions among the states are governed by a set of transition probabilities. In a particular state an outcome or observation can be generated, according to the associated probability distribution. It is only the outcome, not the state visible to an external observer and therefore states are "hidden" to the outside; hence the name Hidden Markov Model.

- **n-gram model**- An *n*-gram model is a type of probabilistic language model for predicting the next item in such a sequence in the form of a $(n-1)$ order Markov model.

3. HUMAN BRAIN AND ARTIFICIAL INTELLIGENCE

Human Brain contains of a densely interconnected set of nerve cells, or basic information-processing units, called neurons. Nerve cells, or neurons, are long, thin cells with branching ends. In the cerebral cortex, which is where visual processing happens, each neuron has about 10,000 branches at each end. The human brain incorporates nearly 10 billion neurons and 60 trillion connections, synapses, between them. By using multiple neurons simultaneously, the brain can perform its functions much faster than the fastest computers in existence today. The figure 1 is the basic structure of human brain and neuron.
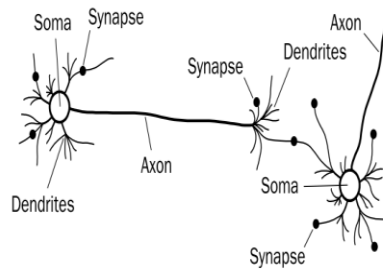

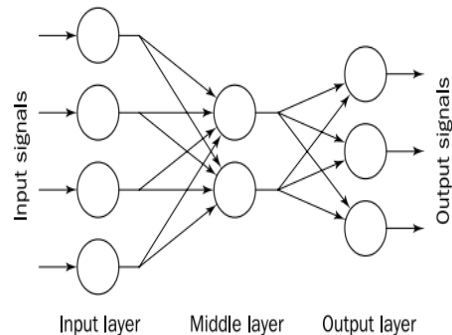Fig1.Natural Neuron (Human Brain)

Fig 2.Artificial Neural Network (ANN)

Signals are propagated from neuron to neuron by electrochemical reaction. Chemical substances are released from the synapses and enter the dendrite, raising or lowering the electrical potential of the cell body.When a potential reaches a threshold, an electrical pulse or action potential is sent down the axon The pulse spreads out along the branches of the axon, eventually reaching synapses and releasing transmitters into the bodies of other cells. Basic Artificial Neural Network is shown in figure 2. It consists of a number of very simple and highly interconnected processors called neurons.The neurons are connected by weighted links passing signals from one neuron to another. The output signal is transmitted through the neuron's outgoing connection. The outgoing connection splits into a number of

branches that transmit the same signal. The outgoing ranches terminate at the incoming connections of other neurons in the network.

In human brain, each synapse has its own "weight," a factor by which it multiplies the strength of an incoming signal. The signals crossing all 10,000 synapses are then added together in the body of the neuron. Patterns of stimulation and electrical activity change the weights of synapses over time, which is the mechanism by which habits and memories become ingrained. A key operation in the branch of mathematics known as linear algebra is the dot-product, which takes two sequences of numbers — or vectors — multiplies their elements together in an orderly way, and adds up the results to yield a single number. In the cortex, the output of a single neural circuit could thus be thought of as the dot-product of two 10,000-variable vectors. That's a very large calculation that each neuron in the brain can do at a stroke [3]. This is the basic way how human brain operates. All images and objects from human eye is stored in a part of brain with categories and actions that we see. Categories that activate the same brain areas have similar colors. For example, humans are green, animals are yellow, vehicles are pink and violet and buildings are blue [4].
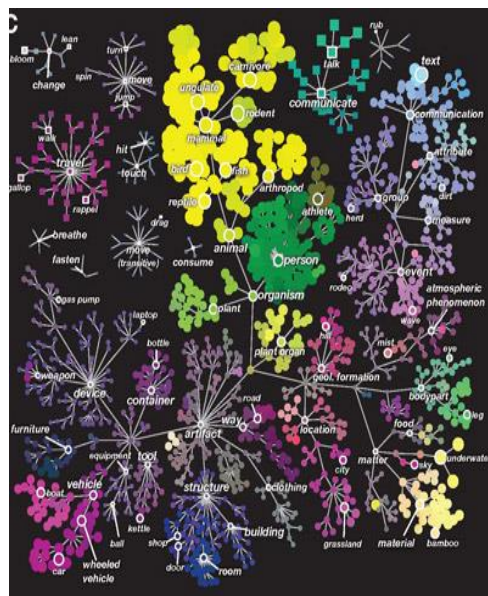

Fig 3. Image of brain part and categorization of viewed object [5].

4. MACHINE INTELLIGENCE SOLUTIONS

During design of system that think like human i.e to say that machine intelligence like human, there are various factors that should be taken into considerations. There are challenges to make machine intelligence as human. In this sub topic I am going to cover basic challenges and probable solutions.

4.1 Image processing and recognition

The basic purpose of this unit is to take image as input and process and recognize it properly. Basic image processing involves following steps:

- Image Acquisition - In this step, the image is captured by a sensor (such as a monochrome or colorTV camera) and digitized, if the output of the camera or sensor is not already in digital form-

an analog-to-digital converter (ADC) digitizes it.

- Image Enhancement- It is the process of manipulating an image so that the result is more suitable than the original for specific applications. Enhancement techniques are so varied, and use so many different image processing approaches.
- Image Restoration- It is the improvement of appearance of image.
- Color Image Processing- It uses the color of the image to extract features of interest in an image.
- Wavelets- It is used in image data compression and pyramidal representation.
- Compression- It is for
  - Reducing the storage required to save an image.
  - Reducing the size of the image to transmit it ("JPEG Standard"), with suitable bandwidth required for transmission.
- Morphological Processing- These are the tools for extracting image' components that are useful in the representation and description of shape.
- Image Segmentation- In this process, computer tries to separate objects from the image background.
- Representation and Description- Representation makes a decision whether the data should be represented as a boundary or as a complete region.

- Recognition and Interpretation- It is the process that assigns label to an object based on the information provided by its descriptors.
- Knowledge base- It controls the interaction between modules.[6]

This image processing system doesn't holds well for irregular and hand written letter or characters. Hand written characters are challenges for exact recognition. Many algorithms receives good performance with large number of training data, including K-nearest neighbors (5% test error), support vector machines (about 1% test error), and convolutional neural networks (below 1% test error. The best results achieved using deep convolutional nets are very close to human-level performance at an error rate of 0.2%. Results applying convolutional nets challenging ImageNet object recognition have produced result nearer to human performance [7]. Also writing of characters by people may vary. For example some people may write extra horizontal cross bar on writing '7', 'Z' or '*' for '×' etc. Additional progress may be achieved by combining deep learning and probabilistic program induction to tackle even variegates versions of the Characters Challenge [8].

4.2 Speech recognition

Speech recognition basic means talking to the computer and computer understands whatever we talk with computer. Using speech recognition to machine, it understands the speech or voice and performs as per speech. Figure 4 represents basic block diagram of speech recognizer. The system is based on continuous density Hidden Markov Models for acoustic modeling and on n-gram statistical language models. It consists of three main modules, segmentation, features extraction, and decoding. The core module is a speech decoder, which needs three data sources for its
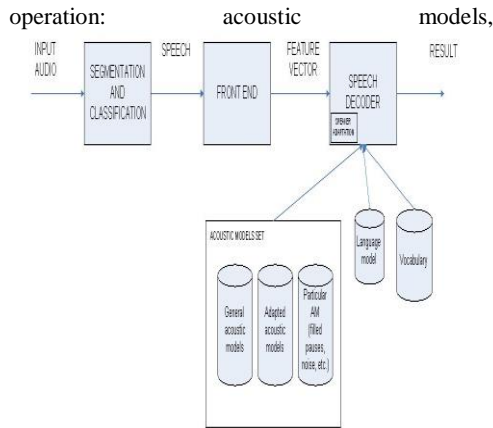
operation: acoustic   models,

Fig 4 Block Diagram of speech recognizer [9]

The input of this system is raw speech or voice resulting desired recognition of voice or speech. The use of this system is for psychological intuitive of machine which may sense from the voice and act rightly for the right situation as human does.

4.3 Action recognition

The first thing of human intelligence is to identify the image and pose or action of the object. Every action is recognized as image and processed as likely. The figure 5 below is the system architecture for pose and action recognition.
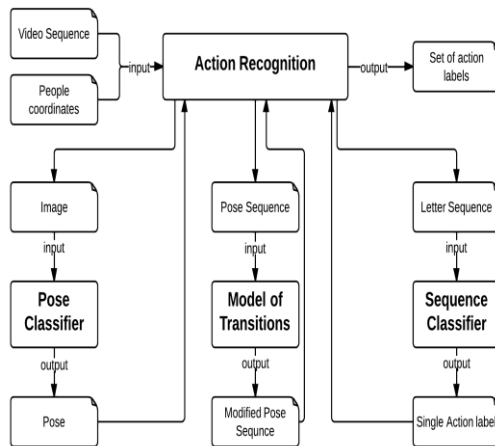
Fig 5. System Architecture for Action Recognition [10]

This architecture consists of following components

4.3.1 Inputs and outputs

A sequence of video frame is taken as input which contains human activities. The output is action. The **Pose Classifier** takes input a single frame image and the pose label that describes a pose of a human in the given image as output .It has two layer: one is training layer and another is classifier layer. In the first stage of the training, a binary classifier is trained for every pair of poses. This produces N^2 classifiers from N poses. Based on experiment, each $pose_i$ $example_j$ pair gets a score equal to the number of binary classifiers that classified the $example_j$ as $pose_i$. The pose that has the highest score for a given example is picked as an estimate pose for that example. When all the examples are evaluated, an N $\times$ N matrix is computed where each cell (i; j) represents a number of hidden poses i (each example is an example of a particular "hidden" pose) that were estimated to be pose j. Based on the N $\times$ N matrix of results, we can compute a closeness matrix. The closeness matrix represents the measure of closeness between any two poses or more specifically how difficult it is for a classifier to distinguish between any two poses. The element of the closeness matrix is defined as follows:

$$C[i; j] = (R[i; j]/\sum_j R[i; j]) + (R[j; i]/\sum_i R[j; i])$$

where C is the closeness matrix, R the results matrix. The equation is symmetric for i and j, so $C[i; j] \equiv C[j; i]$.

Once the closeness matrix is computed, two poses are grouped -i and j that are closest to each other. Then consider that group as one pose, leaving with a total of N-1 poses. The binary classifiers between the other poses and this newly formed grouped have to be trained. For efficiency reasons they are trained using the fragments left from binary classifiers corresponding to poses i and j. The process is repeated until only two groups are left at which point a hierarchical binary group tree is naturally formed. Every non-leaf node in the tree represents a pose group and has associated with it a binary classifier that splits the group into

two smaller groups. The hierarchical group tree represents an N-pose classifier. When a new image is ready for classification, it is passed through the nodes of the tree until it reaches the final pose. An alternative to this method would be to simply look at the results matrix and decide on the pose based on that. But hierarchical method is better one. After pose training layer, classifier layer then selects the right pose of the incoming image. The **Model of Transition** layer modifies the various levels and possible transition of the image. Hidden Markov Model (HMM) is used to model the pose transitions. Output of this system produces the pose sequence as action which is the error corrected data of input images. The **Sequence Classifier** produces a single action label. **Action Recognition** component is the core part of the whole system. It lakes input as video sequence and coordinate of people in video sequence, and produces action label with start and end of the action poses as output. Frame extraction, motion extraction, coordinate extraction of the input video sequence is performed. Finally, the **Sequence Selector** class selects sequence of frames to analyze for action. This system solves the particular problem of vision-based human-action recognition by simple actions such as running, walking, playing, kicking etc.

5. INTUITIVE MACHINE

Human are physically and psychologically intuitive. The first step to make machine as human is to make intuitive physically and psychologically. The second thing is machine learning. There are generally two types of learning namely supervised and unsupervised learning. Learning strategy is the key factor for the intelligence of machine. To produce machines that learn like humans and as fast as humans do, we may also have to build machines that learn what humans learn. We believe that adopting more compositional, causal forms of knowledge representation helps both humans and machines get the most from learning-to-learn. We want to emphasize more generally that we believe all of the core ingredients for learning rich models articulated compositionality, causality, and learning-to-learn – can be incorporated into deep learning systems, and that these ideas will only

benefit from being integrated together. Each one on its own is valuable, but their synergies are even more valuable for building truly human-like machine learning systems [11].

6. EMOTIONAL MACHINE

When we human get some good news and situation we become happy and for bad news and situation we become sad. The happiness and sadness of human can also clearly viewed from facial and other expression. When we scold badly to a person this person becomes sad or may be aggressive. This is what human behavior and emotional nature of human. Various critical decision must be based on emotion as well. The crucial factor to behave machine as human is to make machine emotional. Becoming an emotional is the key factor for the right decision or self-judgment. Machine also needs to some extent of emotional intelligence to act and behave like human. This paper is also focusing on this point. Its approach is to develop theory and applications are data driven For emotional machine-

First observe which states naturally are communicated from people to computers, Then build and test models that can predict what is measured and reflected in the data. In one project, the building of a computerized learning companion, two of the key affective states found from the data are interest and bored- two states that are not on most theorists "basic emotions" list. However, discriminating these states is vital to the machine's ability to adapt the pedagogy to help keep the learning experience going, and our model addresses them [12].Emotional Intelligence can be affected by geography, society, people, culture, science etc. Emotion of human can also be predicted by examining various natural phenomenons like heart beat, facial expression, sensing skin characters, eye brows contraction and relaxation, blood pressure, and various speech and voice pattern. There are vast research success in sensing and analyzing these types of human behavior which can be taken data for machine learning. But for machine that could express emotions might be represented by various physical parameters like bit rate of data, power consumption etc. If machine is angry it could be represented by generating various sounds or signals or alarms.

7. LEARNING PROCEDURE

The main difference between human and machine learning is that human can learn fast and with less data or hint but machine learns with numbers of training data. As explained in Section 5 (Intuitive Machine), compositionality, causality, and learning-to-learn plays vital role.

Compositionality is the common technique that human has, to define an infinite number of new representations from available or primitive elements through the combination of primitive elements i.e from finite representations. In computer programming, primitive functions can be combined together to create new functions, and these new functions can be further combined to create even more complex functions. Productivity is at the core of compositionality: an infinite number of representations can be constructed from a finite set of primitives, just as the mind can think an infinite number of thoughts, utter or understand an infinite number of sentences, or learn new concepts from a seemingly infinite space of possibilities [13,14]. For example, the two-wheeled vehicle might be represented as two wheels connected by a platform, which provides the base for a post, which holds the handlebars, etc. Parts can themselves be composed of sub-parts, of part-whole relationships that can be used to construct conceptual representations [15]. Two wheels (finite elements) can be combined to form infinite elements by arrangements (combinations of wheels can construct motorcycle, bicycle, adding more wheels can construct cars, busses, trucks and so on). Starting from a letter we can construct numerous words. This is what human does with compositionality. Deep neural network has limited compositionality. To capture the full extent of the mind's compositionality, a model must include explicit representations of objects, identity, and relations – all while maintaining a notion of "coherence" when understanding new configurations[16]. Let us say as on former wheel example, compositionality and basic intelligence says that vehicles can be constructed from wheel and it can travel distance but compositionality is unaware of the situations. Compositionality doesn't says to drive vehicles at road or safer place. Compositionality holds well even bicycle arranged from wheel is subjected to ride at oceans because it is unaware of situations.

Causality is about notion of coherence and tells about the use of knowledge of outer world or scenarios to describe situations. For above example of vehicle, causality of machine improves like *if there is no road then stop here.* Deep neural network may provide essential causality to machine [17].

Learning-to-Learn is a simple and basic natural phenomenon. It is said that to be saint we have to learn a lot. Learning is only one way of building wisdom in human. Like human machine also needs to learn. It means as much as we train machine, that performs well.

8. DECISION MAKING AND JUDGMENT

Decision making is the significant part of machine intelligence. Right judgment is adopting right decision. Decision making is the process of selecting best option among the available or possible options. Different decision theories explain decision making process.

In game theory, a decision problem can be modeled as a triple,
For example:
$d = (\mathbf{\Omega}, C, \mathbf{A})$
Where $\mathbf{\Omega}$ is a set of possible states of the nature, C is a set of consequences, and $\mathbf{A}$ is a set of actions, $\mathbf{A} \in {}^{C}\mathbf{\Omega}$.

If an action $a \in \mathbf{A}$ is chosen, and the prevailing state is $\omega \in \mathbf{\Omega}$, then a certain consequence $\alpha(\omega) \in C$ can be obtained. Assuming a probability estimation and a utility function be defined for a given action a as $p(a)$: A → R and u: C → R , respectively, a choice function based on the utility theory can be expressed as

$$d=\{ a \ /\Sigma u[a(\omega)]p(a) = max(\Sigma u[x(\omega)]p(x)) \wedge x \in \mathbf{A})\} \quad \mathbf{\Omega} \qquad \mathbf{\Omega}$$

In Bayesian theory, the choice function is called a decision rule. A loss function, L, is adopted to evaluate the consequence of an action as follows:
$L: \mathbf{\Omega} \times A \rightarrow R$

Where Ω is a set of all possible states of nature, **A** is a set of actions, and $\Omega \times$ **A** denotes a Cartesian product of choice.

Using the loss function for determining possible risks, a choice function for decision making can be derived as follows:

$d = \{ a \,/p[L(\omega, \alpha)] = \min (p[L(\omega,x)])$
$\quad\quad\quad\quad\quad x \in A$

Where $p[L(\omega, \alpha)]$ is the expected probability of loss for action x on $\omega \in \Omega$.

The cognitive process of decision machine can be visualized as the following figure 6.

On the basis of figure 6 decision making is performed. On the basis of the LRMB [19] and Object Attribute Relation (OAR) models developed in cognitive informatics [20, 21, 22, and 23] the cognitive process of decision making may be informally described by the following courses:

1. To comprehend the decision making problem and to identify the decision goal in terms of Object (O) and its attributes (A).
2. To search in the abstract layer of Long Term Memory (LTM) [24] for alternative solutions (A) and criteria for useful decision strategies (C).
3. To quantify A and C and determine if the search should be go on.
4. To build a set of decisions by using A and C as obtained in previous searches
5. To select the preferred decision(s) on the basis of satisfaction of decision makers.
6. To represent the decision(s) in a new sub-OAR model.
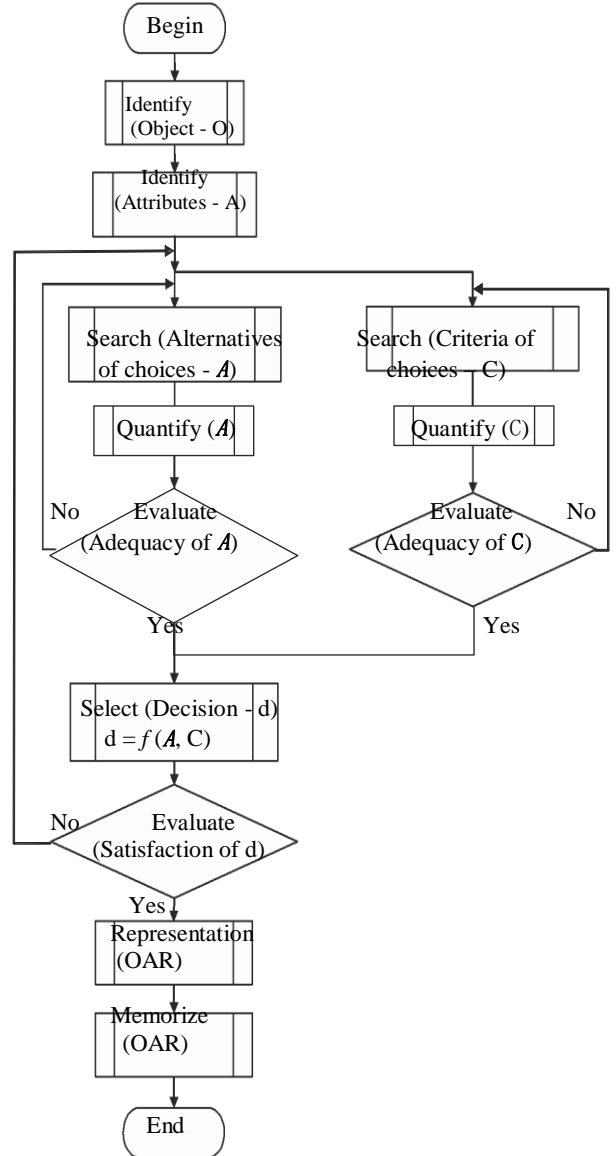7. . To memorize the sub-OAR model in LTM

Fig 6 The cognitive process of decision making [18]

By this all decision can be made by machine. Decision tree could also be one for taking decision.

9. CONCLUSION AND FURTHER WORKS

Machine can think like human as per paper's explanation. If we can improve on causality and training procedure machine intelligence may be remarkably increased. If we can train the machine with real world data continuously and long time machine learning-to-learn can be improved. If training of data will exact equal to raw physical data, intuitive physical property may be achieved. Simple problems of intuitive psychology are solved but it is not satisfactory. Deep neural network with intuitive psychology should be progressed. Human intelligence is natural but artificial intelligence with best performance can be achieved as Human Brain and Cognition performs. Cognitive Science's transcend research can be applied at machine for real time machine intelligence. This is the gist thing that I tried to explain in this paper. This is not a far away that machine intelligence will be as equal or nearly equal to human intelligence.

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PERFORMANCE ANALYSIS OF MLP, C4.5 AND NAÏVE BAYES CLASSIFICATION ALGORITHMS USING INCOME AND IRIS DATASETS

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ABSTRACT

Data mining is extraction of interesting and useful patterns or knowledge from huge amount of archived historical data. There are different standard and significant data mining techniques that can be used in day to day human life so that important and unknown information can be discovered which ultimately would enhance their domain of knowledge. Classification is one of the supervised technique of data mining which can be realized using various popular algorithms namely decision tree, neural network, Naïve Bayes, Support Vector Machines etc. The aim of this research is to analyze the performance of three popular classification algorithms like C4.5, Naïve Bayes and Multi-Layer Perceptron with the aid of two different types of dataset namely iris and income datasets which were obtained from UCI repository. With reference from several conference papers published in recent years and data mining text books, research was accomplished by training and testing selected algorithms with same datasets using 10-fold cross validation method in weka tool. The results showed that C4.5 outperforms other two algorithms in terms of accuracy, recall, precision, and F_score. The perfection of algorithms in classifying the datasets, is further explained with the analysis of ROC curve. Results also showed that the performance of classification algorithms depends upon type and size of datasets. Finally, the classification algorithm that has the potential to significantly improve the common or conventional methods was suggested for use in large scale data.

Keywords: Classification, Naïve Bayesian classifier, C4.5, Multilayer Neural Network, Accuracy, F_score, ROC curve, 10 Fold Cross Validation

1. INTRODUCTION
1.1 Background
Data mining is automatic analysis of huge amount of historic data to find out previously unknown interesting knowledge or pattern. There are different approaches that can be used such as NB, NNs, Bayesian Networks, and DTs etc.[1]

This thesis report was about comparing three classification algorithms Neural Network, Naïve Bayes and Decision Tree using the iris and income datasets collected from archive.ics.uci.edu/ml/datasets/adult which was extracted from 1994 census database [11].

1.1.1 Classification
One of the data mining technique is classification. Classification is the supervised learning in which different data or transactions are mapped to the predetermined classes or group.

1.1.2 Decision Tree
Decision Tree is an important model to realize the classification. It is the flowchart like structure in which internal node i.e. non-leaf node denotes a test on an attribute, each branch is result of the test and each leaf node denotes class label [2].

1.1.3 Neural Network
A Neural network is also a classification algorithm that stimulated the learning process of human brain [4]. Neural Network consisted of neurons at different layers. Each neuron at a layer is connected to every neuron at other layers.

1.1.4 Multilayer Perceptron
MLP consists of many layers between input layer and output layer called hidden layers as shown. One of the advantage of MLP is that they could be used to construct high level non-linear function estimation models [4]. It is feed forward neural network and learnt using back propagation algorithm.

1.1.5 Naïve Bayes Classifier
Naïve Bayes classifier is based on Bayes conditional probability with a simple assumption. The assumption is that, given a class label, the value of each attribute is independent to each other. That is why it is called Naïve Bayes Classifier.

1.2 Problem Statement
Even though, the data mining techniques had been implemented in many areas but there had been less research that predicted income of different persons over a year. Also, there had been many researches that

compared different data mining techniques including naive Bayes, C4.5 and MLP. However, they used small data sets. There had been less papers published that compares naive Bayes and MLP.

1.3 Objective
Objectives of this research were as follows:

- o To compare the performance of MLP, C4.5 and Naïve Bayes Classifier using income and iris data sets.
- o To predict the high earning people so that others can be guided in high earning environment.
- o To predict the type of iris plant based on the length and width of their sepal and petal.

1.4 Scope of the Research
The scope and limitations of research were:

- o Data sets used are iris and income datasets.
- o Iris data sets contained 4 attributes and a class label whereas income datasets contain 10 attributes and a class label.
- o The study will compare the performance of MLP, C4.5 and Naïve Bayes classifier.

2. LITERATURE REVIEW
2.1 Related Works
In paper [1], they compared NN, DT, NB with enhanced NB algorithm and found that enhanced NB is in the lead by over 7% both in accuracy and F_score. The datasets were generated by sampling the web-pages contents. The datasets contained 9734 instances which were divided into 711 training sets and 8725 testing datasets.

In paper [5], they studied about C4.5*stat algorithm which used variance as a splitting criteria and compared with other algorithms like C4.5, NN, Naïve Bayes using different data sets like Iris, segment, diabetes, letter, breast cancer etc. It was found that statistical measure like variance was good substitutes for conventional information theory. The proposed algorithm is only meant for numeric datasets.

Paper [2] is research paper that compared Simple CART and J48 algorithm using iris datasets and found that J48 was better than CART in small to medium size data sets. They used weka tool to study the performance of both algorithms using datasets obtained from UCI data repository.

3. METHODOLOGY
3.1 Background
This chapter was about the framework for comparing the performance of the classification algorithms NB, C4.5 and MLP using Iris and Income datasets.

3.2 Data Set Description
Income and Iris datasets, used for this research, had following parameters.

3.2.1 Income Datasets
The income data set used in this study is available in UCI repository. The training and testing income datasets were combined to form total of 48857 instances composed of 10 continuous and discrete fields and a class label.

3.2.2 Iris Datasets
Iris datasets was also obtained from UCI repository which contained 150 instances composed of four numeric attributes and a class label.

3.3 Proposed Model
There were five steps in the proposed framework.

Step 1: Data sets Preprocessing

Step 2: Data splitting

Step 3: Model construction

Step 4: Compare the performance metrics

Step 5: Identify the best algorithm

3.4 Performance Evaluation Metrics for System Validation
Performance of the classifiers was measured in terms of different standard metrics like accuracy, precision, recall, F_score, 10-fold cross validation, ROC curve and time complexity which was defined as follows. The results of these metrics were used to validate the system.

3.4.1 Accuracy
Accuracy of a classifier is defined as the percentage of test set tuples that are correctly classified by the model.

i.e. Accuracy $= \frac{TP+TN}{TP+FP+FN+TN} \times 100\%$

3.4.2 Precision
Precision refers to the measure of exactness that means what percentage of tuples labeled as positive were actually such.

i.e. Precision $= \frac{TP}{TP+FP} \times 100\%$

3.4.3 Recall
Recall refers to the true positive rate that means the proportion of positive tuples that were correctly identified. It is also known as sensitivity of the classifier.

i.e. Recall $= \frac{TP}{TP+FN} \times 100\%$

3.4.4 F_Score
The F score also refers to F measures that combined both the measures Precision and Recall as the harmonic mean

i.e. F_score $= \frac{2 \times recall \times precision}{recall+precision} \times 100\%$

3.4.5 10-Fold Cross Validation
Here, the initial data was randomly split into 10 equal sized datasets $D_1, D_2, \ldots D_{10}$, which were mutually

exclusive. Training and testing was done for 10 times. For i^{th} iteration, D_i was testing dataset where as other were training datasets. The accuracy was estimated by dividing the overall number of correct classifications from k iterations by total number of tuples.

3.4.6 ROC Curve
Receiver Operating Characteristics curved showed both sensitivity and specificity of the test. The comparison of TPR (True Positive Rate) and FPR (False Positive Rate) is defined as ROC curve. The TPR is the proportion of positive tuples that are correctly labeled by the model whereas FPR is of negative tuples misclassified as positive.

i.e. TPR = TP(TP+FN)

and FPR = FP(FP+TN)

3.4.7 Time Complexity
Time complexity was measured theoretically as well as practically. Theoretically, the time complexity is expressed by counting the no. of statements that must be executed and expressing them in Big O notation. Time complexity could also be measured practically by executing the algorithms and measuring the time taken to execute.

4. EXPERIMENTS AND RESULTS ANALYSIS
4.1 Overview
To evaluate the selected classification algorithms using iris and income datasets in terms of different evaluation metrics, several experiments were conducted in weka 3.7.10

4.2 Weka Tool
In all the experiments, Weka 3.7.10 was used to study the performance of proposed algorithms using proposed datasets.

Weka application could be found in following link

http://www.cs.waikato.ac.nz/ml/weka/downloading.html

4.3 Experimental Environment
Experiment was conducted in following hardware and software environment.

Processor: Intel® Core™ 2 Duo CPU T5750 @ 2.00GHz

Memory: 1.00GB

OS: 32 bit, Windows 8

4.4 Theoretical Time Complexity
Time complexity of C4.5 = O (n |D| log|D|)

Time complexity of Multilayer Neural Network = O (b |D| w)

Time complexity of Naïve Bayes = O (|D| v)

Where,

n is no. of attributes

|D| is no. of instances

v is no. of values in an attribute

b is no. of epochs

4.5 Experiment using Income Datasets
48857 instances of income datasets were fed into different classification algorithms in Weka to train and test three algorithms using 10 Fold cross validation.

4.5.1 Performance Comparison for Income Datasets
After conducting the experiment with income datasets, results were noted into table and further explained with chart and ROC curve.
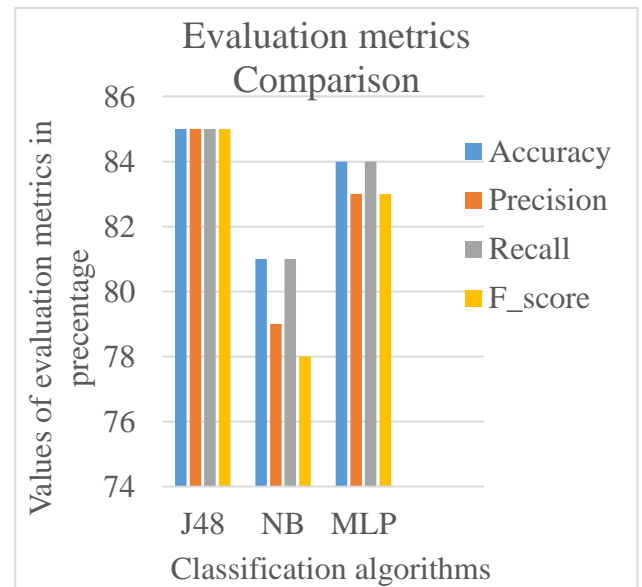

Figure 1: Performance Comparison in Graph for

Algorithms	Accuracy	Precision	Recall	F_score
J48	85	85	85	85
NB	81	79	81	78
MLP	84	83	84	83

Income datasets

Table 1: Performance comparison using income dataset

	TPR	FPR	ROC Area
J48	0.58	0.05	0.88 units
NB	0.95	0.63	0.87 units
MLP	0.94	0.48	0.88 units

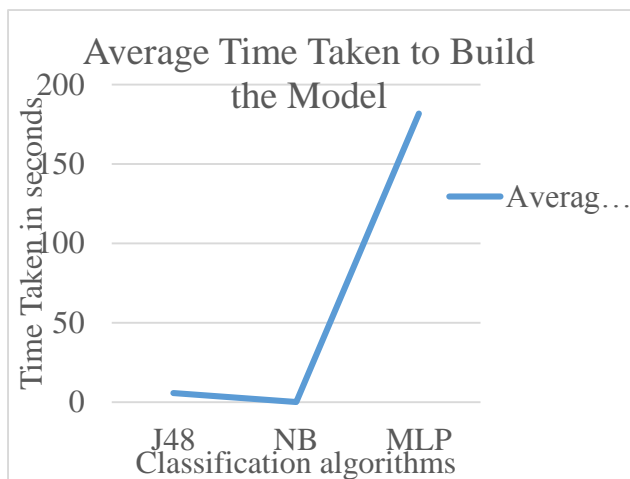Table 2: ROC space values for income datasets
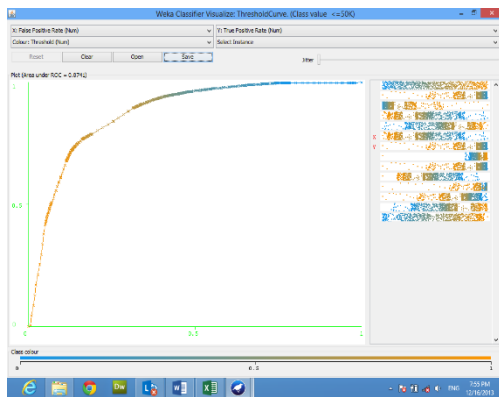
Figure 2: Average time taken to build model

Figure 3: ROC space for income datasets

4.6 Experiment Using Iris Datasets

Iris datasets was also obtained from UCI repository which contains 150 instances composed of four numeric attributes and a class label.

4.6.1 Performance Comparison Iris Datasets
Learning Rate= 0.1

No. of Hidden layer= 1

Nodes in Hidden layer= 2

Algorithms	Accuracy	Precision	Recall	F_score
J48	96	96	96	96
NB	96	97	96	96
MLP	96	97	96	96

Table 3: Performance comparing with Iris datasets

Run	1	2	3	Average
J48	0.04	0.01	0.01	0.02
MLP	0.16	0.25	0.16	0.19
NB	0.02	0.001	0.02	0.01

Table 4: Average time taken to build model with iris datasets

4.6.4 ROC Space Values

	TPR	FPR	ROC Area
J48	0.9	0	0.88 units
NB	1	0	0.87 units
MLP	1	0	0.88 units

Table 5: ROC space values of Iris datasets

4.7 Experimental Results Analysis

Experiment was conducted with two different datasets namely iris and income datasets using weka tool. The first experiment with income dataset showed that C4.5 had highest accuracy, precision and recall at about 85 percentage. This proved that C4.5 was good for medium to large datasets. The NB classifier had least accuracy, precision, recall and F_score at about 80 percentages. The slowest classifier was MLP at about 180 seconds average time to build the model whereas fastest classifier is NB at about 0 seconds. The second experiment also depicted more or less same result. As the iris datasets was of instances 150 and all were numeric, the accuracy of all three algorithms were increased to 96 and even F_score was increased to 96 percentages. Both experiment showed that all three algorithms were good at classifying predicting the datasets to different classes which was also evident by analyzing the ROC curve.

5. CONCLUSION AND FUTURE WORKS
5.1 Conclusion

To evaluate the performance of selected algorithms, various experiments were conducted. For numeric and small datasets, MLP could be selected as the best algorithm for classification and prediction among selected three algorithms. MLP was found to be slowest algorithm which took average time at 0.18 seconds for iris datasets and 0.181 seconds for income datasets whereas Naïve Bayes took least time to build the model and was fastest algorithm among these three algorithms. This suggested that C4.5 could classify even large datasets efficiently and could be used in different domains like income prediction, iris plant

classification, weather prediction etc. MLP classified small dataset efficiently. It was also evident that all three selected algorithms were best for the classification and prediction as they were about to touch the perfect classification point shown in ROC space chart.

5.2 Future works

Extending this work by including other classification algorithms like SVM, CART, and Prediction through regression using other large data sets can be interesting. Another future direction can be testing with data sets of different domains other than standard UCI repository that can be from real life data or obtained from survey on different domains.

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Privacy and Security issues in IOT:
An issue of high concern

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Abstract- The Internet of Things (IOT) is an emerging topic of technical, social and economic significance that has been gaining a huge interest. Today, many devices and everyday objects are being connected to the Internet. From small scale consumer products to the large scale Industrial and utility equipment and sensor, all are being combined with the Internet Connectivity and the data analytic capabilities, that promises to transform the way we are living and working.

However, we also need to consider the fact that if everything around us is connected and linked, these networks must ensure security and privacy to the end-user. This paper highlights the significant challenges it might face in the real world application, in the way of realizing its potential benefits. Accordingly, a collaborative approach will be needed to develop effective and appropriate solutions for maximizing its benefits while at the same time minimizing the risks and challenges.

Keywords: IoT, Internet of Things, Security, Privacy, IoT Challenges, Threats

I. INTRODUCTION

The term "Internet of Things" (IoT) was first used in 1999 by British technology pioneer Kevin Ashton to describe a system in which objects in the physical world could be connected to the Internet by sensors. [1]

IoT generally refers to scenarios where network connectivity and computing capability extends to objects, sensors and everyday items, allowing these devices to generate, exchange and consume data with minimal human intervention.

II. EVOLUTION OF IoT

To date, the world has deployed more than 18 billion "smart" connected things. Predictions (by Federal Trade Commission FTC) say there will be 50 billion connected devices by 2020 and in our lifetime we will experience life with a trillion-node network. Those are huge figures. The industry will only achieve the reality of 50 billion connected devices by simplifying how things connect and communicate today and realizing the security and privacy parameters.

The Internet of Things (IoT) is rapidly evolving. There is a need to understand challenges in obtaining horizontal and vertical application balance.

Table1: Evolution of IoT [2]

Year	Connected Devices in Billions
2012	8.7
2013	11.2
2014	14.4
2015	18.2
2016	22.9
2017	28.4
2018	34.8
2019	42.1
2020	50

III. IoT PRIVACY AND SECURITY ISSUES

As more devices become connected to the Internet, networks between devices, especially sensors, will become more prominent. The data collected and communicated over these networks may contain user-sensitive information such as personal data, financial and health data. It is important to ensure the security and privacy of the users of these networks.

Protection of data has been an issue ever since the first two computers were connected to each other. With the commercialization of the Internet, security concerns expanded to cover personal privacy, financial transactions, and the threat of cyber theft. According to a recent survey, consumers are concerned about both IoT security (75%) and privacy (44%).

If the proper balance is not struck between the benefits of the Internet of Things and individual privacy and security, the evolution of the IoT is likely to be seriously compromised. The ongoing deployment of IoT devices is already creating serious issues and discussions about the privacy of users, IoT security, and the potential threat of cyber criminals.
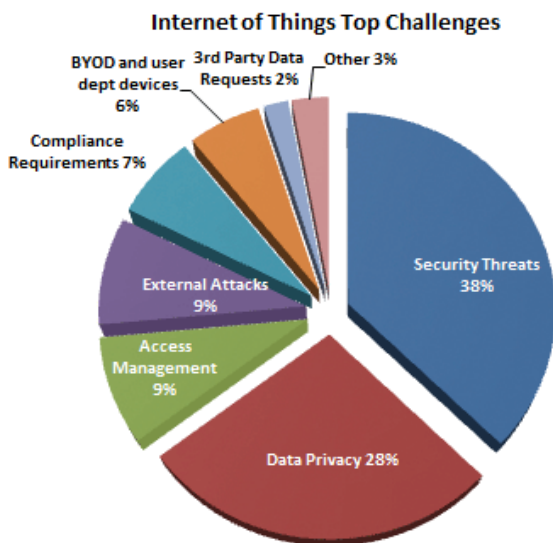

Figure 1: IoT Top Challenges [3]

A. Privacy Issues

As individuals will have their daily activities and behaviors measured, recorded and analyzed, there is a pressing need for developers and policy-makers to turn their minds to informing consumers and citizens as to who collects what kind of personal information, how it is then stored, used and disclosed to whom and for what purposes. Privacy principles dictate that users should be able to keep control of their data as well as to be able to opt out of the "smart" environment without incurring negative consequences

1. Privacy Definition

Information privacy was defined by Westin in 1968 as "the right to select what personal information about me is known to what people" [4].

2. Classification of Privacy Threats and Challenges in IoT

Privacy rights and respect for user privacy expectations are integral to ensuring user trust and confidence in the Internet, connected devices, and related services. The definition of privacy captures in essence the idea of informational self-determination by enabling the subject (i) to assess his personal privacy risks, (ii) to take appropriate action to protect his privacy, and (iii) to be assured that it is enforced beyond his immediate control sphere. As much of the information in an IoT system may be personal data, there is a requirement to support anonymity and restrictive handling of personal information.

This section presents classification of the possible threats.

2.1 Identification

Identification denotes the threat of associating a (persistent) identifier, e.g. a name and address or a pseudonym of any kind, with an individual and data about him.

First, surveillance camera technology is increasingly integrated and used in non-security contexts, e.g. for analytics and marketing [5, 6]. As facial databases

(e.g. from Facebook) become available also to non-governmental parties like marketing platforms [7]. Second, the increasing (wireless) interconnection and vertical communication of everyday things, opens up possibilities for identification of devices through fingerprinting. It was recognized already for RFID technology that individuals can be identified by the aura of their things [5]. Third, speech recognition is widely used in mobile applications and huge data-bases of speech samples are already being built. Those could potentially be used to recognize and identify individuals, e.g. by governments requesting access to that data [8].

2.2 .Localization and Tracking

Localization and tracking is the threat of determining and recording a person's location through time and space. Already today, tracking is possible through different means, e.g. GPS, internet traffic, or cell phone location. Many concrete privacy violations have been identified related to this threat, e.g. GPS stalking.

2.3. Profiling

Profiling denotes the threat of compiling information dossiers about individuals in order to infer interests by correlation with other profiles and data. Profiling methods are mostly used for personalization in e-commerce (e.g. in recommender systems, newsletters and advertisements) but also for internal optimization based on customer demographics and interests.

Examples where profiling leads to a violation of privacy are unsolicited advertisements [9], social engineering [10], or erroneous automatic decisions [11], e.g. by Facebook's automatic detection of sexual offenders [12].

2.4. Privacy-violating interaction and presentation

This threat refers to conveying private information through a public medium and in the process disclosing it to an unwanted audience. Many IoT applications, e.g. smart retail, transportation, and healthcare, envision and require heavy interaction with the user. This becomes a threat to privacy when private information is exchanged between the system and its user. An example is recommendations in stores that reflect private interests, such as specific diet food and medicine, movies or books on precarious topics.

2.5. Inventory attack

Inventory attacks refer to the unauthorized collection of information about the existence and characteristics of personal things. One evolving feature of the IoT is interconnection. While things can then be queried from anywhere by legitimate entities (e.g. the owner and authorized users of the system), non-legitimate parties can query and exploit this to compile an inventory list of things at a specific place, e.g. of a household, office building, or factory.

B. Security Issues

With the advances that Internet of things brings to our lives, we tend to forget the challenges and issue we will be facing in the future. It will be a matter for high concern when we will have to confront those issues. As cyber security has been a matter for high concern in the recent years, the security for data and information has been kept at the top priority.

Even though Internet of things is being embraced by society, it will certainly take time for seeing through the challenges that it might come with. Till then the question remains, how are we going to tackle those issues? Or are we even ready for embracing IOT in our lives to its full potential? However it's not that we have not come across the issues. Researches have been carried out and issues have been minimized to a certain level.

When we enter into the world of IoT, it is obvious that there will be billions of devices that will be communicating with each other and with security issues in the network itself, it will be the internet of insecure things that we will be living on. While this embracing of IoT might be a good thing for

enterprises that are working on it, it might be a matter of big concern to those who will have to embrace it in their lives. As the possibility of IoT seems limitless, the concern for issues should be same.

1. Security Definition

Information security, (InfoSec) is the practice of defending information from unauthorized access, use, disclosure, disruption, modification, inspection, recording or destruction. It is a general term that can be used regardless of the form the data may take (e.g. electronic, physical). In information technology, security is the protection of information assets through the use of technology, processes and training. [13]

2. Classification of Security Threats and Challenges in IoT

Looking into the security issue, devices that are connected to the internet has an embedded operating system deployed in the firmware. These operating systems aren't often designed with security concerns as their primary concerns. So it's a matter of time that IoT will start to get all the malware that the Android devices have been receiving all along.

2.1. Disruption and Distributed denial of service

Disruption of the service is one of the common issues that IoT might face. Be it a physical damage or a distributed denial of service attack on the server, legitimate users as well as the enterprise that provide the analysis both are going to suffer. For the safety from the physical damage, the devices are to be kept with topmost security because if they are in wrong hands, there is a high chance of ambiguity. As with ddos attacks, the enterprise is going to lose their potential customers also with trust over enterprise security. Response time plays a vital role with the satisfaction of customers which is not going to be possible with the disruption of service itself.

2.2. Social Engineering

When it comes to security, social engineering is also one of the biggest concerns. Collection of

consumer's data with the help of fraud emails and links either to get control over their device or misuse of the information has been and will be always a problem without a proper security measure. Social media with its approach to globalizing communication has also been held responsible for such attack.

2.3. Eavesdropping- man in the middle attack

An example of eavesdropping is the man in the middle attack where a hacker tries to get inside a network to alter the information and data being shared which can lead to a catastrophe in the case of IoT as IoT has a huge possibility of being used in most of the devices. This might lead to malfunctioning of devices as well as wrong transmission of information according to the hackers will. This is one of the dangerous attack because users aren't aware of someone's eavesdropping and altering the information.

2.4. Botnets

As the devices are in a network in IoT, they are most likely to be controlled remotely and this leads to threats of having control over the devices by unauthorized users for distributing malware. Therefore a collection of systems in a network is created i.e. a botnet to perform the task. It is easier to determine the device if only one of it is sending thousands of emails but if many are sending at once then it's a lot harder. Therefore botnets are used to crash the target system by sending thousands of requests at once. They are used for criminal activities especially including ddos attack, exploiting enterprise data, stealing private data.

2.5. Identity theft

Identity theft is one of the most discussed subjects and it is crucial as well. When hackers gain access to the personal information through different devices like laptops, mobile phones, fitness trackers, transportation devices, music preferences and also including todays increasing social media use, they can almost know more than what people know about themselves. The more the data they collect, the more sophisticated are the identity theft attack and we ourselves become the reason for it.

IV. IMPROVING PRIVACY AND SECURITY

IoT manufacturers can improve security and privacy in their devices and alleviate the public's concerns in the ways as listed below:

1) Follow a principal of "security by design"—embedding defenses from the start rather than tacking them on once a product has been designed
2) Minimize the amount of data collected and limit the duration it is stored to reduce risk of a breach
3) Building Security Mechanisms (Firewall, IPS, Access control, security booting, device authentication, etc.)
4) Build a layered security, from endpoints to advanced detection of targeted threats
5) Ensure all employees are well trained and understand the importance of cybersecurity
6) Hold contractors and other third parties to the same high security standards as internal employees
7) Enforce tight access controls along the lines of "least privilege"
8) Provide security patches to devices as soon as issues become known

V. CONCLUSION

The IoT is expected to transform how we live, work and play. From factory automation and automotive connectivity to wearable body sensors and home appliances, the IoT is set to touch every facet of our lives. IoT has the potential to enable extensions and enhancements to fundamental services in transportation, logistics, security, utilities, education, healthcare and other areas.

Yet the issues and challenges associated with IoT need to be considered and addressed in order for the potential benefits for individuals, society, and the economy to be realized. Ultimately, solutions for maximizing the benefits of the Internet of Things while minimizing the risks should be implemented. Measures ensuring the architecture's resilience to attacks, data authentication, and access control and client privacy need to be established

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ROLE OF ICT IN CONSTRUCTION

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ABSTRACT

The information and communication technology has made a huge impact on our daily activities .It has brought the revolutionary changes in every social, economic and legal sector. Our paper presents the application of ICT during different construction phases i.e. predesign, design, construction, operation and maintenance.
Here, we discuss about how ICT has made the construction works easier, cost effective, and faster.

KEYWORDS: ICT, Construction, design, collaboration

1. INTRODUCTION

Information technology has brought an industrial revolution in the construction process throughout the world. It has brought comprehensive improvement in the performance of construction processes in terms of expenditure, time, quality and client satisfaction. In modern days, ICT can be implemented into different phases and processes of construction project. Here, construction processes represents the whole life cycle of a construction, including predesign, design, construction, operation and maintenance. Use of ICT improves co-ordination, processes and collaboration between costumer, contractor and engineer.
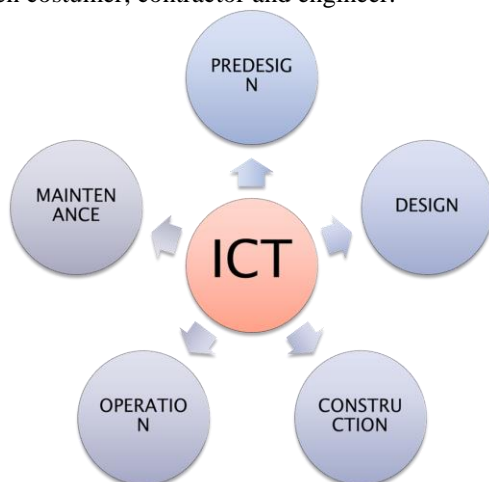

Figure 1: ICT in construction process

2. ICT IN CONSTRUCTION

Simply, ICT in construction means the adaptation of information communication and technology in construction procedure.
ICT in construction can be broken down into different segments for its better understanding and its role in construction.

➢ Before construction procedure firstly, construction industry participants and organizations communicate with each other and are concerned with information exchange, dealing with drawings, specification, cost estimation and changes in design.

➢ Communication can include conversation, listening, networking and information collection, mails, using different electronic medium or manual means.

➢ Technology includes design tools like CAD, SAP, BIM used for design, cost estimation, change in design etc.

3. NEED OF ICT FOR COLLABORATIVE WORKING

For the timely, economical, and successful completion of a construction project, collaborative working is the most essential. Collaborative working mainly depends on the efficiency of information management and communication in project life cycle. Figure 3 below shows the traditional and envisioned approach in information and communication management in the project life cycle. There are number of participants in a project. As the number of participants' increases, this communication process becomes complicated and difficult to organize and control. In an advanced project information management and sharing system, all project information is gathered into a central database from where it is transferred to the appropriate participant and hence, advancing the collaboration.

3.1 Conventional approach

Flow of information is difficult and expensive due to extra expenditure like travelling, fax, telephone, hard copies etc. Refer figure 2(a)
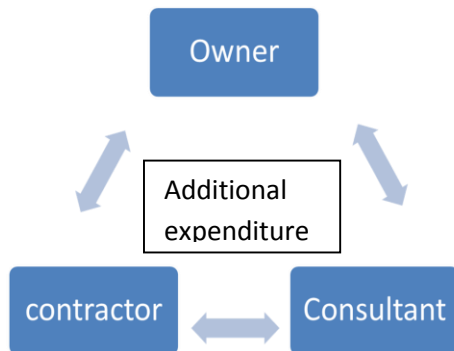
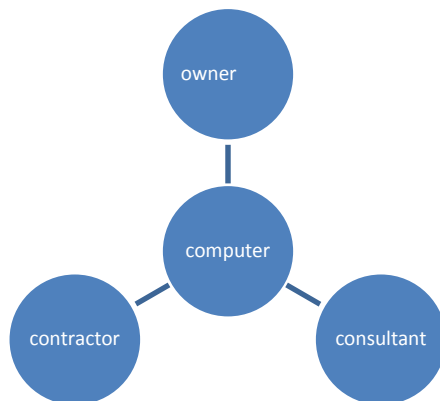

Figure 2(a): conventional approach [1]

Figure 2(b): Modern approach [1]

3.2 Modern approach

Combined medium is provided through computer database making the flow of information easier, safer, more reliable, and faster.

4. APPLICATION OF ICT IN CONSTRUCTION

1. Predesign
2. Design
3. Construction
4. Operation
5. Maintenance

4.1 Predesign

➢ To define the requirements of the clients with respect to space management, cost, quality and time of completion of project.
➢ It includes preliminary design, layouts, site soil tests, topography etc. to check the feasibility of the project.
➢ For predesign the following computer programs may be found applicable:
   a) Google Earth
   b) GPS
   c) GIS etc.

4.2 Design

➢ Designing phase includes virtual construction before starting the real construction to check the efficiency of the project.
➢ It's considered major step to be taken in the construction that highly improves the performance of the project in all respects.
➢ The design software includes the following:
   a) CAD
   b) SAP
   c) ETAB
   d) STAAD
   e) BIM etc.

4.3 Construction planning

➢ It involves cost estimation and schedule management or any one of them.
➢ It may also include choice of technology, time taken to complete each tasks, required resources etc.
➢ In bigger projects, both the dimensions i.e. schedule and budget information must be considered.
➢ Though intellectual construction planning is not widely used in Nepal, Microsoft project is software commonly used in Nepal for construction management.

4.4 Construction

Construction includes the following:

a) *Batching*:
Concrete mix aggregates are introduced in the mixture in correct proportion within accuracy by the direct input of data in computer.

b) *Compaction*:
By fixing number and frequency of vibrations digitally compaction in roads, foundations etc. can be done easily.

c) *Curing:*

Amount of water required for curing can be instructed from the computerized system.

4.5   Operation

➤ Computerized system is used in the operation of structures like adjustment of gate of dam.

➤ It is also highly useful in structures like hospitals, shopping complexes foe the operation of elevator, lift, escalator etc.

4.6   Maintenance

➤ Regular maintenance of the constructed structures can be done using ICT.

➤ For example:

Scanner can be used to detect the width of internal crack and determine whether the structure is safe or not.

5.   MERITS:

- Improves the performance of construction processes in terms of cost, time, and quality and client satisfaction.
- Enhance cooperation, coordination and collaboration level.
- Change in design can be made efficiently.
- Works as catalyst in development processes.
- Lower financial risk
- It helps completing the project in estimated time and budget.
- Effective communication between project participants.
- Group decision making is made easier.
- Possibility of error is minimized.
- Information flow is accurate

6.   CHALLENGES IN NEPAL

Successful implementation of ICT is not as much easy as it is thought of. Mainly developing countries like Nepal face more challenges for the use of ICT in the construction. Some of the major ongoing challenges are as follows:

1. The Nepalese society is not sufficiently exposed to IT and it's benefit.
2. Government should lower the tariffs on IT tools.
3. New technology demand new skills sets and training.so there is need of qualified and skillful IT professionals in the country.

7.   CONCLUSION

Researchers are developing visual simulation of construction process each day which is regarded as the major step forward for the perfection in design. It Challenges the existing methods of evaluation that are often more laborious and time consuming. The success stories of utilizing ICTs in developed countries have drawn the attention of researchers in developing countries like Nepal regarding the beneficial effects of using ICTs into construction processes.

The uses of technology in construction are complex and expensive solutions .Although its initial cost is greater the use of ICT is found to have long term benefits in the construction process. Nepalese contractors can save a huge amount of Nepalese currency from foreign contractors by using the new technology efficiently.

Hence, developing countries like ours must realize the need of new technologies of information and communication in civil engineering prospects and break the technical crises.

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Samjhana: ICT Enabled System to Improve Medication Adherence Rate among Senior Citizen

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ABSTRACT

Medication adherence is the degree or extent to which a patient takes the right medication at the proper time according to a doctor's prescription. Human beings in their life time suffer from various kinds of diseases. These diseases require treatment which usually includes proper intake of medicines at proper time. However this effortless task has proven to be a difficult task for many people, especially among the senior citizens due to their inability to remember the proper dosage and proper time to take the medication

This paper proposes an android application named Samjhana. Samjhana reminds patient to take right dosage of medication at precise time through notification and ringtone service. The caretaker is responsible for scheduling the proper time and dosage of medication for the patient. The patient receives the reminder on the basis of this information. In condition where patient fails to take medicine, the system automatically sends SMS to the caretaker informing him/her that the patient has failed to take the medication. Besides this the system also keeps track of the patient's remaining medicine amount, informing when the refill is required. Samjhana aims towards improving medication adherence rate among senior citizens by providing senior citizen friendly periodic reminder. These periodic reminders are scheduled in the patient's mobile devices further assuring that the patient is taking the medicine properly.

Keywords: medication adherence, senior health, senior citizens, mobile healthcare, medicine scheduler, notification system, Samjhana, android application.

1. INTRODUCTION

With the different advancements in the field of medicine, more and more number of diseases can be effectively treated using proper regiment of medicine. However it is absolutely important that prescribed medicine regimen be followed by the patient for optimal treatment of an illness.

Adhering to the right medication at the right time has been a problem for many people. With the today's busy society it has proven difficult for someone to constantly remember to take the medicine at the right time. However this problem is wide spread among older adults. According to recent study 50% of elders who take at least 1 medication find adherence challenging [1]. They may be adherent to some of their medications and non-adherent to others. Studies have shown adherence rate lowers from approximately 80% for patients taking only one medication one times daily to 50% for those patients taking medications 4 times a day [2].

In our technology dependent life we rely largely on various gadgets especially smartphones. More and more number of people are adopting smartphones as a part of their life. Health industry has always tried to adopt new technologies in order to better their service delivery. Keeping this in mind, Smartphones have also been increasingly adopted by the healthcare industry. These technologies provide greater ease and improved accessibility to both patients and healthcare professional. With large amount of population adopting to the mobile technology, more mobile healthcare applications will be developed and adopted by general population, especially those deemed to be useful and user friendly [3].

Keeping these factors in mind, the paper proposes a mobile based reminder system named Samjhana. This

system is designed to provide notification regarding the proper dosage of medication at the right time.

2. RELATED WORKS

Various different techniques have been adopted in order to improve the condition of poor medication adherence. These techniques range from mobile application to different separate device.

Medisafe medication reminder system is an android and ios based application designed to manage various medication schedule of the patient. This system provides reminder based on the patients schedule. It also tracks your prescriptions and reminds you when it's time for a refill. It's the highest rated and most downloaded medicine reminder on the Apple store [4].

William M. Vollmer and the team conducted a research on the effectiveness of intervention based on health information technology (HIT) using speech recognition software on Asthma patient. The research showed potential for improving medication adherence using HIT based intervention [5].

Tabtime vibe is another approach to maintain the medication adherence. This is a modern spin to the classic pill case technique. The Tabtime Vibe Vibrating Pill Timer Reminder consists of five compartments with different alarms that beep and vibrate when it's time to take your medicine [6].

Zao J.K., Peihsuan Tsai, Mei-Ying Wang, and Liu J.W.S. proposed Wedjat: Smart Phone Application designed to avoid medicine administration errors easing the patient[7].

Prasad B proposed Medicine reminder pro. In this system user can set reminders as repeating or non-repeating alarm patterns. The system then produces alarm on the scheduled time [8].

3. PROPOSED SYSTEM

This paper proposes a system that aims at improving the medication adherence among the senior. To be specific, the paper proposes an android application that provides the proper medication reminder to the patient according to the intake schedule. The medication reminder will be provided through notification and ringtone which will be broadcasted as per the medication schedule. When the notification

is clicked, the user is provided with the screen that displays name of the medicine along with the time, dosage for that particular intake and picture reference of the medicine.

There may be cases when user doesn't take the medicine even if the notification and ringtone are provided. The paper proposes a feature where a message about the medicine intake miss will be sent to the caretaker if the user fails to acknowledge the notification within specified time.

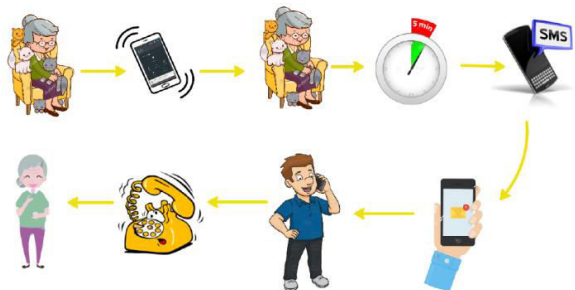Fig 3.1: Medicine Reminder Proposed

Fig 3.2: Message to caretaker on intake misses

Another message feature is a message regarding medicine refill to the Vendor. The vendor will receive refill message if the medicine stock falls below the specified threshold amount. The system focuses on various other objectives to help improve medication adherence among senior citizen. One of the objectives is to provide medication scheduling through a remote application. This feature will requires Internet connection and login credentials for patient and the caretaker. Another objective proposed by the paper is a web based information access panel which will provide doctors and caretaker to check the intake history, medicine amount and the schedule.

The system will provide doctor's appointment scheduling as well. Reminders at particular date will be provided through ringtone and notification. The system provides support for native Nepali language as well. It will enable caretaker to enter the medicine

information in Nepali language favorable for senior citizens.

4. SYSTEM WORKING

The system starts by checking if any pending schedule exists, if it does then it displays the notification for that schedule with ringtone. If there isn't any then it directs the user to a new add screen. The system allows caretaker to add new schedule. The sub process to add new schedule involves adding the medicine name and the proper dosage. It also involves setting up time for the given dosage. The system also allows caretaker to keep track of the current medicine stock. The process involves selecting medicine name and adding medicine quantity to it. The system also allows adding personal information regarding the caretaker. The process involves adding the caretaker full name, his/her contact information. After that the data is inserted into the database. Likewise the system also allows adding personal information regarding the vendor. The process involves adding the vendor full name, his/her contact information. After that the data is inserted into the database. The system also processes the notification regarding the pending schedule. It involves checking the schedule table for any pending schedule and if yes then the system sends the appropriate notification.

An important part of the system includes adding new medicine which is added to the Medicine database. After adding information regarding medicine, scheduling information related to that given medicine is added. The information is then added to the scheduling database. The caretaker also adds information regarding the current medicine storage to the Medicine storage database. Based on the scheduling information, the system determines the pending schedule. Based on this information and the information from the Medicine database, it sends notification to the patient. The patient then reacts to this notification. Based on the type of reaction, the system determines whether or not to send SMS to the caretaker. If the reaction isn't positive, the system obtains contact information from the Caretaker database and then sends the SMS. If the reaction from the patient is positive, then the system updates the medicine storage database based on the dosage consumed. The system also calculates whether the current medicine amount is less than the threshold. If

yes then it sends SMS to the vendor obtaining contact information from the vendor database.
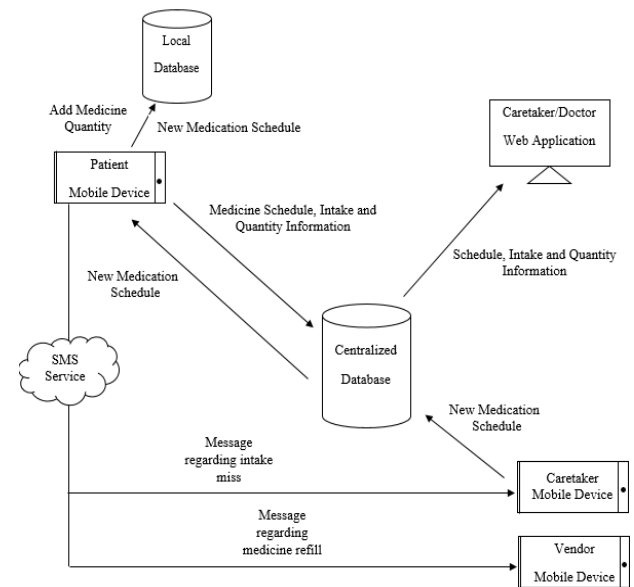

Fig 4.1: System working

With this paper the author aims to take it further by developing a system that can address other various kinds of diseases especially targeting the senior citizens. The system aims at creating a reminder system that can automatically send reminder regarding the medicine to be taken by the patient. In the condition where the patient fails to take the medicine, the system automatically sends the notification to their respective caretaker. The system also keep track of the medicine stock and sends the information to the vendor regarding the medicine refill once the medicine amount falls below the threshold amount.

The system also provides feature of medication schedule through remote application. Though the application can be operated offline for the basic reminder needs, this feature needs Internet connection with login for both patient and the caretaker. The caretaker will schedule the medication schedule in their application which will be updated in the patient application. This system also provides a web platform through which the caretaker and doctors can monitor the patient intake history, schedule and medicine stock.

This system can be widely adopted by those people who don't live with their parents, but want to keep track of their health. This system also can be used by the old age nursing home, retirement homes etc. to monitors the patients' health [9].
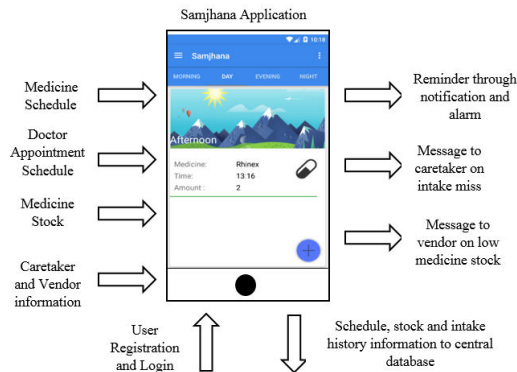
5. SYSTEM OVERVIEW

Fig 5.1: Input and Output Data Flows

The figure in 5.1 shows the input and output data flows of the proposed system. The input data flows include medicine schedule which is entered by the patient or the caretaker locally or through a remote application. The medicine schedule includes medicine name, dosage, time and picture of the medicine. Another Input Data Flow includes the scheduling of doctor's appointment where particular data and time of the appointment are set. The system optionally allows user to enter the stock of the medicine and Caretaker and Vendor Information. The Caretaker mobile number information enables system to send a message regarding medication intake miss to the specified caretaker. The Vendor mobile number information enables system to send a message to the Vendor regarding medicine refill in case of low quantity of medicine stock. For remote scheduling, the patient and caretaker are required to register and login to the system. This feature is optional and available in case of Internet connection. The user can access the application even if it not connected to internet [10].

The output data flows include the reminder which is provided by the system through ringtone and notification in specified schedule time. In case user fails to acknowledge the notification, an intake miss message will be sent to the patient, if the patient information is present in the system. A message to vendor is sent if the medicine stock information and vendor information are present, and the medicine stock reaches below the low amount. Caretaker and Doctor can access the schedule information, stock and intake history information all through a web application. Thisinformation is provided by the application to a centralized database and web

application is used to access those information from the database.

6. CONCLUSION

Lack of proper medication adherence has been a major source of problem in health sector. It further brings forward the need of other treatments and medication which imposes a financial burden on health care systems. The problem of medication adherence affects people from various age gaps. However this problem is wide spread mostly in older adults. Samjhana is an android application designed to address the issue of Medical non-adherence among elder citizens. Like Samjhana various different medication reminder systems are available out there in the market, however very few are targeted towards elder citizens. This system is specifically designed such that elder citizens can easily operate it. Samjhana's biggest shortcoming is that in order for anyone to use it they must have at least basic knowledge regarding how to operate a mobile device. This can be a barrier especially with senior citizens. Samjhana stands out in the crowd with its senior citizen friendly design and its easy to use interface. It has tried to address the shortcomings of the available system and further enhanced it with adding new features. This can be a great alternative for those who are looking for a medication reminder system.

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SocialNepal: a social networking platform for Nepal

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Abstract—**Social networks, an age-old and pervasive medium for distance interaction among people of various origin is prevalent on the modern Internet. The research has begun to take momentum in recent days with the advent of popular social networking platforms such as Facebook, Google Plus and Twitter where all these tools and platform enable users to benefit from communications regarding knowledge sharing and socializing various stuff. There are rapidly growing artificial and intelligent interfaces that allow users to learn, share, collaborate, and engage among themselves with various modern social networking tools and platforms. However, there is a scarcity of social networking platform that does not focus on particular community for sharing ideas and thoughts. In this paper, a social networking platform for Nepal has been developed, which is called namely: SocialNepal. Here, a study of design, development and how SocialNepal users use this emerging social networking platform has been described. The results imply that one can build a working platform as a foundation for building online communities that might act as a product or solution to a real common world problem.**

Keywords—socialnepal; tools, application, networking, social networking; platform; Nepal;

I. INTRODUCTION

In recent times, there are several popular social networking sites (SNSs) for example Facebook, Twitter, LinkedIn, and Google+ among others which have attracted millions of users and users of these sites are actively participating every day [1, 2] in social networking activities [5]. The academic research in the field of social networking sites is abundant. However, there is limited research and development in social networking platform [6, 7] that focuses on particular community. While most of the technologies are often similar across these platforms, the cultural factors differ across these sites [3]. There is hardly any social network which attracts people based on common language or shared racial, gender, ethnic, or nationality-based identities for incorporating the cultural attributes that might be useful in developing the social networking platform [9]. A social networking platform entitled, "SocialNepal" [12] has been designed and developed to address this research problem.

II. ARCHITECTURE

A. Core Overview

The research problem is tackled with the software architectural pattern which is critical for implementing not just the user interfaces, but also dividing an application into interconnected parts. SocialNepal platform is built and developed around the well known MVC (model-view-controller) programming architecture [4]. In essence, the model is responsible for managing the data, logic, and rules of the application. The view can refer to the representation of information where multiple views of the same information can be presented. Finally, the controller accepts inputs and converts it to suitable commands for the model or the view.

B. Overview of the M-V-C

The *model* part of the architecture deals with the data. This part is responsible for most data-related application and logic. Usually, it is used to fetch and save the data into the database. All functions inside a model are invoked from the controller, and the model is usually mapped to a single database table. The *controller* component processes and responds to all events such as user actions and invokes changes to the model (i.e. the database) or the view based on that model.

Each controller can have many different actions or activities. For example, the controller might be 'search' and action might be 'users'. Unless overridden, each controller/action is automatically mapped to the appropriate directory/file inside the view layer. This view is presentation layer, which deals with how user looks and feels about the platform. The *view* layer is the last part which will be executed on the server side. Some view files are 'partial' or 'common' which means they are used in many different places as small chunks of code.

III. TECHNOLOGY AND FEATURES

With SocialNepal the social networking platform grows and scales all the way up. The platform has been built with recent web technologies which have over 25k lines of code in the core part.

A. Technologies used

The technology utilized in the development of SocialNepal platform are PHP [16], Apache2, Bootstrap v3, custom template, and themes, native API (application programming interface) with SMTP and PHP mail() email adapters. PHP session drives the database, and there is Blowfish-based password protection [17] with MD5 fallback and support of MySQL replication and also support for load balancing [18].

B. Features supported

SocialNepal platform as of today can support many features, some of the core features supported are:

- Creation of user profiles with user roles (guest user, reviewer, anonymous user and admin user)

- Groups and Pages creation

- Real-time messaging system

- User posts with various level of privacy

- Real time user notification systems

- Emotions support

- Search for users, groups, pages or posts

- Friends suggestions

- Posts videos and referral links from third-parties

- User's Timeline displaying posts from followed people

- Possibility of image resampling upon submission to platform

- Creation and facilitation of Images and Albums

- Comments on posts and images

- Friendly URLs for all users, pages and groups profiles

- Admin panel for app management and administration

- App development and play hub for free gaming

C. Key Components

Some of the key elements of the SocialNepal are:

- **Friends & Followers**: SocialNepal has an easy follow and friends system that works well. Users of SocialNepal platform can manage their relationships with friends and followers in the ultimately reasonable form.

- **Groups & Pages**: SocialNepal users can create groups to share their community and shared interests and pages for entities like celebrities, businesses or brands. While Pages were designed to be the profiles for entities, such as celebrities, brands or businesses, groups are the place for small assemblage communication and for people to share their mutual and collective interests and express their opinion. Groups allow people to come together around a common cause, issue or activity to organize, express objectives, discuss issues, post photos and share related content.

- Pages do not have privacy; they are always public and visible to all users and guests. Only the admin of a page can post, but the post's author (and avatar) will represent the page itself.

- **Images & Albums**: In SocialNepal platform uploading and managing images is necessary as it is with every social networking sites. Users will relish albums and features like crop and rotate in the platform.

- **Mobile Friendly**: Responsive Bootstrap layout [14, 15] looks great on every device and with most form-factor. Modern design and MVC pattern will be easy to work with when it comes to customization.

- **Scalable Technology**: Easily add more features to SocialNepal platform. Addon/Extension system allows developers to customize and extending almost any aspect of the SocialNepal script. As the foundation of SocialNepal is based on Zend Framework [8], which is "an open source, object-oriented web application framework implemented in PHP5" [13], it is easy to scale up the technological stack.

D. Application workflow and URL mapping

The application workflow has been simplified so that it is easier to follow the M-V-C pattern [4]. The application request is sent from the URL to the Controller. The controller handles the action to and from the model or across the database. The controller sends the view and outputs it to the browser.

Note from the above URL mapping the controller is 'notifications, that has specific action i.e. 'list' and a parameter called 'page' with a specific value is shown. Each browser's requests is mapped like this pattern:

http://www.yourplatform.com/[controller]/[action](/[param1]/[value1]/[param2]/[value2]/...)

http://www.yourplatform.com/notifications/list/page/5

E. Four-tier follow system

In SocialNepal platform following someone simply means subscribing to user's posts, so it is convenient to receive them and read them on users own timeline. Followers are the users who follow or subscribe to another user's posts. Friends are simply mutual followers (or in other words people who follow them back).

- In the first tier, two people usually have no relationship. For example, Bob and Jack have no connection (B J)

- In the second tier, Bob is following Jack (B>J) or in other words; Bob is Jack's Follower (B>J). When Bob is logged in the SocialNepal platform, he will see posts from Jack on his wall (home page).

- In the third tier, Jack is following Bob (B < J) or in other words Bob has Jack as a follower (B < J). When Bob is logged in he can find posts from Jack on section "All Posts" or by using the generic search feature of the platform.

- In the fourth tier, Bob and Jack are friends (B<>J) or in other words, Bob is following Jack and Jack is following Bob (B<>J). Both Bob and Jack can see each other's posts on their timeline. They can also write on each other's walls. However, if they break their friendship, all those posts will be deleted automatically.

IV. USER ROLES, LANGUAGES AND SECURITY ISSUES

There can be many different types of user roles in the system. However, in the SocialNepal platform following specific roles has been defined. The administrator of the platform can assign one of the four different user roles to each user.

A. User

The user is a default user role assigned to the registration process. This user can manage only his/her content. Posts shown to this user are filtered through the strict security policy.

B. Subscriber

The subscriber is similar to default 'user' role, but one can assign some extras with different application settings. For example, one can allow custom profile background for this role. One can also disable groups and pages features for users but allow for subscribers (and other roles above).

C. Reviewer

A user with this role can see all posts and comments, edit and delete them. This user can also access 'reviews' section to administer reported content and send a message even to those users who have chosen 'only friends can contact me.'

D. Administrator

This user can see and manage everything. Pick the adamant password and be careful with this for security purposes.

One of the core features in bridging the social-cultural gap is via localization. Thus, adding a new language in SocialNepal platform is simple, all one have to do is to upload one or more language files, the platform handles the rest. The SocialNepal interface is currently translated into English and Nepalese. It is important to note that language translation file must be encoded with UTF8 without BOM (Byte Order Mark). Also, the RTL (right-to-left) is not entirely supported, at the moment as there is no RTL layout.

Security in the social networking platform is of utmost important. Therefore, the author has considered security to be applied to each post, user profiles, and groups.

The security on posts can be set as:

- Friends only - only user's friends can see this

- Friends & Followers - user's friends and their followers/ subscribers can see this

- Everyone - anyone with an account, currently logged in can see this

- Public - anyone can see this including people without an account (this level can be disabled in settings under "Allow public posts")

The user profile security can be set as:

- Private profile - only friends can see user's profile

- Semi-private profile - friends and followers can see user's profile

- Open profile - anyone with an account, currently logged in can see user's profile

- Public profile - any person including people without an account (this level can be disabled in settings)

The group security can be set as:

- Secret Group - only members can see who is in this group and their posts. Membership request must be approved by the Group admin (the user who created this Group).

- Private Group - all users can see who is in, but only members can see posts. Anyone can join this group.

- Open Group - all users can see who is in, members and posts. Anyone can join this group.

- Public Group - any person including people without an account can see who is in, members and posts. (this level can be disabled in settings).

V. SOCIALNEPAL MOBILE APP

SocialNepal Mobile app (Fig 1) is also developed in order for users to use the platform fully and get more interaction and engagement in the activities of social networking. Users can easily play games on the platform or indulge in normal social networking activities.
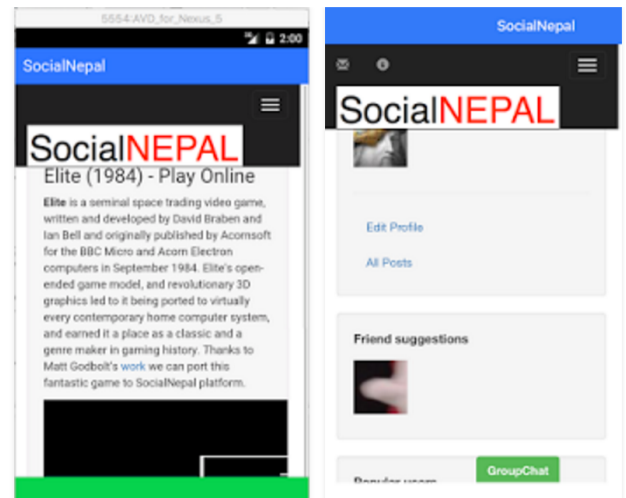

Figure 1. SocialNepal mobile app development

VI. SOCIALNEPAL API

SocialNepal's API (application programming interface) is a powerful tool that allows other developers to build and connect various mobile and desktop applications to SocialNepal powered platforms. The native API has been introduced in SocialNepal's latest version. API sits on every page, listen to requests and responds by resulting JSON formatted data. Available data set depends on requested URL, but it is easy to fetch JSON-packed data for the corresponding page that one sees in the browser on this URL. For example, if there is a call to the API toward specific user profile URL one will receive all user-related data as well as posts on his timeline, all the metadata, and other related variables. It may also receive form descriptions and other variables that are not visible in standard HTML output. Technically, this API can only be used to retrieve data from the server, for writing data and posting to the server using the standard GET/POST requests.

When the user is logged in using the "API key", the application will return user identity in JSON format. To login user and authenticate with the SocialNepal platform use the

standard POST form submit (form#Login). When logged in, API will respect all the filtering and security.

VII. LOAD BALANCING AND DATABASE REPLICATION

When the number of users grows in the platform, it is important to handle and distribute incoming traffic across several workstations. By allocating the processing accessory to several devices, and providing redundancy to the application — warranting fault tolerance and intensified balance. As SocialNepal platform considers the popular Round Robin algorithm [10] for load balancing, which sends users to one of a set of IPs. In the most basic implementation, it is relatively easy to distribute server load without considering more nuanced factors i.e. server response time or the visitors geographical location. The SocialNepal platform supports load balancing since it has a centralized session management as well as an ability to store all user's files into the cloud.

Master-Slave replication (MSR) is a very common feature in modern databases [11] which has also been fully utilized in the platform. MSR is the method of sending all database to write operations from one server (i.e. the master) to another server (i.e. one or more slaves). The slaves then replay the queries and thus replicate the master's data.

VIII. EXPERIMENTS AND TESTING

The SocialNepal platform experimented with load test consisting of one virtual user population for a total of 25 virtual users (Fig 2). The population was made up of 25 virtual users at peak load. The user load was scheduled to ramp up naturally for 5 minutes, continue at peak load for 5 minutes, and then ramp down naturally for 5 minutes.
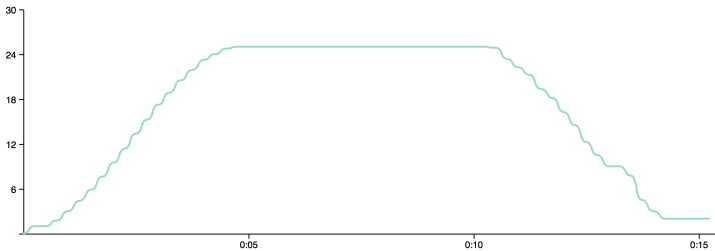
Figure 2.   Twenty-five virtual users on the SocialNepal platform

IX. RESULTS

The initial tests ran for a total of 15 minutes 27 seconds, generating a total of 6203 hits and 3332-page requests (see Table 1).

TABLE 1: RESULTS

Category	Max	Avg	Min
Pages per Second	11.50	3.61	0.00
Hits per Second	36.50	6.71	0.00
Bytes per Second	370666.17	99064.91	0.00

A. Test totals

This section shows the high-level totals as measured by the experiment (see Table 2).

TABLE 2: PAGES AND NUMBER OF HITS

Category	Total
Pages	3332
Hits	6203
Bytes	87.66 MB
Errors	463
User Iterations	201

B. Test throughput

The table below shows test throughput regarding pages, hits, and bytes per second.

C. Response Times

The average response times by page is shown below in the figure (Fig 3):
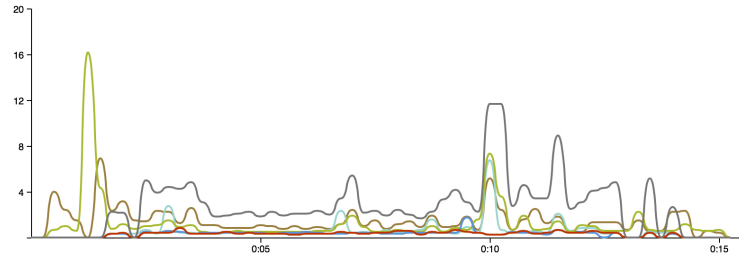
Figure 3. Average response time by page.

Below is a table indicating the maximum, average, minimum, and total response times by page (see Table 3). Pages with the highest total response time are at the top. These may be the best candidates for optimization.

TABLE 3: TOTAL RESPONSE TIME BY PAGE

Page	Max (s)	Avg (s)	Min (s)	Total (s)
http://socialnepal.xyz/index/validateformajax/	19.48	0.91	0.18	1834.92
http://socialnepal.xyz/	25.55	1.34	0.18	1346.56
http:${_redirect}${_redirect}socialnepal.xyz${_redirect}	13.47	3.13	0.20	554.51
http://socialnepal.xyz/index/logout	7.60	0.86	0.20	172.14
http://socialnepal.xyz/notifications/callback/	7.85	0.44	0.05	88.96
http://socialnepal.xyz/notifications/heartbeat/	2.08	0.41	0.05	82.44

X. CONCLUSION AND DISCUSSIONS

There are several academic articles on benefits of a social network, prior research, however, has not examined social networking for particular country or community in general for relatively new phenomenon of Internet-based social networks. People are usually highly motivated to engage in social networking activities and participate in social issues through the creation of pages, groups and user roles. The SocialNepal

platform provides through which young adults who are not just interested in community services but also general issues such as socializing and sharing common interests can participate in one single platform.

This article presented a novel experimental development and execution of social network platform that enables a systematic sharing of contents by leveraging social network user profiles, user roles, and access control. The platform experimented with twenty-five virtual users also through data collection, analysis, and testing, and it has been shown that various type of users on SocialNepal platform can do so because they serve better the users' needs to appear to others, connect and communicate with their contacts, and share content with them. While developing the platform it appears that user security and privacy is the most important aspect of social network where limiting access to user data, flood control, and encrypting data have been appropriated. It can be suggested that this platform can be explored a bit more in the future to enhance the scalability and QoS (Quality of Service).

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Software Defined Network (SDN)

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Abstract-The ground laying problem with conventional network organization is that it is unvarying. Manual configuration of proprietary devices are slow and error-prone, and they cannot fully utilize the power of physical network setup. Users don't have a much modulating capability and is serving current networking requirement of the user. Innovation in networking is too inadequate with respect to network regulation, virtualization, automation, scalability, programmability, and fault tolerance. Development of information and communication technologies (ICT) are creating new problems to future Internet, for which universal accessibility, high bandwidth, and dynamic management are mandatory fields to be researched. Software Defined Networking (SDN) has been recommended as one of the most hopeful solutions for future Internet. It does so by separating the control plane from data plane and providing programmability for network application development which could result in more efficient design, better performance and higher flexibility to provide innovative network designs without the use of proprietary devices.

In this paper, we are going to present latest development activities related to SDN. First of all, we will discuss the general definition of SDN with its previously mentioned characteristic features and potential benefits of SDN. We then discuss three-layer architecture of SDN which includes Physical network layer and Network OS, virtualization layer, and control layer and briefly discuss current efforts made in related research areas. We follow that with successful implementation of SDN and also provide some ways to migrate to SDN-based network from existing conventional network which would help enterprise secure time, effort and money.

Keywords-Software Defined Network (SDN), Conventional Network, Proprietary Devices, virtualization

INTRODUCTION: In today's paradigm of high-end devices, that uses a variety of trends in ICT domain such as, cloud, mobile computing, social networking, data sharing and hosting uses higher bandwidth and should support a large number of traffic with varieties of services at a different level of users. Current use of network has not been limited to sharing files and data, further, it is being used for Telecommunication, IP-TV, HD-TV which brings tsunami in the data centers available for communication. These connections are demanding higher speed network connections than ever. A large number of mobile network connection and social network is demanding anytime available connection to fulfil needs of general people. Social networks have also been increased rapidly over few years [2]. Similarly, cloud computing has also demanded more flexible and agile computer networks. One of the key characteristics of Infrastructure as a Service (IaaS), Platform as a service (PaaS) and Software as a Service (SaaS) is self-managing services [1]. Also, cloud is being rapidly used in today's world and finding an efficient way to access those data is a challenge to today's computing paradigm. In response to mentioned requirements of today's global network would be to make an additional investment in network infrastructure to enhance the existing computer networks. Further expansions on today's network infrastructure would increase network complexity. Today's networks are enormous. A medium sized organization; such as a college would contain hundreds or even thousands of devices connected to or in a network. Also, Networks are heterogeneous. Devices connected may be from different manufacturers, vendors, and providers. It is found that humans are the biggest contributor to network downtime, responsible for about 50-80 percentage of network devices outages [3]. Due to size, heterogeneity and complexity of current and future computer networks; older approaches for configuration, optimization, and troubleshooting the network would be inefficient, also insufficient in some cases. Moreover, if we implement local optimization in a single domain, without cross-domain coordination, that may lead to unnecessary conflicting operation with undesirable outcomes. The situation could be made worse; as legacy network

platform does not have inbuilt programmability, flexibility, and support to implement and test new networking ideas without interrupting ongoing services [1]. Indeed, the networking community and industry have long noticed the stated problems. Few ideas are also been introduced for a better design of future networks including; Named Data Network (NDN), programmable networks, "HTTP as a narrow-waist" and SDN.

SDN Definition, Benefits and Challenges:

SDN have become one of the most popular subject of study in ICT domain. SDN being a new concept, a exact definition of SDN has not yet been developed. However, many definitions of SDN have been made. In this section, we first present a generally accepted definition of SDN, the Benefits and Challenges of SDN with a SDN reference model that will act as the anchor of this paper.

Definition: The Open Networking Foundation (ONF) has provided the most explicit and well received definition of SDN as Software-Defined Networking (SDN) is an emerging architecture that is dynamic, manageable, cost-effective, and adaptable, making it ideal for the high-bandwidth, dynamic nature of today's applications. This architecture decouples the network control and forwarding functions enabling the network control to become directly programmable and the underlying infrastructure to be abstracted for applications and network services. The OpenFlow protocol is a foundational element for building SDN solutions [4].

Benefits: Separating data plane and control plane from each other, SDN provides better control over network and flexibility by introducing programmability in network. Some of the benefits of SDN are Enhanced configuration, improving performance and encourage innovation .In this section, we will discuss about the aforementioned benefits of SDN.

Enhancing Configuration: Referencing to traditional network designs, devices connected in network were needed to be configured manually which was a tedious and error prone job. Also, in case of bad configuration or configuration loss, the devices had to be manually reconfigured again. In SDN, different devices are connected to control plane and makes it possible to control and configure network devices from a single point automatically using software controlling.

Improving Performance: Maximum utilization of network infrastructure is one of the key objective of network operation. Introducing SDN to network improves network globally. SDN allows us for a centralized control with global network view and a feedback control by exchanging information between different layers in network architecture. It allows traffic scheduling, end to end congestion control, load balanced packet routing, and energy efficient operation and Quality of Service (QoS) support [1].

Encouraging Innovation: SDN acts as a platform for network as well as software enthusiasts to implement experiment and install new innovative ideas. High configurability of SDN offers clear separation among virtual networks permitting experiments on real environment.

SDN Challenges: SDN is still in development stage but have promises to provide enhanced configuration, improved performance and encouraged innovation. Standardization and adoption are the most fundamental issues in SDN that are to be solved. Though, the definition of SDN provided by ONF describes about the Openflow protocol, it is not a matured solution. Moreover, OpenFlow drivers are yet to be developed. Also, a stable platform for combining network device vendors, SDN application developers, and network device consumers are yet to be developed. Making a leap from traditional format of network to SDN might be tedious and hard to implement. SDN deployments are still limited to researches prototypes and yet to be implemented in real world for common network infrastructure.

SDN Reference Model: ONF has also provided a reference model for SDN as given in figure below. This model consists of three layers namely, Infrastructure layer, Control Layer and application layer.
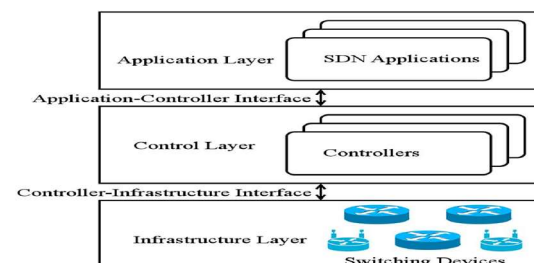

Figure 1 SDN refrence model [1]

INFRASTRUCTURE LAYER: Infrastructure layer represents the physical hardware of networking world and the components interconnecting them. According to the SDN reference model it is the lowest layer in SDN architecture. It consist of Networking Devices like switches, routers, repeaters, etc. which are interconnected with transmission media. Transmission media may be wired or wireless depending upon the network setup. It might be copper wires, optical fibers, radio links, microwave links, etc. In this section we try to describe how infrastructure layer can be utilized to it optimum potential.
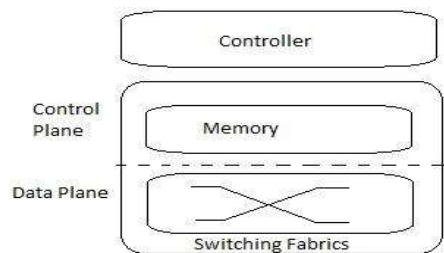

Figure 2 switching device model in SDN [1]

Switching Devices: SDN reference model explains the design of SDN switching device. Two logical components, the data plane and the control plane are present in SDN switch. The data plane perform packet forwarding through its processor based on packet forwarding rules. The forwarding rules are the commands invoked by the control layer. Some of the well-known network processor are developed by:

Broadcom (XLP processor family-MIPS64 architecture), Intel (XS-cale processor-ARM architecture), EZChip (NP-x NPUs), Freescale (PowerQUICC Communication Processor-Power architecture), Netronome (NFP series processor-ARM architecture), Marvell (Xelerated HX family), Cavium (OCTEON series Processor-MIPS64 architecture) [5]

The control plane in switching devices communicates with controller at control layer to obtain rules like packet forwarding and link turning which are used at switching layer and data-link layer. The rules are stored in memory (NVRAM, SRAM, and TCAM) at control plane so that to behave the same way in future when similar condition arises. Switches manufactured with SDN technique have low manufacturing cost and reduced complexity. SDN switches are simply responsible for gathering network status and forward packet based on the packet forwarding and link forwarding rules. A new and improved hardware design is also required to achieve these features of SDN.

Control Plane: The new design for SDN switches came with a big challenge on efficient use of onboard memory. Basically memory on switches is proportional to the size of the network. Larger the network bigger is the memory required. Hardware upgrades can also solve this problem. Insufficient memory might lead to slower network performance. This is because the controller has to make packet forwarding decision [6]. Memory management is SDN switches can be adapted from traditional switches for storing rules and using the limited memory efficiently. Massive routing records can be handled by the techniques of cache replacement policy [1] and route aggregation. These technique can reduce memory usage and thus the limited memory can be used efficiently. Various Storage technology like SRAM (Static Random Access Memory), TCAM (Ternary Content Addressable Memory), NVRAM (Nonvolatile Random Access Memory) can be added to SDN Switches for easier scalability, faster search and easier data recovery[1]. Second, varying nature of elephant flow and mice flow can exploited. If CPU is involved in forwarding process it might result in slower network performance.in order to reduce this irrelevant behavior Lu et al. proposed a technique which forwarded "elephant" flow packets via ACISs and mice flow via CPU to reduce the overall load on the CPU [7]

Data Plane: Packet forwarding job is done by data plane of SDN switching devices. It does show by identifying the forwarding rules appropriate for the packet. Packet forwarding in proprietary devices based on IP and MAC address, while in the case of SDN packet forwarding is also done based on TCP, UDP,VLAN tag, entry switch port, etc. There are several ways by which packets are processed, among them long vector is a way which increases the computational complexity resulting in increased cost and efficiency in packet processing.

In order to process the incoming packets on data plane itself, several techniques have been proposed out of those two are explained. First, in PC-based switching devices, software if used to make a decision regarding packet forwarding might decrease processing throughput. A better option proposed by Tanyingyong et al. suggest the use of hardware to increase processing throughput [22]. With this design, incoming packets are redirected to Onboard NIC which makes forwarding decision based on flow signature making a CPU free from lookup process. Second, varying nature of elephant flow and mice flow can exploit. if CPU is involved in forwarding process it might result in slower network performance.in order to reduce this irrelevant behaviour Lu et al. proposed a technique which forwarded "elephant" flow packets via ACISs and mice flow via CPU to reduce the overall load on the CPU[1]

Transmission Media: SDN architecture should support all the available transmission Medias like the

wired, wireless and optical medium for global access. Different media have their own data transmission and receiving technologies. The digital message obtained from the computer is changed to radio signals if the transmission is to be occurred through Wi-Fi. Similarly, to light if through the optical fiber and to electrical impulses if the wired connection is established. This part of communication is carried out by Transmission media through control layer [8].

Wireless radio: Different kinds of technology exist in wireless communication which are designed to maximize spectrum utilization. A technology called Software Defined Radio (SDR) which permits control of wireless transmission strategies via software [14]. Since SDR has similar nature as the SDN so it can be easily integrated with SDN. Bansal et al. point out that Modern wireless systems have varying configuration but processing blocks are common at physical layer [1]. When packet is to be forwarded to remote client via OpenFlow switches through wireless radio the controller notes down the generic data associated with the packet i.e. packet size, total air time utilization, total no of packets so that if same packets arrives in the future then it can select transmission rate, channel selection, traffic shaping and link association for client and access point based on current and historical information [1].

Optical fibers: Optical Fiber are widely used in setting up network backbone due to its low power consumption and high capacity transmission. A device called ROADMs (Reconfigurable Optical Add/Drop Multiplexers) [9] can be used to achieve remote configuration and reconfiguration which makes it better option for integrating with SDN. These devices can block, add, pass or redirect visible light and modulated infrared (IR) beams of various wavelengths in a fiber optic network. Mostly used in systems which uses wavelength division multiplexing [1].

CONTROL LAYER: SDN control layer works as a bridge between the Application layer and Infrastructure layer. In this section we focus on two critical issues at the control layer namely rule and policy validation and performance challenges with possible solutions at control layer. For the logical design of SDN controller we mainly require the basic four components namely High level language, a rule update, network status collection and network status synchronization process.

Controller Design: The controller is the central core of the SDN network. It is an application which manages flow control to create intelligent Networking. In our proposed architecture design, SDN controllers are based on protocols such as OpenFlow that allow servers to tell the other devices such as switches about where the packet

needs to be forwarded. OpenFlow is used to configure network devices and choose the optimal path for the incoming traffic on application. SDN controller works as an operating system for the Networks. It takes the control plane off the hardware and run it as a software which decreases the complexity of controlling hardware manually. It also facilitates automated network management and makes easier to combine and control business applications. The logical design can be disengage into four main building components namely High level Language, a rule update process, a network status collection process and a network status synchronization process.
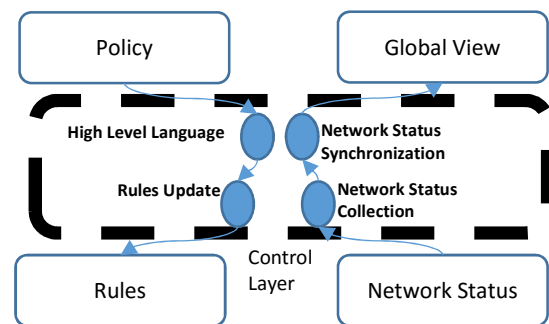

Figure 3 controller logical design [1]

High Level Language: The major functionality of SDN controller is to convert application request into packet Forwarding rules. A well-defined protocol must be defined for communication between application and control layer. Adapting to earlier technologies might not be a better option like Cisco IOS CLI, which might cause problem while managing complex networks. A better option would be to use high level languages like Java, Python, C++ which provides API and libraries for better application development.

Rules Update: An SDN controller should also be able to generate packet forwarding rules describing the policies and installing them into appropriate switching devices. At the same time for the changes of configuration and to provide dynamic control such as directing traffic from one to another replica for dynamical load balancing[10], migration of virtual machine[11] and recovery of network after unexpected failure, the forwarding rules in the switching devices needs to be updated. While updating the rules consistency of a rule should be preserved to arrange and maintain proper network performance. Rule consistency can be established in two different taste. They can be explained as:

Strict Consistency: It ensures that either the original or the updated rule set is used. It could be used for every packets in which each packets is proceed or in a per-flow measure where all packets of a flow are processed. Reitblatt et al. propose a strict consistency implementation that combines versioning with rule timeouts [1]. Every

packets are stamped with a version number at the time of submission to the switch which indicates the type of rule to be applied. Later packets will be stamped to take updated rule set. Thus, updated rules are mostly followed at the end. Original and updated rule will be included in switching devices before the expiration of the original rule.

Eventual Consistency: It ensures that later packets are forwarded using the updated rule set after the update procedure completes and also allows the earlier packets of the same flow to use original rule set before or during the update procedure. Later, McGeer et al. implemented eventual consistency to preserve memory space by ensuring that only a single set of rules is presented in a switching device at any time [1]. Every switching devices needs to be informed to aim the affected packets to the controller when a new policy is to be applied. Then the controller generates new packet forwarding rules based on the defined policy and replaces rules in switching devices with the new rules. The affected packets which are buffered in a controller are released back to the switching devices after the replacement of rules in switching devices. Hence eventual consistency are preferred if the memory space is low.

Network status collection: In the upward flow, illustrated in figure 3 to gain a global view of an entire connected network, controllers collect network status and provide the application layer with necessary information. Traffic statistics such as duration time, packet number, data size, and bandwidth share of a flow falls under the network status. Each switching devices collects and stores local traffic statistics within its storage. These statistics can be retrieved by controllers using "pull" mode or reported to controllers using "push" mode. The different mode has different characteristic in measurement overhead and accuracy. Therefore a key objective is to find an optimal point with adequate accuracy and also maintaining low measurement overhead.

Network status Synchronization: Assigning control to a centralized controller can cause congestion at the centralized controller. A common solution to overcome this problem is deploying multiple controllers as peer, backup, or replicate controllers [12]. Inconsistent states may result making incorrect decisions in the application layer which then leads to inappropriate or suboptimal operations of the network [12].Hence, to ensure the proper network operations a consistent global view among all controllers needs to be maintained. Publish/subscribe systems are widely used to achieve a synchronized global network view. Whenever a system changes is detected each controller uses a publish/subscribe system to publish an event about the change. The new updated system status is forwarded to the particular controllers for immediate updating.

Policy and Rule Validation: Policy and rules are used in controller to forward incoming packets according to organizational policies. These policy are designed by network administrator by the use of Application software. A single controller might be serving multiple requests from switches. Most widely used techniques are Model Checking which automatically verifies the correctness of a finite-state system. FlowChecker is proposed to identify intra-switch defective configuration and inter-switch inconsistency, maximizing the benefits of model checking [1]. It provides a generic property-based interface to verify reachability and security properties written in Computational Tree Logic (CTL). Using CTL language it is easier to write processes to validate certain properties and also to obtain statistics to be used for further analysis of the network. Flow checker conducts the "what-if" analysis to validate the policies and rules. It uses Binary Decision Diagrams (BBDs) to encode network configurations and also simulate the global behavior of the network in a single state machine. Further NICE (No bugs In Controller Execution), OFTEN (OpenFlow Testing Environment), VeriFlow are introduced and different ideas are used for Model Checking. After the change in network state, it is important to check rules in real time. Low latency during real-time checks is much important. khurshid et al. presented VeriFlow to maintain low latency during real-time checks. For that, they introduced a proxy between controller and switching devices to check breach dynamically in the network [1].

Control Layer Performance: The performance of SDN network depends on the control layer which is restricted by the scalability of centralized controllers. Unknown packets arriving in the switch is forwarded to the controller via the control plane. When the first packet of each flow arrives the switching devices, they need to request controllers for packet forwarding rules immediately. SDN controllers should be placed only at those places where maximum traffic utilization can be achieved which will reduce scalability issue [13], which would need network status synchronization. Many types of research are made to increase processing ability of a controller or decrease number of request to be processed.

Increasing Processing Ability: A controller is a Piece of software. Processing ability of controller can be optimized by the use of efficient algorithm and optimization techniques like parallelism and batching. Different application such as Maestro (Java), NOX-MT (C++ implementation of NOX), Beacon (Java), McNettle (Haskell) [20].

Reducing Request Frequency: Frequent request on controller could increase delay on SDN controller. A number of strategies have been developed out of which one is to handle the incoming packets from data plane

itself. This is by far the most efficient way to reduce request frequency. Another method is to arrange the structure of switching devices to maximize the throughput of overall network.

Performance Benchmarking: performance benchmarking is a process of identifying and increasing the overall performance of the controller. Some of the tools used for this process are Cbench, OFCBenchmark. Cbench generates packet in event for new-flow. It does so by emulating the bunch of switches which establish connection to controller, transmit packet-in messages, and look after flow-mod to gets pushed down [21]. OFCBenchmark is a performance benchmarking tools which measures the performance by Load balancing, Topology representation, Reply of Captured traffic, individual packet monitoring, and individual switch configuration [20].

APPLICATION LAYER: Application layer lies at top of control layer. Through the control layer below the application layer, applications related to SDN can conveniently access global network view with instantaneous status through a northbound interface of controllers. Hence, SDN applications can programmatically implement strategies to manipulate the underlying physical network using High Level programming in control layer. In this way, SDN provides "Platform as a service" model for networking [1]. Several SDN applications are introduced below:

Adaptive Routing: Packet switching and routing are the main function of network. For packet switching and routing, SDN provides closed loop control and offers application to adaptively control the network.

Two popular SDN applications in this domain are load balancing and cross layer design. A common practice of load balancing in data center is installing of front end load balancer to direct each client request to the server replica increasing throughputs and avoid overloading of network. In SDN, we assume uniform traffic from all client with different IP address and use a binary tree to arrange IP prefixes. A cross layer approach is a highly touted technique to enhance integration of entities at different layer in layered architecture. Since SDN enables a platform for application to access network information, cross layer approach can be easily implemented.

Network Maintenance: Most of the networks fail due to configuration error. It is found that more than 60% network downtime is due to configuration error by human [15]. SDN provides centralized or automated management and consistent policy enforcement that helps to reduce configuration errors. The central control of SDN

implementation can directly resolve network failure with shorter router coverage time [1].

Network Security: Network security is a notable part of cyber security. Traditional practices used firewall, proxy and tedious network configuration. SDN provides a convenient platform to check policies and configuration to make sure the required protection is done or not. SDN also provides better way to detect attacks relatively. SDN is capable of providing direct and fine grained control over network
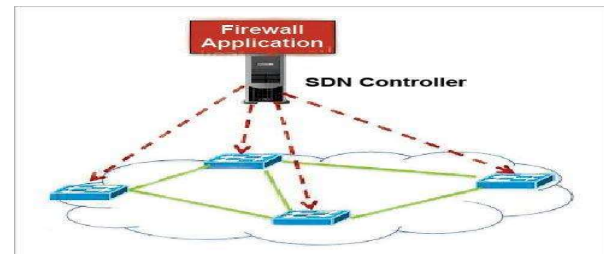

Figure 4 SDN based firewall [16]

SDN based firewalls creates rule in application layer and push it to the SDN controller which then imposes those rules on control plane of the infrastructure layer and updates it if new changes are made. Some of the controllers are Brocade SDN Controller, NorthStar WAN SDN Network Controller, Floodlight OpenFlow Controller Open Daylight controller.
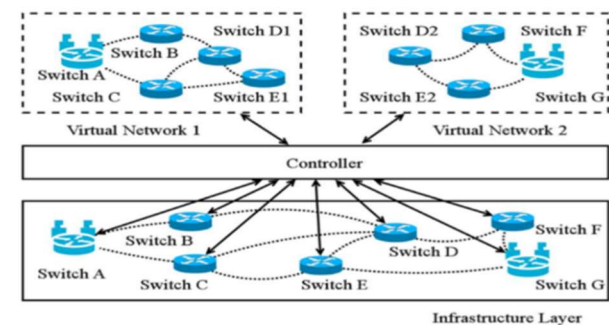
Network virtualization:

Figure 5 Network virtualization [1]

Network virtualization is a common technique to allow multiple heterogeneous network architecture to be stored in shared Infrastructure [17]. Generally in case of virtualization slicing of physical network is done into multiple instances and assign them to different users.

SDN for cloud computing: Cloud computing is the modern way of computing. It provides computing and storage resources on demand and charges according to the usage basis. SDN provides opportunities to extend the service of IaaS with rich set of network services for more flexible and efficient cloud computing [1]. Two unique issues in cloud computing are virtual switching and VM

migration. Virtual switching is used for communication among VMs in the same host. As a solution, open Vswitch enables virtual edge switching for VMs with visibility and increased control supporting the idea of SDN. VM migration is widely used in data center for statically multiplexing or dynamic communication pattern to achieve higher bandwidth for tightly coupled hosts [18].

For example: Google data centers are connected through iWAN network. The entire iWAN network is connected to SDN control plane which uses Hadoop technology for distributed computing. When user requests for any service a request is sent to index server with physical or logical address and provides result to user through g-scale network. All google products for user uses g-scale. User are connected to traditional architecture of network that uses g-scale network. The request sent by user is sent to a server. The server then forwards the request to iWAN network which uses SDN architecture. Desired result is obtained from the data centers and provided again to g-scale network through servers as mediators. Here, the data centers are in SDN architecture whereas g-scale is in data centers are in SDN architecture where the g-scale is in traditional form. Hence, SDN shows a tightly coupled connection despite of having entirely different architecture. Therefore, SDN can be implemented in today's paradigm of cloud computing.

OPENFLOW: Data plane and control plane is separated by SDN. When a network implements SDN, controller becomes the main part of the network that manages the connection. Every switches connected contains information about all other connected or traversed OpenFlow table.At this subsection, we consider a scenario where we include two pc's namely pc1 and pc2, and two switch namely switch1 and switch2 and a controller. Let us assume, pc1 is connected to port 1 of switch1 and pc2 is connected to switch2 through port 1 of switch 2. Both the switches are connected by their port 2. Once switch1 receives packet from
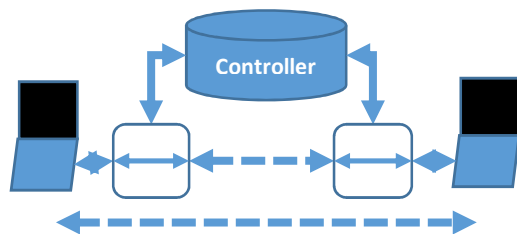

Figure 6 Use of OpenFlow protocol in OpenFlow switch [1]

pc1, the destination is unknown to switch1. Hence, due to information on the open flow table, the packet is forwarded to controller with PacketIn message. The controller then floods the stamped packets which contains the details of destination. Since, OpenFlow table of switch2 contains information of destination, and hence accepts the packet. Along with the PacketOut message

sent by controller to switch2, a flow modification message is also sent that modifies the OpenFlow table at switch2 with information of pc1.To result of packet being received by pc2, Sync/Ack packet is sent again to switch2. Same scenario continues since the destination is unknown at first. The packet is forwarded to controller. The controller now know the position of pc2. Hence, transfers a PacketOut message. Finally packet is received by pc1 with modification in openflow table of switch1. Switch1 now contains location of pc2 and switch2 now contains location of pc1. Hence, communication can take place now without the help of controller [19].

OpenFlow Software Projects:

Name	Platform	Features
NOX/POX	C++/Python	The first OpenFlow controller
Beacon	Java	Support both event-based and threaded operation, Provide WEB UI
Floodlight	Java	Developer friendly with good documentation
OpenDayLight Controller	Java	Provides REST API and Web GUI
McNettle	Haskell	High-level Declarative expressive language, Multi-core Optimization

[1]

SUMMARY AND CONCLUSION: Mobile multimedia, cloud computing, big data, etc. are demanding more convenient networks. SDN is considered to be the best option to meet these requirements. Benefits of SDN such as enhanced configuration, improved performance and encouraged innovation are highlighted. We have provided a surface overview about infrastructure layer, control layer and application layer. Finally we have introduced OpenFlow in the last section of our paper. SDN cab be implemented in physical network after testing the configuration in emulators like mininet. We can also use simple python server, OpenDayLight controller and POX. To monitor the packet flow in simulated environment Wireshark is used.

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Status of e-Waste in Nepal and its Mitigating Measures through Information Communication Technology

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ABSTRACT

The paper, "Status of e-Waste in Nepal and its Mitigating Measures through Information Communication Technology" is presented envisioning the condition of e-Waste in Nepal and the controlling measures that can be implemented to mitigate its increasing, irresponsible and unplanned management in Nepal. Lack of awareness about e-Waste in our country and treatment of it merely as solid waste by dumping and incineration posing serious threat to the environment and health, is the main reason behind conducting this research. This paper focuses on the status of e-Waste through the research taken from survey, interview and meetings. The mitigating measures comprises the use of technology for mass awareness about e-Waste and computation of the e-Waste generated by the user's devices through software. With technology, users can be provided with analytical tools to analyze various parameters of e-Waste such as composition analysis, trends and what-if analyses. Such applications also include communication between different stake holders for buying, selling or donating electronic products. In this paper two models are proposed with and without a recycling center for e-Waste management suitable in the context of Nepal. This paper aims the consumers, distributors, environmental and social organizations, analysts and the general people and through ICT, provides them e-solution to evaluate and analyze their e-Waste and aware them in parallel. It is also envisaged to be a useful and an initiative research project in the field of e-Waste management in Nepal.

Keywords: e-Waste, mitigation, management, analysis, recycle, ICT, kawadi

1. INTRODUCTION

With the population across the world increasing, the usage of electrical and electronic equipment (EEE) is also escalating. Millions of mobile phones, laptops, tablets, and other electronic devices are generated and likewise electrical and electronic waste (e-Waste) are also generated enormously around the earth. [1]

Electronic goods are packed with toxic chemicals containing harmful substances such as barium, mercury , lead, cadmium, arsenic and flame retardants. The most updated and replaced technologies are mobile phones and computers that ultimately increases the e-waste. Most of the e-Waste ends up in landfills where toxic metals percolate into the environment. [2] Individuals who work at sites meet frequent bouts of illness. Waste electronics are contaminating drinking water and destroying ecosystems around the world. [3]

As mentioned above e-waste has posed threat to all the aspects of human life and environment. The major problem is that, e-waste is obscure to majority of people in the country as found according to the survey. This problem needs to be addressed from individual level and managed scientifically by the government.

2. STATUS OF e-WASTE IN NEPAL

Imports of electronic products are accelerating day by day. Among all the electrical products, taking only an instance of a trend of computers and its e-Waste generation is analyzed in this paper. [3] The estimated imports of computer from the department of customs from the year 2057 to 2063 B.S. is illustrated below.

Fiscal Year	2057/58	2058/59	2059/60	2060/61
Computer	37073	26526	20777	46566
Fiscal Year	2061/62	2062/63	Total 2057-2063	
Computer	25238	216713	372,893	

Table 1: Computers imported in given years (Source: Compiled from the information of Department o

Table 1 depicts the gradual increase of imports of computers. It can be observed that there is a drastic increase in the year 2062/2063 B.S.
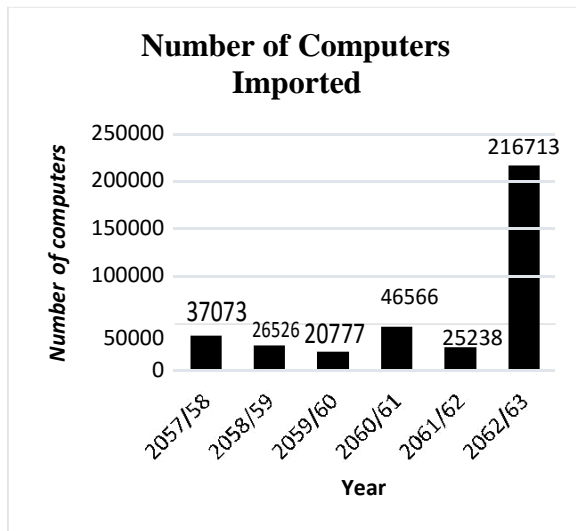
Number of Computers Imported

Figure 1: Trend of computers imported

Using 'consumption and use' method and taking an average weight of computer to be 9.9 kg and life span about 5 years, [6] the estimated e-Waste generation is shown below:
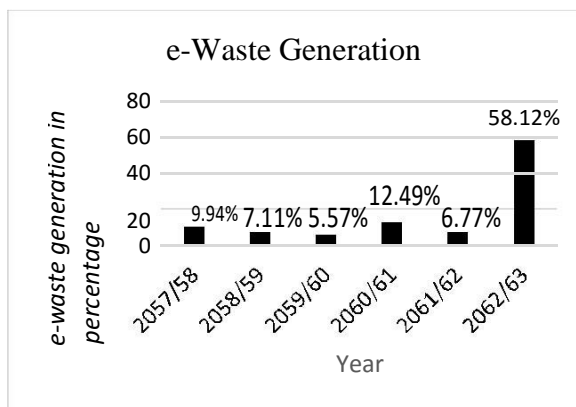

Figure 2: e-Waste generated in given years

Figure 2 is a bar graph representation of e-Waste generated in each year as noted in Table 1.

Using google forms and hard copy forms we conducted survey, meetings and interviews to know about the concerns of e-Waste and if any regulations carried out for its management. Interacting with dealers and distributors it was found that no responsibility was taken for e-Waste. In the visit to environment department of Kathmandu Municipality in Teku, it was found that no separate management of e-Waste from solid waste management from the government has been made. From one of the environmentalist from Women Environment Preservation Committee (WEPCO) informed that there are no recycling centers or any sorts of management of e-Waste organized by the government. [9] Solid waste management in Lalitpur introduced some policies of e-Waste and its harmful effects but was not implemented practically.

From the survey statistics, it was deduced that only thirty five percent of the people were aware about e-Waste and only 26.5% of the people were known to the health hazards whereas 73.5% of the people are obscure about it. Furthermore only 26.5% of the people were known to the health hazards. It was also found that half of the people such as dealers, distributors, and repairing centers of respective companies treat e-Waste as solid waste whereas half of the other treat by selling or giving to the kabaddis.

3. e-WASTE MANAGEMENT

3.1 Current Flow of e-Waste in Nepal

Below, Figure 3 shows the flow of e-Waste management in Nepal. The imported electrical products are sold to people from distributors and dealers. After the products get damaged it is either sent to repairing centers, sold to kawadis or disposed as garbage which later is collected by garbage collectors. At kawadi center the products are dissembled for extraction of beneficial and valuable metals and rest is either sent to India for further recycling or treated as municipality solid waste. [8] There is neither recycling centers in Nepal nor policy to treat the e-Waste.
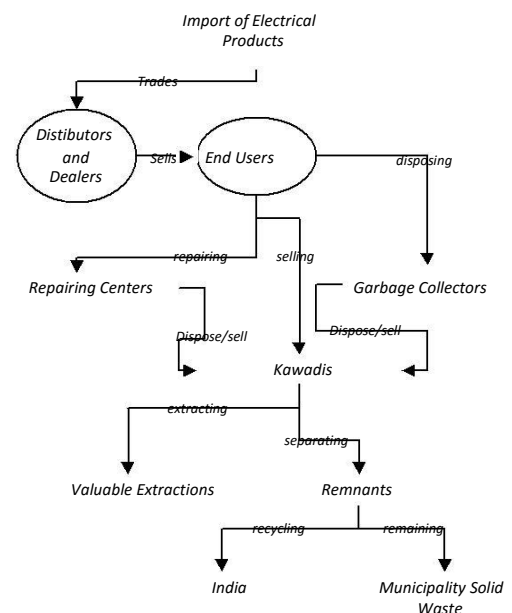

Figure 3: Current flow of e-Waste management in Nepal

3.2 e-Waste Management Model in India

In context of neighboring countries, India implements e-Waste management system with shared responsibility for the collection and recycling of electronic wastes amongst the manufacturers / assemblers, importers, recyclers, regulatory bodies and the consumers.[4] Whereas in China, management regulation on pollution control of electronic

information products is issued by seven ministries and formulated by State Environmental Protection Administration (SEPA).[5]
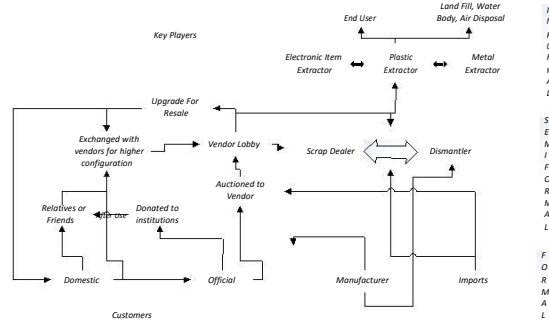

Figure 4: Stakeholders hierarchy in India. (Source: CPCB/MoEF. Presentation of Delhi study, March 2004)

Figure 4 shows the stakeholders' hierarchy involved in flow of e-Waste as presented in Delhi study. Divided into three level, the model depicts how e-Waste is collected and transferred to recyclers by various stakeholders. The model supports the required entities involved in e-Waste and follows a systematic approach in handling e-Waste.

4. HOW e-WASTE CAN BE MANAGED THROUGH ICT?

4.1 Awareness

First and foremost every people needs awareness about e-Waste because the management starts from the root level. So a mass awareness is required which is possible through television broadcast, radio broadcast and use of internet and mobile technologies.

4.2 Policy and Regulations Regarding e-Waste

With strong rules and regulation systematic management of e-Waste is possible. The policy needs to include the collection e-Waste separately and treatment of e-Waste in a scientific manner preventing from any environmental or health hazards. Proper business policies needs to be formulated with concept of extended producer responsibility (EPR) [7] and environmental policies regarding e-Waste.

4.3 Recycling Center

Without recycling center there can be no proper way to manage e-Waste. The used products can be recycled to gain valuable materials such as copper, silver, gold and many more which can be used again. Recycling center should also be organized with health policies and security for the workers. Recycling center can be set up either by government or any private sectors compliance with the law as

done in countries like Switzerland, Netherland, Canada and many more.

4.4 Estimation and Analysis of e-Waste through Technology

Through ICT, using the existing technologies mass awareness is possible using the software application by estimating and analyzing e-Waste generation and also through established communication between different stakeholders such as recycling centers, repairing centers and other organizations e-Waste can be systematically managed through ICT.

The estimation is possible through proposed e-Waste quantifications such as in the 'consumption and use method' assumes a basket of EEE-commodities per household. An assumed weight is multiplied by the total quantity of items and divided by medium life span for e-Waste generation. [16] The detailed diagram is shown in Figure 5.

4.5 Establishing Communication between Stakeholders, Consumers and Government

Through the use of web and mobile technology the general people can communicate with the stakeholders such as repairing centers, recycling centers, environmental organizations and government for trading their used products so that it can be treated properly.

5. Detailed Components of ICT Framework

Figure 5 depicts the entities of ICT that facilitate in management of e-Waste through estimation of e-Waste generation, analyses through tools, automatic report generation and communication using mobile applications that can track nearest recycling, repairing or refurbishing centers.

A software application can be developed that can estimate the e-Waste generated by individual. It can further inform about the environmental and health risks about the e-Waste generated. The application can also provide the users with the analytical methods for analyzing e-Waste generated through pie-charts, trends analysis through line graphs and what-if analysis for self-assessments. The application with analysis and report generation facilitates users with decision making process.

ICT framework can back up the flow of e-Waste management as shown in Figure 6 and Figure 7 for efficient communication and analyses between different stakeholders and consumers.
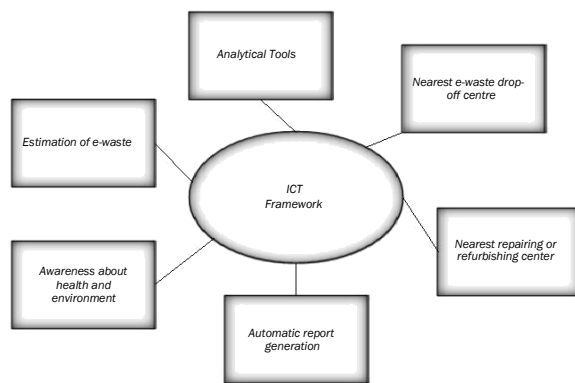
Figure 5: ICT for e-Waste management

6. Proposed e-Waste Management through ICT if No Recycling Center is Setup within the Country
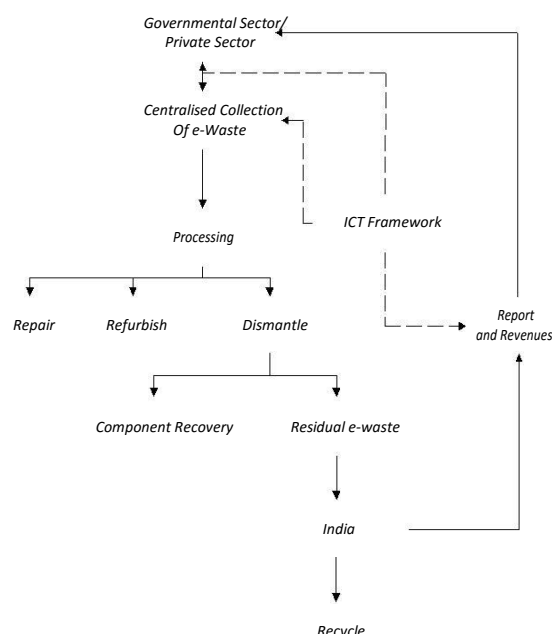

Figure 6: e-Waste management with no recycling center

Figure 6 illustrates the management of e-Waste if no recycling center can be set up in the country. Currently, there is no recycling center in Nepal. The most efficient method of e-Waste management is through recycle, however with the high cost of installation of a recycling center, no laws and regulation and governmental policies, it may be infeasible in the current scenario. From study it was found that the remaining e-Waste is sent to India for recycling but not proper laws, policies and reports is maintained to supervise flow of e-Waste. Shipping to other countries requires additional high cost thus, dealing with India with proper law and agreement can help in e-Waste management without recycling center in the country. With the current flow of e-

Waste there is no proper supervision and organization of how e-Waste is handled in Nepal so instead a systematic flow can be maintained with central collection of e-Waste either by a government or a private sector which delegates further processing of e-Waste. The e-Waste collected is either repaired, refurbished or dismantled in the country. The component recovered is useful which can be sold and the rest of e-Waste which cannot be further treated can be sent to India for further recycling. Additionally a follow up should be done to maintain the record through reports and revenues collected from India.

7. Proposed e-Waste Management Model through ICT Using Recycling Center

Below, Figure 7 shows the proposed model of e-Waste management by setting up recycling center that can be implemented in Nepal with the foundation of ICT for flow of information and establishing communication through technology. It is divided into three levels. The core is the ICT framework (dotted line) that provides the necessary tools for assisting the management of e-Waste throughout the system. The detailed components of ICT framework is explained in Figure 5. The second level (solid line) consists of flow of material between the entities that uses electrical products and where e-Waste is generated. The consumers, dealers, distributers, producers, manufactures and others that have generated e-Waste is collected through municipality or local collection. Here, business policy such as EPR can be implemented where producer takes the responsibility of the product after the end of its use. Through ICT the collection can be efficiently managed by establishing communication between stakeholders and the users. The collected e-Waste that can be upgraded is refurbished, those that can be repaired is used again while those that is to be recycled can be further processed from which useful metals are recovered and sold to manufacturers and scraps to scrap dealers. The new products manufactured by producers is again sold to the consumers, dealers and distributers which forms a complete cycle for sustainable and efficient e-Waste management. Third level (long short line) shows the financial flow between different stakeholders responsible for trading e-Waste before and after recycle. This flow starts from consumer. Consumer can either donate or sell their e-Waste based on policy that can be established by government and environmental organizations. The private sector or government delegate the recycler for further processing and thus paid accordingly. The recovered raw metals are then sold to manufacturers and from manufacturers to producers who built new products from these recovered materials. Finally the new products are again sold to consumers through dealers and distributors.
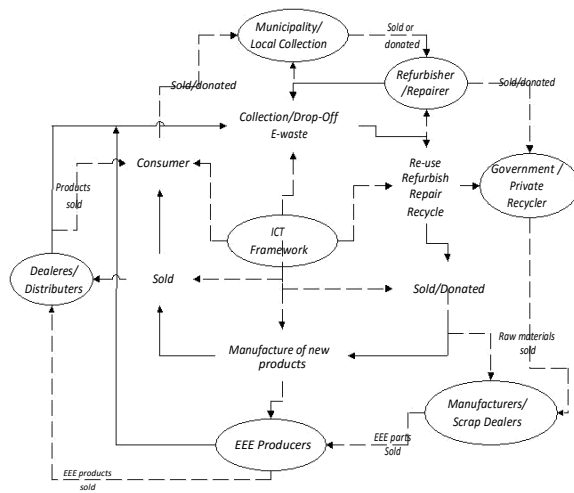
Figure 7: Sustainable and efficient e-Waste management through ICT

── ▸Financial Flow ──▸ Material Flow ──▸ ICT flow

8. CONCLUSION

From the above facts we can deduce that Nepal lacks awareness in e-Waste and its harmful effects on health and environment. Moreover, there is no recycling center or any kind of scientific methods implemented for proper management of e-Waste. With no governmental policy, business policy and environmental policy, e-Waste is being handled merely as a solid waste which can cause dire consequence health and environment in the future. To overcome this unmanaged and uncontrolled growth of e-Waste we proposed a simple management of e-Waste through ICT as shown in Figure 6 and 7. With the use of mobile and web technology we can built applications that can overcome any kind of geographical disparities and facilitates in computation of e-Waste generation, provides analytical tools for decision making and provides mitigation through systematic handling of flow of e-Waste between users, stakeholders and garbage collectors. Finally, separation of e-Waste from solid waste, adopting scientific approach to dismantle the electrical products and reusing and recycling them can help in management of e-Waste in our country.

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Techniques of Image Mosaicing for Steganography

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ABSTRACT

Steganography is the science of hiding secret messages into cover media so that no one can realize the existence of the secret data. Image mosaicing is a technique which enables to combine together many small images into one large image, from which, more information can be collected easily. "Techniques of Image Mosaicing for Steganography" is a study basically focused on the use of secret-fragment-visible mosaic and cubism-like mosaic techniques for secured transfer of information containing images. A number of experiments have been performed to analyze the performance of these image mosaicing techniques. The result obtained by embedding secret images into target images is then compared using root mean square error (rmse) and peak signal to noise ratio (psnr) values. The result of the experiments conducted shows a trade-off between secure transfer of images and better recovery. The secret-fragment visible mosaic is better suited for applications which require secure transmission where the mosaiced images are more similar to the target images and cubism-like mosaic for those which require more accurate recovery of the original secret images. But, the difference in error values between the two algorithms is very less thus leaving the selection of the algorithm to the user.

KEYWORDS:

Cubism-like mosaic, Secret-fragment-visible mosaic, Steganography

1. INTRODUCTION

Information security is turning to be great challenge when sending information from one place to another with the aid of technology. Steganography is one of the techniques for the secured data transmission which involves hiding secret information generally inside other information in such a way that only the intended receiver will know the existence of secret information. This study is meant for combining small tiles of secret image to form a target in the sense of mosaic and comparing the mosaics obtained using different techniques. When this artwork is viewed at close, the observer can view smaller elements, yet when viewed at a distance the collection of tiles blend together to yield the overall picture. When the mosaic generating process starts, original image is divided into many tiles. Before splitting the image, compare the image for mosaic creation. Mosaic image is created automatically by composing small fragments of a given image into target image, achieving an effect of embedding the given source image secretly in the resulting mosaic image [1].

Steganography is the science of hiding secret messages into cover media so that no one can realize the existence of the secret data. Existing steganography techniques may be classified into three categories − image, video, and text steganographies, and image steganography aims to embed a secret image into a cover image with the yielded stego-image looking like the original cover image. Lai and Tsai proposed a new type of computer art image, called secret-fragment-visible mosaic image, which is the result of random rearrangement of the fragments of a secret image in disguise of another image called target

image, creating exactly an effect of image steganography [2].

A new method of combining art image generation and hiding a secret image into this cubism like image to enhance the camouflage effect for various information-hiding applications is proposed in [3]. First, a new type of computer art, called line-based Cubism-like image, which keeps a characteristic of the Cubism art created by extract prominent lines and regions. Then the cubism like image is divided into target tiles and the secret is also divided into secret tiles of same size as target. A mapping sequence is created based on secret-target tile similarity and the secret image is embedded into the target using that mapping sequence. That mapping information is also embedded into the Cubism Image. Finally, a secret-embedded-mosaic-image is created as stego image and that is sent to the receiver.

2. LITERATURE REVIEW

In traditional methods, secret text can be hidden into image which is called as Steganography. Mosaic image technique is one of the efficient techniques to hide the secret images. This methodology needs another image which is said to be cover image. An image is fragmented into small tiles. Then, these tiles are randomly embedded onto a cover image. Secret key is used for embedding the small tiles of secret image onto cover image. LSB (least significant bit) replacement scheme is a technique mainly used for embedding process. LSB technique reduces or avoids the blur effect of encrypted mosaic image. [1].

The original idea of the mosaic image steganography has been proposed by Secret-Fragment- Visible Mosaic Image-A New Computer Art and Its Application to Information Hiding by Lai and Tsai [2]. A new type of art image, called secret-fragment-visible mosaic image, which contains small fragments of a given source image is proposed in this study by Lai and Tsai. Observing such a type of mosaic image, one can see all the fragments of the source image, but the fragments are so tiny in size and so random in position that the observer cannot figure out what the source image looks like. Therefore, the source image may be said to be secretly embedded in the resulting mosaic image, though the fragment pieces are all visible to the observer. And this is the reason why the resulting mosaic image is named secret-fragment-visible.

In recent years, the topic of automatic art image creation via the use of computers arouses interests of many people and many methods have been proposed. The common goal of creating these image styles is to make the generated art images look like some other types of images. Mosaic image is also a type of computer art image is composed of many small identical tiles, such as squares, circles, triangles, and so on. Images may contain private or confidential information that should be protected from leakages during transmissions. Cubism artists transform a natural scene into geometric forms in paintings by breaking up, analyzing, and reassembling objects in the scene from multiple viewpoints. In addition, with the scene objects rearranged to intersect at random angles, each Cubism painting seems to be composed of intersecting lines and fragmented regions in an abstract style. The idea of the proposed art image creation technique as described in "An Enhanced Image Steganography Technique in Art Images" is inspired by these concepts of the Cubism art. [3]

A new type of image similarity method was proposed in "New Image Steganography by Secret Fragment Visible Mosaic Image for Secret Image Hiding", which created embedded image automatically by composing small fragments of given secret image in mosaic form in the target image. The mosaic image is yielded by dividing the secret image into fragments and transforming the color characteristics of secret image to that of target image. Skillful techniques are used in the color transformation process so that secret image may be recovered nearly lossless [4].

The main aim of data hiding is to keep the data as secure as possible and also to protect from the hackers. The significant importance in which the images are used for data hiding is that the human beings are very weak in analyzing the small color changes. Data can be kept secure in medical images, aerial images, texture images and also on art images. Aesthetic data hiding is a new form of data hiding by the use of art image generated by some art image generation algorithm. People are attracted by the art image and thus they are not noticed about the hidden data. Thus data can be kept more securely. Cubism paintings are composed of intersecting line segments and various regions from different viewpoints. [5]

3. METHODOLOGY

The basic working principle for cubism image creation is as shown in figure 3.1. The secret image is embedded into the target image or the cubism-like target image as shown in figure 3.2. The detailed algorithm is described in section 3.2.
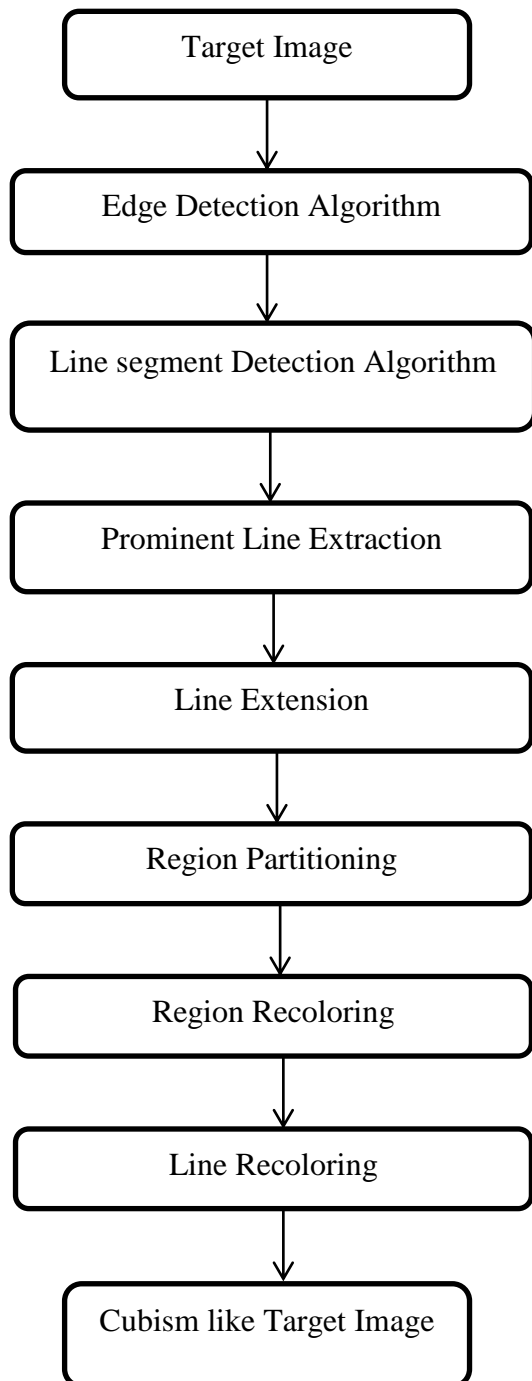
Target Image

↓

Edge Detection Algorithm

↓

Line segment Detection Algorithm

↓

Prominent Line Extraction

↓

Line Extension

↓

Region Partitioning

↓

Region Recoloring

↓

Line Recoloring

↓

Cubism like Target Image

Figure 3.1 Process Flow for cubism-like target image creation

Secret Image

↓

Dividing into blocks

↓

Calculating mean and standard deviation

↓

Sorting blocks according to average standard deviation

Target Image / Cubism-like Target Image

↓

Dividing into blocks

↓

Calculating mean and standard deviation

↓

Sorting blocks according to average standard deviation

↓

Embedding secret blocks into corresponding target blocks

↓

Color conversion of embedded image

↓

Embedding secret image recovery information

↓ Image transfer from source to destination

Extracting secret image recovery information

↓

Recovered secret image

↓

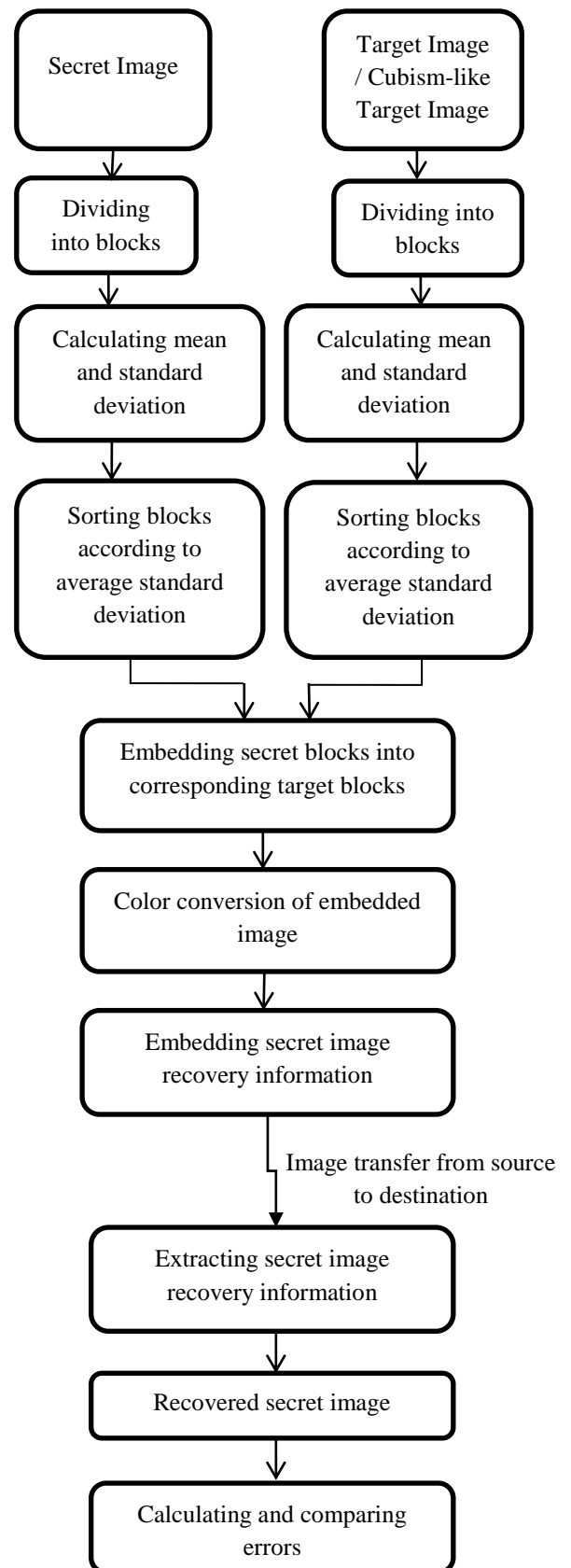Calculating and comparing errors

Figure 3.2 Process Flow for secret image embedding and recovery

3.1 Working Principle

3.1.1 Color Transformations between Blocks

Suppose that in the first phase of this method, a tile image T in a given secret image is to be fit into a target block B in a pre-selected target image. Since the color characteristics of T and B are different from each other, how to change their color distributions to make them look alike is the main issue here. More specifically, let T and B be described as two pixel sets {p1, p2, …, pn} and {p1′, p2′, …, pn′}, respectively, assuming that both blocks are of the same dimensions with size n. Let the color of pixel pi in the RGB color space be denoted by (ri, gi, bi) and that of pi′ by (ri′, gi′, bi′). First, we compute the means and standard deviations of T and B, respectively, in each of the three color channels R, G, and B by the following formulas:

$$\mu c = \frac{1}{n}\sum_{i=1}^{n} ci, \quad \mu c' = \frac{1}{n}\sum_{i=1}^{n} ci' \quad \text{……….....….Eq. 3.1}$$

$$\sigma c = \sqrt{(1/n)\sum_{i=1}^{n}(ci - \mu c)^2} \quad ,$$
$$\sigma c' = \sqrt{(1/n)\sum_{i=1}^{n}(ci' - \mu c')^2} \quad \text{…………......Eq. 3.2}$$

where, ci and ci′ denote the C-channel values of pixels pi and pi′, respectively, with c denoting r, g, b.

Next, we compute new color values (ri″, gi″, bi″) for each pi in T by:

$$c_i{}'' = (\sigma_{c'}/\sigma_c)(c_i - \mu_{c}) + \mu_{c'} \text{ with } c = r, g, \text{ and}$$
b.………………………………………………Eq. 3.3

This results in a new tile image T′ with a new color characteristic similar to that of target block B. Also, we use the following formula, which is the inverse of Eq. 3.3, to compute the original color values (ri, gi, bi) of pi from the new ones (ri″, gi″, bi″):

$$c_i = (\sigma_c/\sigma_{c'})(c_i{}'' - \mu_{c'}) + \mu_c \text{ with } c = r, g, \text{ and}$$
b.………………………………….………...Eq. 3.4

Furthermore, we have to embed into the created mosaic image sufficient information about the transformed tile image T′ for use in later recovery of the original secret image.

3.1.2 Choosing Appropriate Target Blocks to Fit Better

In transforming the color characteristic of a tile image T to be that of a corresponding target block B as described above, how to choose an appropriate B for each T (i.e., how to fit each T to a proper B) is an issue. If two blocks are more similar in color

distributions originally, a better transformation effect will result. For this, we use the standard deviation of block colors as a measure to select the most similar target block B for each tile image T. First, we compute the standard deviations of every tile image and target block for each color channel. Then, we sort all the tile images to form a sequence, Stile, and all the target blocks to form another, Starget, according to the mean of the standard deviation values of the three colors. Finally, we fit the first tile image in Stile to the first target block in Starget; fit the second in Stile to the second in Starget and so on.

3.1.3 Embedding Secret Image Recovery Information

In order to recover the secret image from the mosaic image, we have to embed relevant recovery information into the mosaic image. The information required to recover a tile image T which is mapped to a target block B includes: (1) the sorted rows and columns of secret image; (2) the sorted rows and columns of target image; and (3) the means and the related standard deviation quotients of all color channels of mosaiced image.

After embedding the bit stream into the mosaic image, we can recover the secret image back. But some loss will be incurred in the recovered secret image (i.e., the recovered image is not identical to the original one).

3.1.4 Image Comparison

Similarity analysis is one of the important portions of this thesis. Following approaches have been implemented for image comparison.

Mean Square Error (MSE)

The mean square error (MSE) of an estimator measure of the average of the square of the errors, that is difference between estimator and what is estimated.

In this thesis, MSE is used to compare original images with recovered and with mosaiced image. MSE is calculated as:

$$MSE = \frac{\sum_{x=1}^{M}\sum_{y=1}^{N}[Im(x,y) - Im'(x,y)]^2}{(M.N)} \text{…Eq. 3.5}$$

Where, M, N stands for the size of the image in both horizontal and vertical axes, I_m is the original image and $I_{m'}$ is the reconstructed image that is to be examined.

Peak Signal to Noise Ratio (PSNR)

PNSR is defined as the ratio between the maximum possible power of signal and the power of corrupting

noise that affects the fidelity of representation. Because many signal have wide dynamic range PNSR is usually expressed in term of logarithmic decibel scale.

PSNR is calculated using following formula:

$$PSNR = 20 * log_{10}\left[\frac{255}{\sqrt{MSE}}\right] \ldots\ldots\ldots Eq.\ 3.6$$

3.2 Mosaic Image Creation and Secret Image Recovery Algorithms

Based on the above discussions, detailed algorithms for mosaic image creation and secret image recovery may now be described as:

Algorithm 1. Secret-fragment-visible Image Mosaic Algorithm 1.1. Secret-fragment-visible mosaic image creation

Input: a secret image S with n tile images of size N_T; a pre-selected target image T of the same size of S;
Output: a secret-fragment-visible mosaic image F.

Steps:
Stage 1.1.1 — fitting tile images into target blocks.

1. Divide secret image S into a sequence of n tile images of size N_T, denoted as $S_{tile}=\{T_1, T_2, \ldots, T_n\}$; and divide target image T into another sequence of n target blocks also with size N_T, denoted as $S_{target} = \{B_1, B_2, \ldots, B_n\}$.

2. Compute the means (μ_r, μ_g, μ_b) and the standard deviations (σ_r, σ_g, σ_b) of each Ti in Stile for the three color channels according to Eqs. 3.1 and 3.2; and compute the average standard deviation $\sigma_{Ti} = (\sigma_r + \sigma_g + \sigma_b)/3$ for Ti where i = 1 through n.

3. Do similarly to the last step to compute the means ($\mu r'$, $\mu g'$, $\mu b'$), the standard deviations ($\sigma r'$, $\sigma g'$, $\sigma b'$), and the average standard deviation $\sigma_{Bj} = (\sigma r' + \sigma g' + \sigma b')/3$ for each Bj in Starget where j = 1 through n.

4. Sort the blocks in Stile and Starget according to the average standard deviation values of the blocks; map in order the blocks in the sorted Stile to those in the sorted Starget in a 1-to-1 manner.

5. Create a mosaic image F by fitting the tile images of secret image S to the corresponding target blocks of target image T.

Stage 1.1.2 — performing color conversion between the tile images and target blocks.

6. For each pair Ti → Bji, let the means μ_c and $\mu_{c'}$ of Ti and Bji respectively and the standard deviation be σ_c and $\sigma_{c'}$

7. For each pixel pi in each tile image Ti of mosaic image F with color value ci where c = r, g, b, transform ci into a new value ci″ by Eq. 3.3

Stage 1.1.3 — embedding the secret image recovery information.

8. For each tile image Ti in F, construct a bit stream Mi for recovering Ti as described in Section 3.1.3, including the bit-segments which encode the data items of: 1) the sorted rows and columns of secret image; (2) the sorted rows and columns of target image; and (3) the means and the related standard deviation of all color channels of mosaiced image.

Algorithm 1.2 Secret image recovery.
Input: a mosaic image F with n tile images used in Algorithm 1.1.
Output: the secret image S embedded in F using Algorithm 1.1.

Steps:
Stage 1.2.1 — extracting the secret image recovery information.

1. Extracting from mosaic image F, the bit stream Mt′ for secret image recovery by a reverse version of the LSB replacement scheme

2. Decomposing Mt into n bit streams Mi for the n to-be-constructed tile images Ti in S, respectively, where i = 1 through n.

3. Decoding the bit stream Mi of each tile image Ti to obtain the following data: 1) the sorted rows and columns of secret image; (2) the sorted rows and columns of target image; and (3) the means and the related standard deviation of all color channels of mosaiced image.

Stage 1.2.2 — recovering the secret image.

4. Recovering each block from the tile images Ti, i = 1 through n, of the desired secret image S by using the received information.

5. Composing all the final tile images to form the desired secret image S as output.

Algorithm 2. Cubism like Image Mosaic
Input: a secret image S with n tile images of size N_T; a pre-selected target image T of the same size of S;
Output: the secret image S embedded in cubism-like image.

Steps:
Stage 2.1: Prominent line extraction.
1. (Edge detection) Applying Canny edge detection to image S, resulting in a new image S' of edge points.

2. (Line segment detection)Applying the Hough transform to S' to find a list of line segments L1,L2,....Lm sorted according to their lengths, yielding a second new image S" of the line type.

3. (Prominent line extraction) Finding prominent lines in S" by the following steps.
   3.1 Selecting those line segments in S" with lengths larger than threshold Lmin and discard the others, resulting in a shorter list of line segments L1',L2',....Lm'.
   3.2 For all i=0 through n and all j=0 through n with i≠j and both Li' and Lj ' not deleted yet, comparing Li' and Lj ' and and if the distance between Li' and Lj ' and is smaller than threshold, Dmin then deleting the shorter one of Li' and Lj '.

Stage 2.2 Region recoloring.
4. (Line extension) Extending each remaining line segment in S" to the image boundaries of S".

5. (Region partitioning) Partitioning S" into regions R1,R2,...Rk by the extended lines.

6. (Region recoloring) Recoloring each region Ri in S" by the following steps with i=1,2,....k.
   6.1 Computing the area Ai (in unit of pixel) of Ri and the average color (Cir ,Cig ,Cib) of all the pixels in Ri.

6.2 Recoloring each pixel in Ri by (Cir, Cig, Cib).

7. (Line recoloring) Recoloring all region boundaries in S" by the white color.

8. The final S" is the desired line-based Cubism-like image SC.

Stage 2.3 Repeating all the steps from algorithm 1 using this line-based Cubism-like image SC as the target image.

Finally, calculating RMSE and PSNR values between the original secret image and the recovered secret image and between the mosaiced target image and original target image using both the algorithms and comparing them.

4. RESULTS AND DISCUSSIONS

19 experiments are performed in total, 12 experiments comparing secret-fragment-visible mosaic and cubism-like mosaic and 7 experiments elaborating secret-fragment-visible mosaic. The results obtained using both the algorithms are then compared and analyzed. The images used are collected from various sources including reference papers, online databases and real life images captured using normal cameras. Two sample experiments have been presented here.
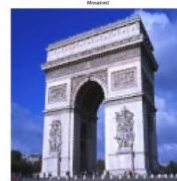
Experiment no. 01:

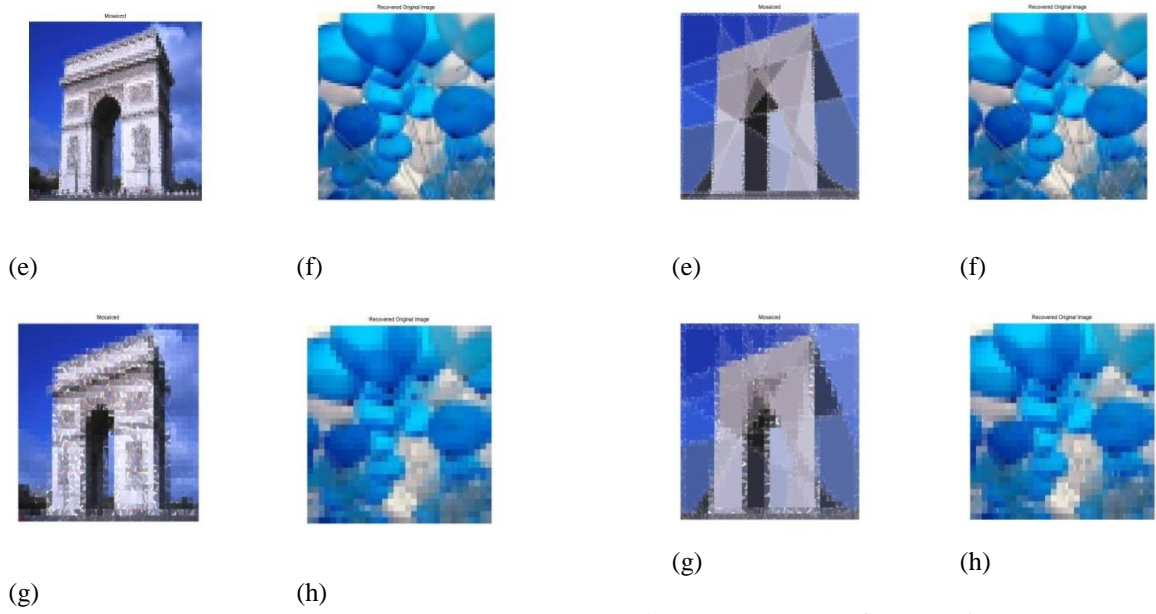(a)   (b)

(c)   (d)

(e)   (f)

(g)   (h)

Figure 4.1: Images for Experiment no. 01(a)secret image (b)target image (c)mosaiced image for block size 4x4 (d)recovered secret image for block size 4x4 (e)mosaiced image for block size 8x8 (f)recovered secret image for block size 8x8 (g)mosaiced image for block size 16x16 (h)recovered secret image for block size 16x16

Figure 4.1 shows the results obtained using secret image and target image for three block sizes. As seen from the figure, also illustrated by Figure 4.3, the mosaiced images are more similar to the target images and recovered images to the secret images for lower block sizes than compared to higher ones.
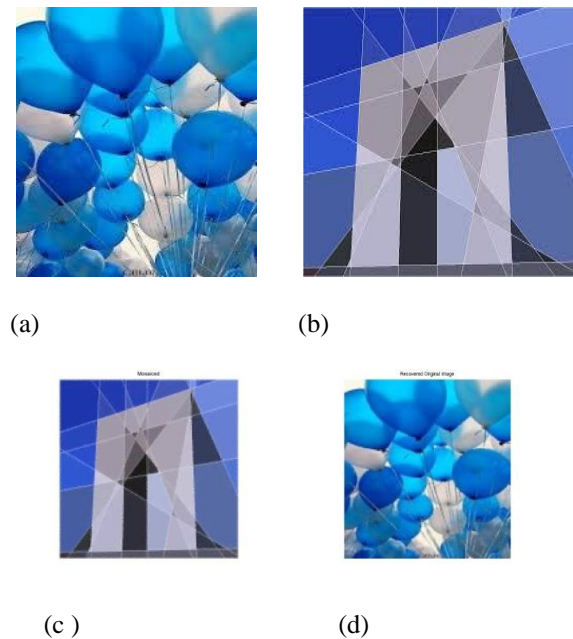
Experiment no. 02:

(a)   (b)

(c)   (d)

(e)   (f)

(g)   (h)

Figure 4.2: Images for Experiment no. 02 (a)secret image (b)target image (c)mosaiced image for block size 4x4 (d)recovered secret image for block size 4x4 (e)mosaiced image for block size 8x8 (f)recovered secret image for block size 8x8 (g)mosaiced image for block size 16x16 (h)recovered secret image for block size 16x16

Figure 4.2 shows the results obtained using secret image same as used in Experiment no. 01 and cubism form of the target image used in Experiment no. 01 for three block sizes. It shows that the mosaiced image obtained by combining secret image and target image is similar to that of the target image. As seen from the figure, also illustrated by Figure 4.4, the mosaiced mages are more similar to the target images and recovered images to the secret images for lower block sizes than compared to higher ones. On comparison of results obtained from Experiment no. 01 and Experiment no. 02, lower rmse and higher psnr of the mosaiced image with respect to the target image is obtained from Experiment no. 01 than Experiment no. 02 whereas lower rmse and higher psnr of the recovered secret image with respect to the original secret image is obtained from Experiment no. 02 than Experiment no. 01.

5. CONCLUSION

This study is meant for combining small tiles of secret image to form a target in the sense of mosaic and comparing the mosaics obtained using different techniques. The experiments conducted conclude that the two algorithms have a trade-off for secure transfer

of image or better recovery. For experiments using secret-fragment-visible mosaic, there is a higher chance of secure transmission with lower rmse and higher psnr values for mosaiced images with reference to target images as compared to those using cubism-like images. Whereas in case of experiments using cubism-like image, there is a higher chance of better recovery of images with lower rmse and higher psnr values for recovered secret images with reference to original secret images as compared to those using secret-fragment-visible mosaic. The difference in errors values between the two algorithms is very less hence, either one of the algorithms can be selected for steganography, but the slight trade-off can be considered as per the necessity of the application. The images need to be of equal size and similar to each other for these algorithms to be applicable.
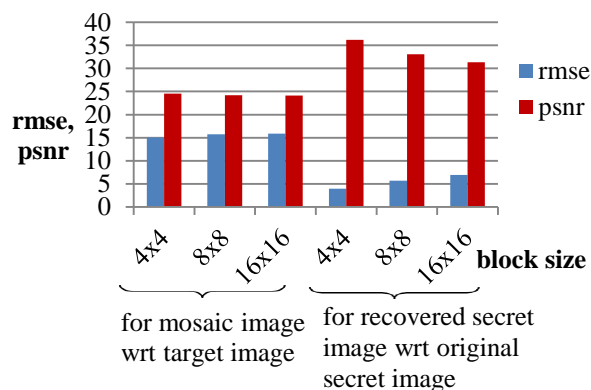

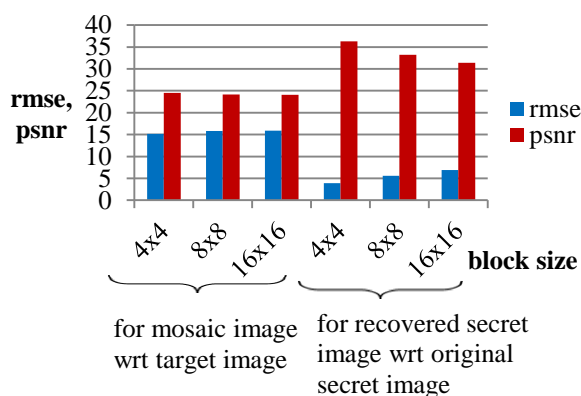Figure 4.3: Plot of errors for Experiment no. 01

Figure 4.4: Plot of errors for Experiment no. 02

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The impact of Software Defined Networking on the network infrastructures of enterprise networks and the growing ISP industry of Nepal

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ABSTRACT

The increase in the size and the complexity of legacy computer network infrastructures has made it difficult to meet the demands of today's enterprises and end users. To tackle this problem, a simpler kind of approach that simplifies the configuration of such networks is necessary. This exact approach is provided by the ideas brought by Software Defined Networking as it renovates the way traditional networking operations are handled. SDN is an emerging technology in which not only the design and manipulation of the networks is improved but innovation is given a room as well. The OpenFlow protocol is a foundation element for building SDN solutions. According to the Management Information Systems (MIS) report published by Nepal Telecommunications Authority (NTA), the number of internet service subscribers in Nepal crossed the 11-million mark on Nov 29, 2015. To meet the demands of such rapidly increasing number of users, the country's ISPs have to grow their network infrastructures which inevitably increases the complexity. This paper seeks to identify whether it is beneficial for the enterprise networks and ISPs of Nepal to consider SDN as an alternative to the current traditional network.

Keywords: SDN (Software Defined Networking), OpenFlow, ISPs (Internet Service Providers), Enterprises Networks.

1. INTRODUCTION

A network model where the controller (a central software program) dictates the complete network activities is identified as software-defined networking (SDN) [1]. The typical architecture of a generic switch (device facilitating communication between connected hosts in LAN) comprises of a control plane and a forwarding plane. The former comprises of the decisions regarding packet forwarding whereas the latter forwards the data based on those decisions. Both of these planes are combined in traditional switches that result in a non-scalable switching solution. SDN pursues the solution by isolating one plane from another and running them into separate devices [2]. In SDN, network devices become simple packet forwarding devices (data plane), while the "brain" or control logic is implemented in the controller (control plane) [1].

The communication protocol between the controller and the switches is defined by OpenFlow. The control logic is transferred from a switch into the controller using the OpenFlow specification [3].The OpenFlow specification is composed of two components namely, the OpenFlow controller and the OpenFlow switch. An OpenFlow controller is a software package that takes the forwarding decisions by analyzing the first packet of every flow based on rules defined by the administrator. An OpenFlow switch can be a generic computer running one of the many software-based switching packages available in the market or it may be a dedicated hardware running OpenFlow as a protocol with both controller and forwarding plane sitting on the same device [2].

SDN has a lot of benefits in comparison to legacy networking. One of the key benefits being the ability for new ideas to be introduced in the network .Unlike proprietary network devices that use fixed set of commands, SDN uses a software program that can change and manipulate the commands easily. Another major benefit is the replacement of distributed management with the centralized approach to network configuration. It makes it easier for the operators to configure the entire network's traffic forwarding decisions from the controller rather than from each individual network devices [1].

Clear distinction between the traditional network model and the SDN model can be seen in Figure 1.

Unlike that in the traditional model, SDN model separates the control plane from each of the network switches and then centralizes them into a single controller which makes it a lot easier to configure the entire network as it can be done from a single logical unit. Network intelligence is (logically) centralized in software-based SDN controllers, which maintains a global view of the network [4]. The OpenFlow governs the communication between the controller and the switches (data plane only).
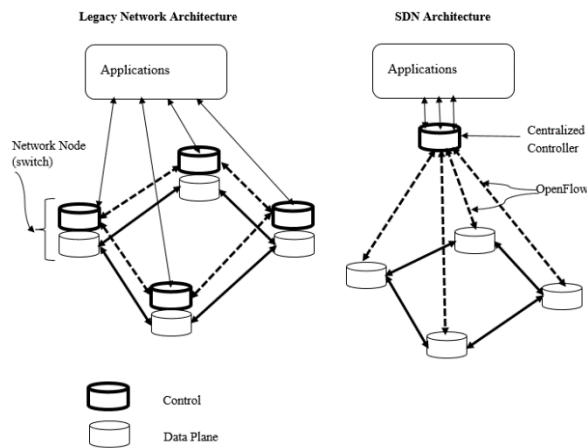

Figure 1. Legacy network model vs. SDN model

2. PRESENT SCENARIO OF NETWORK INFRASTRUCTURES OF THE ENTERPRISE NETWORKS AND ISPs IN NEPAL

Talking about the network infrastructures of the Internet Service Providers of Nepal, traditional Network Environment is implemented with regular switches lacking dynamic programmability. The general architecture which is currently being implemented in the production environment was designed in the past to provide services to a limited number of users. As the numbers of users are increasing day by day, the traditional architecture is not being able to support such high traffic demands causing network errors or slow rate of network transmissions. Also, the additional users being added from mobile environments such as smartphones, tablets as well as wireless devices are causing difficulties in proper and smooth functioning of the day to day network operations. The programmability of network infrastructure has become must to facilitate the end user's demand in real time system, as these trends demand a network that is able to respond quickly to changing demands and hence Software defined networks [10].

3. BENEFITS OF USING SDN

Open Networking Foundation (ONF) is an organization focusing on adoption of Software-Defined Networking (SDN) through open standards development. According to the ONF [5], "Software-Defined Networking (SDN) is an emerging architecture that is dynamic, manageable, cost-effective, and adaptable, making it ideal for the high-bandwidth, dynamic nature of today's applications. The OpenFlow™ protocol is a foundational element for building SDN solutions." We can see the differences between the basic features of SDN and traditional networking in Table 1 [6].

According to the ONF, the SDN architecture has the following features:

3.1. Direct Programmability

Decoupling the network control from its forwarding functions will result in direct programmability of such centralized network control.

3.2. Agile

SDN is agile in the sense that network administrators can benefit from using SDN-based switches as it lets them dynamically adjust the network traffic to meet the changing demands which is made possible by abstracting control from the forwarding plane.

3.3. Centralized Management

Logically centralized network intelligence is present in software-based SDN controllers which retain a global view of the entire network appearing as if it were a single, logical switch in front of different users and applications.

3.4. Programmable Configuration

Using SDN-based switches, network managers can configure, optimize, manage and secure their network resources at a faster rate through dynamic, automated SDN programs, which can write themselves as these programs are independent of the proprietary software.

3.5. Open Standards-based and Vendor-Neutral

Open standards implementation will result in simplification of the network design and its operations as instructions are provided by the main controller rather than multiple vender specified devices and protocols.

	SDN	Traditional Networking
Features	Decoupled data and control plane, and programmability.	A new protocol per problem, complex network control[7]
Configuration	Automated configuration with centralized validation	Error prone manual configuration
Performance	Dynamic global control with cross layer information	Limited information, and relatively static configuration
Innovation	Easy software implementation for new ideas, sufficient test environment with isolation, and quick deployment using software upgrade	Difficult hardware implementation for new ideas, limited testing environment, long standardization process.

Table 1. Comparison between SDN and traditional networking

4. OVERVIEW OF AVAILABLE OPENFLOW DEVICES

There are various kinds of OpenFlow-enabled devices that have been produced by networking hardware manufacturers, as shown in Table 2 [8]. These devices range from equipment for small businesses to high-class data centre equipment. The start-up enterprises dedicated to SDN include Big Switch, Pica8, Cyan, Plexxi and NoviFlow.

Product	Type	Maker/Developer
8200zl and 5400zl	chassis	Hewlett-Packard
Arista 7150 Series	switch	Arista Networks
BlackDiamond X8	switch	Extreme Networks
CX600 Series	router	Huawei
EX9200 Ethernet	chassis	Juniper
EZchip NP-4	chip	EZchip Technologies
MLX Series	router	Brocade
NoviSwitch G8264	switch	NoviFlow
NetFPGA	card	NetFPGA
RackSwitch G8264	switch	IBM
PF5240 and PF5820	switch	NEC
Pica8 3920	switch	Pica8
Plexxi Switch	switch	Plexxi
V330 Series	switch	Centec Networks
Z-Series	switch	Cyan

Table 2. OpenFlow enabled hardware devices

5. RECOMMENDED APPROACH TO SDN

There is no doubt that programmable SDN implementation will bring forth flexibility in future networks; however, they must be approached with care. These technology breakthroughs are still in the development phase and haven't yet reached any sort of mass recognition. Only the ones that have accepted this technology have implemented SDN in a single portion of their entire network in small scale so that they can test the promised benefits and have room for innovation based on SDN. According to the progress made in SDN, organizations are recommended to follow the listed approach:

5.1. Understanding SDN

The organizations with heavy network implementation must first understand what SDN is and how it is beneficial for optimization of their network as well as programmability to satisfy ever changing demands of their network.

5.2. User Acceptance

The organizations involving heavy networks should keep an open mind and be ready to start testing out SDN-based switches even if it is on a small scale basis to discover it benefits and do a comparative analysis on the efficiency increase that we get from SDN approach.

5.3. Planning

Make a future plan involving what devices and applications are connected to your network and how efficiently your network is handling the user's requests. Also, plan how your network will satisfy the organization's needs in the next decade and if some infrastructures are to be added such that there can be room for implementing SDN on a small scale to test its features.

5.4. Avoid Rush for a Complete Change

SDN is being combined with pre-existing network technologies to have added benefits. These technologies need to be understood for what they are. Just because SDN shows better on paper doesn't mean that you need to reconfigure your organization's entire network by implementing SDN. Keep a note to yourself that SDN is in its initial phase and there might be loopholes and unheard discoveries that can have a huge impact on your business or network infrastructure later on. Additionally, there's much work to be done regarding SDN standards which will improve with respect to time. So, there should not be much rush for a complete change rather understanding and small scale implementation can be considered satisfactory.

5.5. Better Understanding of the Operational Impact of SDN

You need to think beforehand about the impact that SDN will have on your network operations on a daily basis. It might bring forth remarkable changes to your network environment bringing mostly positive and few negative changes.

5.6. Consulting an Expert

Take help from an expert in the field of networking, network infrastructures, and protocols as well as with someone having experience of virtualized infrastructures and cloud computing just to be on the safer side. [9]

6. CONCLUSION

It is clear that the SDN way has a lot of advantages over the traditional network system used in the enterprise networks and the ISPs of Nepal. But then

again moving to SDN is a huge step for any organization even though it provides them with quite significant long-term benefits. The best option for the enterprise networks and the ISPs of Nepal is that they can implement SDN in a small section of their network and compare the differences it brings. Parallel deployment with the traditional network architecture can be done so that they can guarantee their ongoing operations. SDN is not just new for Nepal but is an emerging technology in this world. So, there has not been many large scale practical implementation of this technology yet. But one thing is sure- it will definitely shape the future of enterprise network.

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15%2Fdownload&usg=AFQjCNFMYF4eBchYeifzi8 PDnQWsmUGi_A&sig2=EC4K-l5LbswxeNolNfqN_w

Ubiquitous Computing – The Future of Computing

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ABSTRACT

"The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it." This statement was written by Mark Weiser – the father of Ubiquitous Computing, in his well-known "The Computer for the Twenty-First Century". Ubiquitous Computing is a concept in computer science where computing is made to appear anytime and everywhere by embedding microprocessors in everyday objects in any location and in any format, so they can communicate information. The development in technologies like ambient intelligence, augmented reality and wearable computing will change the perspective of people towards computing.

This paper deals with ubiquitous computing, the eras of computing, generic features of ubiquitous computing like natural interfaces, context-aware learning and automated capture and access to live experiences, related areas of ubiquitous computing like ambient intelligence, augmented reality, wearable computing, how it has changed the way humans interact with the computers and the future of computing.

Keywords: **Ubiquitous computing, augmented reality, ambient intelligence, wearable computing, future of computing,**

1. INTRODUCTION

Ubiquitous Computing is a technology that interlinks physical and digital world together. It aims to do so by embedding microprocessors in devices of various forms including laptops, tablets and in everyday objects such as fridge, tables, walls, pair of glasses, etc. The basic idea behind Ubiquitous Computing is to embed chips in almost any devices, from clothing to tools to appliances to cars to homes to kitchens to the human body to connect it with an infinite network of other devices. Ubiquitous computing is also known as Pervasive Computing or ambient intelligence or "Unicomp" or "everyware. [3][14][18]

There are various underlying technologies that support ubiquitous computing like advanced middleware, internet, operating system, microprocessors, sensors, mobile codes, new I/O and user interfaces. It touches a wide range of research topics – distributed computing, mobile computing, mobile networking, location computing, context-aware computing, sensor networks, human-computer interaction and artificial intelligence. [18] The goal of ubiquitous computing is to build an environment where the inter-relation of devices is embedded in such a way that the connectivity does not draw attention of the user and is always available. All ubiquitous computing models has a vision of inexpensive, small and robust networked processing devices distributed at all scales throughout everyday life. [5][20]

2. THREE GENERATION OF COMPUTING

The evolution and development of computing have come a long way which can be divided into following generations of computing.

i. The first era of computing were the mainframes, which were huge, that would occupy a single room and used by large organizations for evaluative applications and scalable data processing. The

relation between the mainframe and the users was many people to one computer.

ii.   The second era is the personal computing era, developed for individual use, where one person uses one computer. Personal computers are faster, smaller, cheaper and portable than compared to the mainframes.

iii.   The third era is the era of ubiquitous computing, or the age of calm technology, when technology recedes into the background of people's lives. In this, many person uses many computers or one person uses many computers. [17][20]
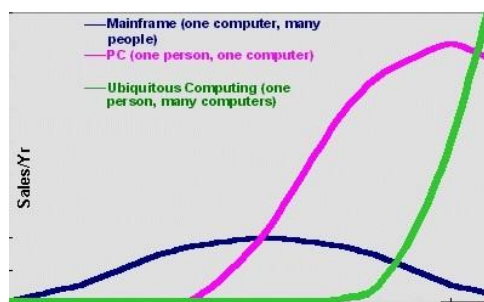
[17]

3.   GENERIC FEATURES

3.1 Natural Interfaces

Unlike desktop computing that requires keyboards, mouse or any other input devices, ubiquitous computing motivates interaction between humans and computers to be more like the way humans interacts with the physical world. Humans speak, write and use gestures in order to communicate with other humans. Similarly, ubiquitous computing also aims to incorporate these natural interactions like speech recognition, gesture recognition, free form pen interaction, computational perception, etc. in its system. These interfaces are admired for their general ease of use, quick learnability and performing tasks without drastically changing the structure of those tasks. [10]

3.2 Context-Aware Learning

Context is the information about the environment with which the application is associated. For example: location and time. Context-awareness is a property of mobile devices which is defined complementarily to location awareness where location determine how certain processes around a contributing devices operate. This concept is associated more with smartphones. A

tablet computer that switches the orientation of the screen and adapts the zoom level and orientation according to it, switches on the backlight of the phone when used in the dark and dims the brightness of the screen in sunlight are some examples of computers that are aware of their environment and their context of use. Context-aware learning enables the smart device to learn from its environment and adapt accordingly. [21]

Location is a common context-aware example which is used in the development of application and software. The most popular application have been GPS-based car navigation systems and "tour guide" systems. Another important piece of context is recognizing individual objects by the use of vision-based recognition system for example face recognition system. [4][21]

3.3 Automated Capture and Access to Live Experience

Automatic capturing of data is the method that automatically identifies objects, collects data about them, and enters that data directly into the computer systems automatically, i.e. without the involvement of human and also saving it in the database for future use. Automated capture is a very important feature of ubiquitous computing that captures the everyday experiences and makes that information available for later use. A huge amount of time is spent to listen to and record, that the information may or may not be recorded accurately, and the piece of information may not be available when needed the most. This problem is solved by the automated capture feature. But one challenge in ubiquitous computing is to provide automated tools that support capture, integration and future access of information. [22]

The technologies that automatically identifies and captures data include bar codes, Radio Frequency Identification, biometrics, magnetic stripes, smart cards, voice recognition and Optical Character Recognition (OCR). [22]

4.   RELATED AREAS

4.1 Ambient Intelligence

Ambient Intelligence is an emerging discipline that holds a great vision on the future of consumer electronics, telecommunications and computing. The Advisory Group to the European Community's Information Society Technology defines the term Ambient Intelligence as "the convergence of ubiquitous

computing, ubiquitous communication and interface adapting to the user." The intention of ambient intelligence is to expand the interaction between human beings and digital information technology by the use of ubiquitous computing devices. Ambient Intelligence largely depends on the technology like sensors and devices interconnected through networks. Similarly, it also depends on the intelligence of the software. Ambient Intelligence is aligned with the concept of disappearing computing (users will not be aware that they are using the computer but in fact they will be) and the disappearing computing is directly linked with ubiquitous computing. [8][9]

One of the key factor in ambient intelligence is the presence of intelligence. Ambient intelligence is based on sensing, reasoning and acting. Sensing relies on sensory data which perceives the environment and uses that information to reason about the environment and to take actions to change the state of the environment. Sensors are small and can be integrated into any ambient intelligent environment. In order to make sensor and acting responsive and adaptive, number of reasoning must take place like user modeling, decision making, activity prediction and recognition and spatial-temporal reasoning. After sensing and reasoning, ambient intelligent systems can execute actions through the intelligent and assistive devices. [9][13]
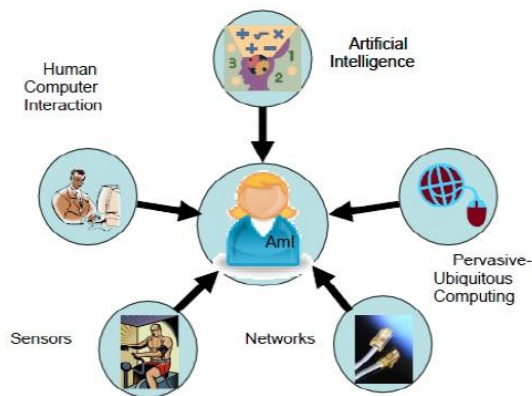

Figure 2: Ambient Intelligence [27]

4.2 Augmented Reality

Augmented reality is the combination of digital information with the natural environment in real time. It is a live view of physical real-world environment but adds graphics, sound, videos and haptic feedback to the natural world as it exist. Augmented reality is different than virtual reality. [15] Virtual reality creates a total artificial environment whereas augmented reality uses the existing natural environment and masks new information on top of it. Augmented reality can make the real world interactive and digitally manipulative. Special 3D program is used to develop augmented reality applications. Global Positioning System (GPS) is used to pinpoint the location of the user and also to detect the orientation of the device if augmented reality is to be used in smartphones or tablet computers. Other hardware components that are used in augmented reality are processor, display, sensors and input devices. [15][16]

The basic idea behind augmented reality is to mask audio, graphics and other sensory augmentations over real-world environment in real time. The most famous example of augmented reality is Google Glass, a pair of eyeglasses which is an optical head-mounted display connected to the internet and displayed information in a smartphone-like hands-free format and controlled via natural language voice commands. [16]
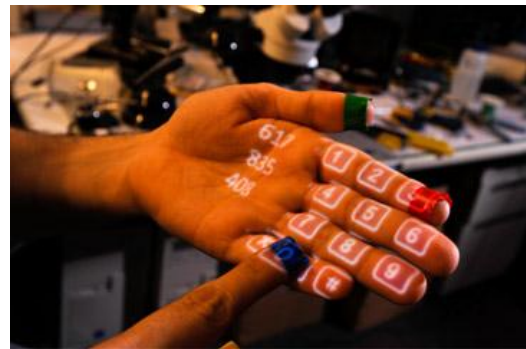

Figure 3: Augmented reality [16]

4.3 Wearable Computing

Wearable computing refers to the computer powered electronic devices that can be worn by a user, with or on top of clothing. [24] Such devices are miniature electronic devices whose application can range from general to special use like smartphone or smartwatch to heart monitoring and pedometer capabilities. Wearable computers are also known as wearables or body-borne computers. [26] Wearables are usually integrated into the user's clothing or can be attached to the body itself through some means like wristband or wristwatch. Wearable technology is portable and wearable devices are always with the users, so the user is able to execute instruction while walking around or doing any other work. [25]

Unlike other computing, in wearable computing, user's body is actively involved as the device's interface which usually includes the hand, skin, voice, eyes and arms. Wearable computing has been implemented in sensory integration, health care monitoring, system service management, behavioral modeling, mobile phones, smartphones, smart watch, fashion design and

so on. Some challenges of wearable computing are how to reduce the size, weight and bulkiness of the device, how and where to locate the display, etc. Wearable computing is still a topic of active research with other areas of study including augmented reality, pattern recognition and user interface design. [25]

Figure 4: Wearable computers

5. FUTURE OF COMPUTING

As we look to the future of computing, we can see the vision and use of ubiquitous computing emerging rapidly. If we are to look back at the evolution of computer, we can see that the computer have become smaller, cheaper, powerful and abundant. So this continuing trend means that the computer will become even smaller, cheaper, powerful and more abundant. [4] The computer will become ubiquitous and they will find their way into everyday objects. This will result in the creation of "smart" objects, which can access the internet, communicate and exchange information with other smart devices. At the present time, the smartphones are the popular computer that will later develop into a control center for a multitude of other personal auxiliary devices. Eventually, ubiquitous computing will take a great economic significance. [5][6]

The effects of rapid progress, growth and development in microelectronics and information technology can be demonstrated using the example of mobile phone. Few years ago, mobile phones were so big, expensive and limited in their functionality that they didn't sell very well. But now, the same mobile phone has become a device that offers beyond its pure functionality of voice transmission. It has now become smartphone, with internet connection, camera, radio, calculator, calendar, etc. in one single device and is one powerful computing device. This rapidly growing technical progress clearly indicates that we are standing at the edge of a new era of computer applications that will influence the lives of people in a great deal. [19][23]

5.1 Invisible and Ubiquitous Computing

Continuous technical progress in ubiquitous computing and communication will lead to the trend of invisible computing technology, where the computer as a dedicated device will disappear, while at the same time make its information processing capabilities available throughout the surroundings. [1] The invisibility of computer can happen in different way. Disappearing can take different forms as described by Streitz (2001) – the physical disappearance that refers to the miniaturization of devices and their integration in everyday objects and the mental disappearance that refers to the situation that the objects can still be large but they are not perceived as computers because the people perceive them as, e.g., interactive tables or interactive walls. The technology moves mentally into the background. [1][19]

5.2 Everyday objects become "smart" and network themselves

Because of the technologies like ubiquitous computing, ambient intelligence, augmented reality and wearables, the everyday objects become "smart" having internet connection that enables them to communicate and exchange information with other smart objects. [17] Many types of smart devices are conceivable. Wearable computing devices will be used to keep people informed, updated, connected and entertained. The smart objects will not only be portable but should become a part of clothing and be worn more or less directly on the bodies. Not only wearables but other objects like for example, the kitchen will become smart, refrigerators, tables, walls, vehicles, etc. will also be smart. [23][17]

5.3 Perspective

The technology trend is clearly pointing towards continued informatization of the world. We are gradually moving towards the ultimate vision of ubiquitous computing where everyday objects communicate and become wearable. If technical progress means more and more everyday objects becoming "smart", it will ultimately lead to a different world. People will not look at the objects as they look now.

6. CONCLUSION

Ubiquitous computing, including areas like ambient intelligence, augmented reality and wearable computing are the bricks that will build the house of

future computing. The future of computing is all about smart and intelligent computing, where everyday objects become "smart" with internet connection so that they can communicate and network with other smart objects around them. [23]

This is possible through pervasive computing or ubiquitous computing that embeds microprocessor in everyday objects. The smart new world will accept input through the human body, unlike previous input devices - keyboard or mouse. The interaction between computer and human become natural through more natural interactions like speech recognition, gesture recognition, free form pen interaction, computational perception, etc. [23] Computing becomes invisible, i.e. it disappears either physically where the devices becomes small and integrates into everyday objects or mentally where the objects can still be large but the user perceive them as normal objects, the computer hides in the background. [19] Hence, ubiquitous computing is the future of computing.

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Using Virtual Reality and Augmented Reality for E-Learning in Context of Nepal

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ABSTRACT

Traditional e-learning methods have been discussed and in some cases even applied in Nepal but there are lots of barriers for implementation of e-learning in developing countries like Nepal. Some of these can be tackled with Virtual Reality (VR) and Augmented Reality (AR) for their affordability and promising application in education. AR and VR let students learn in real life like situations and environment with an immersive experience which is otherwise either impossible or very expensive. This paper states the obstacles of implementing e-learning in Nepal and proposes effectively integrating VR and AR in e-learning in context of Nepal using inexpensive smartphones and Head Mounted Display (HMD) Google Cardboard.

Categories and Subject Descriptors

H.3.5 [**Information Interfaces and Presentation**]: Online Information Services – *web based* services; H.5.1 [**Information Interfaces and Presentation**]: Multimedia Information Systems – *artificial, augmented and virtual realities*; K.3.1 [**Computers and Education**]: Computer Uses in Education – *distance learning*

General Terms

Human Factors, Standardization

Keywords

Virtual Reality, E-Learning, Education, Adaptation, Teaching, Accessibility

1. INTRODUCTION

E-learning is the use of electronic media for a variety of learning purposes that range from add-on functions in conventional classrooms to full substitution for the face-to-face meetings by online encounters [1]. One of the earliest application of computers has been to aid on teaching and learning experience. Since Apple Inc. donated its Apple I computer to schools in 1975A.D. in the United States of America, the use of computers in school classroom has been popular worldwide. Computer and its multimedia resources for text, audio, video and animation representation have been used to engage and aid the students in classroom. In 1840s, Sir Isaac Pitman started teaching system of short hands by sending postcards to students and receiving back the students' transcriptions for correction and feedbacks via postal service of England. This is the example of first distance learning in modern sense [2].

As the technology evolved and Internet and Email became the important means of communication, distance learning started adapting to Internet and Emails which also proved to be more effective as two way communication was very easy and fast and to maintain database of students' records and score management in digital form was very inexpensive.

Giving a user an experience of being in a lifelike scenario is not a new concept. Virtual Reality (VR) is electronic simulations of environments experienced via head mounted eye goggles and wired clothing enabling the end user to interact in realistic three-dimensional situations [3]. One of its unique capabilities is the ability to allow students to visualize abstract concepts, to observe events at atomic or planetary scales, and to visit environments and interact with events that distance, time, or safety factors make unavailable [4].

Augmented reality (AR) is a variation of virtual reality in which the user can not only see the real environment around, but also can interact with different virtual objects there. AR can supplement or modify reality without replacing it making it appear to the user that both the real and virtual objects exist in the same space [5].

In this paper, we will discuss certain limitations of e-learning methods in Nepal, a developing country where physical access of many elements may be inaccessible to a student living in rural parts of the country. In addition, this paper will suggest some applications of VR and AR technologies that can be used to overcome some of those limitations making the learning process more effective and interact able for the student. This can help the student grasp more knowledge in an easier way.

2. METHODLOGY

In this paper we divide e-learning broadly into two categories: online learning and offline learning. Online e-learning, where the students connect to the internet to get the learning material contents and/or instructions where a virtual environment may or may not be setup to manage the contents and student's records and scores. The content is stored on a web server and is well maintained and updated regularly to fit the needs of the course. Moodle is an example of such a system. Offline e-learning is learning where the learning materials contents and instructions are saved locally in stand-alone devices or fetched from intranet. Encarta is an example of such. Online e-learning is not mutually exclusive to offline e-learning, Hybrid e-learning system is possible with both online and

offline learning features available. The figure below depicts the scope of e-learning through online and offline learning.
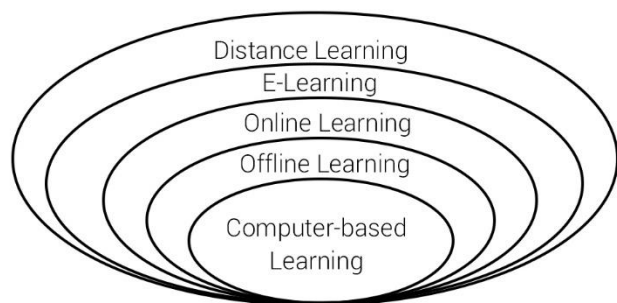

Figure 1. Scope of e-learning.

Virtual Reality experience can be achieved through a HMD, available in three options:
1. Computer VR Headset - HMD is mounted to VR capable Personal Computer (PC) which renders the VR environment in the HMD. Oculus Rift and HTC Vive are some examples of such devices.
2. Mobile VR Headset - Smart phones are fitted inside the binocular HMD. The display of the mobile phone is made stereoscopic. Google Cardboard and Samsung Gear VR are examples of such headsets.
3. Stand Alone VR headset - The VR headset has all the necessary tracking sensor and 3D display rendering capabilities and can provide the user a VR experience without being mounted or having to add any other devices. Razer's OSVR and Microsoft Hololens are examples of such headsets.

Among the three options, Mobile VR headset is the least expensive and most accessible option and we will be discussing use of Google's Cardboard for e-learning using VR. Minimum API level required to support Google VR is Android 4.1 (Android Jellybean) or higher on android and iOS version 8.0 or higher on Iphone with hardware requirement of a gyroscope sensor [6]. Google search on August 5, 2016 for price of android phones with these features shows phone as cheap as NRs. 15000 (Karbonn Quattro L52) [7]. Inputs can be given in this headset through a single magnetic button and gazing at interact able objects. Google has made the Cardboard HMD design, specifications and assembly instructions freely available on their website allowing users to assemble Cardboards themselves. Materials needed to building one based on the market price at Kathmandu of as 9th August 2016 are shown in the table below.

Table 1. Market price of materials for making cardboard

S. No.	Material Name	Specification	Price (in NRs.)
1	Corrugated cardboard sheet	E Flute size: 8.75in x 22in and 0.06in thickness	100
2	Biconvex Lens - 2	45mm focal distance	600
3	1 neodymium ring magnet and 1 ceramic disc magnet	0.75in diameter and 0.12in thickness	400
4	2 straps regular Velcro	0.75in x 1.25in	100
5	1 rubber band	3.2in	5
		Total	1205

All smartphones with requirements meeting that of Google VR are capable of giving a smooth AR experience. Objects can be rendered in the phone screen on top of the live feed from the phone's camera.

David Antonio Gomez Jauregui has proposed an online e-learning approach through VR in [8], which explains creating an online e-learning application in immersive virtual reality with a virtual classroom environment that students can join in with their specific avatars and have a classroom like experience while not having to physically attend a lecture class or field visit. This is one of the online e-learning models possible in VR.

In offline e-learning, we propose a tailored application that is designed based of the curriculum of the students. The Virtual Reality application can give students a virtual experience of the content in the course book like a virtual chemistry lab or zoo explained in the text book. Images can be pre-stored locally to scan and match images in text book and produce relevant object or play a video on top of the picture using AR technologies. The device can be distributed through District Education Office (DEO). If the school doesn't have internet connectivity to update apps, mobile device could be brought to the district headquarter at DEO and updated when necessary. Also, the teachers can be given Training of Tutor (ToT) to use the application at the DEO.

3. APPLICATIONS IN E-LEARNING

With the development of VR and AR technologies, its applications in the field of education are been growing. Following are some of the applications found:

- Traditionally, a student learns about a new place by reading some information in the course book and seeing some pictures in the course book. If a virtual application is used and the student is given a virtual tour of the place while being taught about it, the amount of anxiousness and knowledge attained is considerably a lot better. For example, student can be given a Solar System VR application and taught about different planets when he/she looks at them.
- Observing wildlife in their natural habitat is not safe for students but would be great learning experience. Using an AR application to scan a page of a book and show the animal rendered in 3D on the mobile screen adding interactions to it could be a better way to show the student how the animal behaves in different situations.
- Differently abled students for whom, it is physically not possible to reach new destinations can be given experiences of being in those place with a VR application. The student could sit at the comfort of his/her home and virtually reach any place in the world. Nowadays, there are VR applications available in the Google Play store with when installed and used with a Google cardboard can give an experience of actually being at the destination.

4. PROBLEMS IN E-LEARNING IN NEPAL AND SOME APPROACHES THROUGH VR AND AR

The potentials of virtual reality technology can facilitate learning process avoiding many problems characterizing traditional educational methods [9]. General Problems of e-learning in Developing Countries [10] are listed below with some approaches to overcome them with the use of VR and AR technologies:

4.1.Support and guidance for Students

Support and guidance refers to the support systems needed for the students to make it through the course [10]. General Nepali population mass are still technologically illiterate and very technophobic. A standard desktop computer has 104 keys keyboards and 3 buttons combination of mouse for input. The desktop computer's software and operating system use metaphors for representation that is not common among Nepali culture. Desktop computers as first experience to technology can be overwhelming and confusing which is a big hurdle in implementation of e-learning as it scares staffs discouraging them from further interaction. As a result, there are no proper support staff or tutor available for the students.

The proposed Google Headset has just one touch and gaze for input. It is less confusing to navigate the interface with these option. The VR experience replicates the real world environment instead of using metaphors. AR would mean pointing the phone's camera in the relevant pictures. VR and AR requires less energy and time for tutors to be trained. VR and AR can be more pleasing experience as introductory experience to technology.

Figure 2. First class in VR at MG Opava [11]

4.2. Flexibility

Flexibility references to the availability of e-learning to anyone, anytime and anywhere. This aspect is one of the most challenging one for implementation of e-learning in Nepal. According to World Bank Gross National Capita (GNI) per capita of Nepal is US$ 730 which is not a sign of a good economy. Owning a Personal Computer is a distant luxury that an average family can't afford or don't consider necessary. Students get to access e-learning tools only while at school. It can be very difficult for a new learner to grasp all the things learned in a small time. Every student has his/her own pace at studying and creating a strict deadline for completion of a course makes it hard for the student to learn freely. Also, there has been a problem of proper internet connection in the rural parts of the country.

While PCs are still not a common household entity in Nepal especially in rural areas, mobile phone is highly popular. Mobile phones are not seen as a luxury but basic necessity. Report of Nepal Telecommunications Authority (NTA) on Management Information System (MIS) 2016 shows that mobile penetration has reached 102.18 percent [12]. Hence having a mobile based e-

learning experience makes much more sense and can help address the flexibility in e-learning.

4.3. Motivation

The process of learning can be a complex task for the students since it requires a lot of effort from them, which is why they need the motivation to learn [13]. The success or failure of understanding online instructions is perhaps related to student motivation. Creating motivating and effective e-Learning environment requires intentionality and an attention to the learner [14].

Gamification and rewards system can be motivation element to the students. Gamification is a new movement to create effect in non-game fields by applying game mechanics and game thinking that makes game fun not unlike points, level-up, ranking, achievements, competition, and reward [15]. But in Nepal, gamification in e-learning is a struggle where students have limited access time to spend with computers. Mobile based educational course can be solution to this. Educational software for smartphones benefits the education process and makes it more interesting for students. Especially if it follows the computer game technology to render 3D graphics for the software and make it more amusing for the students while still delivering the necessary knowledge [15]. The development of VR apps is like game development. Google provides Google VR Software Development Kit (SDK) for Unity Game Engine. VR apps can be developed with the same game developing technologies and principles. Providing the motivation for the learning experience can be a leap towards a student to learn more.

4.4. Teaching and Learning Activities

E-learning and distance education involves a shift from a more instructor centered approach to a learner oriented approach where students take ownership of their learning [16]. A traditional classroom with only blackboard providing very less interaction that students has to be overcome. VR encourages students to explore the environment. Interaction in VR is immersive which isolates the student from the teacher's visual instruction and is limited to the audio instruction only. So this provides a barrier for teachers and instructors who are used to culture of spoon feeding the students in the class. AR can be effectively used as a teaching aid. AR lets the text described or illustrated in books sprung into life even with animations. This can help better understand and visualize the objects, situations or places mentioned in the book. Having life like replica or representation in their same reality can address the curiosity of students and examine them more.

4.5. Access

In distance learning process, accessibility of a proper connection is very significant. The issue is both hardware and software related. Reaching rural villages of Nepal could take few days on foot. Transporting the hardware to these remote village can be a logistic nightmare which doesn't encourage the schools to adopt e-learning system. Having to transport the hardware back to the cities or closest repair location could again mean traveling the same road less route. Proposed mobile based e-learning needs no more hardware than mobile phones, chargers and lightweight HMD. There is also issue of software related accessibility.

According to [12], Internet penetration in Nepal is 50.11%. Hence almost half of the population still can't access the internet. The rural places that are connected to internet are mostly from mobile data where the connectivity is both slow and expensive. The proposed

e-learning system hence makes emphasis on offline e-learning and making the offline applications for such cases whose database can be stored on phone and updated when internet connection is available.

4.6. Academic confidence

Academic confidence refers to the students' previous academic experience and qualifications - not only in relation to their Grade Point Average (GPA) but also in relation to which subjects they have studied) [10]. Moreover the student's parents´ educational level and the student's cognitive skills are often key ingredients to this confidence [10].
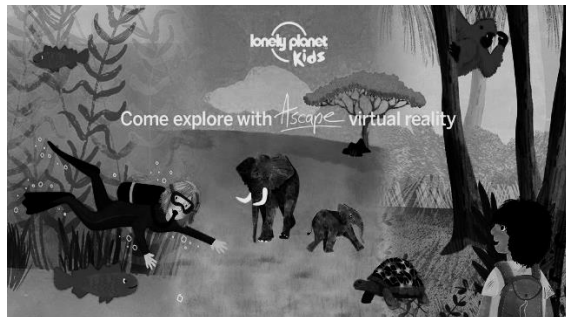
Figure 3. Lonely Planet VR experience in works [17]

According to United Nations Educational, Scientific and Cultural Organization Institution of Statistics, Adult literacy rate of Nepal for 2015 was projected to be an indicator of 66.1% and targeted to be 74.3% [18]. The student's academic confidence is a good predictor of a student's success or failure in e-learning courses [10]. The literacy rate of Nepal is a poor indicator for its success in e-learning. Experiential Learning provided by AR and VR based e-learning tries to blend the learning experience as close to the real world surrounding. So learning means interaction with the real world situation. This learning wouldn't scare low confidence students. In fact, it can be very welcoming experience and address to curious attribute that students tend to happen. Institute for Creative Technologies of the University of Southern California has created The BRAVEMIND VR Exposure Therapy Software to help delivery of Prolonged Exposure Therapy for the treatment of combat-related Post Trauma Stress Disorder which could indicate properly designed VR apps can help in-fact boost confidence of students too.

4.7. Localization of content

Formal English education is started only from 4th Grade by the curriculum of Nepal Government, Ministry of Education. Proper implementation of e-learning is applicable but only the contents are localized to the local language, which could not mean Nepali language. There are lots of places where the general population have low understanding of Nepali language and fluent only in their mother tongue which is regional languages or caste based languages. Not even all the metaphors used in User Interface can be assumed to be understood by all students. A student from rural part of Nepal cannot be assumed to relate the icon of Floppy Disc to save or even the trash can they see daily be relatable to the trash can icon popularly used in delete option in computer application.

Localization of VR and AR applications is expensive in comparison to localization of computer application, which would mean replaceable collection of strings. To truly localize VR and AR application contents to fit for educational purpose of the students of Nepal who are new to technology in general, it would require to

sometime even localize the 2D/3D models, storytelling of the contents or even the user interface and experience. Building one from scratch makes more sense economically.

This however gives opportunity to homebrew e-learning contents, software system. The very core of this form of e-learning can be integrated with the educational system of Nepal. Once the students are fluent in this technology it is easier to introduce them to general VR and AR contents and applications. Localizing these general contents could be easier which could sometimes mean just replacing strings or sometime audio file only. It is also possible to create applications to plug-and-play the different entity including 3D models, like in entity component system architectural pattern used in game development. This would mean even the models only can be changed to make it better representing to Nepali students in very low cost and same models could be used across different applications.

4.8. Attitude on e-learning

Low literacy rate could be a factor to indicate that the computer literacy rate is not good. The society in general is yet to adopt the modern technologies. In Nepal, Governmental works are mostly manual paper works and many offices don't even have a computer. In rural and even urban Nepal computer education is more achievable to privileged education. However, the society is very adapting to new technology and don't reject in total.

Introducing e-learning to Nepali students could be successful but it is important to focus on implementation. The use of technology at classrooms could be, for many, a first impression and experience of technology in whole. If students have bad experience at first impression of technology, they could resist technology till later in their lives. The immersive VR technology can help them grow their imaginations regarding possibilities with technology. Help them learn by providing virtual experience which in real world would be either not feasible, expensive or impossible. For example, students could be given experience of being on beach; look and have immersive experience of an ocean; then explore around and study the environment. Then if a student is interested at a rock there and sees it, geological information regarding the rock sedimentation can be provided. Considering there is no sea in Nepal, having such experience to a student of Nepal is expensive and not always feasible.

In addition to these general problems, there another problem, more specific to Nepal that should be considered a barrier for implementation of e-learning:

4.9 Electricity Problem

According to [19], only 76.30% of population had access electricity by 2012. Nepal is in crisis of energy for electricity. Nepal has frequent scheduled power cuts so electricity is not always available. This is a huge problem if a school bases its classroom with lots of electric hardware. Proposed mobile based e-learning will be energy efficient. The batteries in modern cell phones can last long enough during the power cuts and also it is cheaper to have backup mobile phone chargers than main power backup or buying laptops.

5. CONCLUSION

Main purpose of this paper was to understand the limitations of e-learning in Nepal and how AR and VR technologies can help address them. For this we proposed a mobile phone based Google Cardboard HMD technology with capability of either online or

offline access to the contents. We discussed how such system can address the seven major challenges in developing countries published in [10]. VR and AR applications can be very effective and efficient in Nepal to tackle these challenges. There are however 3 factors that should be considered:

a. VR and AR technology are not yet cheap and even ready enough to completely replace other e-learning applications but other technologies are not yet advanced enough to give the immersive experiential learning experience that AR and VR can provide.

b. For proper implementation of VR and AR technologies for e-learning in classrooms of Nepal, the contents have to be tailor-made to suit the students there.

c. AR and VR cannot replace or meet the technological experience and knowledge; students need to learn but they can be very effective to introduce students into the modern technology. Student will still need to learn and use personal computers. If possible computers based e-learning should also be implemented in classroom along with this system.

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Verdant Recreation: ICT for Smart Solid Waste Management

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ABSTRACT

Solid Waste Management (SWM) is one of the major concerns in established and emerging towns of Nepal. Urbanization is increasing at an alarming rate putting immense pressure on the management of solid waste. Smart SWM is thus a critical component within urban sanitation. Implementation of technology is vital for maintaining a balance between rapid urbanization and environment sustainability. Information Communication Technologies (ICTs) have a profound impact as they provide techniques and methodologies for the conservation and sustainability of environment. The paper presents the design and development of barcode enabled, electronic ticketing system for garbage collection at recreation sites. The idea is to design a smart waste management module with barcode scan system for efficient waste monitoring at the site. Barcode technology with sticker generation and scan can be regarded as a solution for proper waste disposal. The systems approach to smart waste handling focuses recreation sites, reducing waste where possible, re-using, recycling and recovering for the safety of visitors and the environment.

Keywords: SWM, Smart, Solid waste, ICT, Barcode Technology

1. INTRODUCTION

Information Communication Technology (ICT) is the technologies that handle communication and the processing and transmission of information. Smart is a process where it takes some input from somewhere, process it with some brain power and takes some actions. [1] Solid waste problems comprises weak waste collection systems and inappropriate disposal, which results to environmental pollution and degradation.

Implementation of ICT in Smart waste management can help apply effective environmental strategies for the fractious solid waste problems. The methods of controlling the generation, collection, transfer and movement handling and efficient disposal of solid waste in a mutual understanding of public health, economic, engineering, conservation and that is

susceptible to public attitude can be implemented through ICT. [2]

Smart waste management solution would be inexpensive, straightforward, and involve local people. [3] The technology has to be cost-effective and fit consistently.

2. INTERNATIONAL SCENARIO OF SWM

One of the major challenges in developing countries is solid waste management. Rapid economic and population growth in developing countries is followed by escalating quantity of solid waste which becomes very challenging for municipalities to manage. [4] The method of waste management varies among the countries and there may be different waste disposal practices.
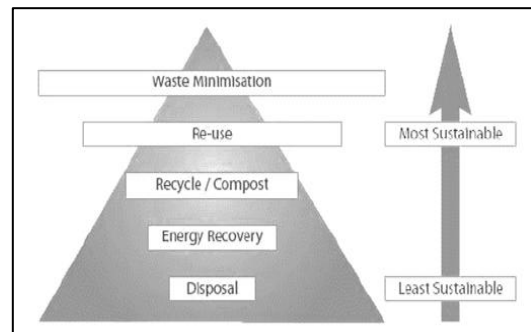

Fig 1: The Waste Hierarchy of EU (Source: IEEP, 2009).

Fig 1 shows the waste hierarchy used by the countries belonging to European Union. The model gives significance to the handling of waste by minimizing them, the well-being of human health and the environment. This structure is not properly followed by developing countries like Nepal itself and other countries. The main causes of solid waste problems in developing countries are relevant to the wanton generation of solid waste without study of the demolition.

The door to door collection is followed by many developing countries consisting of methods such as rickshaw in Kathmandu and Beijing, animal traction in Nicaragua and Lahore, wheelbarrow in Hambatota and Lusaka, tractor in Langeberg and Balangoda,

truck in Kuthaya and Nakuru, compactor in Banda Aceh, San Jose etc. [4]

3. SWM IN NEPAL

With constantly growing population and industrialization, solid waste is increasing at an alarming rate. Rapid unplanned urbanization has been contributing to choking pollution. Unplanned use of available resources, technologies and methods has posed a huge challenge in the habitual management of municipal solid waste. The total amount of waste generated in Nepal is estimated to be 500,000 tons per year. [5] The composition of solid waste in Kathmandu Metropolitan City (KMC) is represented in Fig 2. Organic waste covers the largest portion of solid waste (63.22%). Major portion of inorganic waste comprise paper and plastic.
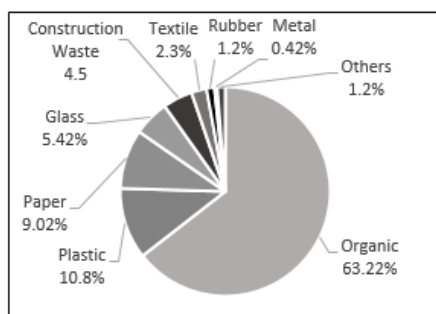
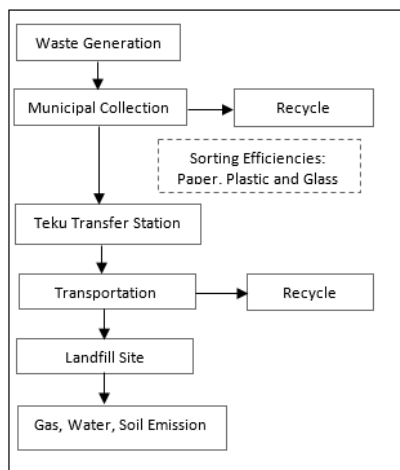Fig 2. Composition of solid waste in KMC (Source: KMC 2012)

Fig 3. Municipal solid waste flow of KMC (Source: KMC 2012)

The work of municipalities' is often limited to sweeping streets, picking garbage and dumping the collected waste in the nearest river or vacant land. Open waste piles and garbage items lying around in the streets are a common site. As the problem became serious, KMC, NGOs, INGOs and private organizations concentrated their efforts towards managing solid waste. The collection and disposal of solid waste was systematically started in KMC in 1986 along with the development of Gokarna

Landfill. The integrated solid waste system is illustrated in Fig 3. KMC follows this solid waste system to this day.

Besides KMC, Solid Waste Management (SWM) has also started in other municipalities. It is estimated that 58 municipalities are spending approximately 13% of their total budget on SWM, but in most cases, the amount is not spent efficiently due to many challenges faced by the municipalities. [6] In spite of the challenges faces, municipalities have joined hands with private sector and local communities to integrate innovative approaches for making SWM efficient as well as cost effective.

Practical Action Nepal has initiated "Strengthening Local Capacities in Integrated Sustainable Waste Management (ISWM)", a SWM project in small and medium municipalities of Nepal. The project has been financially supported by European Union under its EC Asia Pro Eco II Programme. The project has adopted international best practices for sustainable SWM and is targeted at four municipalities– Nepalgunj, Birendranagar, Vyas and Bharatpur. [7] The approaches, technologies and methods implemented are well suited to the selective municipalities.

4. SWM IN RECREATIONAL SITES IN NEPAL

Recreational sites are gaining popularity, especially in the urban cities. Fun parks, amusement parks and water parks are attracting a lot of city dwellers as well as tourists. There are about 10 recreational parks in the Kathmandu alone.

With the increase in the number of visitors, the problem of pollution and waste management is also increasing in the recreational sites. Inappropriate planning, weak institutions, lack of resources and poor implementation of policies has added to pollution in the sites. According to the environment statistics of 2014, the dissatisfaction towards the current waste management system is 81.67 out of 100. [8]

The irresponsible behavior of visitors is a major factor for pollution in the recreational areas. The land area of the parks is littered with garbage items such as plastic and glass bottles, food packets and wrappers. The problem of pollution, litter abatement and waste management has caused the sites to lose their beauty and aesthetic appeal. A few government agencies and NGOs are slowly focusing on these sites. WATO-Nepal has been actively participating in the construction of a community park in Kathmandu with the assistance of departments of Nepal Government and local and foreign donor agencies. [9]
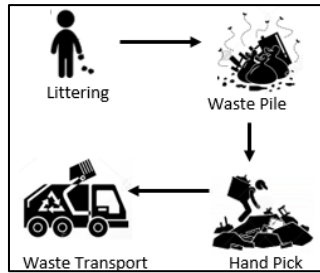
Fig 4. Traditional Solid Waste Management

The traditional SWM is illustrated in Fig 4. Although waste bins are installed in the sites, people litter the area with garbage items which has resulted waste piles in the site. Traditional SWM involves manual picking of waste and transportation for disposal.

5. USE OF ICT IN SWM

ICTs have an exceptive purpose for the sustainability of environment by contributing strong means that can help in conserving the environment. Increasing pollution and booming industrialization has a negative impact on the recreational areas in Kathmandu. The pollution left behind by the visitors and improper disposal of solid waste threatens the fragile ecosystem of the sites. [10] Lack of awareness to the visitors, local communities and management regarding the proper solid waste management is one of the most significant factors adding to the degradation of environment.

As a solution for the management of the area and the proper garbage disposal, a system is developed for the site. To improve the management of solid waste, improvement in collection and disposal a garbage management module will be developed which implements the use of Barcode technology.

Using ICTs for the solid waste management is basically focusing on building a sustainable environment. [11] The use of ICTs can help gain symbolic improvements in solid waste management especially in developing countries.

6. USE OF BARCODE TECHNOLOGY IN SWM

Barcode technology has become outspread since it offers diverse advantages in a broad supply of works. The generation of barcodes, its availability of cheap equipment has made barcodes. These days almost all the smart phones now have applications that can scan and read barcodes. [12]

Barcode technology will be used in the solid waste management module of the web-based application. The use of barcode scanner provides and efficient solution for the solid waste disposal system which is similar to the use in inventory control. [13] This is a

new concept which can be further used for solutions in pollution control and environment conservation.

7. POSSIBLE MODELS FOR SWM IN NEPAL

Industrial growth and rapid urbanization aggravate environment pollution with the pressure felt most acutely in Kathmandu. There are various possible sustainable solutions of waste management in Nepal. A basic solution can be decreasing the amount of waste generation and throwing out less waste. The waste generated at house itself can be separated into bio degradable and non-biodegradable waste. The biodegradable waste can be handled at home itself by composting the waste. The non-biodegradable waste is then collected by the municipalities which are involved in door to door waste collection. Due to improper waste collection, it is then disposed and buried along the riverbanks. [14]
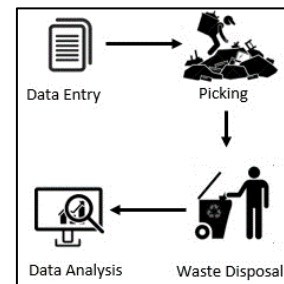
7.1 Proposed SWM Model-1

Fig 5. Solid Waste Management Model-1

With people visiting the recreational areas, massive amounts of garbage, such as bottles, cans or wrappers, get into the parks. A possible model can be hand picking the garbage, collecting them, transporting, disposing the waste and analyzing through data reports, as shown in Fig 5.However, this model can be expensive and labor intensive.
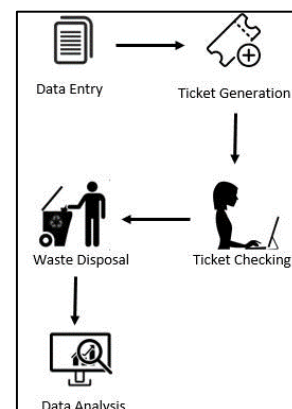
7.2 Proposed SWM Model-2

Fig 6. Solid Waste Management Model-2

Fig 6 can be taken as another possible alternative as a sustainable solution for waste management in Nepal. The garbage in the recreational areas can be managed by issuing the number of solid waste entered in the park. The model below requires manually entering the data and comparing it with the database and which is not efficient.
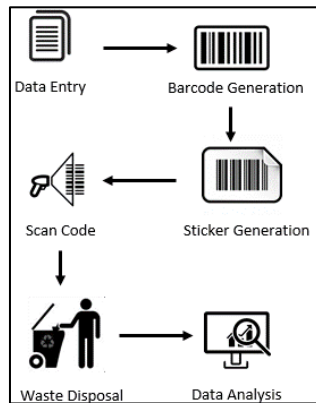
7.3 Proposed SWM Model-3

Fig 7. Solid Waste Management Model-3

A better approach is to integrate the system with barcode scan system. The system uses barcode information from which stickers will be generated and pasted onto the possible waste materials. These stickers will be scanned later during the collection. Fig 7 represents the recommended SWM model for better accuracy and efficiency.

8. METHOD

The waste management module is based on optical recognition with the use of barcode scanner.

8.1. Data Collection

The system requires data about the potential solid waste to be collected at the site. The waste items are categorized according to the type of material, such as glass bottles, plastic bottles, packets, etc. It provides a data entry module where the details of the waste items can be stored and analyzed. The interface has been designed keeping in mind various types of waste materials that may be collected at the sites.

8.2. Sticker Generation

This module allows the generation of stickers according to the type of waste items. Since waste items are to be scanned with a barcode scanner, barcode stickers are generated. The barcode format used is Code39. This module provides an interface where the user is allowed to select the type and number of stickers to be generated per day.

8.3. Optical Recognition

Barcode information encoded in the stickers is read by an optical scanner from the waste items in the first phase. After the information is sent from the scanner to the computer it's then cross referenced to a database - which is also stored on the computer - to which the scanner is connected to. When a match is made, it ensures that the waste has been properly disposed. This is the monitoring module of the system.

8.4. Waste Disposal

The waste items that are extracted after the recognition would be further categorized into biodegradable and non-biodegradable. Further actions would be taken according to type of waste items. Methods such as recycling, combustion, incineration, landfills, composting and anaerobic decomposition can be carried out to dispose the collected waste materials.

8.5. Data Analysis

Report generation is an important phase of the system. Waste collection report aids in analyzing the effectiveness of the system.
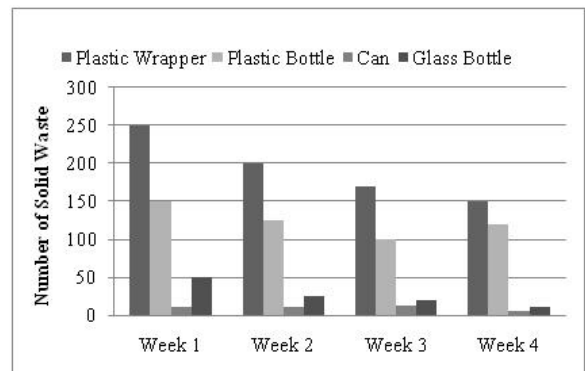

Fig 8. Solid Waste Collection and Disposal

Fig 8 is the graphical representation of solid waste collection on the basis of categories. The graph shows the decrease in waste generated and collected in the area.
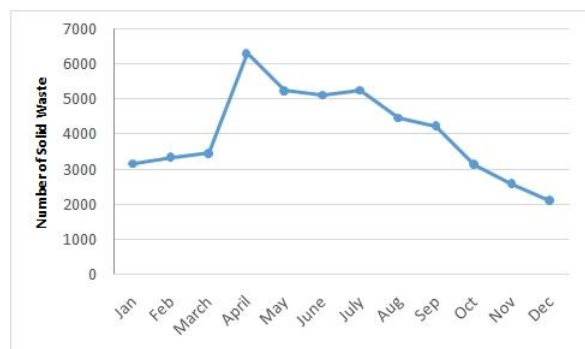

Fig 9. Solid Waste Generation and Disposal

Fig 9 represents the number of waste collected throughout the year. The fall in graph shows the minimization of solid waste which is directly proportional to the labor and cost required to manage the solid waste.

Visual representation using graphs and charts help in decision making process and evaluating trends in waste generation. Furthermore, it assists in identifying overall progress and develops strategic plans for future.

The key stakeholders include waste producers (visitors of the recreation site), recreation sites and parks, NGOs, government agencies, waste pickers and private sector companies involved in waste collection. A preliminary stakeholder assessment has been carried out during project preparation, and an overall strategy for stakeholder engagement has been outlined based on requirements at the operations stage of the project. Early engagement with stakeholders is a key design element.

9. CONCLUSION

Waste management in the recreation sites is still in primitive state. Traditional methods are followed for collection and disposal of waste items. ICTs provide a powerful tool that can bring advantages in conserving the environment. Increasingly, ICTs play a critical role for the sustainability of environment. ICT methodologies are yet to be applied for effective waste management and monitoring. The strategic goal of the application is to integrate ICT with barcode technology that will enable more accessibility and visibility of information in garbage monitoring. This is a concept which can be further used for solutions in pollution control and environment conservation.

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Video Conferencing in Education Using Tele-Presence Robots

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Abstract— **Most robotic systems are usually used and tested in labs setup for specific limited period of time. Tele-presence robots are Tele-operated robotic system platforms that are capable of providing two way audio and video communication. Tele-presence is a broad terminology defining techniques, methods and way to make someone present at a location virtually to achieve a specific goal. Tele-presence robotics is the emerging area of robotics concerned with communication of robot and control of robot from a distance, extensively using wireless communication connection focused on Tele-presence and Tele-operation. Due to recent advancement in cloud computing, mobile computing, high-speed communication and mobile robotics systems results in expanding the available technology for intelligent system. In this paper, I describe the technology and briefly summarize the research that may help in academia using Tele-presence Robots. This paper studies the benefits of using lecturer operated and student operated robot system for the purpose of remote academia. This paper evaluates a robotics Tele-presence platform to be used with teacher and student.**

Keywords: Tele-presence, Tele-operation, video streaming, academic robotics system, Human Robot interaction

1. Introduction:

"Tele-presence is defined as the experience of presence in an environment by means of a communication medium"[1] Tele presence robots are further development of videoconferencing system.With the evolution of Tele-presence robots there exists an emerging relationship: human to machine to human. Technologies for the Education has been evolving in a high speed from online courses to virtual media based teaching system. With the massive increasing popularity of video conferencing. Many academia have been considered for remote education.

Although there are many popular mode of tele-conferencing tools likes the Google hangout, Skype etc. But all those mode of tele- presence have certain of limitation due to various aspects. There may be condition where one to one virtual interaction may not be acceptable. Although one to one video conferencing is appropriate for focused teaching like teaching of foreign language teaching. But this may not be ideal for the situation where many-one or one-many teaching atmosphere is considered. Although if the video is added to audio communication, remote participants often cannot see or hear everyone at the remote location. To overcome those type of situations tele-operated tele-presence robotic system could be used. There have been some studies[1, 2, 3] that explain use of video conferencing provides the limitation in communication.

The use of tele-presence robotic system may be an appropriate solution. In contrast to use of standard video conference which involve only audio and video communication from remote place, tele-presence robots can enable the operators to some degree of physical interaction with remote environments that include the listeners. These types of system may be important factor in the developing countries where the international teaching faculty may interact with the students in the remote places

2. Overview of Tele-presence Robots:

There are many mobile robot tele-presence systems ranging in different prices. With the low cost of less than $500 for hobbyist to more than $10,000 for advanced research purposes. The complexity of these systems may differ considerably but the common feature is basic tele-operation commands by which the remote user can move the robot with keyboard or joysticks. Most of the live video based remote operated systems use a ceiling mounted camera to obtain an overhead view of workspace. The advent of robotic tele-presence also reflects a powerful trend where many of us are becoming even more connected and available. To provide real tele-presence experi-ence, different sensory and technologies must be used to replicate the human sensory element of vision,

sound and manipulation. A simplest system usually includes visual feedback Ideally the entire field of view of user is filled with a view of remote location. The ability to manipulate a remote object or environment is a very important aspect for tele-presence user.

A tele-presence robot can be controlled remotely and allows the user to interact naturally with a remote environment.

Preliminary stage tele-presence robots, designed to explore the social aspects of remote presence, were developed in the 1990s. In the paper [2], simple moving base is fabricated which is controlled by arduino microcontroller and which are carrying a laptop. Also C# code written by H. Wiguna[3] is used to make use of Skype's Skype4COM windows desktop API and modified it to send command to a pan/tilt camera and also move robot base. As an example of an existing root under the tele-presence is a patent work by Wang et al. which was assigned to InTouch Technologies Inc.[12] It discloses a robotic system that includes a primary remote control station and one or more secondary control stations that are all linked to a tele-presence robot. The system allows the secondary station to observe the video/audio feed provided by the robot. This allows the users of the secondary station to be trained through the robot and primary station.

To give the overview of working Tele-presence robots we can break the system into two parts, the first one is t the robot side and which contains various hardware for movement control along with camera and a receivers for video streaming and instruction reception from the control station respectively. The latter one is the remote station end which is software in the form of application which may be web based operating system based for issuing movement instruction and for displaying the steaming video. The communication between the parts are mostly wireless. This system can be considered as a client and server. So the number of basic desired activity for a tele- presence robot for education use may be:

- Navigation: It should have easy UI, also have smooth movement and able to control the speed and indication obstacles.

- The ability to zoom and wide angle should be the priority for the camera to be used.
- Audio receiving capability for wide range input should be considered as well as the output audio should be loud that could be heard by the audience.
- Video display should show the remote user's face close to actual size.
- The Tele-presence robot should be height of human like sitting or standing
- It should be Robust and durable

These desiderata are applicable in general academic users. Tele- Presence robots are extensive gaining increased attention as new media for remote communication. Their application domain has been expanding and companies has already commercialized tele-presence robots products for use in areas such as health care, remote collaboration, conference and education[4, 5, 6, 7, 8, 9]
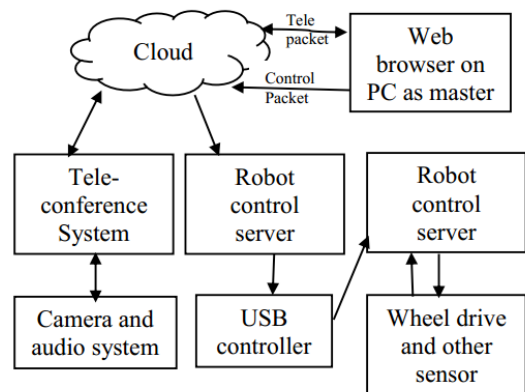

Figure 1: Tele-presence system basic architecture

Since this paper is intended to be read mainly by non roboticists, with little or no former knowledge in this field. And specifically, the paper is meant as a medium to explain about use of tele-presence robots in Education who might not be experts in robotics but are still interested to learn. Mostly the Tele-presence robotics can be classified for Education on two division and explained in below sections.

2. Classification and Overview of Tele-presence Robotics Application in Education/Academia:

Education can be viewed from the perspective of teacher and students. Traditional Education system is based on classroom where teacher and student interact with each other. But with this system there may arise different questions. So the Tele-presence robots can be classified in terms for perspective of

the users in education. Several institutes have investigated the use of these robots in educational settings. A pilot program at the UCF experimented with tele-presence robots, exploring their use in several learning and campus life scenarios, including substituting for sick faculty, student, visiting with a remote environment. Researcher also tested a robot at the student groups. National museum of Australia is experimenting with tele-presence robots for students and other patrons who want to visit the exhibits but are restricted by distance expense, time constraints or physical disability. The robots allow students and instructors who join from afar to move from a passive role to more active participation. Because they control what they see and where they are, they can move among study groups, examine items and point out things missed by others.

3.1. Tele-Presence Robot Implications for Learning :

Regarding use of tele-presence robots for educational purposes, one study discussed the development of a tele- presence robot, which was remotely controlled by the adult teacher who gave lessons from a remote location using the robot.[10] The goal ws to compensate for the shortage of native English teachers in South Korea. The research group developed a user interface for the teacher to remotely control the robot semi autonomously. That study aimed at identifying how a tele-presence robot can be integrated to the education system. In the article[11] student used a mobile telepresence robot to collaborate with students 500 miles away. With the help of tele- presence robot gives students the opportunity to explore the effectiveness and limitation of remote two way communication. Using a tele-presence robot in a higher education environment can hold many advantages as well as challenges. Tele-presence allows absent students to interact in the remote environment. That means, sick or unavailable students have a chance to participate in university class without being physically present.

3.2. Tele-presence Robot for Implications for Teaching:

Tele-presence robots represent another form of robots to be found in classrooms. They have been used to enable tele-presence communication between student and remote teacher and also between students in different classroom [11]. It is apparent that the current abilities of robot teachers

to operate autonomously are still quite limited and often aided by covert or even overt human intervention or remote. Tele-presence robot allows guest speakers to join a classroom, move about to inspect student work, examine artifacts, or asses lab efforts.

The user's a-priori needs included delivering lectures remotely at conferences, socializing at conferencing, remote teaching and advising at the home university and participating remotely in student defences, faculty meetings etc.

Figure 2: Teacher Teaching using tele-presence robot to students [13]

3. Future System:

As they evolve, tele-presence robots will acquire greater autonomy and better remote manipulation. Hardware improvement that enable manoeuvring in stair climbing etc. To advance the sensory modality of the user, it is possible to improve and apply a wearable tactile feedback system to relay the force information from the robot to the wearable tactile display. It is possible to investigate how the addition of tactile sensory affect the usability of system and the efficacy of relaying safety information to the user. To overcome the limit of visual feedback, the new method of 3d haptic display can be developed and applied. It is possible to apply the motion planning method combined with shared control technology to guarantee the safety and increase the usability. A future campus tour for a students may feature a selected faculty member strolling along.

4. Conclusion:

In this paper I have summarized my effort in explaining the use of tele-presence robot in Education. This paper result that student operated and teacher operated tele- presence robots, are useful for the purpose of remote education. There is potential to

overcome issues encountered during conventional video conferencing. I have thrown light on how human machine collaborative real time systems executes. The concept of tele-presence robot is also being used to give students a virtual experience of exploring outer space. Till now we are in the early stage of this technologies. Future interfaces may merge virtual reality interface.

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Vision based Non-contact Health Monitoring Estimation

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Abstract – **Heart beat rate and blood pressure are among most important indication of people's physiological state. Digital medical devices has been one of the extensive research topic due to the ability to show case the detail information about individual physiological data. Every individual must be able to control over their physiological data so they can manage their role in their health conditioning. However, current techniques for health monitoring is time consuming and requires some lever of experience. In recent years, many papers on health monitoring from contact based. This discourages regular use because the sensors can be uncomfortable. In this paper, I focus on the technique to manipulate small movements in video based on Eulerian Video Motion Magnification and generation beats per second to find heart beat rate. This paper is based on the Eulerian Video magnification algorithm presented at SIGGRAPH 2012. The objective of this paper is to design and implement that using this method, it is possible to visualize the follow of blood as it fills the face and to assess the heart rate in a non-contact way using a camera. Since it is a cheap method of assessing vital signs in non-contact way, this research work has potential for advancing field such as telemedicine and personal health care.**

Keywords – Computer vision, Image Processing, Eulerian Video Motion, video magnification, Photo-plethysmographic signal

1. Introduction

Heart beat rate (HBR) is a most important indication of people's physiological state. Heart beats is generated in the form of spontaneous electrical activity of primary pace maker cells of Sino-atrial node. The heart rate can be observed by several methods. It can be easily measured by placing the individual finger tips against a large artery and count of blood coming from the heart. It may also be detected more autonomously by measuring electrical impulse generated by the heart through a well-established method called Electrocardiography (ECG). The third method used is photoplethymography (PPG) where the use of optics helps determine the change of the arteries due to heartbeats.

Methods stated above requires some form of physical contact. Most common HBR measurement methods rely on special electronics or optical sensors, and most of instrument requires contact with skin which makes them inconvenient and uncomfortable. There may be situation where physical contact may be inappropriate or undesirable. For example, in medical practice, burn victims have skin which is too sensitive to attach probes necessary for measuring vitals situations. Another inconvenient scenario is when trying to track heart rate of newly born babies where attaching the probes is uncomfortable. Mostly all commercial collection of physiological information requires user to strap on bulky sensor or sticky electrode probes.

Heart Rate measurement research is a conventional topic in the field of biomedical study. There have been extensive research that implement non-contact monitoring system, among them video processing domain. Video processing domain is known to be used for recognizing and analyzing explicit characteristics like shapes, texture or movement but there have been less research done in HR measurement using video (or visible light). But now, with the help of computer vision and digital image processing method to solve the problem of heart rate measurement.

There are motions which are too small in amplitude and variations which are invisible for human eye can be useful to extract important information. The motions with low spatial amplitude are hard to see for human. The algorithm presented in SIGGRAPH 2012 states a video motion magnification which is called Eulerian video motion magnification is useful in the field of scientific and medical application.

The ability to use conventional cameras to remotely measure Heart rate would open doors to many possibilities. For example, a networked camera system could be setup in a nursing home to continually monitor patient health for long term without uncomfortable sensors.

Recent works [1, 2, 3] has demonstrated the vital ability of video based HBR measurement. The most important part of those research mainly focuses on Eulerian video motion Magnification approach. The eulerian Video motion Magnification approach is to study variations of pixel over time at any given spatial location and magnifying variation in interested temporal frequency band. Temporal filtering is applied to lower spatial frequencies such as human heart rate or respiration. The temporal filtering amplifies color variations as well as explore the low amplitude motion. By combining techniques in computer vision and advanced signal processing, a person's heart rate can be computed from optical signal reflected off the frame off the face with an error of less than three beats.[1] For monitoring vital signs based on the eulerian Video Magnification method must include following features:

(1) Heart beat rate detection and assessment based on the Eulerian video magnification method
(2) Calculate real time changes such as the magnified blood flow, obtained from the eulerian video magnification algorithm.

2.1. Photo-plethysmography:

Photo-plethysmography (PPG) is the technique of measuring volumetric changes of an organ optically. PPG is based on the principle that blood absorbs more light then tissue thus variations on blood volume affect light reflectance. [6, 10]. This method captures the pixel value of facial area of a video and then the pixel values within a region of interest were then average for each frame. Due to spatial averaging there will be significantly increased signal to noise ratio. The heart rate estimation is then calculated by applying Fast Fourier transform.

2.2. Computer Vision and Image Processing:

Humans use their eyes and their brains to see and visually sense the world. Computer vision is the discipline that studies about how to acquire, process, analysis and understand images. It is concerned about

the theory behind artificial systems that extract information from images. The image data can be video sequences or two dimensional image or multi – dimensional data from different scanners. The sub domains and related field includes event detection, object recognition, motion estimation, image restoration, image processing, image analysis, machine vision etc. The main difference that can be pointed out is that limitation of memory, illusion and limitation to visible spectrum.

Image processing is processing of images using mathematical process by using different forms of signal processing for which the image is an image or video frame. Output of image may be image or a parameters related to image. Typical image processing operation may include image compression, restoration and enhancement.

Most computer vision algorithms usually assumes a significant amount of image processing has taken place to improve image quality.

2.3. Eulerian Video Magnification:

The Eulerian Video Magnification method approach combines spatial and temporal processing to emphasize subtle temporal changes in a video. In this method, the first video sequence is decomposed in to different spatial frequency bands. Because they may exhibit different signal-to-noise ratios, they can be magnified differently. In most case, the full laplacian pyramid can be computed. Then, temporal processing is performed on each spatial band decomposed before.
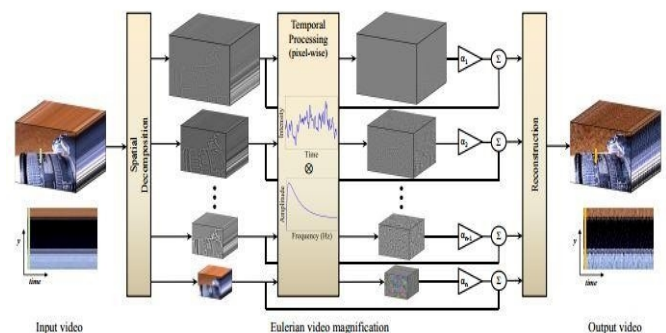

Figure 1: Overview of Eulerian Video Magnification Method [1]

The temporal processing is uniform for all spatial bands, and for all pixels within each band. Then the extracted band pass signal is magnified by a factor of X, which can be specified by the user and may be attenuated automatically. All those magnified signal is added to the original image and the spatial pyramid collapsed to obtain the final output.

Temporal filtering is used for extracting the motions to be amplifying. Eulerian video magnification allows for amplify- cation and visualization of heart rate signal ate each location on the face. This creates the potential for monitoring and diagnostic to medicine. EVM method is inspired by the Eulerian perspective.

2.4. Heart Rate Estimation:

The heart beat rate estimation is computed using Fourier transformation, which is a mathematical transform capable of converting a function of time, f(t), into new function representing the frequency domain of original function. The heart rate can be determined by frequency analysis of color variation in extracted band pass signal. For the better result, the size of temporal window is found as 10-20 for 30 frames per seconds for video [7]. To get noise free results, for color amplification narrow pass band filter is preferred while motion magnification, wide band pass band is preferred.

In an automated algorithm [5] for fast pulse wave detection in presented. With the help of this algorithm we can able to obtain an estimative of the heart rate from PPG signal. Below describes the algorithm that is present.

1. Identification of possible peaks and foots of individual pulses

   a. Maximum(MAX)
      The signal is divided into consecutive 200ms time intervals and for every segment the absolute maximum is determined.
   b. Minimum (MIN)
      The absolute minimum is determined between every two adjacent maximums.

2. Examine and verify of the rising edges

   a. Validation of single rising edge
   b. Estimation of similarity of a rising edge to preceding and following rising edges accepted as valid.
   c. Verification of current rising edge

3. Experiment:

In order to attain the better result of the heart rate from the video it was designed in a way to minimize external environ- mental effect. The individual was placed in front of ordinary webcam of laptop and color video was recorded at real time at 30 frames per second.

The code[8] used in this experiment was developed by Tristan Hearn at NASA Glenn Research Center which is based on Eulerian Video Magnification. The indiv- dual is placed at distance away of about 500 cm form the webcam. The video was being lived real time and the heart rate of the subject was noted down manually using a heart rate monitor. The pulse wave was started by the heart beat travels through the whole artery system and reaches the face causing short term volume change in the blood.

4. **Algorithm[7]**

1. Perform face detection on single frame of the video

2. By using Gaussian pyramid decomposition algorithm, decompose this frame into sub frames such that highest level of the pyramid has low pass information.

3. Each level of the pyramid is then filtered using band pass filter.

4. Then the intensities of the frequency band of interest by a magnification factor X is magnified.

5. Then the pyramid is combined into single frame.

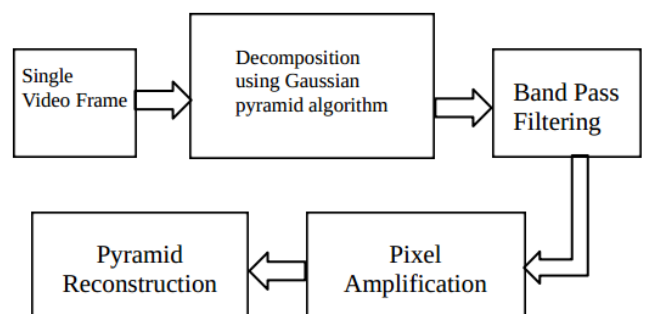6. All the remaining frames of the video undergoes the above 5 steps.

Figure 2: Block Diagram

More explained flowchart for implemented algorithm to obtain the heart rate of a person from a web cam or video using the Eulerian video magnification method is displayed in figure below. Basically, it

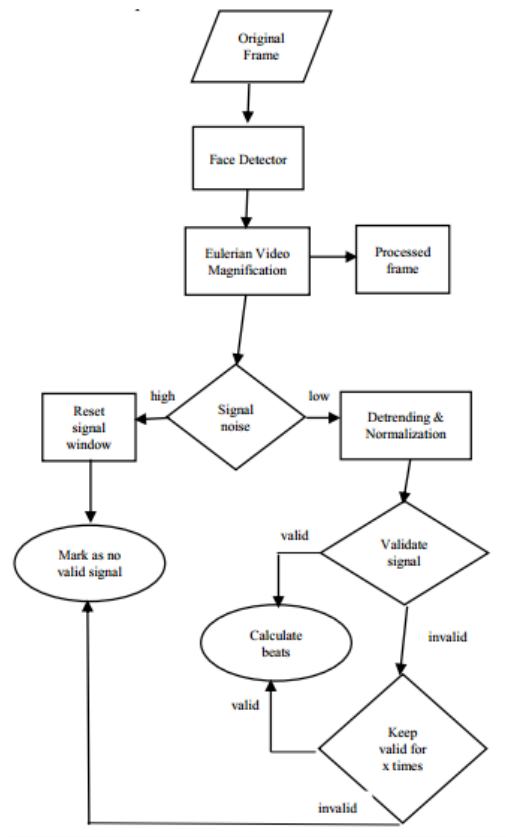performs one operation on one set of input and returns one output.

Figure 3: Overview of the implemented algorithm to obtain the heart rate of the person from a webcam

5. Results:

The algorithm was implemented using python programming language and tested on different people.The error range form 5-10 BPM difference.

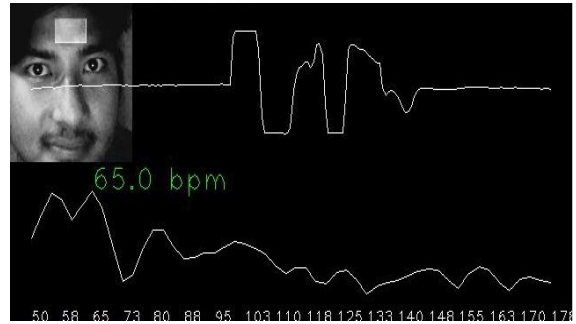Figure 4: Determining the area of pixel to analysis the BPM

Figure 5: Visualization of Data Log in Real Time

To validate the heart rate value obtained by the implemented code, a test was run and reading obtained to total of 5 individual is listed in table below.

Table 1: Data obtained from the test

Individual	Calculated Heart Rate
5 years	80
20 years	85
25 years	70
40 years	67
55 years	63

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Wireless Detections in MIMO System

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Abstract – **Multiple-Input Multiple-Output (MIMO) communication technology has received a significant attention in the area of wireless communication systems. MIMO provide reliable transmission and increasing data rate than traditional single input single output system. Increasing the number of transmit or receive antennas increases channel throughput. In this paper linear and non-linear detection techniques are analyzed. The linear detection techniques such as Zero Forcing (ZF) Minimum Mean Square Error (MMSE) are tested and results are analyzed. In linear MIMO wireless detection schemes, pre-coding at the transmitter is provided. It is observed that this detection scheme is sensitive to the impact of spatial correlation caused by mutual coupling between antenna elements and the spatial propagation conditions of the wireless channel. Also, the non-linear MIMO wireless detection techniques which include Maximum Likelihood (ML), Minimum Mean Square Error-Successive Interference Cancellation (MMSE-SIC) are tested and results are analyzed. The results depicts how to apply non-linear detection, which can help mitigating the impact of correlated signals, in a closed-loop MIMO system and compare the average rates achieved with different detection schemes.**

Keywords: MIMO, Wireless detections, MMSE, Zero-Forcing, Maximum Likelihood, MMSE-SIC, Wireless communication.

I. Introduction

Wireless communication system uses antennas on transmitter and receiver side for transmission of radio waves. The frequency spectrum is the scarce resource for wireless communication systems and the rapid increase of wireless applications has demanded the new techniques to achieve higher spectral efficiency. The availability of spectrum has been an influential factor impeding a rapid and efficient convergence of technologies.

The multiple-input multiple-output (MIMO) system utilizes the spatial diversity to increase the data rate and spectral efficiency. MIMO is considered to be the potential solution in combating the challenges of bandwidth constraints and high data rate demands. MIMO systems are regarded as one of the most promising research areas of wireless communications. This is due to the fact that a MIMO channel can offer a significant capacity gain over a traditional Single Input Single Output (SISO) channel. This provides a fundamental limit on data throughput in MIMO systems. MIMO systems improve data transmission reliability without increasing transmits power and bandwidth. The spatial diversity obtained from transmit and receive antennas can be combined with channel coding. This combined process leads to space-time coding in a coded system [1].
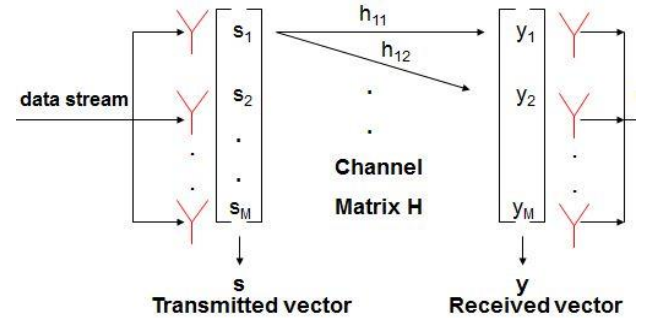

Figure 1: MIMO System Model

MIMO Detectors

MIMO detectors consist of different linear and non-linear detections techniques which include:

a) Zero Forcing (ZF)

Zero Forcing (ZF) is a linear detection method which treats all the transmitted signals as interferences except for the desired stream from the target transmit antenna. Therefore, interference signals from other transmit antennas are minimized or nullified in the course of detecting the desired signal from the target transmit antenna. ZF receiver works

best with high SNR level. Zero forcing method is based on the calculation of pseudo inverse of channel matrix H i.e. facilitate the detection of desired signals from each antenna, the effect of the channel is inverted by a weight matrix W [3] [8]. In simple form,

$$Y = HX + N \dots \dots (1)$$

To solve the 'X' the weight matrix W is to solved out which satisfies WH=I. The Zero Forcing (ZF) linear detector for meeting this constraint is given by,

$$W = (H^H H)^{-1} H^H \dots \dots (2)$$

Where,H^H is the Hermitian transpose.

b) MMSE Signal Detection

Minimum Mean Square Error (MMSE) is linear detection method in which mean squared error (MSE) is minimized between the transmitted signals. MMSE equalizer does not usually eliminate ISI completely but, minimizes the total power of the noise and ISI components in the output [3]. In order to obtain the unknown transmitted signal MMSE use a weight matrix given by $W = (H^H H + N_0 I)^{-1} H^H$ ....(3) where I is the identity matrix.

In the classical approach, the Minimum Variance Unbiased Estimator (MVUE) is derived by first considering minimization of the mean square error i.e., $\theta 1 = \arg \min_\theta mse(\theta)$ where:
$mse(\theta 1) = E[(\theta 1 - \theta)^2] = \int (\theta 1 - \theta)^2 p(x; \theta) \, dx$...................(4)
and $p(x; \theta)$ is the PDF of x parameterized by θ.

c) MMSE-SIC Signal Detection

Minimum Mean Square Error Successive Interference Cancellation (MMSE-SIC) is signal detection method where weight matrix is used same as linear detector MMSE. The receiver can obtained an estimate of the two transmitted symbol x1, x2 as:

$$\begin{bmatrix} \hat{x}1 \\ \hat{x}2 \end{bmatrix} = (H^H H + N_0 I)^{-1} H^H \begin{bmatrix} y1 \\ y2 \end{bmatrix} \dots \dots (5)$$

This method is similar to that of ZF-SIC except the weight matrix used to identify the unknown transmitted symbols. In classical SIC an approach, the receiver arbitrarily takes one of the estimated symbols and subtracts its effect from the received symbols. Instead of choosing random estimated symbols, another intelligent way is optimal ordering in which received power at the transmitted symbols are determined [3] [8].

d) ML Signal Detection

Maximum Likelihood (ML) is optimal decoding method that compares between the received signal and possible transmitted signal. As the transmitted signal is modified by channel matrix, we need to estimate transmit symbol by using maximum likelihood detection algorithm.

$$\hat{x} = \arg x_k \in \{x1, x2 \dots x_N\} \min \|r - H_{xk}\|^2 \dots \dots (6)$$

Where $\|r - H_{xk}\|^2$ is ML metric which achieve maximum performance when transmitted vectors are equally likely [1],[4].r be the received signal and h be the channel matrix. Since the receiver has to consider $|M|^{nTX}$ possible symbols so it has complexity issues as the number of transmitter increases. Here M defines the 'modulation constellation' and nTx defines the no of transmitted antenna system. For example 2×2 MIMO system and QPSK system, the total possible symbol is 16.

II. Related Work

Several research works have already been done and many research papers have been published regarding detection algorithms. Since, each of the papers has focused on different detection techniques being implemented in MIMO with their resulted output in simulation tools as well. However, the comparative analysis is very rare and proposed research is crucial in today's time in order get the de-facto standard for efficient detection techniques implementation. Some of the related works that are closely related to proposed work are highlighted below along with their scope of research.

The research work done by Xiaoqing Peng, Weimin Wu, Jun Sun, and Yingzhuang Liu [1] put forward about the detection of symbols via compressive sensing algorithms, to reduce the original MIMO system to a new one, whose input dimension is much less than the output dimension. Also, the research done by Max Scharrenbroich, Michael Zatman and et.al [2] explain about non-linear detection and requires a prior knowledge of the target SNR and it depicts more result for the stationary case only. Similarly, the research completed by Gurpreet Singh, Rahul Vij and Priyanka Mishra[3] put an approach for spatial multiplexing technique with various decoding techniques got more optimal result specifically for 1x4 antennas. Besides, the result obtained by Shreedhar. A. Joshi Dr. Rukmini T S, Dr. Mahesh H M[4] on V-BLAST technique with MIMO exhibits better bit error rates.

III. Methodology

This chapter deals with the explanation of observed system model. Here, the binary data generator generates the random binary data with equal probability of being 1 and 0. The binary data are created as they were easy to analyze, and they are matched to the real digital communication world. The encoder encodes the data using the Convolution Encoder. If the encoder takes k input bit streams (that is, it can receive 2^k possible input symbols), the block input vector length is L*k for some positive integer L. To solve the problem, systematic steps are needed which is better to explain in the flow chart form:

```
          Start
            │
            ▼
     ┌──────────────┐
     │ Input Data   │
     │ Streams      │
     └──────────────┘
            │
            ▼
     ┌──────────────┐
     │ Convolutional│
     │ Encoder      │
     └──────────────┘
            │
            ▼
     ┌──────────────┐
     │ QPSK         │
     │ Modulation   │
     └──────────────┘
            │
            ▼
  ┌─────────────────────┐
  │ Rayleigh+ Rician    │
  │ Channel+ AWGN Noise │
  └─────────────────────┘
            │
            ▼
     ┌──────────────┐
     │ Define SNR   │
     └──────────────┘
            │
            ▼
     ┌──────────────┐
     │ Transmitter  │
     │ [2x2]        │
     └──────────────┘
            │
            ▼
  ┌─────────────────────┐
  │ Receive Transmitted │
  │ Data                │
  └─────────────────────┘
            │
            ▼
     ┌──────────────┐
     │ Demodulate   │
     └──────────────┘
            │
            ▼
     ┌──────────────┐
     │ Decoder Part │
     └──────────────┘
            │
            ▼
  ┌──────────────────────────┐
  │ Detection Techniques: ZF,│
  │ CMMSE, MMSE, ML,         │
  │ MMSE-SIC, ZF-SIC         │
  └──────────────────────────┘
            │
            ▼
  ┌──────────────────────┐
  │ Plot BER Vs SNR      │
  └──────────────────────┘
```
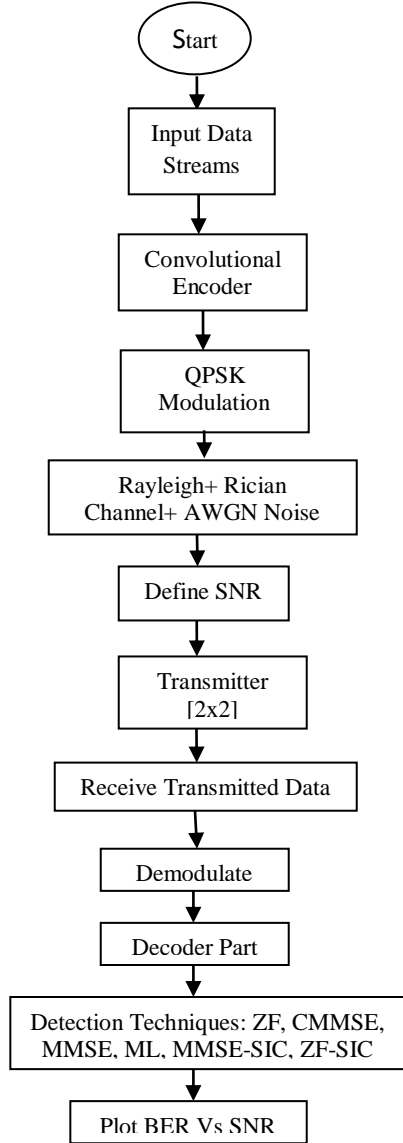
Figure 2: Flowchart of the system

Similarly, if the encoder produces n output bit streams (that is, it can produce 2^n possible output symbols), the block output vector length is L*n. Additive White Gaussian Noise (AWGN) is present in every electronic system. It cannot be removed by any means. It has to be modeled in an electronic system if the system is to be made noise tolerant. AWGN is modeled in this dissertation. The randomly generated AWGN is added in the sample points after the modulation is performed in the randomly generated data sample points. The mean value of the noise is 0 where as the variance is 1. The decoded bits from the different decoding techniques at the decoder are compared with the originally generated random data bits. The difference gives the number of errors encountered by the receiver. Bit error rate defines how good the communication receiver is.

IV. Simulation Results and Discussions

To verify the proposed method, MATLAB simulation is done. Parameters which are necessary for the simulation are taken from the standards in the MIMO communication system. The simulation results are obtained, after the MATLAB programming by using the parameters as shown below:

Table 1: Simulation Parameters

Simulation Parameters	Values
No. of bits	10^6
Encoder	Convolutional Encoder
MIMO configuration	2x2
Modulation type	QPSK
No. of transmitter/ receiver	2
Channel	Rayleigh, Rician fading channels
Noise type	AWGN
Detection Scheme	ZF, MMSE,ML and MMSE-SIC

The fig. 3 shows that the capacity of channel increases as the value of SNR increases i.e. lower most line has lowest capacity compared to other. Although the capacity increases as the value of SNR increases (here from 2 to 20), it is least compared to MIMO system which has 2x2, 3x3 or 4x4 antennas. SNR value 18dB corresponds to the capacity of 6 bit/Sec/Hz for SISO, but for the same SNR value the capacity for $[2 \times 2], [3 \times 3],$ and $[4 \times 4]$ antennas are 10.5, 15.5 and 21 respectively. It can be analyzed that for the fixed SNR the capacity of system increases as the number of antennas increases. From this it can be said that any system can increase its channel capacity by increasing the number of antennas at both transmitter and receiver side without increasing SNR value.
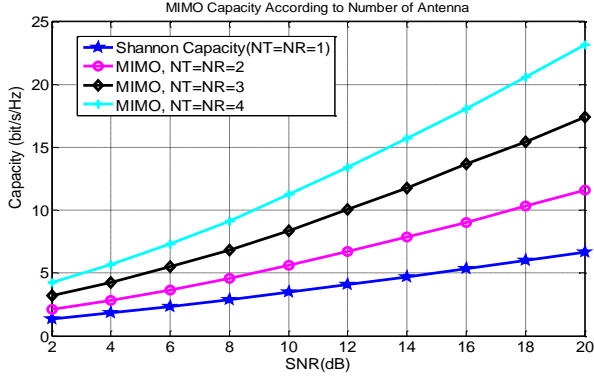
Figure 3: SNR vs. Capacity plot for different transmit and receive configurations

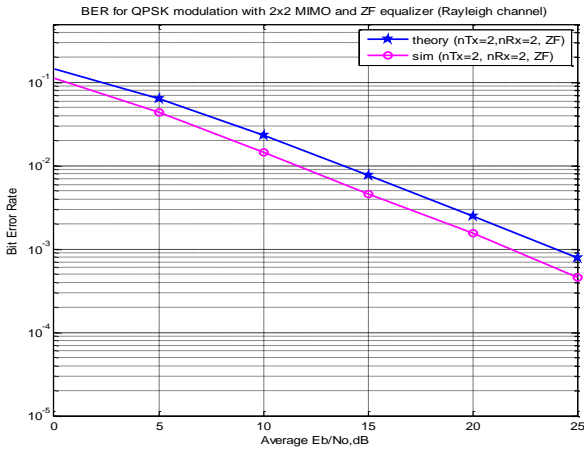**Figure 5**: SNR vs. BER plot for 2x2 MIMO case with ZF equalizer in Rician Channel

Figure 4: BER vs. SNR plot of the ZF receiving technique over the Rayleigh Channel

ZF detection algorithm for MIMO is the most simple and basic algorithm, and the basic idea of ZF algorithm is kept of MIMO-channel interference by multiplying received signal and the inverse matrix of channel matrix.

Here, over Rayleigh channel for 10^{-2} BER, there exist 12 dB of SNR value of ZF detection technique as in fig. 4. The fig. 5 depicts the MIMO case of 2x2 in the Rician fading channel using ZF as a linear detecting technique.

The simulated results with a 2×2 MIMO system using QPSK modulation in Rayleigh/Rician fading channel shows matching results as obtained in for a 1×1 system for same modulation in Rayleigh/Rician channel. The ZF equalizer helps us to achieve the data rate gain, but not take advantage of diversity gain (as there is two receiving antennas). It might not be able to achieve the two fold data rate improvement here.
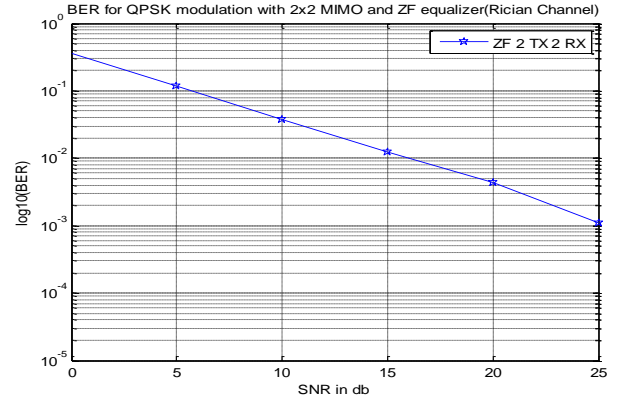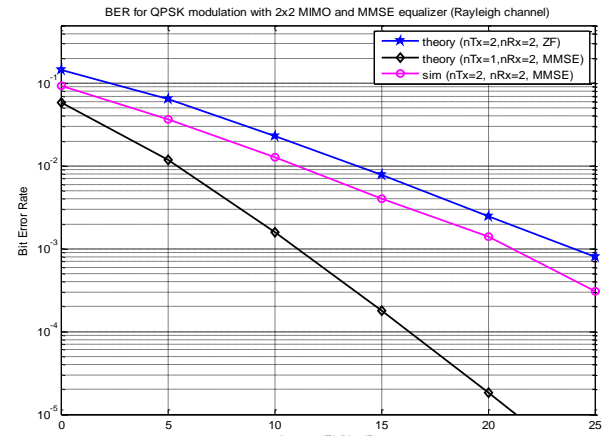

Figure 6: BER Vs. SNR plot of MMSE equalizer for Rayleigh Channel

A MMSE estimator is a method in which it minimizes the mean square error (MSE), which is a universal measure of estimator quality. The most important characteristic of MMSE equalizer is that it does not usually eliminate ISI totally but instead it minimizes the total power of the noise and ISI components in the output.
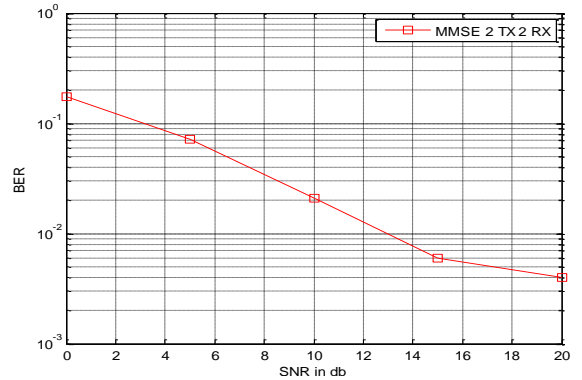

Figure 7: BER Vs SNR in case of MMSE equalizer for 2x2 MIMO case in Rician fading

The fig. 8 is the case of 2x2 MIMO, which uses the MMSE equalizer at the receiver. This depicts the analysis of various cases, performance, and comparison of the simulated and theoretical bit error rate of the MMSE with that of the ZF.
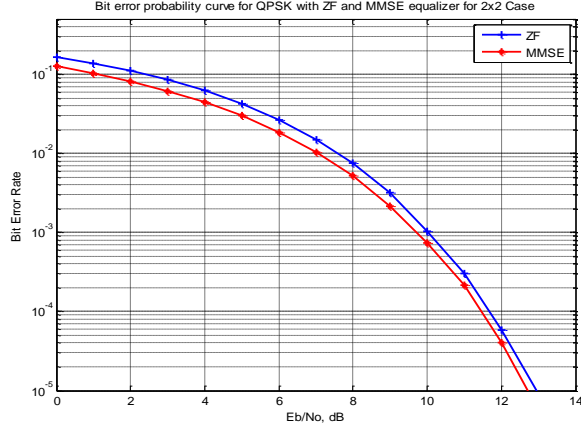

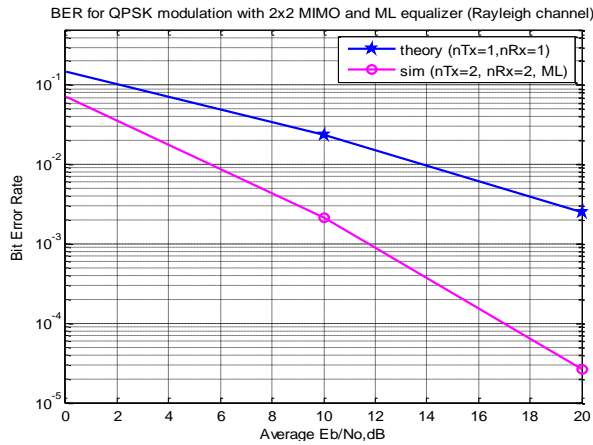**Figure 8**: Comparative analysis of ZF and MMSE over 2x2 MIMO case

Figure 9: BER for QPSK modulation with 2x2 MIMO and ML equalizer for Rayleigh Channel

This shows that the performance of the MMSE is highly impressive compared to that of the ZF. Equalization techniques can combat for ISI even in mobile fading channel with high efficiency. MMSE equalizer uses LMS to compensate ISI. The MMSE equalizer results in around 3dB of improvement when compared with Zero Forcing equalizer.From the simulation result as shown in fig. 8, it can be summarized that, ZF equalization in addition of noise gets boosted up and thus spoils the overall signal to noise ratio. Hence it is considered good to a receiver under noise free conditions. The multiple antennas are used to increase data rates through multiple antennas to improve performance through diversity. This technique offers higher capacity to wireless systems and the capacity increases

linearly with the number of antennas and link range without additional bandwidth and power requirements.
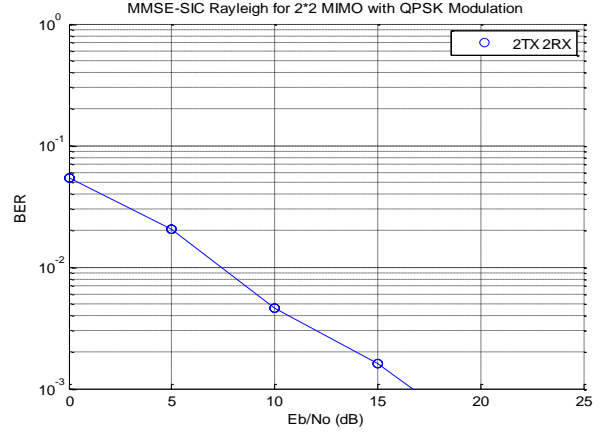

Figure 10: BER vs. SNR plot for MMSE-SIC Rayleigh of 2X2 MIMO with QPSK Modulation

In fig. 9, for 10^{-2} BER there is 5.8 dB of SNR for ML equalizer for Rayleigh Channel. In fig. 10 for 10^{-2} BER, there is 7.5dB of SNR. Comparing the results of ML and MMSE-SIC of Rayleigh fading channel for same BER i.e. 10^{-2}, SNR of MMSE-SIC gets improved than that of ML signal detection. The result of fig.10 is obtained after average of 10 times of MATAB simulation for MMSE-SIC. In fig. 11, for 10^{-2} BER there is 8 dB of SNR for MMSE-SIC Rician Channel. In fig. 10 for 10^{-2} BER, there is 7.5dB of SNR. Comparing the results of MMSE-SIC of Rayleigh fading channel and MMSE-SIC of Rician fading channel, for same BER i.e. 10^{-2}, SNR of MMSE-SIC Rician channel gets improved than that of MMSE-SIC Rayleigh channel.
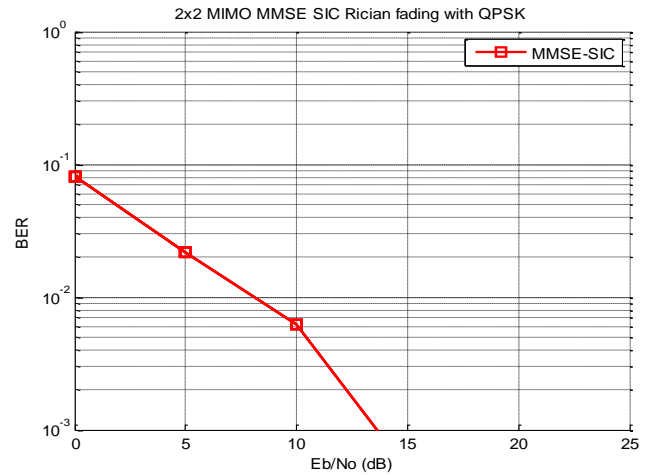

Figure 11: BER vs. SNR plot for MMSE-SIC Rician of 2X2 MIMO with QPSK Modulation

The SNR is 0.5 dB more in MMSE-SIC of Rician Fading. The result of fig. 11 is obtained after average of 8 times of MATAB simulation.

V. Conclusion and Future Work

Conclusion:
The Rician channel has the good SNR value than the Rayleigh in all detections and in varying configuration of the MIMO system. MMSE-SIC is much better than MMSE. It can be concluded that wireless MIMO receiver with ML detection has the least BER for a given SNR and ZF detector has a greater BER. Also, the simulation results obtained shows that by combining SIC with MMSE provide better BER performance characteristics than normal receiver consisting simple MMSE or ZF respectively. And, MMSE-SIC provides better overall system performance than MMSE, ZF and ML the increasing diversity order.

Future Work
The different modulation schemes and antenna configurations can be used to analyze the performance of the MIMO system. Detections techniques can be used for designing of adaptive channel estimation with beam forming antenna and MIMO-OFDM.

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