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A Comprehensive lossless modified compression in medical application on DICOM CT images

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ABSTRACT : *In current days, Digital Imaging and Communication in Medicine (DICOM) is widely used for viewing medical images from different modalities, distribution and storage. Image processing can be processed by photographic, optical and electronic means, because digital methods are precise, fast and flexible, image processing using digital computers are the most common method. Image Processing can extract information, modify pictures to improves and change their structure (image editing, composition and image compression etc.). Image compression is the major entities of storage system and communication which is capable of crippling disadvantages of data transmission and image storage and also capable of reducing the data redundancy. Medical images are require to stored for future reference of the patients and their hospital findings hence, the medical image need to undergo the process of compression before storing it. Medical images are much important in the field of medicine, all these Medical image compression is necessary for huge database storage in Medical Centre and medical data transfer for the purpose of diagnosis. Presently Discrete cosine transforms (DCT), Run Length Encoding Lossless compression technique, Wavelet transforms (DWT), are the most usefully and wider accepted approach for the purpose of compression. On basis of based on discrete wavelet transform we present a new DICOM based lossless image compression method. In the proposed method, each DICOM image stored in the data set is compressed on the basis of vertically, horizontally and diagonally compression. We analyze the results from our study of all the DICOM images in the data set using two quality measures namely PSNR and RMSE. The performance and comparison was made over each images stored in the set of data set of DICOM images. This work is presenting the performance comparison between input images (without compression) and after compression results for each images in the data set using DWT method. Further the performance of DWT method with HAAR process is compared with 2D-DWT method using the quality metrics of PSNR & RMSE. The performance of these methods for image compression has been simulated using MATLAB.*

Keywords: *JPEG, DCT, DWT, SPIHT, DICOM, VQ, Lossless Compression, Wavelet Transform, image Compression, PSNR, RMSE.*

I. INTRODUCTION

In term preserving a soaring visual quality standard of decompressed image, the main motive of image compression is to achieve a very squat but rate representation. Compression reduces the storage and finds its potency and limitation. Without losing its entropy significantly compression transmits burden of raw information by reducing the ubiquitous redundancy [4]. Two techniques exit for compression to find out, first is lossy technique (in this some of data may be lost or some identified loss or changes may incurred). Second in lossless technique, in this technique the reconstructed images exactly same as the original. In multimedia and digital image compression is considered as an essential technology in providing better result. The challenge is to obtain high compression ration without the loss of image communication field [5]. By using specialized software, which will be described in more detail late in the article, DICOM images can be compressed by converting the data into smaller image file [10]. As compression technique are very helpful in mass storage and transmission, many lossless techniques are used like Discrete Wavelet transform, Huffman coding and run length encoding, arithmetic coding are quality or diagnostic accuracy. The underline ides behind most of the lossy compression algorithm is to transform the image and to project it on an orthogonal function basis in order to distribute the energy of the signal among these de-correlated components. The progress of the theory of multi resolution decomposition has allowed the application of compact coding of Wavelet image representation and these representations diverge in the preference of the wavelet. The principle behind the Wavelet transform is to decompose an original signal into a series of low resolution signal associated with the detailed signal. It contains all the necessary information that is required to rebuild the signal at each resolution level and at the next higher level [1][9]. In DICOM format all the information about the image is contained in the header is the image modality and information about the patient. Over and above this field in the header which defines that ” Transfer

Syntax Unique Identification" that relates to the type of compression applied to the image data. The image data then follows the header. Currently, DICOM standards supports run- length coding (RLE), lossy JPEG, lossless and JPEG 2000 for compression of the image data [Ramakrishnan]. In this paper, by using DWT method through HAAR process DICOM images can be compressed. Discrete Wavelet Transform (DWT) is a proficient tool for multi- resolution sub band decomposition of signals useful numerous signal and image processing applications, without great loss of visual quality than the previous technique such as the Discrete Cosine Technique (DCT) and the Discrete Fourier Transform (DFT) [6]. Wavelet transform divides the information of an image into approximation and detail sub signals. The approximation sub signal shows the general trend of pixel values and other three detail sub signals show the vertical, horizontal and diagonal details or changes in the images [8].

II. RELATED WORK

Ramakrishnan et al. (2006) proposed a methodology for compression of DICOM images based on wavelets and splint for telemedicine applications. In this paper they proposed a method for compressing DICOM images for different entities on well known set partitioning in hierarchical trees (SPIHT) SPIHT having the progressive transmission capabilities which is quiet useful for telemedicine application in which DICOM image header is transmitted first and then progressively followed by image details transmission in various stages. SPIHT produces embedded bit streams of the image and works on the principle of spatial relationship among the wavelet co-efficient at different levels and frequency sub-bands in the pyramid structure of wavelet decomposition. They compare their results on PSNR, MSSIM metrics for different compression scheme like JPEG-200, JPEGCS, JPEG to the propose scheme (SPIHT). Finally, they concluded that SPIHT gives better result as compare to other scheme by consuming less bandwidth and saving time [11].

Kumar et al. (2008) proposed a mechanism for performance of image compression techniques Using DCT (Discrete Cosine transform), SVD (Singular Value Decomposition), BTC (Block Truncation Code), STD (Standard Deviation) methods depending upon the image properties and requirements. In this paper, the two main compression techniques SVD and BTC associated to DCT in JPEG baseline coding to find its potential and limitation of data redundancies. The advantages of SVD were due to the property of energy compaction and ability to adapt the local statistical variation of an image. Moreover, BTC generally preserves the first and second moments of movements of each block. Finally, they concluded that the obtained results of the proposed work clearly depicts that the incorporation of SVD and BTC in age compression along with DCT was in an adaptive manners which enhanced the compression performance significantly. The proposed work result was quiet reliable in terms of PSNR and MSE [4].

Bairagi et al. (2009) proposed a methodology for selection of wavelets for medical image compression. They mainly worked over various wavelets transform methods to analyze DICOM CT image over several metrics like MSE (Mean Square Error), PSNR (Peak Signal Noise Ratio), Structural contents, Normalized Absolute Error etc. Moreover, they found out quality of measure for different wavelet type on DICOM CT images. They read the some of the limitation of SPIHT techniques in which there was no specification for particular wavelets type used as image compression. Furthermore, they had done analysis over all the 'db' wavelet series and compare their results over several metrics. In this paper, comparison and analysis was made over the class of wavelets like orthogonal and bi-orthogonal and the author concluded that the bi-orthogonal 4.4 wavelet was most suitable for medical image compression application [1].

Dhawan et al. (2011) reviewed and discussed about the image compression, need of image compression, its principles, classes and various algorithm of image compression. They mainly worked over gray scale images of Lena and finger print images. The author discussed over various compression algorithms based upon wavelet, JPEG/DCT, VQ, fractal and compare their results on the basis of PSNR values and CPU time over encoding and decoding. Finally, the author concluded that the wavelet based compression algorithms are strongly recommended. Discrete cosine transform should use an adaptive quantization table. VQ approach is not appropriate for a low bit rate compression and fractal approach should utilize its resolution-free decoding property for a low bit rate compression [7].

Morales et al. (2012) presented a method for finger print verification by correlation using wavelet compression of pre-processing digital images. In this paper, they implemented a practical digital security system that combines digital correlation, wavelet compression with digital images pre-processing. The proposed work had been implemented a biometric system that used as pattern the recognition of digital fingerprint which satisfied the characteristics of uniqueness, universally, performance and collectability. The biometric fingerprint system mainly contains two inputs that were passwords and fingerprints. The fingerprint was captured by the biometric sensor "APCBIOPOD", then the image was pre-processed took skeleton itself and stored in a database for making the comparison and to authenticate the user. The author used specific Fourier transform and wavelet transform to perform the function using correlation, compression, compressed filter, transformation and finally user interface implementation [3].

Dubey et al. (2012) presented a new JPEG 2000 based lossy image compression method based on 2D discrete wavelet transform. They mainly worked over 3D medical image compression using Huffman encoding technique. In the proposed method, 3D image was divided into smaller non-overlapping tiles on which 2D DWT was applied and after that hard thresholding and Huffman coding were applied on each of the tiles to get compressed image. Moreover, the author explained that the performance of the proposed work of 3D JPEG 2000 image compression algorithm was measured over various images and concluded that the proposed algorithm had better performance than JPEG compression in low and high bit rates [2].

III. PROPOSED WORK

In proposed method, a advanced approach to image compression technique is used that upgrade or improve its performance ,minimum data loss and also reconstructed that image, which is known as Discrete wavelet transform in dcm. We are using lossless compression technique, one of the method used is HAAR process. This process is a sequence of square shaped function that further forms wavelet and this wavelet is based on Fourier Transform. HAAR uses orthogonal combination on unit interval. The technical, directional and anatomical aspects of an image are compressed using wavelets transformation of HAAR process. HAAR Wavelet decomposition is one of the best methods of decomposition of images.
Development of Discrete Wavelet Coding Algorithm

1. Development of a representative data set of DICOM CT images.
2. Study of various linguistic Image Compression Techniques.
3. Select an input image from the set of data set.
4. Development of a storage schema which maps the discrete wavelets Transformation techniques for image compression using HAAR process.
5. Development of an interface for storing the step wise procedure of compression for wavelet transformation.
6. Analyze the results for approximation A1 with respect to input image for metrics like RMSE, PSNR. Metrics like RMSE, PSNR.
7. Rescheduling the image compression procedure after approximation A1
8. Analyze the results for approximation A2 with respect to input image for requisite metrics.
9. Save the some sort of information of input images as according to their modality in the dataset. Results analysis and comparison for all the inputs in the dataset.
10. Performance of DWT method with HAAR process is compared with 2D-DWT method using the quality metrics of PSNR & RMSE.

IV. RESULTS AND DISCUSSION

HAAR Wavelet approximation is one of the best methods of discrete images. For input, approximated images is passed to the HAAR process to compress and this process measure the best in compression for the DICOM CT images. The input images can be the set of images from data set can be brain image then analyze the result for approximation 1 and approximation 2 with respect to input images. The performance of compression images is measured by PSNR and RMSE. MATLAB gives graphics tools and reference-standard algorithms for image processing, analysis, to examine a region of pixels, to detect and measure features, and analyze shapes and textures, visualization, and algorithm development. HAAR is proved to be best as compared to the other processes. Original image formatted in DICOM format of size 256×256 with 8 bit resolution is input to software. The 'Compressed image' is the image which is generated at the decoder side after reconstruction process. This shows that our HAAR process gives better results. The Haar transform is the simplest of the wavelet transforms. This transform cross-multiplies a function against the Haar wavelet with various shifts and stretches, like the Fourier transform cross-multiplies a function against a sine wave with two phases and many stretches. Evaluation of performance of any medical DICOM CT images can be made by the parameters such as RMSE and PSNR. Root-mean-square error (RMSE) is a frequently used measure of the differences between values predicted by a model or an estimator and the values actually observed.

$$RMSD = \sqrt{\frac{\sum_{t=1}^{n}(y_t - \hat{y}_t)^2}{n}}$$

PSNR is generally used to analyze quality of image, sound and video files in dB (decibels). In other words, *PSNR is* to measure the quality of reconstructed images that have been compressed.

$$MSE = \frac{1}{m\,n}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[I(i,j) - K(i,j)]^2$$

Where, MSE represents the squared error of the images defined as,

$$PSNR = 10.\log_{10}\frac{(MAX_1^2)}{MSE}$$
$$= 20.\log_{10}\left(\frac{MAX_1}{\sqrt{MSE}}\right)$$
$$= 20.\log_{10}(MAX_1) - 10.\log_{10}(MSE)$$

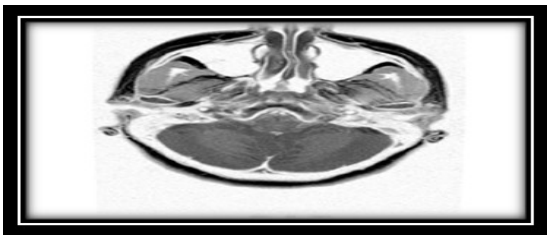

Figure 1: Input DICOM brain image at client side

The above image is the input image which is undertaken for the simulation and after which we may proceed for further compression process to be carry out. This is the very first result of input image at client end.

Figure 2: Converting input image into gray scale

The figure depicts the very first step of image compression in which we first convert the taken input image into gray scale and other more properties like size and image contrast for poor and adjusted terms of nature of the image. This is the basic step of compression of image which is performed according to the need and performing nature of implementation of the requisite process.

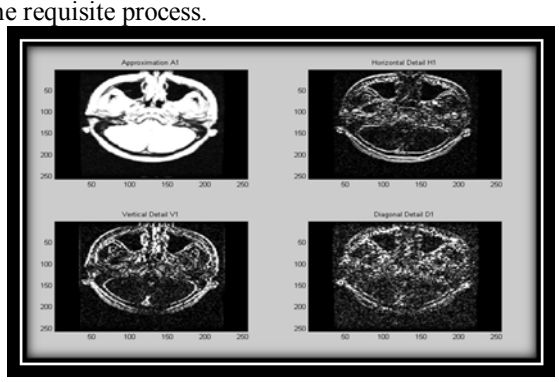

Figure 3: Results for input image after Approximation A1 (decomposition level first)

The figure signifies the result of first level decomposition of image by approximation $A1$. In this step, we find the results of compression according to their Horizontal detail compression termed as $H1$, vertical detail compression termed as $V1$ and diagonal detail compression termed as $D1$. From the analysis of above figure 5.5 we found that there is

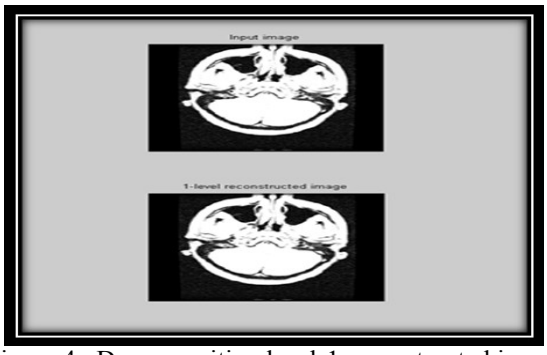

Figure 4: Decomposition level-1 reconstructed image

The figure depicts the results of reconstructed image after first level decomposition in which we carry out compression of image diagonally, vertically and horizontal. For the sake of further compression at that time, it must require to reconstruct the image by applying inverse mechanism. From the results of reconstructed 1-level decomposition level we may now in position to do further decomposition of the input image.

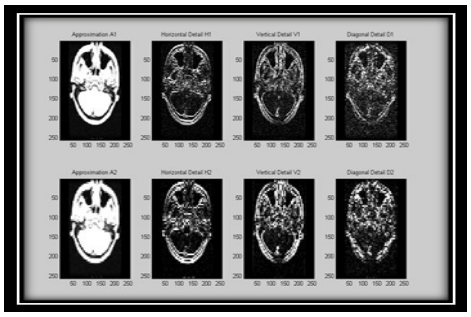

Figure 5: Comparison snap shot for both level of decomposition of the image

The figure depicts the comparison analysis for both level of decomposition namely approximation A1 and approximation A2.The result signifies that the two level decomposition results are quiet good and vulnerable as compare to decomposition level-1. The results analysis and comparison is totally based over wavelet transform for the proposed process on different coefficients and labels. Furthermore, the evaluated results made comparison over the analysis of horizontal, vertical and diagonal diagnosis.

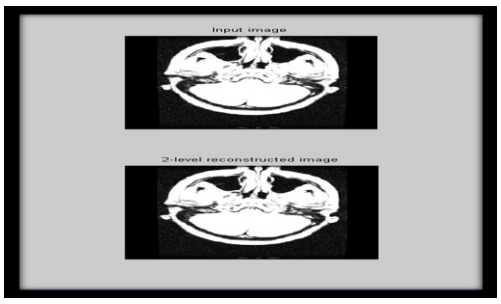

Figure 6: 2-level reconstructed image for wavelet decomposition

The above results in snap shot clearly signifies that the two level decomposition for image compression is quiet reliable and can be seen and processed for the input image which are during the compression process. The 2-level decomposition results found by applying inverse wavelet transform methods for requisite parameters under the taken process.

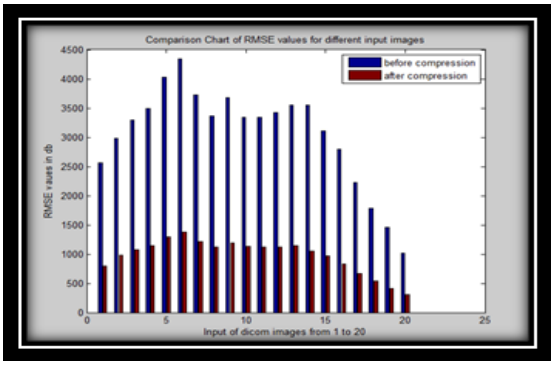

Figure 7: Comparison chart of RMSE values for different images for Wavelet HAAR

As seen from the figure which clearly depicts the comparison chart of root mean square value for all the different images taken and get results one by one. The results are totally base over before compression and after compression values for the input images.

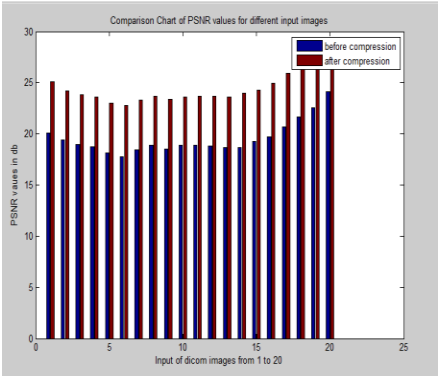

Figure 8: Comparison chart of PSNR values for different input images for Wavelet HAAR

As seen from the figure which clearly depict the comparison chart of peak signals to noise ratio for all the different images taken and get results one by one. The results are totally based over before compression and after compression values for the input images. The above results clearly depicts that the PSNR values after compression for each images are quiet high as compare to before compression of image which is quiet reliable and good for the entire simulation process.

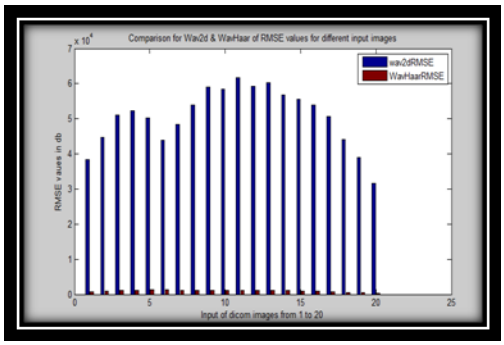

Figure 9: Comparison of Wavelet2d and proposed (Wavelet HAAR) of RMSE values for different input images

The figure is the comparison chart analysis of RMSE values for Wavelet2d techniques and the proposed Wavelet HAAR techniques. As seen from the above graph the results of RMSE values for different set of datasets are quiet reliable and robust for image compression process.

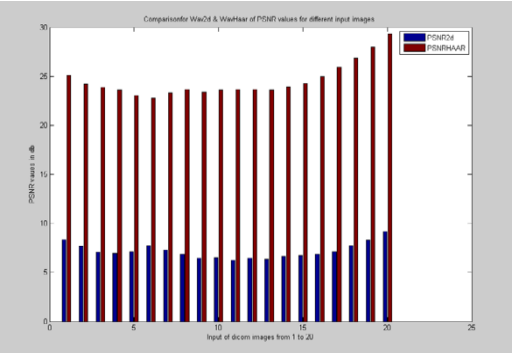

Figure 10: Comparison of PSNR values for both Wavelet 2d and proposed method

The above figure clearly depicts the comparison of both techniques on the basis of PSNR values. The above results quiet familiarize that the values of Wavelet HAAR transform is quiet reliable and optimist as compare to Wavelet 2d transform.

V. CONCLUSIONS

In this work, we have stressed towards the compression of DICOM images using DWT. Digital Imaging and Communications in Medicine (DICOM) is a standard image format for distribution and viewing of medical images from different modalities .Nowadays, due to medical advancement the usage of medical images became necessary for diagnosis of patients. It is the recommended format for medical images, which provides information pertaining to an image, imaging modality and patient in a header The performance and comparison was made over each images stored in the set of data set of DICOM images. Here, we have taken two metrics namely PSNR and RMSE. The results clearly depicts that the value of PSNR for all the images stored in the set of dataset is high after compression in compare to the value of before compression which is quiet good, reliable and scalable for data storage and removes the data redundancy. The performance of our proposed method of DWT using HAAR process is measured over various images and observed the results for both decomposition levels. The proposed algorithm scheme has given superior image compression results for DICOM images.

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WSO-LINK: Algorithm to Eliminate Web Structure Outliers in Web Pages

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Abstract: *Web Mining is specialized field of Data Mining which deals with the methods and techniques of data mining to extract useful patterns from the web data that is available in web server logs/databases. Web content mining is one of the classifications of web mining which extracts information from the web documents containing texts, links, videos and multimedia data available in World Wide Web databases. Further, web structure mining is a kind of web content mining which extracts patterns and meaningful information from the structure of hyperlinks contained in web documents having the same domain. The hyperlinks which are not related to content or the invalid ones are called web structure outliers. In this paper the basic aim is to find out these web structure outliers.*

Keywords- *Outliers, web outlier mining, web structure mining, Web mining, web structure documents.*

I. Introduction

Millions and millions of users are uploading and downloading web data into/from the web databases in World Wide Web. That's why, data in web server logs and databases are increasing exponentially. Updating and retrieving efficient and relevant data from web databases is a major concern. The aim of our research is to develop a new methodology for efficiently and effectively mine useful and relevant data from the web documents having the same domain. Web mining tasks can be divided into three main categories, namely, Web Structure Mining, Web Usage Mining and Web Content Mining. Web Structure Mining mines relevant knowledge and meaningful patterns from the structure of hyperlinks contained in web pages. Web Usage Mining is the application of web mining techniques to mine information from web usage logs. Web Content Mining extracts efficient and relevant information from web pages having text, image, video and hyperlinks as their content [3], [4], [5] and [6]. Web structure mining is a kind of Web content mining as it mines relevant data from the hyperlinks of web documents to be mined by the algorithms of web content mining [1]. Existing Web Content Mining algorithms focus on web documents of same domain; these algorithms do not consider web pages with varying contents of the same domain called the Web Content Outliers. In general, Outliers are the data that are irrelevant in terms of meaning and behavior of the existing data.

II. Outline of work

Section II provides the brief review of related work in web content mining. Section III explains the proposed algorithm. Section IV provides the results while in section V conclusions and future work is summarized.

III. Related Work

Outliers are those data objects which behave differently on the basis of their properties and valuable information that they contain. Outlier Mining is mainly studied in statistics because standard distribution techniques are applied on data objects to find out the outliers. A prior knowledge of data distribution like Poisson, Normal, etc. is mainly required to apply the statistical techniques which are the major setback. Outlier Detection techniques can be of following categories:

1. **Statistical techniques**: The statistical techniques like depth, distance, derivation and density based techniques can be applied on numeric data objects/sets.
2. **Web Text Outlier Mining Algorithm:** This computes the difference in web texts within a certain domain.
3. **WCO-ND algorithm:** This algorithm is designed to determine the similarity between different but related words in text processing.

All the above discussed algorithms make use of web texts present in the various web documents. For example, consider the following scenario for a web search engine.

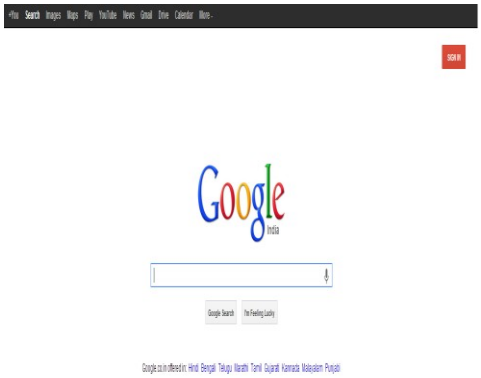


Figure1

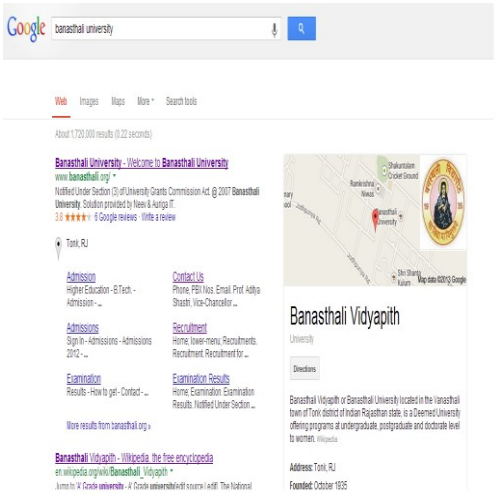
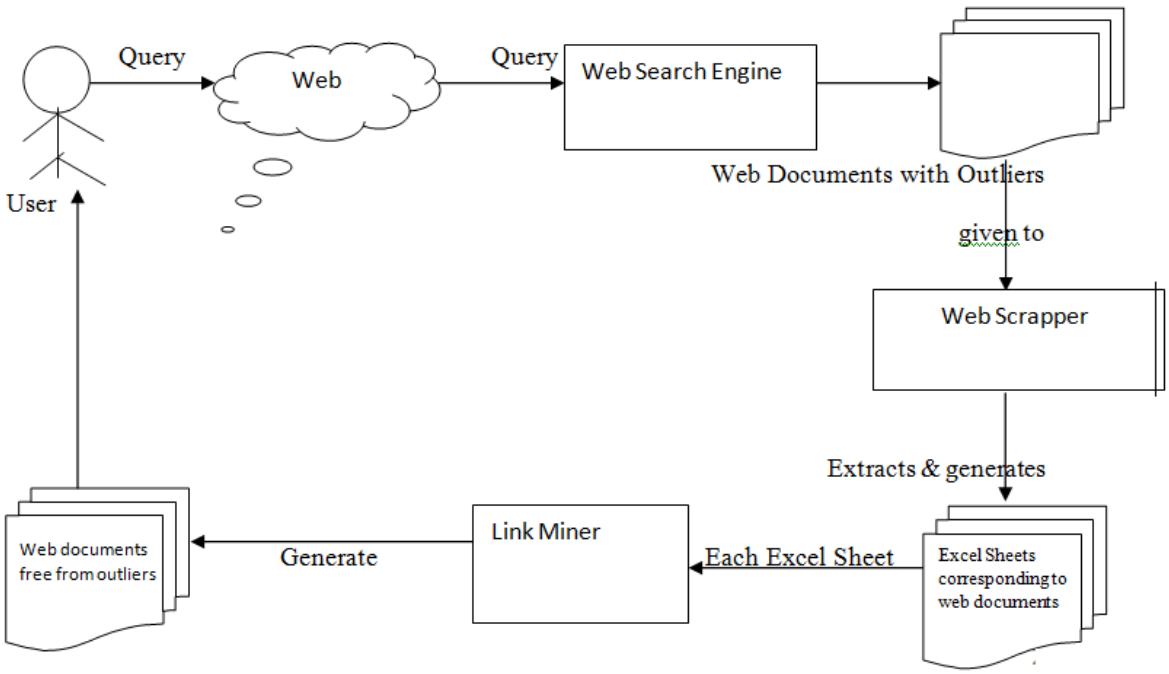


figure2

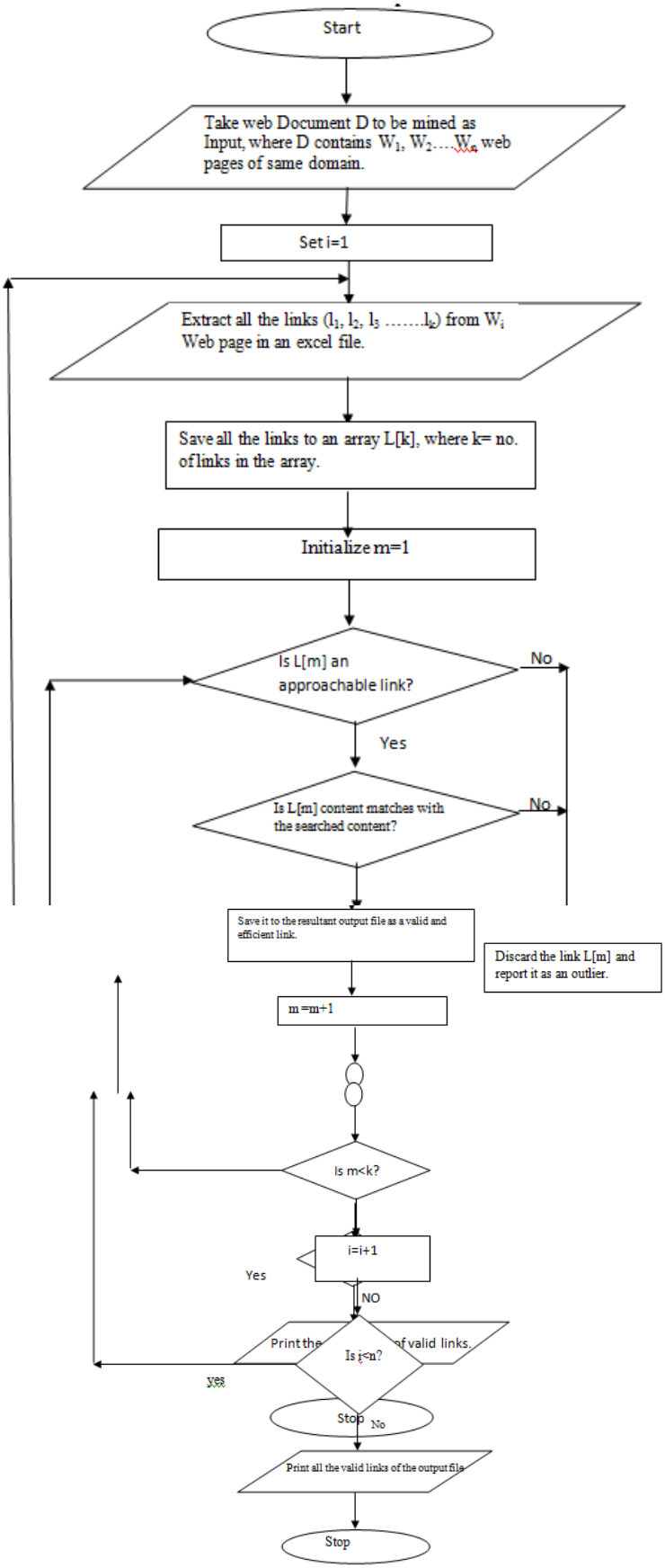
In figure1 Google search engine is there and in figure2, after searching **Banasthali** by Google, list of web documents containing hyperlinks (not the simple text related to Banasthali) is listed. That is why, the above simple web discussed algorithms are not sufficient to yield the desired and efficient output.

IV. Architecture of the proposed system

In the proposed system, query given by the user is searched using a web scrapper. Web search engine, opened in web scrapper, then generates a list of related web pages. Each web page is preprocessed by extracting all the links in an excel file. Now corresponding to each page, a separate excel file on the disk is placed. After this, each excel file is processed by a programming code to eliminate the web structure outliers.



V. Proposed Flowchart



VI. Proposed Algorithm

Step1:- Enter the query on the web search engine opened in the web scrapper.

Step2:- Take the input as document D to be mined.

Step3:- Document D is consisted of:

$$D=\bigcup_{i=1}^{n} W_i$$

Where i=1, 2, 3……n web pages.

Step4:- Initialize i=1

Step5:- Assign $L[K]=\bigcup_{t=1}^{k} L_t$

Where L=name of array whose elements are links from web page W_i

L=name of array whose elements links from webpage W_i

t=1, 2, 3……K where k= total no. of links in W_i

Step6:- Our aim is to find the web structure outlier from W_i which are the links not related to searched content as well as not reachable that means the fake hyperlinks.

Step7:- We can say $D=\bigcup_{I=1}^{n} W_I = \bigcup_{i=1}^{n} \left(\bigcup_{t=1}^{k} L_t\right)_i$

Step8:- for m=1 to k, check whether L_m of L[k](which is equivalent to $L[k]=\bigcup_{m=1}^{k} L_m$) where m=1, 2..k

At first instance, m=1 L [1] is

(i) A valid hyperlink or not by checking through a java code.

(ii) A hyperlink related to the searched content or not.

Step9:- If (i) and (ii) are true then repeat the above step8 for k times.

Step10:- Repeat both the step8 & 9 for n times so that we can remove outliers from all the web pages contained in a document 'D'.

VII. Observations

Elimination of outliers results in the reduction of space and time complexity. Quality of search engine gets increased as web content is efficient and relevant to the searched content. In statistics, we have a measurement to find the quality of refined pages which is known as Precision. It can be defined as the ratio between the number of relevant pages and the total number of relevant documents returned after the elimination of outliers [9].

$$\text{Precision} = \frac{\text{Relevant documents retrieved originally}}{\text{Refined documents retrieved}}$$

VIII. Future Work

Web mining is a growing research area in data mining research. This paper proposes an algorithm to find the outliers to improve the efficiency of web search engine. Future work aims at experimental evaluation and comparative study of our algorithm with results of existing web content mining algorithms.

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A Novel Approach for Examination of Visually Challenged Candidates by E-Evaluation Techniques

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ABSTRACT : *The evaluation of physically challenged is always a challenging task as any evaluation of them is compared with that of normal candidates. The case of visually challenged is still more difficult as vision is a nunerouno sensor in the field of study and knowledge enhancement and evaluation of them on par with other candidate is very difficult. The aim of this paper is to present an approach for E-evaluation model for the visually challenged students/candidates for the screening tests conducted by the different examination authorities. The major attempt is made to use the personal computer and avoid the use of a scriber by the candidate so that candidate can take the exam independently. A portion of the PC keyboard is slightly modified in its software functionality to help them in undergoing the test. Also described is the functioning of this model of E-Evaluation and its relative advantages.*

Keywords: *E-evaluation, PC keyboard, visually challenged candidate*

I. INTRODUCTION

Electronic evaluation (or e- evaluation) is a type of Technology supported evaluation where the medium of instruction is through computer and communication technologies. E-evaluation is a part of e-learning and evaluation is a process to assess a candidate. E-learning is benefiting the sections of the human society hitherto that was very difficult to make learning in those sections like people from rural areas, Working personal, Physically challenged etc… One of those vulnerable sections of the society is Visually Challenged Candidates (VCC). This paper gives a novel approach for the E-evaluation of the visually challenged people which can be compared to be on par with the examination of other normal candidates.

1.1 THE CHALLENGE OF A VCC :In one of the developing country like India, as per the 2001 population census [1], 10.635 million people (about 1%) are visually impaired, i.e., one person in every hundred is suffering from visual impairment. It is an inhumane from our part if such a large chunk of population is denied the chances and rights on par with others. Most of these persons are not opting for higher education and thus for good jobs because of the obstacles in learning, qualifying and also related problems in writing exams. Some Universities do not admit the visually impaired at all, while some are giving them admissions with a limited option of subjects. Most of the reasons as told by them are the problems involved in evaluation & teaching then on par with normal students.

Under this challenging environment, even when some VCCs get qualified in the University exams, next problem they face is the hurdle of screening tests or competitive exams conducted for the jobs by different recruiting agencies like Union and State Public service commissions, Companies, Boards etc. In one of the ad [2], a job recruiting agency prescribes the rules for VCCs as: 1) the candidate has to arrange candidate's own scribe/writer at candidate's own cost. 2) The scribe/writer must be in at least one grade junior in academic qualification to the candidate. 3) Scribe/writer should be one possessing marks of 50% or less. 4) Candidate should be from an academic discipline other than that of the candidate. 5) Both candidate and scriber shall have to give a suitable undertaking conforming that the scribe fulfils all the stipulated eligibility criteria. 6) They will be given 20 minutes extra for every one hour of the exams [3]. The careful observation of these above rules show us the difficulties faced by a VCC candidate.

In this technological age where a number of electronic gadgets are available and software has penetrated in to every aspect of our life, the methods of E-learning and E-evaluation can be used to reduce the hurdles of the VCC candidate [4][5] . This paper gives a model where in it explains an approach on how a VCC can take a screening test using E-gadgets and without any scriber's help.

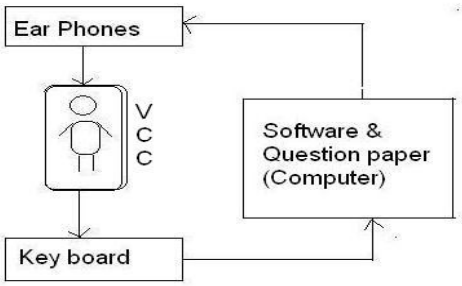
II. THE COMPONENTS OF THE E-EVALUATION MODEL

In this model of E-evaluation for VCCs, the gadgets required are a personal computer with a keyboard, an earphone and a CD/storage devise (with E-evaluation software and question paper). The candidate undergoing exam has to use these gadgets during candidate's evaluation. This model is aimed for the objective type exams that are most common for the screening tests. The algorithm that is to be followed by the evaluation

program software is presented in this paper and it explains how a VCC takes an exam and how candidate's evaluation is carried out without the help of any other person.

The components of this model are :- a) a computer with program software and question paper and answer sheet(QA sheet) in the CD, b) Earphones, c) Keyboard and d) Visually Challenged candidate taking the exam. The course of evaluation of VCC requires the complimentary use of these components as shown in Fig-1.

Fig-1



2.1 Computer -This is the platform on which a VCC takes this exam/screening test. It can be a general configuration Personal computer with a CPU, monitor, keyboard, CD player with read/write facility, earphone facility etc. This type of computer setup is now a common hardware easily available in any examination centre.

2.2 Keyboard - This is a single way interface between the software and the candidate by which VCC answers and controls the question paper. Only a small portion (right side of the board) of the ordinary computer keyboard is to be used by the candidate. The keys of this portion of the keyboard (Fig-2A) are to be pasted with symbols as shown in the Fig-2B below. On enough practice even this may not be required by the candidate. The functions of the symbols/keys are explained in below table.

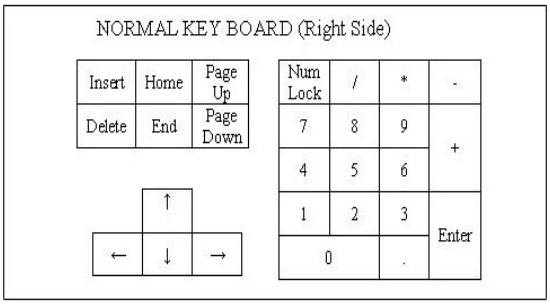


Fig-2A

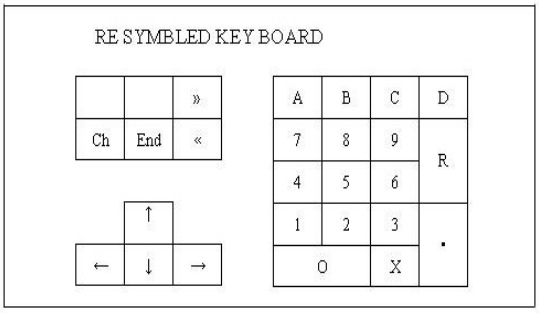


Fig-2B

The nornal keyboard with its general symbols is shown in Fig- 2A. The modified key board functions differently with its symbols changed as shown in Fig-2B. This is done by the program software of the CD when inserted into PC for the evaluation purpose. This modification is essential and critical as this is the media by which the VCC interacts with the QA sheet. The functions of the new symbols are shown in Fig-3.

Fig-3

Symbol	Function
A ,B, C, D	Answers for the Question
0,1,2,3,4,5,6,7,8,9	Question No or other any No
.	Enter to go next or whenever called
↑ , ↓ , → ,←	for previous or next Question
« , »	For previous or next section
R	For repeating the question
X	For canceling the answer
CH	Check the already answered question
E	End

2.3 Earphones-This is also a single way interface [6] between the software and the candidate by which VCC hears the instructions and questions from the CD.

2.4 C.D./Storage device-This is the storage device and resembles in a way similar to a question paper and answer sheet to a normal candidate. This also contains the program software to run the exam and give instructions to the candidate. This is a password protected read-write device and two passwords are required to open it. One password has to be entered by the examiner / invigilator and the other by the VCC candidate. Candidates password can be given in candidate's hall ticket.

III. Algorithm Of The Software

The software developed for this e-evaluation uses the text reading software as a subroutine. Texts reading software is now-a-days became common and are used in many fields. The program software designed for our purpose reads the instructions and questions for the candidate. It takes the commands from the keyboard and operates the next function (i.e. marks/changes the answer sheet and reads the next question / message) as described in below algorithm. The answer sheet gets updated on the entering of keys-A, B, C or D. End of every question or instruction reading waits for a command from keyboard and every entry from keyboard results in reading of next question / instruction.

Proposed algorithm:

Step1: Enter the CD into Computer.
// Auto playing CD and Software gets installed into the PC.

Step2: Enter the password of the Invigilator.
// Invigilator has to enter candidate's password and Time gets displayed and invigilator reads the same.

Step3: Enter the password of the VC candidate.
//Candidate has to enter candidate's password and now program opens

Step4: Enter the language code.
//For entering language code (optional), Eg: 1-English, 2-Hindi, 3-Telugu, 4-Tamil
Or this can be set with the invigilator from the application form)

Step5: Explains the details of the exam and question paper.
//Software explains the details of the exam, Question paper, Rules and Regulations etc…
//All these are heard by candidates through ear phone.

Step6: Exam starts
//Reads first question

Step7: Candidate can do anyone of the following action

(i) *Press A or B or C or D for answering the question or*

(ii) *Press R for re-read the question or*

(iii) *Press* → ↓ *for go to next question or*

(iv) *Press* ← ↑ *for go to previous question or*

(v) *Press >> for go to next section* — *asks for Q1 or*

(vi) *Press << for go to previous section* — *Enter Q.No.*

(vii) *Press XYZ question number*

After all questions are answered/read

(viii) *Press CH to check the answered question*
1. *Reads Q.No. from start and Enter section >>, <<*
2. *After hearing the Question and Answer press. for "OK- No changes" or press * for "Cancel the Answer".*
3. *if * is pressed, then enter the new answer - Press A or B or C or D*
4. *Press CH to go to next answered question – step (viii) repeats*
5. *Press . to go to next unanswered question.- step (ix) follows*

(ix) *Press . check the unanswered question*
1. *Reads unanswered questions from start*
2. *Step7 repeats*

Step8: Submit the answered paper **or** if time elapses the program will close

Step9: End

IV. Exam Course

Generally before the start of any exam, there will be some pre exam work. In most of the cases it involves: filling of hall ticket no, writing of name of exam, year, paper code etc. But in this case, the pre exam involves the entry of Passwords. The CD has to come with all the information filled in the exam application form of the VCC. As the CD is inserted in the computer, it auto plays the program. In this CD, the time duration of the exam is already set and the invigilator reads out the time to the candidate after entering his password. Then the candidate has to enter candidate's password. Before the actual start of exams, the instructions and the details of the question paper are to be read by the computer and the candidate hears it though the earphones.

With the pre exam work completed, the VCC is ready for the exam. At the exact time, exam starts with the reading of Question no-1. The candidate starts answering using the keyboard and the answer sheet in the CD gets updated as shown in the above algorithm. The exam ends automatically with the lapse of time as the time period is already set in the program. The Program automatically closes the CD with the end of the exam.

4.1 EVALUATION OF THE EXAM PAPER

The CD of the paper completed by VCC can be read /opened with a secured password for the evaluation purpose. There are two ways of evaluation of this paper:

1) Evaluation can be done by getting the QA sheet printed and then corrected in the normal procedure or
2) From this CD, a softcopy of the QA sheet has to be taken and giving this to the evaluation computer directly, we can get the result.

4.2 ADVANTAGES OF THIS MODEL

This model evaluation of a VCC has many advantages over other existing systems of evaluation. The advantages are:

1) It uses the existing computer hardware facilities at the examination center. Only ear phones and CDs are to be supplied by the Examination / recruiting agencies.
2) As there is no use of scribe, there is a total confidence on a candidate's performance and evaluation
3) As no external help is required for the VCC candidate, this model makes candidate independent like normal candidate. Also the burden of getting the proper scribe [3] is taken away from the candidate.
4) Candidate can practice this model if candidate is given a model CD with the issue of hall ticket and candidate can learn it with least difficulty as number of gadgets to be operated is few.
5) Due to the use of limited no of keys and that to a particular part of the keyboard, this model is user friendly.
6) It is a language independent; an objective type test in any language can be conducted for the VCC, provided the text reading software is available in that language.

For getting better results this model is to be practiced by the candidate before exam. This can be made practiced in VCC rehabilitation centers, colleges, etc. to get accustomed by the candidate. A practice CD is to be issued by examination/recruiting agency with the issue of candidate's hall ticket. Whether extra time can be given to the VCC undergoing evaluation in this model can be decided by an expert committee involving VCC. An efficient text reading software is to be selected for a success of this model.

V. Conclusion

An effort has been made to evolve a friendly and secured model to evaluate a Visually Challenged Candidate. The approach of this model is created by making use of the generally available e-gadgets and the software technology to make a VCC to take an objective type test without the help of a scriber/writer. Further attempts are to be made to realize software and make a sample survey to tune the program for its effectiveness.

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Steganography
Technique of Sending Random Passwords on Receiver's Mobile (A New Technique to Hide Information File with an Image)

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Abstract: *Steganography is the art of hiding the fact that communication is taking place, by hiding information in other information. There are many application of Steganography with different carrier file format. Here we perform Steganography Technique with sending OTP on receiver mobile, which is one of the best secured technique in current scenario. This technique is hiding file information into image with OTP password that is only known by receiver. And can decrypt using that OTP only this is pure Steganography. Pure Steganography means that there is none prior information shared by two communication parties. We are not sharing OTP information by two communication parties. So this is more secure than other technique.*
Key Words : *Steganography, OTP, ICT, Password, IP, UDP, SIHS, LSB.*

I. Introduction

One of the reasons that intruders can be successful is the most of the information they acquire from a system is in a form that they can read and comprehend. Intruders may reveal the information to others, modify it to misrepresent an individual or organization, or use it to launch an attack. One solution to this problem is, through the use of Steganography. Steganography is a technique of hiding information in digital media. In contrast to cryptography, it is not to keep others from knowing the hidden information but it is to keep others from thinking that the information even exists.

Steganography become more important as more people join the cyberspace revolution. Steganography is the art of concealing information in ways that prevents the detection of hidden messages. Steganography include an array of secret communication methods that hide the message from being seen or discovered.

Due to advances in ICT, most of information is kept electronically. Consequently, the security of information has become a fundamental issue. Besides cryptography, Steganography can be employed to secure information. In cryptography, the message or encrypted message is embedded in a digital host before passing it through the network, thus the existence of the message is unknown. Besides hiding data for confidentiality, this approach of information hiding can be extended to copyright protection for digital media: audio, video and images.

The growing possibilities of modern communications need the special means of security especially on computer network. The network security is becoming more important as the number of data being exchanged on the internet increases. Therefore, the confidentiality and data integrity are requires to protect against unauthorized access and use. This has resulted in an explosive growth of the field of information hiding Information hiding is an emerging research area, which encompasses applications such as copyright protection for digital media, watermarking, fingerprinting, and Steganography.

Steganography hide the secrete message within the host data set and presence imperceptible and is to be reliably communicated to a receiver. The host data set is purposely corrupted, but in a covert way, designed to be invisible to an information analysis.

II. What is Steganography?

- Steganography is the practice of hiding private or sensitive information within something that appears to be nothing out to the usual. Steganography is often confused with cryptology because the two are similar in the way that they both are used to protect important information. The difference between two is that Steganography involves hiding information so it appears that no information is hidden at all. If a person or persons views the object that the information is hidden inside of he or she will have no idea that there is any hidden information, therefore the person will not attempt to decrypt the information.
- What Steganography essentially does is exploit human perception, human senses are not trained to look for files that have information inside of them, although this software is available that can do what is called Steganography. The most common use of Steganography is to hide a file inside another file.

III. History of Steganography:

Through out history Steganography has been used to secretly communicate information between people. Some examples of use of Steganography is past times are:

During World War 2 invisible ink was used to write information on pieces of paper so that the paper appeared to the average person as just being blank pieces of paper. Liquids such as milk, vinegar and fruit juices were used, because when each one of these substances are heated they darken and become visible to the human eye.

In Ancient Greece they used to select messengers and shave their head, they would then write a message on their head. Once the message had been written the hair was allowed to grow back. After the hair grew back the messenger was sent to deliver the message, the recipient would shave off the messengers hair to see the secrete message.

IV. Project Scope:

This paper is developed for hiding information in any image file. The scope of the paper is implementation of Steganography tools for hiding information includes any type of information file and image files and the path where the user wants to save Image and extruded file.

V. Methodology:

User needs to run the application. The user has two tab options – encrypt and decrypt. If user select encrypt, application give the screen to select image file, information file and option to save the image file. If user select decrypt, application gives the screen to select only image file and ask path where user want to save the secrete file.

This project has two methods – Encrypt and Decrypt.

- In encryption the secrete information is hiding in with any type of image file.
- Decryption is getting the secrete information from image file.

VI. Steganography vs Cryptography:

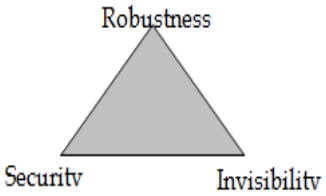
Basically, the purpose of cryptography and Steganography is to provide secret communication. However, Steganography is not the same as cryptography. Cryptography hides the contents of a secrete message from a malicious people, whereas Steganography even conceal the existence of the message. In cryptography, the system is broken when the attacker can read the secret message. Breaking a Steganography system need the attacker to detect that Steganography has been used.

It is possible to combine the techniques by encrypting message using cryptography and then hiding the encrypted message using Steganography. The resulting stego-image can be transmitted without revealing that secret information is being exchanged.

VII. Steganography vs Watermarking:

Steganography pay attention to the degree of Invisibility while watermarking pay most of its attribute to the robustness of the message and its ability to withstand attacks of removal, such as image operations(rotation, cropping, filtering), audio operations(rerecording, filtering)in the case of images and audio files being watermarked respectively.

It is a non-questionable fact that delectability of a vessel with an introduced data (Steganography message or a watermark) is a function of the changeability function of the algorithm over the vessel.



That is the way the algorithm changes the vessel and the severity of such an operation determines with no doubt the delectability of the message, since delectability is a function of file characteristics deviation from the norm, embedding operation attitude and change severity of such change decides vessel file delectability.

A typical triangle of conflict is message Invisibility, Robustness, and Security. Invisibility is a measure of the in notability of the contents of the message within the vessel.

Security is sinominous to the cryptographic idea to message security, meaning inability of reconstruction of the message without the proper secret key material shared.

Robustness refers to the endurance capability of the message to survive distortion or removal attacks intact. It is often used in the watermarking field since watermarking seeks the persistence of the watermark over attacks, steganographic messages on the other hand tend to be of high sensitivity to such attacks. The more invisible the message is the less secure it is (cryptography needs space) and the less robust it is (no error checking/recovery introduced).The more robust the message is embedded the more size it requires and the more visible it is.

VIII. Applications of Steganography

Steganography is applicable to, but not limited to, the following areas.

- Confidential communication and secret data storing
- Protection of data alteration
- Access control system for digital content distribution
- Media Database systems

The area differs in what feature of the Steganography is utilized in each system.

8.1. Legitimate Use

Steganographic techniques have obvious uses, some legitimate, some less so, and some are likely illegal. The business case for protection of property, real and intellectual is strong. The watermarking of digital media is constantly improving, primarily in an attempt to provide hardened watermarks or proof of ownership.
Individuals or organizations may decide to place personal/private/sensitive information in Steganographic carriers. Admittedly, there are usually better ways to manage this task. One can liken these applications to the use of a deadbolt lock on a door. The deadbolt will keep honest people honest, but those determined to break and enter can simply break a window and gain entry. With advances in Steganography, it is possible that this medium could serve as a relatively secure storage/transmission method.

8.2. Illegal Use

Other uses for Steganography range from the trivial to the abhorrent. There are claims that child pornography may be lurking inside innocent image or sound files. While this is entirely possible, a search on the internet for confirmation of this claim was unsuccessful.
An annual report on High Technology crime lists nine common types of computer crime:

- Criminal communications
- Fraud
- Hacking
- Electronic payments
- Gambling and pornography
- Harassment
- Intellectual property offenses
- Viruses
- Pedophilia

In examining this list, one can identify several of these areas where Steganography could be used, especially considering the broad term "criminal communications." If one includes Steganographic techniques other than computer related, the potential grows even more.

In terms of computer security, there are some areas to be aware of. One area that has potential far ranging implications is "A protocol that uses Steganography to circumvent network level censorship." The author, Bennet Haselton, the coordinator of Peacefire.org (an organization that "opposes censorship that targets Internet users under 18…") describes a protocol that is "undetectable to censors."
Finally, computer warfare should be addressed. In his Masters Thesis, Jordan T. Cochran, Captain, USAF investigates Steganographic virus attacks. He finds that "The results indicate that Steganography tools are not conducive to be sole attack weapons. However, the tools combined with other applications could be used to automatically extract the hidden information with minimal user intervention."

In another Masters Thesis, Dale A. Lathrop, Captain, USAF also investigates the possibility of virus attacks using Steganographic techniques. He finds that "The results of this research indicate that the use of a separate engine followed by an HTML-based electronic mail message containing a photographic image with a Steganographically embedded virus or other payload is a vulnerable attack if implemented without the proper environment variables in place." He further finds that "it still requires human intervention to initiate the virus attack."

For those who find themselves as first responders in electronic crimes, the "Electronic Crime Scene Investigation, A Guide for First Responders" written in July 2001 is freely available on the internet. This publication offers basic, sound advice in the preservation and investigation of electronic crime scenes, and does give mention to Steganography.

IX. Future Enhancements, Future Considerations:

- To make it pure Steganography application with multiple password.
- Due to time and computing limitations, we cannot explore all facets of Steganography and detection techniques. As we studied the power in our pictures to test for hidden data. Another method which we were unable to explore was to analyze the noise of the pictures. Adding hidden data adds random noise, so it follows that a properly tuned noise detection algorithm could recognize whether or not a picture had Steganography data or not.

9.1. Future Steganography

According to Richard E. Smith (a data security expert), he doesn't "see many practical uses for Steganography because it only works as long as nobody expects you to use it." The author respectfully takes exception to this statement. Initially after reading this statement, the myth that Charles H. Duell, Commissioner of Patents in 1899 had declared that the Patent Office should be closed because everything that could possibly be invented had already been invented came to mind. Perhaps the computer security community should give up on endless patches, security applications, etc because they only work if nobody expects that they are in use. To quote Dale Carnegie, "Most of the important things in the world have been accomplished by people who have kept on trying when there seemed to be no hope at all."

There are ongoing studies to harden Steganographic images from steganalysis. In his paper, "Defending Against Statistical Steganalysis," Provos presents new methods which would allow one to select a file in which a message might be safely hidden and resistant to standard statistical analysis.

X. Objective

The goal of this Steganography system is to convert communication. So, a fundamental requirement of this Steganography system is that the hider message carried by Stego-media should not be sensible to human beings. The other goad of Steganography is to avoid drawing suspicion to the existence of a hidden message. This approach of information hiding technique has recently became important in a number of application area
This project has following objectives:

- To product security tool based on Steganography techniques.
- To explore techniques of hiding data using encryption module with more secure random password only known by receiver.
- To extract techniques of getting secret data using decryption module by authenticate user.
- Steganography sometimes is used when encryption is not permitted. Or, more commonly, Steganography is used to supplement encryption. An encrypted file may still hide information using Steganography, so even if the encrypted file is deciphered, the hidden message is not seen

XI. Overview

The word Steganography comes from the Greek "***Steganos***", which mean ***covered or secret*** and – "***graphy***" mean **writing or drawing**. Therefore, Steganography means, literally, covered writing. It is the art and science of hiding information such its presence cannot be detected and a communication is happening. A secrete information is encoding in a manner such that the very existence of the information is concealed. Paired with existing communication methods, Steganography can be used to carry out hidden exchanges. The main goal of this paper it to communicate securely in a completely undetectable manner and to avoid drawing suspicion to the transmission of a hider data. There has been a rapid growth of interest in Steganography for two reasons:
The publishing and broadcasting industries have become interested in techniques for hiding encrypted copyright marks and serial numbers in digital films, audio recordings, books and multimedia products
Moves by various governments to restrict the availability of encryption services have motivated people to study methods by which private messages can be embedded in seemingly innocuous cover messages.
The basic model of Steganography consists of Carrier, Message and password. Carrier is also known as cover-object, which the message is embedded and serves to hide the presence of the message.
Basically, the model for Steganography is shown on following figure:

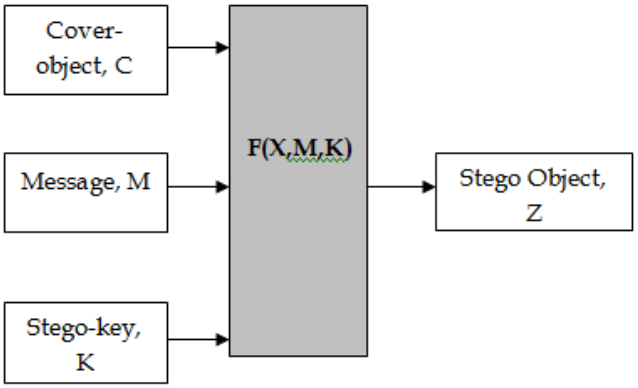


Figure 1 CONCEPT OF STEGANOGRAPHY

Message is the data that the sender wishes to remain it confidential. It can be plain text, cipher text, other image, or anything that can be embedded in a bit stream such as a copyright mark, a covert communication, or a serial number. Password is known as *Stego-key*, which ensures that only recipient who knows the corresponding decoding key will be able to extract the message from a *cover-object*. The *cover-object* with the secretly embedded message is then called the *Stego-object*.

Recovering message from a *Stego-object* requires the *cover-object* itself and a corresponding decoding key if a *Stego-key* was used during the encoding process. The original image may or may not be required in most applications to extract the message. There are several suitable carriers below to be the *cover-object:*

- Network protocols such as TCP, IP and UDP
- Audio that using digital audio formats such as wav, midi, avi, mpeg, mpi and voc
- File and Disk that can hides and append files by using the slack space
- Text such as null characters, just alike morse code including html and java
- Images file such as bmp, gif and jpg, where they can be both color and gray-scale.
- In general, the information hiding process extracts redundant bits from *cover-object.* The process consists of two steps:
- Identification of redundant bits in a *cover-object.* Redundant bits are those bits that can be modified without corrupting the quality or destroying the integrity of the *cover-object.*
- Embedding process then selects the subset of the redundant bits to be replaced with data from a secret message. The *Stego-object* is created by replacing the selected redundant bits with message bits

XII. Requirements:

12.1. Software Requirements:

- .NET Framework 3.5

12.2. Hardware Requirements:

- Processor: Preferably 1.0 GHz or Greater.
- RAM : 1.0 GB or Greater.

XIII. Steganography Techniques:

Over the past few years, numerous Steganography techniques that embed hidden messages in multimedia objects have been proposed. There have been many techniques for hiding information or messages in images in such a manner that alteration made to the image is perceptually indiscernible. Commonly approaches are includes LSB, Masking and filtering and Transform techniques. Least significant bit (LSB) insertion is a simple approach to embedding information in image file. The simplest Steganography techniques embed the bits of the message directly into least significant bit plane of the cover-image in a deterministic sequence. Modulating the least significant bit does not result in human perceptible difference because the amplitude of the change is small. In this technique, the embedding capacity can be increased by using two or more least significant bits. At the same time, not only the risk of making the embedded message statistically detectable increase but also the image fidelity degrades. Hence a variable size LSB embedding schema is presented, in which the number of LSBs used for message embedding/extracting depends on the local characteristics of the pixel. The advantage of LSB-based method is easy to implement and high message pay-load.

Although LSB hides the message in such way that the humans do not perceive it, it is still possible for the opponent to retrieve the message due to the simplicity of the technique. Therefore, malicious people can easily try to extract the message from the beginning of the image if they are suspicious that there exists secret information that was embedded in the image.
Therefore, a system named Secure Information Hiding System (SIHS) is proposed to improve the LSB scheme. It overcomes the sequence-mapping problem by embedding the massage into a set of random pixels, which are scattered on the cover-image. Masking and filtering techniques, usually restricted to 24 bits and gray scale image, hide information by marking an image, in a manner similar to paper watermarks. The technique perform analysis of the image, thus embed the information in significant areas so that the hidden message is more integral to cover image than just hiding it in the noise level.

Transform techniques embed the message by modulating coefficient in a transform domain, such as the Discrete Fourier Transform, or Wavelet Transform. These methods hide messages in significant areas of the cover image, which make them more robust to attack. Transformations can be applied over the entire image, to block throughout the image, or other variant.

13.1. Image Steganography and bitmap pictures:

Using bitmap pictures for hiding secret information is one of most popular choices for Steganography. Many types of software built for this purpose, some of these software use password protection to encrypting information on picture. To use these software you must have a 'BMP' format of a pictures to use it, but using other type of pictures like "JPEG", "GIF" or any other types is rather or never used, because of algorithm of "BMP" pictures for Steganography is simple. Also we know that in the web most popular of image types are "JPEG" and other types not "BPM", so we should have a solution for this problem. This software provide the solution of this problem, it can accept any type of image to hide information file, but finally it give the only "BMP" image as an output that has hidden file inside it.

13.2. Bitmap Steganography:

Bitmap type is the simplest type of picture because that it doesn't have any technology for decreasing file size. Structure of these files is that a bitmap image created from pixels that any pixel created from three colors (Red, Green and Blue said RGB) each color of a pixel is one byte information that shows the density of that color. Merging these three colors makes every color that we see in these pictures. We know that every byte in computer science is created from 8 bit that first bit is Most-Significant-Bit (MSB) and last bit Least-Significant-Bit (LSB), the idea of using Steganography science is in this place; we use LSB bit for writing our security information inside BMP pictures. So if we just use last layer (8st layer) of information, we should change the last bit of pixels, in other hands we have 3 bits in each pixel so we have **3*hight*width** bits memory to write our information. But before writing our data we must write name of data (file), size of name of data & size of data. We can do this by assigning some first bits of memory (8st layer).

(00101101 00011101 11011100)
(10100110 11000101 00001100)
(11010010 10101100 01100011)

Using each 3 pixel of picture to save a byte of data Difference between previous and current system graphical representation is as follows:

XIV. Previous System of Steganography :

Steganography system requires any type of image file and the information or message that is to be hidden. It has two modules encrypt and decrypt.
Microsoft .Net framework prepares a huge amount of tool and options for programmers that they simples programming. One of .Net tools for pictures and images is auto-converting most types of pictures to BMP format. I used this tool in this software called "Steganography" that is written in C#.Net language and you can use this software to hide your information in any type of pictures without any converting its format to BMP (software converts inside it).
The algorithm used for Encryption and Decryption in this application provides using several layers lieu of using only LSB layer of image. Writing data starts from last layer (8st or LSB layer); because significant of this layer is least and every upper layer has doubled significant from its down layer. So every step we go to upper layer image quality decreases and image retouching transpires.
The encrypt module is used to hide information into the image; no one can see that information or file. This module requires any type of image and message and gives the only one image file in destination.

The decrypt module is used to get the hidden information in an image file. It take the image file as an output, and give two file at destination folder, one is the same image file and another is the message file that is hidden it that.

Before encrypting file inside image we must save name and size of file in a definite place of image. We could save file name before file information in LSB layer and save file size and file name size in most right-down pixels of image. Writing this information is needed to retrieve file from encrypted image in decryption state. The graphical representation of this system is as follows:

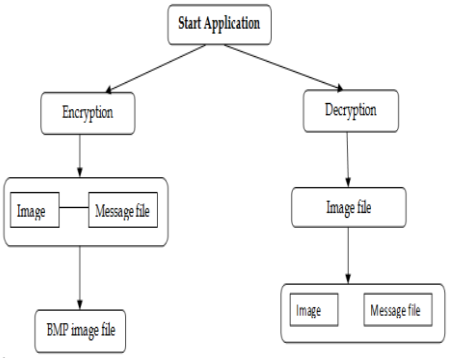


Figure 2 PREVIOUS SYSTEM OF STEGANOGRAPHY

14.1. Current System of Steganography:

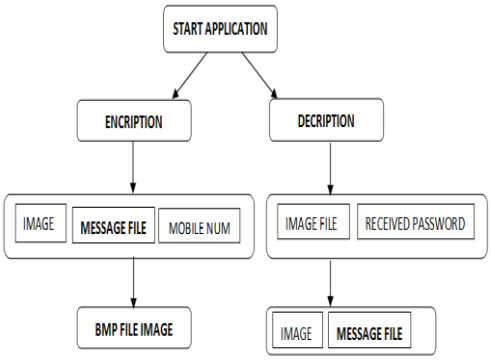


Figure 3 CURRENT SYSTEM OF STEGANOGRAPHY

XV. Limitations of the Software:

This paper has an assumption that is both the sender and receiver must have shared some secret information before imprisonment. Pure Steganography means that there is none prior information shared by two communication parties.

XVI. Conclusion:

Steganography is a really interesting subject and outside of the mainstream cryptography and system administration that most of us deal with day after day. Steganography can be used for hidden communication. We have explored the limits of Steganography theory and practice. We printed out the enhancement of the image Steganography system using LSB approach to provide a means of secure communication. A Stego-key has been applied to the system randomly by system during embedment of the message into the cover image. Stego-key is only known by receiver than remove the previous system drawback, because pure Steganography do not share any common information at both end sender and receiver.

This Steganography application software provided for the purpose to how to use any type of image formats to hiding any type of files inside their. The master work of this application is in supporting any type of pictures without need to convert to bitmap, and lower limitation on file size to hide, because of using maximum memory space in pictures to hide the file. Since ancient times, man has found a desire in the ability to communicate covertly. The recent explosion of research in watermarking to protect intellectual property is evidence that Steganography is not just limited to military or espionage applications. Steganography, like cryptography, will play an increasing role in the future of secure communication in the "digital world".

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A survey on context aware system & intelligent Middleware's

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Abstract: *Context aware system or Sentient system is the most profound concept in the ubiquitous computing. In the cloud system or in distributed computing building a context aware system is difficult task and programmer should use more generic programming framework. On the basis of layered conceptual design, we introduce Context aware systems with Context aware middleware's. On the basis of presented system we will analyze different approaches of context aware computing. There are many components in the distributed system and these components should interact with each other because it is the need of many applications. Plenty Context middleware's have been made but they are giving partial solutions. In this paper we are giving analysis of different middleware's and comprehensive application of it in context caching.*
Keywords: *Context aware system, Context aware Middleware's, Context Cache*

I. INTRODUCTION

The Context aware or Sentient systems are comes under pervasive computing. Weiser (1991) introduced pervasive which refers to the integration of mobile devices such as notebook, PDAs, smartphones etc into the humans everyday life. It is expected that the services should react specifically to their time, places and current locations. Context can be refer as location, identities of nearby people and object, and changes to those objects. The situation of entity can be characterized by context. Users profile, device status, networking information or sensors are the ways to retrieve context information. The first context aware application is developed by Want et. al. (1992) which is based on Active badge Location System. According to the users current location, location-aware tour guide applications developed in middle 1990s. (Abowd et. al., 1997; Sumi et. al., 1998; Cheverest et. al., 2000)

Person's emotional state, focus of attention, place, time and date, people in the user's environment can be defined as the sentient defined by Dey (1998). Hull et al. (1997) describe context as the aspects of the current situation. Brown defines context to be the elements of the user's environment which the computer knows about. Most context aware systems make use of external sentient factors as they provide useful data, such as place information. Furthermore, external attributes are easy to sense by using off-the-shelf sensing technologies. *Watson Project* used logical data (Budzik and Hammond, 2000) and the *IntelliZap Project* (Finkelstein et al., 2001) which support the user by giving useful information due to information read out of web pages, records etc. When dealing with sentient, three entities can be differentiated (Dey and Abowd, 2001): *places* (rooms, buildings etc.), *people* (individuals or groups) and *things* (physical objects, Mobile Component, computer components etc.). These entities may be given by various attributes which can be classified into four categories: *identity* (each entity has a unique identifier), *location* (an entity's position, co-location etc.), *status* (or activity, meaning the properties of an entity, e.g., heat and lightning for a room, processes running currently on a mobile etc.) and *time* (used for timestamps to define events etc.).

II. APPROACHES

The implementation of context-aware system can be done in many ways. The result and system implementation changes when the sensors are at local or remote places. The system users or number of people can change the approach to implement context aware system. These different implementation approaches of the context aware system is given by Matthias Baldauf, Dustdar, S. & Rosenberg [17] are as follows :
1) Sensor Fetching
2) Middleware Implementation
3) Context Server
4) Networked Services
In this section we can briefly explain the concept of all approaches

2.1 Sensor Fetching-

This approach is not used into the distributed system because devices with sensors are locally built in. The application which resides on to the users device can fetch information directly through the sensors. The sensor drivers are hardwired into the application. It will fetch data directly from the sensors so it can be a hard task for the concurrent servers.

2.2 Middleware Implementation-

This approach is useful because it introduces the layered architecture to context aware system. The technique called Encapsulation is applicable in this case because it can hide the implementation details which can be useful for the business purpose. It can be used in caching the contextual data.

2.3 Context Server-

In this approach multiple clients can access the remote data source. So the concept of middleware approach not only act as a broker but also act as a federated broker architecture. Gathering of data from the sensors is now moved to this so called context server. The reuse of these sensors can be neglected by using context servers. This can leads to the increase in power consumption and disk space of devices rather than attached to the sensors.

2.3 Networked Services-

This approach is not so useful as the widget architecture because of complex network based components. Without using the global widget manager this approach using discovery technique.

III. ARCHITECTURE

3.1 Context Broker Architecture-

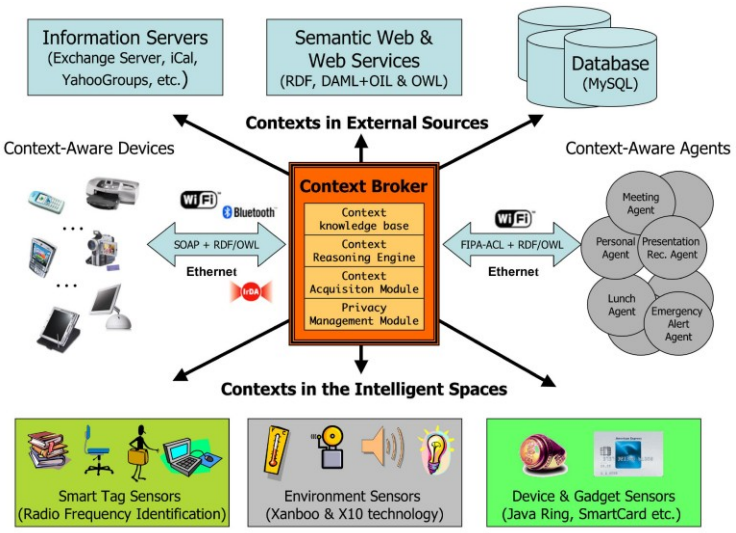


Fig.1 Context Broker Architecture

Context Broker Architecture (*CoBrA*) (Chen et al., 2003) [17], [18] is used to support context aware computing which is an agent based architecture called physical spaces. Physical spaces (e.g., Halls, Bikes, offices and meeting rooms) that are grouped with intelligent systems that provide pervasive computing services to system users. With *CoBrA* there is the presence of an CxB (Context Broker) that maintains and manages a shared contextual framework on the behalf of the agents. These agent can be the applications held by mobile devices , services that are provided by devices in a Hall (e.g., Hall temperature controller) and web services that gives a web presence for individuals, places and things in the physical world (e.g., People tracker service). [10][11] The CxB consists of four functional main components: Context KB, Context Inference Engine, Context Acquisition Module and the Privacy Management Module[14]. *CoBrA* offers the possibility of creating broker federations called as broker synchronization.

3.2 The SOCAM Architecture-

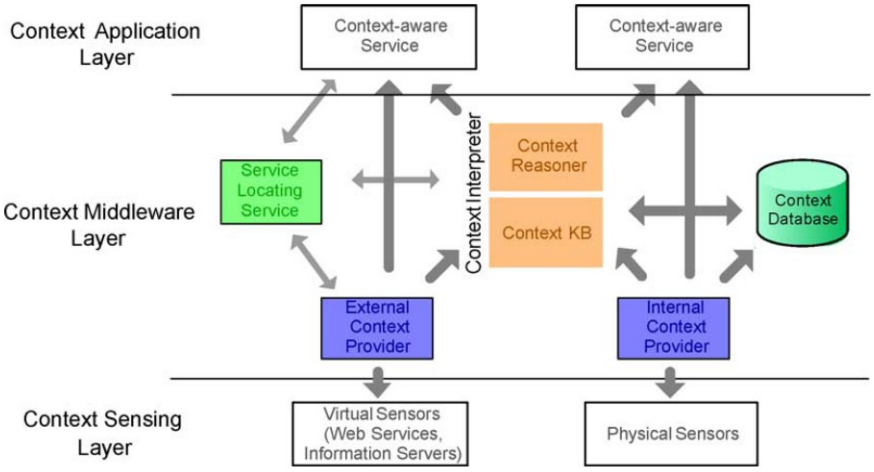
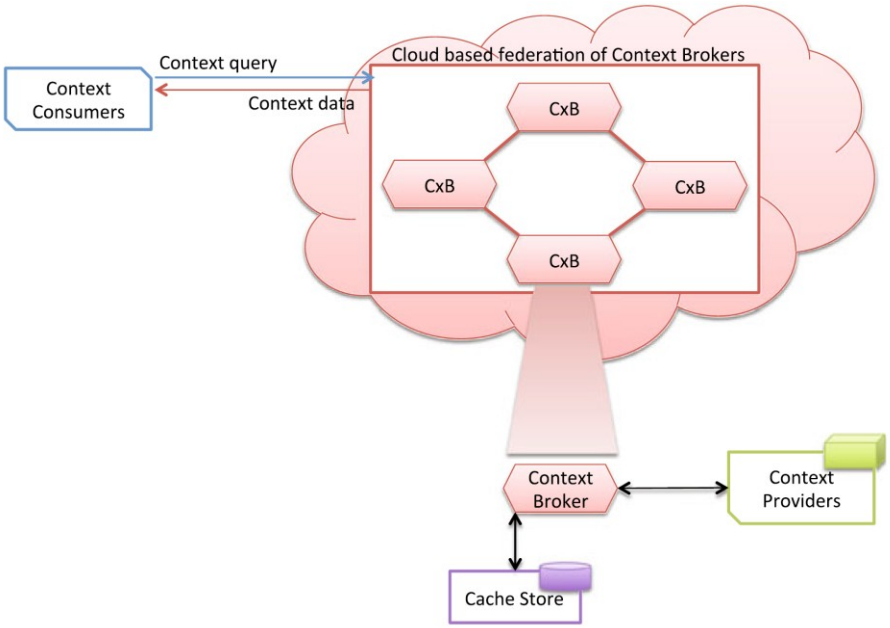


Fig.2 The SOCAM Architecture

In Pervasive computing environment the SOCAM (Service Oriented Context Aware Middleware) [19] architecture provides efficient way to implement context aware system. It consists of the following components which act as independent service components. CxP, Context interpreter, Context database, Context-aware services, locating service[7][11]

IV. APPLICATION – CACHE MANAGEMENT

Cache of the context data is most important part of context aware system. Minimum response time of any query is the primary aim. This cache management application is completed with three main stages. 1. Context Consumer 2. Federated Context Broker 3. Context Consumer. Context consumer send the query by using web application to the federated broker architecture. At broker side cache is maintained. If the answer of that query is available in the cache of the broker then answer directly given to the context consumer. If answer is not presented in the broker's cache then it will ask to the provider. Then provider provides with the answer and it will stored into the brokers cache. For that purpose Saad Kiani (2012) [15][16] implemented three algorithms. A) Remove oldest first B) Remove least used first C) Remove soonest expiring first and after that on the basis of scope and query evaluation time he has implement bipartite context cache algorithm. This bipartite context cache is implemented on the basis of short and long validity. The result can be increased if we have



implement the federated context broker architecture in context cache management. These brokers can be federated into the cloud mechanism.

V. CONCLUSION

This survey paper on the context aware system gives the design principles and architecture of context aware system and the intelligent middleware's. Context aware system can be used in day to day life for better performance. Standardized frameworks and protocols can be used to enhance the performance of the context aware system. Different middleware approaches can give the different solution in context aware system. Ubiquitous computing plays vital role into the context aware system. The context management systems are the middleware's between context aware sources and application.

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Finger Vein Based Licensing And Authentication Scheme Using GSM

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Abstract: *Finger vein authentication scheme is a non imitable biometric authentication scheme. By using this biometric authentication, we can prevent the non license from driving. So we will avoid accidents. The proposed system consists of a smart card capable of storing the finger vein of a particular person. While issuing the license, the specific person's finger vein is to be stored in the card. The same automobile should have facility of finger vein reader. A person, who wishes to drive, must match his finger vein with the smart card otherwise the car will not ignite. Car theft security module also provided using GSM. The groups of vein images were previously stored in the database, when the new vein is introduced the GSM will send a message to the authority. The car will ignite, if it gets a positive reply from the authority otherwise the car gets locked and car theft information will be sent to the nearby police station. Further, door detector, Seat belt detector and alcohol sensor are provided to the authentication module.*

Keywords: *Alcohol sensor, Door detector, Finger vein reader, GSM, Seat belt detector.*

I. Introduction:

Driving without license is a major issue in many countries. Survey says that the accidents happened mostly by the unlicensed drivers. The solution for this problem is a smart card capable for storing the vein image and the vein reader in a car. The person must match its vein with the smart card, before driving a car. Moreover the person must pass the following authentication before driving the car. Firstly, the car door will be properly closed and it is checked by the door detector. Secondly, the seat belt should be engaged and is checked by the seat belt detector. Thirdly, the person should blow the air in front of the alcohol sensor to prove that he is not consumed with any of the alcoholic beverages. Finally, the person matches his vein with the vein image stored in the smart card. After passing all authentications, the car will ignite. The car will not ignite if any one of the authentications fails and will not proceed the next step. The car smart card reader do not accept the license if the license is having any one of the following issues.

A) If the license validity is expired
B) If the license card is disqualified
C) If the license card is temporarily cancelled.

The Car security module consists of a data base, which is stored with the vein images of the family or important persons. When a new vein is introduced, the GSM will send a alert message to the authority. The car will ignite, if it gets a positive reply from the authority otherwise the door gets locked and the car theft message should be sent to the nearby police station.

II. Previous System Model & Problem Statement

In this system model, the finger print is used as a biometric authentication system. Finger print is to be proven as an imitable one and it gives an insecure feeling. Furthermore, in the previous system the vein is used for identifying the persons only. The system using a finger print is not having any other securities such as door detector, alcohol sensor and seat belt detector. In this system the fingerprint authentication system uses the Henry classifier at the enrollment process and Bayes classifier at the authentication process. The system model consists of two phases namely enrollment and authentication process. In the enrollment process, user registers their personal information with their fingerprint through fingerprint sensor. In the authentication process, the database is provided to check whether there is any new fingerprint image is introduced (i.e.) any unauthorized person tries to enter in to the system. The fingerprint images are stored after some of the internal process such as process enhancement, Feature extraction and classification process. The system model which is in previous case is shown below.

In this system model finger print is used as a biometric authentication and two classifiers are used for the finger print identification.

Enrollment Process

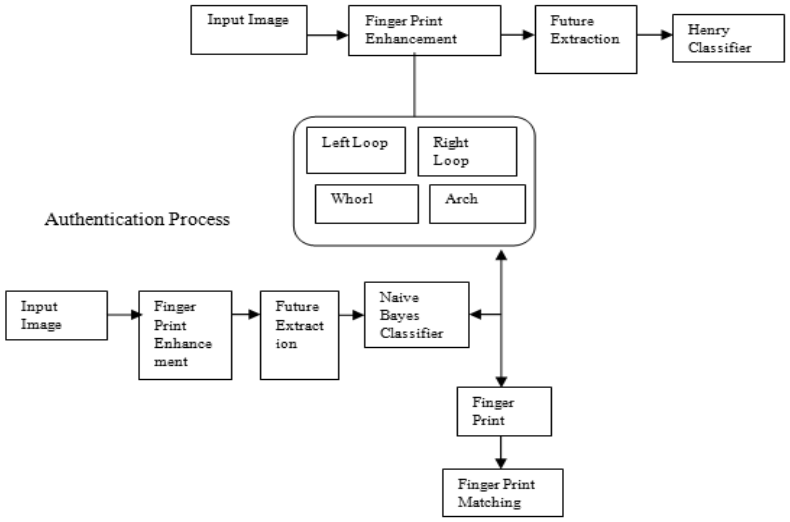

Figure 2: Fingerprint Authentication System (FPAS)

2.1 Fingerprint Enhancement

To reduce the noise present in the image, enhancement process is used. The noise is due to the cut, scarred, creased, dry, wet, worn, etc. The image processing operations done for this process are adaptive matching and adaptive thresholding. This filter is applied to every pixel in the image. Based on the local orientation of the ridges around each pixel, the matched filter is applied to enhance ridges oriented in the same direction as those in the same locality, and decrease anything oriented differently. The incorrect will be eliminated by the matched filter.

2.2 Feature extraction

The feature extraction stage is used to find the minutiae. The minutiae are straightforward to detect, when they are operated on thinned image. Endings are found at the termination points. There will be always extraneous minutiae due noisy original image. These are eliminated by using determined thresholds. Two endings on a very short isolated line are eliminated because this line is likely due to noise. Two endings that are closely opposing are eliminated. Fingerprint enhancement and feature extraction is performed as the same for both enrollment and authentication process

2.3 Fingerprint Classification

The system uses the combination of Henry and Bayes classifier. Henry classifier is used at the enrollment stage and Bayes classifier is used at the authentication stage. Henry classifier classifies the fingerprint image into Right Loop, Left loop, Whorl, Arch.

2.3.1 Henry classification Process

Normally the fingerprint is classified into loop, Whorl and Arch. The Henry classification system classifies the image into Right loop, Left loop, Whorl, Arch and Tented arch. Sixty five percentages of the people is having loop domain. So this system further classifies the loop domain into two parts namely left domain and right domain. The tented arch image should be under arch class in database. During enrollment process, it classifies the human fingerprint image is classified and kept those fingerprints as template in database according to the prescribed pattern classes.

2.3.2 Naive Bayes Classifier

The problem of fingerprint recognition is to associate classes w_i,i=1….N_c, where I is the number of classes. The NBC in this system allows one of the approaches. It gives the following steps:

i) Given a input feature vector x, then a training set $\{x^{(i)}, w_i^{(j)}\}$, j=1,2,….,N_t for each class w_i, where I and j are number of classes and training samples respectively.

ii) Compute probability for each class priory.

iii) The posterior probability is determined using

$$P(w_i|x) = p(x|w_i)\, P(w_i) / p(x)$$

iv) Repeat it until which class w_i gives the highest probability.

v) The input vector x belongs to the expected class w_i decided.

It is the probabilistic method to classify the fingerprint images by comparing probability of input vector p(x) with associated class probability P (w_i).

III. Proposed Work

To overcome the imitable problem in the previous work, here non imitable finger vein is used as a biometric authentication. Finger vein is proved as a non imitable biometric authentication and it will be a secured key system. The following system uses vein as a biometric key and also it adds more feature for driving safety like Door detector, Seatbelt detector, Alcohol sensor and Car theft security using GSM. The proposed work consists of two modules namely (i) Car ignition module, (ii) Car security module. Each module can be described with its function as follows.

3.1 Car ignition module:

In this module, Finger vein reader, Smart card reader, Alcohol sensor, Door detector, Seat belt detector is used. The system is programmed with some authentication levels. To ignite the car, the person must pass the authentication levels. The car fails to ignite, if the person did not satisfy any one of the authentication levels. To start the car the person must close the door properly and then the person will sit on the seat and put the seat belt and then the person will blow the air to the alcohol sensor to prove that the person is not consumed with any alcoholic beverages. After the completion of these three levels, the person will swipe his card on the smart card reader and put the finger on the vein reader for vein matching. The car will start the ignition after the passing of all authentication levels. The ignition will fail, when the user removes the seat belt after the car starts.

3.1.1 Smart card Reader

The smart card reader is capable for reading the vein image present in the smart card. The smart card is printed with the vein image of the person. The vein of the person printed in the smart card is received by using the finger vein reader. When the finger vein of the person is received, the controller will check for the matching of the vein of the person and the vein in the smart card.

3.1.2 Controller:

The controller here using is the PIC microcontroller. The PIC is mostly used for many experiments and it is very easy to use. Because programming for PIC controller is very easy and it is having only 35 instructions. It has an inbuilt ADC and it has a heat resistant. It has a high performance RISC. It consumes very low power of 2- 5 volts. It has a high interrupt capability and high operating speed. It has high interrupt capability. So, in this system we are using this controller. The controller is used to check the authentication process. All the devices are connected to the controllers to control the device actions. Here controller is used as a comparator to check the matching of the vein of smart card and the person. The controller did not accept the license card, if its validity is expired. It also do not allow the license card if the license is temporarily banned for any of the reasons. If the license date is going to expire, it will give the alert signal to the user about the expired date of the license card. When the person inserts the valid license and finger vein is incorrect means, it does not accept the license. The following table will explain about the controller functions in license matching.

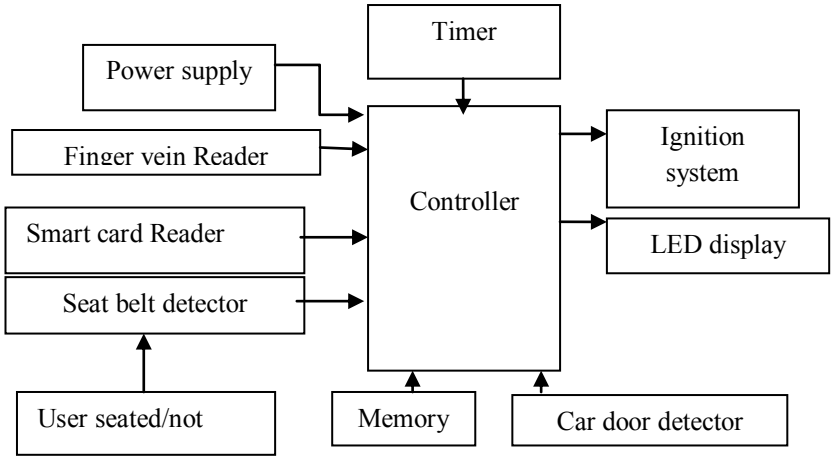

Figure 3.1.2: Ignition Module

Table 1: Input and expected output from the system

Input to the system	Expected output from the system
Valid license inserted	Wait for finger vein input
Valid license and incorrect finger vein	Rejects and request to insert corresponding license
License with validity to be end within 15 days	Alerts the user about the expired date
Fake license	Rejects the license
License, temporarily banned	Rejects the license
License with validity expired	Rejects the license

3.1.3 Car door detector:

For door detector IR sensor is used. When the car door is in open condition the sensor will not get any contact. When the door gets closed, then the sensor gets some contact with the device. When the person tries to ignite the car, the controller will check for the IR sensor result in the door detector. The LED will glow, when the door is not closed properly otherwise, it allows the car to ignite.

3.1.4 Seat belt detector:

For the seat belt detection reed sensors are used. The reed sensor is fixed at the end of the seat belt. When the seat belts are engaged, the reed sensor produces a magnetic field and does not allow the dash indicator lamp. If the seat belts are not engaged, then the reed sensor does not forms a magnetic field and dash indicator lamp will glow.

3.1.5 Finger vein reader

The finger vein reader uses the near infrared rays to read the vein images. When the person put the finger on the reader, the LED will emit an IR rays. The hemoglobin in our blood absorbs the rays. The place where the IR rays are absorbed will be appeared as a dark and remaining will be light. Now the CCD camera below the finger vein reader will capture the image appeared. This will be transferred to the display after some processing of the captured images. This process takes less than 15 seconds.

3.1.6 Alcohol sensor:

The alcohol sensor here using is MQ303A.This sensor has high sensitivity, fast detection range. This sensor is specially used for detecting the alcoholic gases. Here LM 358 is used as a comparator for detecting the alcohol contents present the blown air. Normally the non inverting terminal is higher than the inverting terminal so that the input is given to the transistor as a 0volt and then the transistor will give a one as an input to inverter to pass the authentication level. In case of any alcoholic gas detection, the inverting terminal is high and the transistor will give a 5volt to the inverter and the inverter assumes it as one and it will fails the authentication. By this way the alcohol sensor senses the alcoholic content present in the blown air.

3.2 Authentication Module:

In this module car theft security is discussed. The vein reader is provided with data base. In the data base, the family members or authorized members vein are stored by using the vein reader. Among the persons, one of the people is fixed as an authority. When the third person will try to ignite the car by using their license means, the controller will identify that the third person will try to drive the car. Then the controller will send a message to the authority about the third person. If the authority will know about the third person means, he will send a positive reply and then the car will ignite and allows the person to drive. In case of unknown person, the negative message will be sent by using GSM and the car will not ignite and the door gets locked automatically. Then the car theft message will be sent to the nearby police station. In this case GSM is used for sending and receiving the message and to the authority.

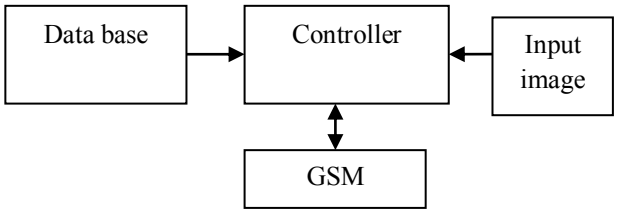

Figure 3.2: Car authentication module

IV. Results:

Here the finger vein extracted from the finger vein reader is processed by various processing techniques. The below figure shows the various vein images resulted from the various image processing techniques. The image processing technique is used to process the image for the purpose to be stored in the smart card. For this image processing various filtering techniques are used to get the clear image. Here Gabos filter is used to get the clear imge for the process. The main purpose of using filter here is to remove the unwanted things in the image as they produce the blurred imge as a output image.

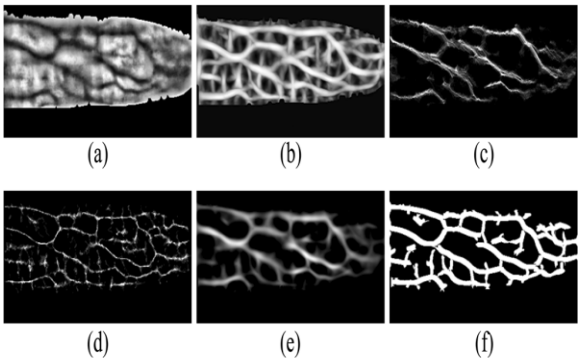

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Figure 4.1: a) Enhanced finger vein image b) Output from the matched filter c)Output from repeated line tracking d)Output from the maximum curvature e)output from the Gabos filter f) output from the morphological operations

Thus the clear finger vein image is taken for the storing purpose in the smart card. The Gabos process shows the maximum achievement in the joint resolution. The morphological operations are commonly used to reduce the computational complexity. The repeated line tracking is used to get the full details of an image. The maximum curvature is used to locate the position that possesses the maximum curvature from the image profile, and then the profile is acquired in different direction. All points are extracted; they are connected and combined according to the rules. Thus the finger vein images extracted from the person will be localized and stretched before stored in a smart card. This process is done to get a clear image of acquired finger vein. Thus different persons have different finger veins. The captured vein images of the person are shown below. To cut off the shaded regions we will use the localization. Localization is necessary to normalize the vein region. We will use the predetermined table to localize the vein images.

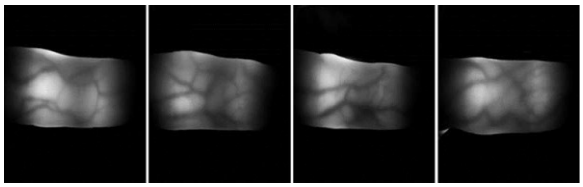

Figure 4.2: Finger vein images of different people

Here maskings are used to localize the vein values, normally finger region is brighter than the background region. The masking value is calculated in Y direction for each X position. The masking value also calculated for the position having high masking value. It was determined between the finger and the background. The main aim of this masking is to retain the original value of the image. Because while cutting, there may be a chance of changing in values.

V. Conclusion And Future Work

From this paper, we conclude that finger vein is a secure biometric authentication and will be used for security purposes. By using this system, no one can drive without license and also no one can use the others license. In this system, the system will also alert the user about the validity period of the license. Due to this the person will not forget about the renewal of the license. This is included to avoid the inconvenience of the person who will not renewal the license. In future this system is updated with continuous or random checking of the vein (i.e.) the system will check the vein of the driving person and the vein lastly recorded in the card reader randomly.

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Optimized Traffic Signal Control System at Traffic Intersections Using Vanet

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Abstract: *Traditional Automated traffic signal control systems normally schedule the vehicles at intersection in a pre timed slot manner. This pre-timed controller approach fails to minimize the waiting time of vehicles at the traffic intersection as it doesn't consider the arrival time of vehicles. To overcome this problem an adaptive and intelligent traffic control system is proposed in such a way that a traffic signal controller with wireless radio installed at the intersection and it is considered as an infrastructure. All the vehicles are equipped with onboard location, speed sensors and a wireless radio to communicate with the infrastructure thereby VANET is formed. Once the vehicles enter into the boundary of traffic area, they broadcast their positional information as data packet with their encapsulated ID in it. The controller at the intersection receives the transmitted packets from all the legs of intersection and then stores it in a temporary log file. Now the controller runs Platooning algorithm to group the vehicles approximately in equal size of platoons. The platoons are formed on the basis of data disseminated by the vehicles. Then the controller runs Oldest Job First algorithm which treats platoons as jobs. The algorithm schedules jobs in conflict free manner and ensures all the jobs utilize equal processing time i.e the vehicles of each platoons cross the intersection at equal delays. The proposed approach is evaluated under various traffic volumes and the performance is analyzed.*

Keywords *Conflict graphs, online job scheduling, traffic signal control, vehicular ad hoc network (VANET) simulation, vehicle-actuated traffic signal control, Webster's algorithm.*

I. INTRODUCTION

In this paper, we examine the possibility of deploying an intelligent and real-time adaptive traffic signal controller, which receives information from vehicles, such as the vehicle's position and speed, and then utilizes this information to optimize the traffic signal scheduling at the intersection. This approach is enabled by onboard sensors in vehicles and standard wireless communication protocols specifically for vehicular applications. For example, all vehicles are already equipped with a speed sensor. In addition, new vehicles are increasingly being equipped with Global Positioning System (GPS) units that can provide location information with accuracy of a few meters [25].

Furthermore, vehicles can use wireless communications for vehicle-to-vehicle (V2V) or vehicle-to-infrastructure (V2I) communications, as described in the dedi- cated short-range communications/wireless access in vehicular environments standards operating in the spectral range of 5.85– 5.95 GHz [19]. We refer to the transient mesh networks formed via V2V or V2I communication links as vehicular ad hoc networks (VANETs).

Intelligent traffic signal control has been extensively studied in the literature [9], [25], [28].Current methods of implementing intelligent traffic signal control include roadside sensors, such as loop detectors and traffic monitoring cameras. Loop detectors can only detect the presence or absence of vehicles [15], [16], which is a serious limitation.

II. MOTIVATION

The main motivation for vehicular communication systems is safety and eliminating the excessive cost of traffic collisions. According to World Health Organizations (WHO), road accidents annually cause approximately 1.2 million deaths worldwide; one fourth of all deaths caused by injury. Also about 50 million persons are injured in traffic accidents. If preventive measures are not taken road death is likely to become the third-leading cause of death in 2020 from ninth place in 1990. A study from the American Automobile Association (AAA) concluded that car crashes cost the United States $300 billion per year.However the deaths caused by car crashes are in principle avoidable. US Department of Transport states that 21,000 of the annual 43,000 road accident deaths in the US are caused by roadway departures and intersection-related incidents. This number can be significantly lowered by deploying local warning systems through vehicular communications. Departing vehicles can inform other vehicles that they intend to depart the highway and arriving cars at intersections can send warning messages to other cars traversing that intersection. Although the main advantage of vehicular networks is safety improvements, there are several other benefits. Vehicular networks can help in

avoiding congestion and finding better routes by processing real time data. This in return saves both time and fuel and has significant economic advantages.

III. DEVELOPMENT

Vehicular communications is mainly motivated by the desire to implement Intelligent Transport Systems (ITS) because of their key benefits in safety and traveling ease. Several ITS institutions operate around the world to bring ITS concepts to real world. In the United States one of the main players is U.S. Department of Transportation (USDoT). The federal DoT promotes ITS through investment in potentially high payoff initiatives. One of these major initiatives, Vehicle Infrastructure Integration (VII), seeks to increase safety by providing vehicle to vehicle and vehicle to roadside units communications through Dedicated Short Range Communications (DSRC).

IV. VANET APPLICATIONS

The speed and location information on vehicles that can be disseminated to the traffic signal controller using VANETs [10] are both spatially and temporally fine-grained. Such precise per- vehicle speed and location information can enable additional capabilities such as being able to predict the time instance when vehicles will reach the stop line of the intersection.

This is in comparison with roadside sensors such as loop detectors that can only detect the presence or absence of vehicles and, at best estimate, the size of vehicle queues. Furthermore, it is cheaper to equip vehicles with wireless devices than to install roadside equipment [25].

V. OUR CONTRIBUTION

In this paper, we present an algorithm, which we call the oldest arrival first (OAF) algorithm, that makes use of the per-vehicle real time position and speed data to do vehicular traffic scheduling at an isolated traffic intersection with the objective of minimizing delays at the intersection. This simple algorithm leads to a near optimal (delay minimizing) schedule that we analyze by reducing the traffic scheduling problem to a job scheduling problem, with conflicts, on processors. The scheduling algorithm captures the conflicts among opposing vehicular traffic with a conflict graph [9], and the objective of the algorithm is to minimize the latency values of the jobs. If the condition that all jobs require equal processing time is enforced, we can show that the OAF algorithm becomes the oldest job first (OJF) algorithm in the job scheduling domain with conflicts between jobs and the objective of minimizing job latency values. We present a 2-competitive (with respect to joblatencies) online algorithm that does nonclairvoyant scheduling [27] with conflicts of the jobs on the processors and then prove a stronger result that the best possible nonclairvoyant scheduling with conflicts algorithm is 2-competitive. We leverage a VANET to implement the OJF algorithm.

An important requirement for the OJF algorithm is that all jobs require equal processing time. We give an algorithm that uses the VANET to divide up the approaching vehicular traffic into platoons that can be treated as jobs in the job scheduling with conflicts. The traffic signal controller can then use the conflict- free schedule from the OJF algorithm to schedule platoons of vehicles in a safe conflict-free manner. This two-phase approach, where we first use the platooning algorithm to divide up the traffic into platoons and then treat each platoon as an equal-sized job and then apply the OJF algorithm on the jobs to generate a conflict-free schedule, leads to what we call the OAF algorithm. To ascertain the performance of the algorithm, we choose the average delay per vehicle that has passed through the intersection as the measure of effectiveness. We compare the performance of the OAF algorithm against an vehicle-actuated traffic signal controller, Webster's algorithm, and a fixed-time algorithm. The vehicle-actuated algorithm and Webster's algo- rithm are well-known traffic algorithms [9] that traditionally utilize fixed road-based sensors such as loop detectors.

VI. TRAFFIC LIGHT SCHEDULING ID REDUCED TO JOB SCHEDULING (OJF ALGORITHM)

Here, we propose a method to reduce traffic signal control problem to the problem of scheduling jobs on processors, and we propose an online job scheduling algorithm called the OJF algorithm. This is phase two of the OAF two-phase traffic signal control algorithm.

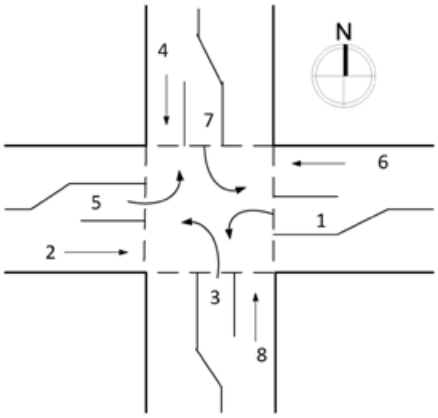

Fig. 1. Typical four-leg intersection showing the different movements on the approaches.

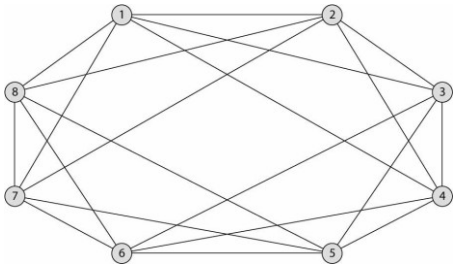

Fig. 2. Conflict graph for the intersection in Fig. 1.

Fig. 1 shows a typical four-leg intersection with eight traffic movements numbered 1–8. This type of intersection is the most common and well-studied type [7], [8]. There are conflicts among some of these movements. For example, traffic move-ments 1 and 2 cannot simultaneously occur. We can reduce the problem of traffic signal control to scheduling of jobs on a processor, where a job is a platoon of one or more vehicles. We classify jobs as follows. A job is of type i if and only if the platoon of vehicles that it represents is part of traffic movement i. A pair of jobs of type i and j are said to be in conflict if the traffic movements i and j are in conflict; hence, jobs of type i and j cannot be scheduled to be simultaneously processed. For the intersection in Fig. 1, we can build a conflict graph G(V, E), where V is a set of vertices, and E is a set of arcs. There is a vertex for each job type, i.e., for each job type $\exists$ vertex $i \in V$.

The arc set E is constructed as follows. If jobs of type i, j are in conflict (and cannot be scheduled simultaneously), then there exists an arc (i, j) in E. E does not contain any other arc, and V does not contain any other vertex. The conflict graph for the four-leg intersection in Fig. 1 is shown in Fig. 2. Conflict graphs have been studied by traffic engineers to build safe traffic signal control plans. In [9], methods of developing safe signal control plans are shown for more complicated traffic intersections. We will assume that jobs are of equal size, and each job i of type j has an arrival time aji , which would correspond to the instance of time when the first vehicle of platoon i arrives at the stop line in movement j. We will assume that time is divided into slots, and since all jobs are equal, without loss of generality, we can assume that all jobs need 1 unit of time to complete. Thus, if a job is scheduled at time t, it will complete at time t + 1. The ability to divide the oncoming traffic into platoons that require approximately equal amount of GREEN time (the green time represents the amount of processing time required) is achieved using a VANET. At the beginning of time unit t, jobs of any type j can arrive, and we can think of them as arriving at vertex j in G. A group of vertices is chosen that do not conflict, and a job from each of these is scheduled in time t. Now, our objective would be to minimize the maximum latency over all jobs. For a particular job aji , the latency is di − aji − 1, where di is the time unit at the beginning of which job i has disappeared (completed), and aji is the time unit at the beginning of which job i of type j arrived.

Therefore, the objective is simply to minimize the maximum latency. In the context of vehicular traffic, minimizing maximum latency is equivalent to minimizing the maximum time that any vehicle spends at rest at an intersection waiting for green light. An important simplification that we make here is that all jobs need equal service time.

A. 2-COMPETITIVE ALGORITHM FOR JOB SCHEDULING

Having made the reduction from vehicular traffic scheduling to job scheduling with conflicts, we present a 2-competitive algorithm that minimizes latency for each job that we call the OJF scheduling algorithm. In addition, it turns out that, under the assumption of no future knowledge, this is the best possible online algorithm. The OJF scheduling algorithm can only be applied to bipartite conflict graphs; therefore, we need to do this transformation first. Graph G in Fig. 2 can be transformed into a bipartite graph G_ by merging vertices 1 and 2, 3 and 4, 5 and 6, and 7 and 8. Fig. 3 shows the bipartite graph. We describe the OJF scheduling algorithm as follows.

Algorithm 1: OJF scheduling algorithm.

Let ari , arj , alk, and alm be the earliest arrival times on each of the vertices of G_;
while r, r_, l, l_ have jobs waiting, do
Let ast be the earliest arrival time among ari , arj , alk, and alm;
Let S be the side of G_ on which vertex s lies; for Each vertex s_ on side S in G_, do
Schedule the job with the earliest arrival ast ;

Let r and r_ be the vertices on the right side, and let l and l_ be the vertices on the left side of the bipartite graph. Let L be the list of jobs that would arrive at the vertices in some time interval. Since we have no prior knowledge of the composition of L, the OJF algorithm aforementioned in Algorithm 1 makes decisions on the fly to reduce the maximum latency and is hence an online algorithm. For example, there exists an algorithm $A*$ that, given L, generates the optimal schedule (a schedule that minimizes maximum latency). $A*$ is the optimal offline algorithm (see Table I for notations). Let us compare the performance of OJF and $A*$ when it comes to minimizing the maximum latency. We claim that the OJF scheduling algorithm is 2-competitive, i.e., for any L, OJF produces a schedule where the maximum latency experienced by any job is at most twice the maximum latency experienced by any job in a schedule produced by $A*$. Thus, the OJF algorithm is 2-competitive. Furthermore, it turns out that there cannot exist a better than 2-competitive algorithm for job scheduling under the assump-tion of no future knowledge.

B. OPTIMALITY OF THE OJF ALGORITHM

Here, we prove that the algorithm presented earlier obtains the optimal competitive ratio. We adopt the proof for a bipartite graph with n vertices given in [17]. The method is based on an adversary technique in which the adversary creates a sequence of job arrivals based on the behavior of the online algorithm. At the beginning of each time unit, the adversary can determine how many jobs arrive and on which vertices of the conflict graph. After the entire job sequence has been determined, theadversary then can determine a schedule for the jobs in an offline manner. The adversary tries to create the worst sequence possible for the online scheduling algorithm. The cost of the online algorithm is then compared with the cost of the adversary determined offline algorithm. For a four-leg intersection, we consider to reproduce the same proof for the much easier case of n = 4, which makes the proof shorter.

VII. VEHICULAR ADHOC NETWORK BASED TRAFFIC INTERSECTION CONTROL

Here, we show how we implemented the platooning phase (phase one) of the OAF algorithm and how we implemented the other traffic light control schemes, such as the vehicle-actuated logic and Webster's method using VANETs. We first explain some of the terms used in describing our adaptive traffic control algorithms that may differ slightly from their conventional definitions.

- **MAX-OUT:** The maximum amount of GREEN time that can be allocated to the current phase.
- **GAP-OUT:** If a vehicle is more than the GAP-OUT units of time away from the stop line, then the signal goes to the next phase.
- **EXTENSION:** If a vehicle is detected less than GAP-OUT units of time away from the stop line, then the GREEN time is extended by EXTENSION units of time.

A. SYSTEM DESCRIPTION

In this paper, we study an isolated intersection. Fig. 1 shows the single traffic intersection under consideration. It is a typical four-leg intersection with eight traffic movement groups represented by the arrows. Each of the legs of the intersection is L meters long, and each of the left turning bays is B meters long. The numbered arrows show the directions of the various traffic movements. For this type of traffic intersection, we

now describe the system architecture of the VANET-based traffic signal controller. In the single traffic intersection scenario, the traffic signal controller is connected to a wireless receiver that is placed at the intersection. The wireless receiver listens to information being broadcast from the vehicles. The broadcast medium is the 5.9–5.95-GHz radio spectrum, and the communication standards are defined in the IEEE 802.11p standards [19]. This system architecture is shown in Fig. 4. The information consists of speed and position data collected from vehicles. Speed data can be gathered from the vehicle speedometers, and position data can be gathered using GPS receivers fitted to the vehicles. In our implementation, the following data are gathered and encapsulated in data packets that are broadcast over the wireless medium. This is what we call the data dissemination phase.

Vehicle ID: Every vehicle is uniquely identified by its Vehicle ID#. In practice, the medium access control (MAC) address of the network interface card in the wireless receiver would serve the same purpose.

Location: each vehicle is speci-fied by the LINK NUMBER#, Lane#, and position from a point of reference. The position from a point of ref-erence is a subfield containing (x, y), which are floating point quantities. We chose to use the stop line as a point of reference; therefore, the stop line has position (0, 0) for each Link Number# and Lane#. Thus, collectively, these three fields describe vehicle location. In practice, it is assumed that each vehicle is equipped with a GPS receiver; therefore, vehicles always know their locations. It is possible to convert the GPS coordinates of each vehicle to the format that we described earlier. We will show later that we can compute the distance from each vehicle to the stop line from this information.

Speed: Speed of a vehicle is a floating point quantity expressed in meters per second and is obtained from the in-vehicle speedometer sensor.

Current Time: The time at which the packet was created. The format is (hh:mm:ss). Because of the nature of the traffic control application, there is no need for a finer grain time. However, we need to assume that all clocks are synchronized. The current time is required to distinguish between old packets and new packets.

After the data dissemination phase, we have the data aggre-gation and processing phase where we actually make use of the transmitted information to do traffic signal control.

B. PLATOONING ALGORITHM

We obtained the lower bounds on how well an online algorithm can perform when it comes to minimizing the maximum latency. These lower bounds were achieved by an online algorithm that had no knowledge of future inputs. Can we use information gathered from the VANET to obtain future knowledge of traffic and use this to obtain a better-than-2-competitive algorithm? Unfortunately, this is unlikely; since due to radio range limitations, the VANET can only provide a relatively myopic view of the future, and in the long run, we will fall back to a 2-competitive performance. However, we can use the information from the VANET in a different way. One of the conditions under which the performance bounds hold is that all jobs, which represent platoons of vehicles, are of equal size and hence require equal processing time. This means that, for the OJF algorithm to be effective, all platoons must require equal amounts of time to pass through the intersection. We can achieve this requirement by using the vehicle position and speed data obtained via the VANET to compute the spatial headways between the vehicles. We can then divide the vehi-cles into platoons using this headway information, where each platoon takes equal amount of time to pass through the intersec-tion. This platooning phase will be the phase one of the OAF algorithm, with the OJF being phase two of the OAF algorithm.

The platooning algorithm is given below:

```
for each approach k do
    Configuration = IntegerPartitions(n)
    for each platoon configuration i in Configuration do for each platoon j in i do
            Platoon_Green_Time[j] =
            Estimate_Green_Time(j);
        Add Platoon_Green_Time[j] to the list Config_Green_Time[i, k];
Min_Diff =
mini∈k,k={1,...,4}{max{Config_Green_Time[i, k]} − min{Config_Green_Time[i, k]}};
Final_Platoon_Configuration =
  arg mini∈k,k={1,...,4}{max{Config_Green_Time[i, k]} − min{Config_Green_Time[i, k]}};
```

VIII. RESULTS AND DISCUSSION

We compare the performance of the OAF algorithm against the VANET-enabled vehicle-actuated control, VANET-enabled Webster's method, and an optimized fixed-time signal control. For the fixed-time approach, the controller has been optimized for the current traffic parameters, following the guidelines in [7]. The timing parameters were 60 s of GREEN for the through traffic and 30 s of GREEN for the left turning for the heavy traffic condition, 40 s of GREEN for the through traffic and 20 s of GREEN for the left turning traffic for the Medium traffic condition, and 35 s of GREEN for the left turning traffic for the Medium traffic condition, and 35 s of GREEN for the through traffic and 15 s of GREEN for left turning traffic for the light traffic. We also tested the effectiveness of the platooning algorithm, which is part of the OAF signal control algorithm.

A. COMPARISON OF TRAFFIC SIGNAL CONTROL METHODS DURING HOMOGENEOUS TRAFFIC ARRIVAL RATES

In our first experiment, we have homogeneous traffic arrival rate on all four approaches to the intersection, and we vary the traffic arrival rates.. 7 shows the performance of the OAF in comparison with the vehicle-actuated logic, the pretimed logic, and the Webster's logic. The performance parameter that we measured was the average delay per vehicle in terms of seconds, and we plot this delay value at 5-min intervals for all the traffic signal control methods.

The labels light, medium, and heavy indicate the time in-tervals during the simulation with different traffic arrival rates. We started out the simulation at a light traffic arrival rate, and 20 min into the simulation, we switched to the medium traffic arrival rate. At the 40-min mark, we switched to a heavy arrival rate, and at 75 min mark, we switched to the light traffic arrival rate, and let the simulation run to the 160-min mark. We can see that, at every instant, the OAF Algorithm performs better than both Webster's and the pretimed algorithm. During a heavy traffic arrival rate, we see that the OAF algorithm degenerates to the vehicle-actuated control since the MAX-OUT times for both the OAF algorithm and the vehicle-actuated algorithm become the same. However, when we switch back to the Light traffic arrival rate, we see that the OAF Algorithm recovers from congestion much faster; hence, the delays experienced decreased much faster. This is because the OAF algorithm is able to take advantage of the gaps that occur among vehicles and create platoons, and then, it minimizes the maximum delay that each platoon experiences.

The delay is then amortized among all the vehicles in the platoon. In effect, it is much more efficient at discharging the queues. Intuitively, this is because Webster's method and the pretimed control method both react very slowly to the changes in the traffic arrival rate.

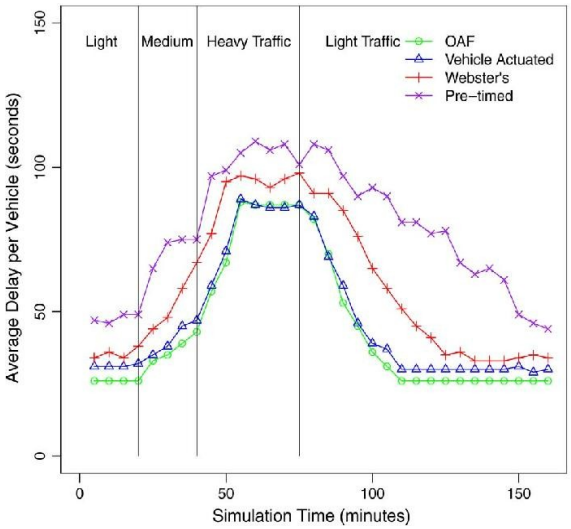

Fig. 7. Performance of OAF algorithm compared with other VANET-based traffic signal scheduling methods when all four approaches have equal vehicle arrival rates

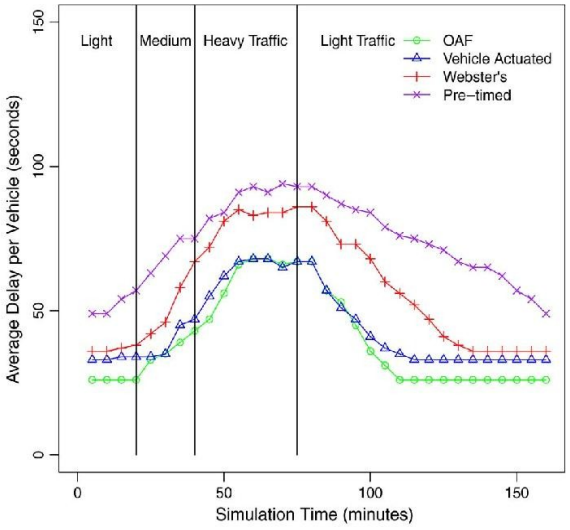

Fig. 8. Performance of the OAF algorithm compared with other VANET-based traffic signal scheduling methods when north–south approaches have constant (800 vehicles/hour) arrival rates and east–west approaches have a varying vehicle arrival rate.

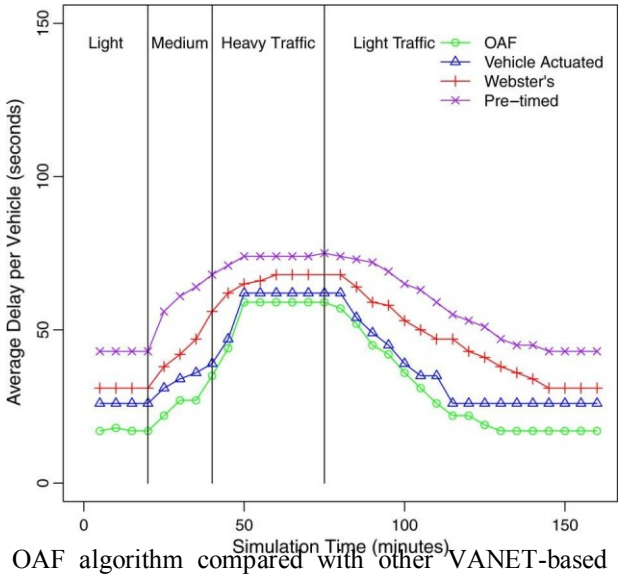

Fig. 9. Performance of the OAF algorithm compared with other VANET-based traffic signal scheduling methods when north–south approaches have constant (100 vehicles/hour) arrival rates and when the east–west approaches have a varying vehicle arrival rate.

B. Comparison of Traffic Signal Control Methods for Heterogeneous Traffic Arrival Rates

Next, we study the performance of the OAF and the other three traffic control algorithms for the case with heterogeneous traffic arrivals. We set up the experiment in the following way. In Figs. 8 and 9, the east-to-west traffic and the west-to-east traffic are set at 800 and 100 vehicles/h, respectively, but the north-to-south traffic and the south-to-north traffic vary from 400 (light), 800 (medium), and 1700 (heavy) vehicles/h and then back to 400 (light) vehicles/h.

Once again, there is a 0.15 probability that a vehicle makes a left turn. Once again, we compare the average delay per vehicle of the OAF algorithm and the vehicle-actuated traffic control algorithm against the Webster's and pretimed traffic signal control methods. Again, the OAF outperforms all the other three algorithms. Because of the lower variance in the traffic arrival rates, the delay curves are flatter than in the identical traffic arrival rate experiment, and the overall delays are lower for all the traffic signal control methods. The OAF and vehicle-actuated traffic control algorithms perform better than both Webster's method and the pretimed logic. However, because of the slower variance of the traffic arrival rates, the vehicle-actuated traffic control algorithm exhibits a flatter average delay curve.

IX. Conclusion

In this paper, we have shown how a VANET can be used to aid in traffic signal control, including a new job-scheduling-based online algorithm, i.e., the OAF algorithm. We imple-mented several adaptive traffic signal control algorithms that use the fine grain information broadcasts by the vehicles. We implemented and compared these algorithms under various traffic conditions. Our experimental results show that the OAF algorithm reduces the delays experienced by the vehicles as they pass through the intersection, as compared with the other three methods under light and medium vehicular traffic loads. Under heavy vehicular traffic load, the performance of the OAF algorithm degenerates to that of the vehicle-actuated traffic method but still produces lower delays, compared with Webster's method and the pretimed signal control method. This is because, under lighter traffic, the OAF algorithm can dynamically skip through phases and minimize the delay of vehicles whenever there is a gap in the traffic. However, when the traffic gets heavier, the gaps in traffic disappear, and we always have queues on the approaches, reducing the advantage that a dynamic scheduling algorithm may have.

X. Future Work

Consider the case of sub lanes connected with main lanes. The vehicle which are at the head of platoon sends information to the vehicles near to sub lanes indicating that GREEN signal is ON in V2V communication. It helps the vehicles to use main lanes itself rather than using sub lanes.

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A Survey of Agent Based Pre-Processing and Knowledge Retrieval

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Abstract: *Information retrieval is the major task in present scenario as quantum of data is increasing with a tremendous speed. So, to manage & mine knowledge for different users as per their interest, is the goal of every organization whether it is related to grid computing, business intelligence, distributed databases or any other. To achieve this goal of extracting quality information from large databases, software agents have proved to be a strong pillar. Over the decades, researchers have implemented the concept of multi agents to get the process of data mining done by focusing on its various steps. Among which data pre-processing is found to be the most sensitive and crucial step as the quality of knowledge to be retrieved is totally dependent on the quality of raw data. Many methods or tools are available to pre-process the data in an automated fashion using intelligent (self learning) mobile agents effectively in distributed as well as centralized databases but various quality factors are still to get attention to improve the retrieved knowledge quality. This article will provide a review of the integration of these two emerging fields of software agents and knowledge retrieval process with the focus on data pre-processing step.*

Keywords: *Data Mining, Multi Agents, Mobile Agents, Preprocessing, Software Agents.*

I. Introduction

Knowledge discovery in databases is a rapidly growing field, its growth can be figured out from the increasing interest of researchers & its practical, social as well as economical needs. The Knowledge Discovery in Databases process comprises of a few steps to get knowledge by processing raw data. The iterative process consists of the steps viz. Data cleaning, Data integration, Data selection, Data transformation, Data mining, Pattern evaluation, and finally Knowledge representation to visually represented the results of data mining. It is common to combine some of these steps together. As data cleaning and data integration can be combined together and known as a pre-processing phase to obtain target data. Data selection and data transformation can also be combined where the selection is done on transformed data. To get this filtered and so called pre-processed data which is used for data mining is our area of focus. This step is significant in the sense that it may play a crucial role to resolve the data quality problems which arise during data collection. As data collection methods are loosely controlled, which results in incomplete, inconsistent, noisy, missing values, etc.(Dasu & Johnson 2003). If there is much irrelevant & redundant information is present in the initially collected data then knowledge retrieval during mining process will not be meaningful. Therefore the need for data cleaning which produces final training set increases significantly for accurate results.

The manual process of data pre-processing becomes tedious as size of data grows and its quality degrades, so the process of data pre-processing needs to be automated to the extent possible. It is also a legitimate option to get it done with the help of software agent. As studies have been conducted on the integration of these two fields of software agents & knowledge discovery.

II. Software Agents

The idea of an agent originated with john McCarthy in the mid-1950's, and the term was coined by Oliver G. Selfridge a few years later, when they were both at the Massachusetts institute of technology (Kay 1984).

A software agent may be assumed as a piece of code/program having autonomy, persistence, proactiveness, reactiveness and some others among its major characteristics as shown in Fig. 1. In the process of data mining, once the task of discovering some knowledge is delegated, it is followed by ascertaining the goal, fixing the strategy and behaving proactively to complete the necessary actions.

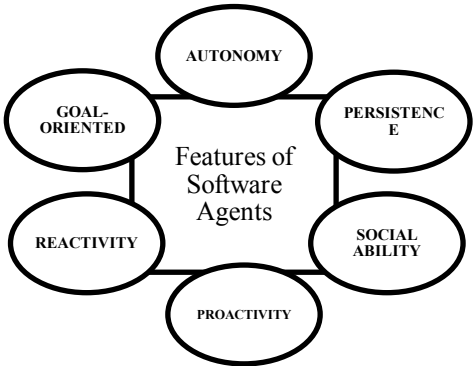

Figure 1 Features of Software Agents

Software agents are being touted & used for various diverse applications as electronic commerce, computer games, personalized information management, interface design and management of complex commercial and industrial processes.

According to N. Jennings & M. Wooldridge, 1996 software agents can be *simple* which execute on pre-specified rules & assumptions, *sophisticated* which execute some specified task on user's request and *predictive* which executes when it finds it appropriate without being explicitly asked. Some special features of software agents helps it to carve its niche among other major streams like ubiquitous computing, distributed processing, object-oriented systems and artificial intelligence.

III. Related Work

(Davies et al. 1995) has introduced Agent-K to work over distributed databases which offers a simple production rule mechanism for programming of agents & these rules respond to the KQML (Finin et al. 1993) messages & the current state of agent. Here, different approaches for knowledge integration has also been discussed. As admitted by the author himself that this approach of knowledge integration turns out to be quite heavy in terms of computation. Further work will require to focus on maximum usage of distributed resources and least network traffic.

(Seydim 1999) represented a study on agent model in the context of information retrieval, filtering, classification and learning along with communication framework for the interchange of information between multiple mobile agents(Harrison, Chess, Kershenbaum 1995) working over distributed systems for knowledge discovery.

(Vassiliadis. 2000) developed ARKTOS, an automated tool for data cleaning and transformation in data warehouse environments. Even though specialized tools for are already available designed by Ardent Software and Data Mirror corporation etc., this ARKTOS tool is well equipped with one graphical interface and two declarative languages closely related with XML and SQL. The tool contains primitive operations for Extraction-Transformation-Loading and more especially cleaning primitives like primary key violation, reference violation, domain mismatch and others.

(Knoblock & Craig 2004) Introduced the set of software agents for travel planning by retrieving information from web. These agents provide interactive interface as user is provided with all the choices & monitors all the aspects of a trip. Finally, this software perform mining over all information to help the user in their decision making.

(Zghal et al. 2005) has introduced the agent framework for data mining of spatial data by combining the different algorithms of data mining & features offered by the multi-agent systems. Authors also resented the architecture of Computer Aided Spatial Agent Mining Mart Environment (CASAMME) and a CASE tool (2003) based on multi agent system.

(Ong et al. 2005) has discussed the problems of wrong assumptions associated with data mining algorithm i.e. static view of data & a stable execution environment as contrast to dynamic view of data and execution environment. As a solution to this, author has introduced a new methodology of designing stream-based algorithms with mobile agents. The proposed multi agent system has been implemented also over stream based data in their Matrix project, where the used the concept of summary structures to develop several mobile agents and they work under the coordination of a special agent called plan and coordinate agent, whose responsibility is to form the execution plan based on current (dynamically altered) data set and dispatch the necessary instructions and information to several mobile agents sitting over distributed locations of data. The experimental results show the speed up attained which is roughly closer to be linear.

(Bach et al. 2005) proposed retrieval of public data spread over web with software agents for business intelligence. Software agent work for retrieval of data from the Data base of stolen cars in Croatia, the data thus

collected is also analyzed and various reports are prepared stating risk involved in different classes and brands of cars to help for better decision making in insurance company.

(Nurmi. 2005) has presented an architecture for distributed data pre-processing. Although the approaches for the development of the context aware application mobile agents may be implemented at application level or middleware level, the architecture proposed by the author enlightens and take the advantage of both levels. The intelligent agents described under this architecture does the sensing of data and then to preprocess the collected data, pattern recognition techniques like handling missing values, outlier removal and normalization etc. are implemented. The architecture framework presented by the authors is initiated with recognition phase, followed by decision making phase. Authors emphasis on the first phase which actually includes several subtasks like feature extraction, feature selection, classification etc. Even though, at first glance the architecture seems to focus on just preprocessing phase whereas it is also claimed that it may actually be implemented over distributed ubiquitous environment with a little touch to interface.

(Tudor et al. 2009) has emphasized the use of software agents to figure out the relevant information so that academic organizations may focus their activities on improving management quality by using knowledge. Here data mining & software agents are combined to work on knowledge management in academic environment with the help of multiple agents at multiple levels(educational, research, administrative, secretarial, others).

(Moemeng et al. 2010) has introduced an agent-based distributed data mining platform named i-Analyst consisting of software packages & development kit for the improved performance of data mining algorithms by maintaining security & privacy of the data. The example results itself reveals the significance of the agents in enhancing the execution performance.

(Singh et al. 2011) discussed & compared five agent development toolkits: JADE, VOYAGER, ZEUS, AGLET & ANCHOR developed by different groups. The comparison has been drawn on the basis of standards followed, security mechanism, agent mobility and migration scheme etc. Authors deduced that Jade (open source) agent development toolkit is most balanced toolkit. Voyager is a commercial tool, Anchor provides good security, Aglet lacks security and scalability but these three doesn't comply with FIPA standards. On the other hand, Zeus supports FIPA standards but doesn't provide agent mobility.

(Jayabrabu et al. 2012) proposed the automated process of data mining for better visualization with the integration of multi-agent system to detect those new and hidden patterns which otherwise are not available to less domain user (novice and specialist users). The automated clustering of relevant data set by these agents leads to good input cluster to mine on, which ultimately returns the better correlated output which are visualized by link charts instead of traditional data mining visualization methods like graphs, pie charts or histograms etc.

IV. Present Scenario

The success story of software agents is itself advocated by the above mentioned developments in the field of data mining. Going through present applications of data mining & software agents as an integrated technology, it is revealed that these fields are proving successful with their efficient outcomes or results. Software agents are designed to perform data mining in various fields like travelling agents, academic management, business intelligence, data-stream mining, distributed data mining & many more areas. Software agents are also capable for collecting valuable data from the Web.

These strong features of software agents are exploited by researchers to achieve the specified goal autonomously & in a predictive manner which is the demand of present customers who want to get knowledge as much as possible for decision making. This increasing demand for better decision support is solved by availability of knowledge discovery products, in the form of research prototypes developed at various universities as well as software products from commercial vendors like WEKA, ORANGE and etc.

For this various authors presented various platforms for the designing of the different types of agents. Many toolkits (JADE, AGLET, ZEUS & ANCHOR) are available which helps in development of software agents.

V. Future Scope

The present situation strongly suggests that the use of intelligent mobile agents is inevitable for the achievement of rationale outcomes in the field of data mining especially distributed one. The work carried on so far by various researchers show the successful implementation of these software agents in unique domains like academic, management and ubiquitous computing. Although the availability of different tools in market focus on Extraction -Transformation-Loading including data cleaning primitives, each one having its own limitations viz. limited transformation primitives, non-availability of impact analyzer, non-availability of optimizer to prefer one efficiency criteria over the other. These open issues motivate the researchers to keep on putting hard efforts for the balanced discovery of intelligent mobile agents based automated tools containing rich variety of primitives for preprocessing and simple point and click type front end. Our future efforts will focus on summarizing the specific problem areas during preprocessing using intelligent mobile agents. Our following

objective aims to find the role of mobile agents for elimination of data cleaning problems existing with data collected from same or different sources. Where both classes have their own inherent problems at schema level or instance level. Better quality of data terminates in a good knowledge outcome since the knowledge discovery is performed on the best quality of data. Other issues among multi-agent systems comes up during agent selection and knowledge integration where some agents have to wait for others to finish their assignment. Other objective focuses the assessment of the available automated tools of data pre-processing where all these will be studied deeply and a comparative analysis will be performed on all those methods to figure out the best one.

VI. Conclusion

Data pre-processing is a very important step in the data mining which has a huge impact on the results but often neglected. Analyzing data that has been carefully screened for problems of data pre processing will produce more accurate & reliable results. The output of data pre-processing is the final training set on which user performs knowledge retrieval process to get desired results. These results should provide user some useful and trustworthy knowledge which will support them in decision making. Therefore data should be pre-processed in automatic manner every time before performing knowledge discovery.

The above review presented is far away from full or comprehensive, although it describes the basic role of intelligent mobile agents in the process of data mining especially preprocessing. There are numerous other application areas of multi agent systems with learning (intelligent) ability like MALE (Sian. 1991), ANIMALS (Davies. 1993) etc., which we could not describe here for the sake of length of the paper. The entire process of preprocessing with agents should be with parallel consideration of scalability and ultimately these intelligent agents should result in resolving the inconsistencies in static or dynamic data and also reduce the size of data. The intelligent mobile agent possessing these characteristics would definitely lead to a drastic drop in the manual preprocessing activities and commercially viable and successful tool.

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Upgrading the Performance of Speech Emotion Recognition at the Segmental Level

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Abstract: *This paper presents an efficient approach for maximizing the accuracy of automatic speech emotion recognition in English, using minimal inputs, minimal features, lesser algorithmic complexity and reduced processing time. Whereas the findings reported here are based on the exclusive use of vowel formants, most of the related previous works used tens or even hundreds of other features. In spite of using a greater level of signal processing, the recognition accuracy reported earlier was often lesser than that obtained by our approach. This method is based on vowel utterances and the first step comprises statistical pre-processing of the vowel formants. This is followed by the identification of the best formants using the KMeans, K-nearest neighbor and Naive Bayes classifiers. The Artificial neural network that was used for the final classification gave an accuracy of 95.6% on elicited emotional speech. Nearly 1500 speech files from ten female speakers in the neutral and six basic emotions were used to prove the efficiency of the proposed approach. Such a result has not been reported earlier for English and is of significance to researchers, sociologists and others interested in speech.*

Keywords: *Artificial Neural Networks, Emotions, Formants, Preprocessing,Vowels.*

I. INTRODUCTION

Emotions constitute an essential part of our existence. Neviarouskaya et al., [1] have observed that emotions are often assigned the role of a sensitive catalyst, which fosters lively interactions between human beings. Over the past few decades the focus of researchers on speech emotion recognition (SER) has progressively increased due to the social acknowledgement of the influence of emotions on the physical as well as mental health of people. Plutchik [2] has pointed out that emotional distress-a common phenomenon in the present world, impels people to seek help. The emphasis placed on emotional quotient, a measure of emotional intelligence (EI), in the wholesome development of an individual is yet another reason for the increased focus on speech emotion recognition. Salovey and Mayer [3] have defined emotional intelligence as the ability to monitor and regulate one's own and other's feelings. As reported by N.Naqvi et al., [4] decision making, which plays a vital role in the behavior of any person, is aided by emotions, especially when these have to be made in the face of uncertainty.

This paper is organized as follows: The motivation for this research is presented in Section 1.1 along with the problem definition. Section 1.2 briefly mentions certain recent, relevant research works in this area. Section 1.3 introduces the segmental units of speech which are the focus of this investigation. The features used in this work are reviewed in Section 1.4. Section 2 outlines the method used in this research. The results are presented in Section. 3 and their significance is discussed. Section. 4 concludes this paper, mentioning major contributions and suggesting directions for future work.

1.1 Motivation for this Investigation and Problem Definition

Research literature on SER abounds with results of speech analysis as given by Moataz El Ayadi et al., [5] and applications of emotional speech, as illustrated by Ramakrishnan S. & El Emary [6]. Underlying all such results was the availability of steadily increasing computational power and also the evolution of signal processing algorithms. Therefore, reducing both the number of features and the complexity of the SER was never in the purview of research in emotional speech, which instead focused solely on obtaining good emotion recognition rates. It is in this context that the authors were motivated to focus both on the methods as well as results so as to achieve reliable and quantitatively superior SER using minimal inputs, features and signal processing. The first step in this direction was obviously the judicious choice of the speech segment. Due to the stand alone nature of certain vowel phonemes in English, it was decided to investigate the emotions in a speech data base comprising such vowel phonemes. Moreover these vowel phonemes represent the minimum input utterances on which reliable SER can be based.

Problem Definition : The main objectives of this investigation were three fold. The first was to achieve accurate speech emotion recognition using minimal length utterances, for which we used the stand alone vowels in English. The second was to identify the optimum formant spectral features for speech recognition with minimum algorithmic complexity. This was done based on the performance of the kMeans, Naïve Bayes and K nearest neighbor classifiers for single formant classes. The third and final objective was to implement efficient speech emotion recognition with the selected formant values given to an artificial neural network classifier.

1.2 Previous Studies in Speech Emotion Recognition

A few relevant works in the processing of emotional speech are briefly introduced here for easy comparison of the results of this investigation. Lee et. al., [7] conducted a study of the averaged tongue tip movement velocity for each of four peripheral vowels sounds (/IY/, /AE/, /AA/, /UW/) in American English as a function of four emotions. Results indicated angry speech to be characterized by greater ranges of displacement and velocity, while it was opposite in sad speech. In a recent SER work done by Morales [8] in Mexican Spanish, HMMs were used for the acoustic modeling of consonants and vowels. The emotional status was detected from the spectrum differences in vowels, though there were confusions between anger and happiness. Hassan and Dampe [9] proposed a hierarchical classification technique called Data-Driven Dimensional Emotion Classification (3DEC) which used binary support vector machines (SVMs) for multiclass classification of emotions. The investigation had been done using 6552 features per speech sample extracted from three databases of acted emotional speech (DES, Berlin and Serbian) and a German database of spontaneous speech (FAU Aibo Emotion Corpus). Investigations in speech recognition based on the Mel-frequency cepstral coefficients (MFCCs) were found to yield superior results when compared to many other features as reported by Wagner et. al. [10] and S. Emerich and E. Lupu [11]

1.3 Segmental Units of Speech – Vowels

A phoneme is a language specific, minimal, meaningful unit of sound. Luengo et al.,[12] observed vowels as one of the most stable segments in a speech signal, making them very appropriate for the computation of certain features in speech recognition as well as speech emotion recognition. The peculiar resonance (formant) gives to each several vowels its distinctive character or quality as a sound of speech. Quateri, T., F [13] has pointed out that the perception of vowels in isolation without the co-articulation effects of neighboring phones is based on their steady state spectra, usually interpreted in terms of the location of the first four formants-F1 to F4. Observed differences in the F1 and F2 distributions of certain vowels suggest varied effects of emotion on the formants of the different vowels. From experimental results, S.Yildirim et. al., [14] concluded that the peripheral vowels other than /IY/ are more affected by changes in emotion. All these indicate that vowels can communicate emotion through language.

1.4 Features- Formants

Formants are the resonant frequencies of the vocal tract and are called so by speech scientists since these resonances tend to "form" the overall spectrum. Ververidis [15] described formants as quantitative characteristics of the vocal tract since the location of vocal tract resonances in the frequency domain, depends upon the shape and the physical dimensions of the vocal tract. It has been found that speakers during stress or under depression do not articulate voiced sounds with the same effort as in the neutral emotional state as pointed out by Tolkmitt and Scherer [16]. A strong dependency of spectral characteristics on phonemes and therefore on the phonetic content of an utterance has been verified by Schuler et al, [17]. Vowels are distinguished primarily by the location of the first three formant frequencies as illustrated by Shaughnessy [18]. Hence the approach adopted in this work takes advantage of these facts by using only formants for SER.

II. METHODOLOGY

Fig. 1 shows the block diagram of the proposed low complexity SER system used to classify emotions based on the first four formants of English vowels. The five vowels a, e, i, o, u, of ten female speakers were recorded in the neutral and six basic emotions to obtain the speech database. The elicitation of authentic emotions from speakers is difficult and restricted to non-extreme states for ethical reasons. Here the subjects were instructed to imagine and re-experience apt situations or events corresponding to each of the seven emotions.

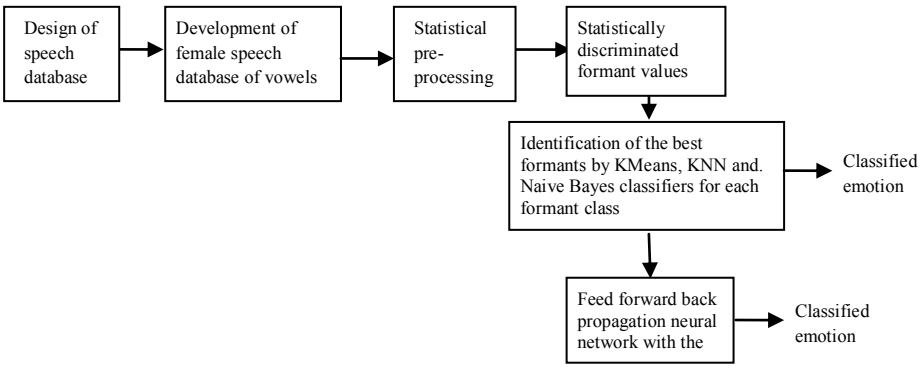

FIG. 1. SCHEMATIC OF THE PROPOSED LOW COMPLEXITY SER SYSTEM

Perceptual listening tests were conducted to ensure the emotional quality of the recorded speech database. The ten voluntary listeners were non-native speakers of English without any known hearing disability. The feedbacks were checked using the identity of the wav files and those files whose emotions were mistaken more than twice were considered unfit and removed from the speech database. The validity of the speech corpus was proven by the overall recognition rate of 92.7% with human listeners.

From each wav file the first four formant values (F1 to F4) for the five English vowels were extracted with the open source speech processing software Praat and tabulated for the seven different emotions . The formants were obtained using the linear prediction method.

Statistical Analysis: Statistical evaluations of the formants were done by analysis of variance (ANOVA).The results of ANOVA indicate the statistical discriminations (at three levels of significance) of the formant values between various emotion classes. Within any specific emotion, the formant values have been reported to change with the specific vowel utterances. Therefore statistical analyses were also carried out to examine and identify significant differences in formant values for the 5 different vowel utterances within the same emotion class. Based on the this, finally only those formant values which reflected the differences in emotions only were used for further classification.

Selection of formants using 3 base classifiers: Separate, formant wise (F1 to F4) classification of emotions using four methods namely Kmeans, Naive Bayes, KNN was done in order to identify the formants that gave the best results in SER. Finally ANN classification was done on the selected formant features. A two-layer feed-forward network, with sigmoid hidden and output neurons and sufficient neurons in its hidden layer was used for the final classification. In this supervised learning technique the network is trained to classify the inputs according to the pre defined targets.

III. Results And Discussion

This section presents the results of the ANOVA, followed by the classification results of the three base classifiers for each formant class. The results of the final classification using ANN are presented in the confusion matrix.

3.1 Results of Statistical Analysis: The formants were examined for statistical difference in feature values by the analysis of variances. Statistical analysis of F1 of vowels revealed anger, sadness and disgust to be better discriminated than the rest of the emotions considered. The repeated measures ANOVA of the logarithm of second formant values showed differences among most of the emotions, at a three star significance level. But happiness could be distinguished from surprise at a low level of significance only. Statistically, anger could not be significantly discriminated from disgust. Neutral and fear were the best discriminated. Statistical analysis of F3 values of vowels revealed sadness to be the best discriminated from all other emotions. Statistical analysis of the logarithm of the fourth formant values of vowels showed two star significance between surprise and disgust. Surprise was better discriminated from the rest of the emotions. When compared with the performance of the first three formants, the statistical discrimination between the seven emotion classes based solely on the F4 values of the vowels was poor. Summarizing the results of ANOVA, all the seven emotions were discriminated well across the four formants, though at different recognition rates.

3.2 Results of Classification of Single Formants: Table 1. below gives the comprehensive results of classification by the Naïve Bayes and the KNN method. With the single formant baseline recognition rate fixed arbitrarily at 20%, each of the four formants recognized almost the same number of cases though for different emotions and with different classifiers. Thus it was inferred that the contribution of each of these four formants is significant and all the four formants were therefore included in the feature set for the final ANN classification. The performance of each of the three classifiers also can be assessed from Table.1, formant wise, for each

emotion. Amongst the three classifiers, the KNN classifier gave the best emotion recognition based on individual vowel formant values and could recognize all the emotions, even though at different rates. This was followed by KMeans classifiers, which could also recognize all emotions. The Naïve Bayes classifier failed to recognize all emotions based on any formant. Based on F1, anger and sadness had high classification rates as obtained with ANOVA. But the low recognition rate of disgust was contradictory to the results of ANOVA. F1 is therefore not recommended for the detection of surprise, fear and disgust.

TABLE 1. SER Rates of various Classifiers for Neutral and Basic Emotions

Formants	Classifier	Happy	Surprise	Neutral	Anger	Sad	Fear	Disgust
F1	KMeans	30.7%	15.8%	24.5%	21.6%	31.3%	19.5%	6.9%
	NB	37.5%	0%	12.5%	43.8%	87.5%	0%	0%
	KNN	25.7%	36.7%	36.4%	51.5%	9.3%	20.7%	19.4%
F2	KMeans	28.2%	11.7%	22.3%	10.6%	10.6 %	11.7%	22.3%
	NB	70%	0%	50%	0%	0%	0%	0%
	KNN	50%	46.7%	41.7%	30%	40%	28.6%	44.4%
F3	KMeans	30.4%	42.9%	23.2%	16.5%	7.1%	3.6%	33.9%
	NB	0%	50%	0%	10%	0%	30%	10%
	KNN	37.5%	15.4%	15.4%	26.3%	25%	23.5%	33.3%
	KMeans	39.2%	31.4%	13.7%	25.5%	3.9%	23.5%	15.7%
	NB	10%	50%	0%	0%	0%	37.5%	10%
F4	KNN	36.8%	25%	32%	19%	14.3%	31.3%	33.3%

3.3 The final ANN classification based on all four formants

All the formant values were given to the ANN classifier since the results of the various classifiers for single formant classes had revealed that all four formants contributed significantly to SER. Table 2 below presents the recognition rates for various emotions based on all the four formants.

TABLE 2. Confusion Matrix Of The Final Ann Classification Based On The First Four Formants

Emotions	Hap	Surp	Neut	Ang	Sad	Fear	Disg
Happy	100%	0%	0%	0%	0%	0%	0%
Surprise	0%	100%	0%	0%	0%	0%	0%
Neutral	0%	0%	100%	0%	0%	0%	0%
Anger	3.4%	0%	0%	96.6%	0%	0%	0%
Sad	0%	0%	3.6%	0%	*96.4%*	0%	0%
Fear	0%	0%	0%	3.8%	11.5%	84.6%	0%
Disgust	0%	4.2%	0%	4.2%	0%	0%	91.7%

Fear was the least recognized. The overall SER rate was 95.6%. The results of the final ANN classification of the first four formant values of the vowels, validates the consolidated findings of ANOVA as well as the results of classifications by the other three classifiers based on single formant values.

3.4 Comparison with state-of-the-art

The results of this investigation are not directly comparable with state-of-the-art results reported elsewhere in the literature on SER. This is because, even for SER in English itself or based exclusively on vowels, the exact database, feature sets, classifiers differ strikingly. Nevertheless, it is informative to provide certain qualitative comparisons between the current results and the state-of-the-art. Schuller et. al, 2009 [19] have reported a speaker independent SER rate of 88.6% on the Berlin speech database. Hassan and Dampe [9] have reported 79.5% on the Berlin database and 80.1% on the Serbian database using the 3DEC method developed by them. The authors have previously reported an obtained recognition rate of 85.3%, with formant bandwidth features on an English database comprising longer utterances comprising several words [20]. Taking into consideration these cited differences in recognition accuracies; we logically conclude that the vowel formant based approach described here, which achieves 95.6% SER rate, is much superior in precision, robustness and computational efficiency. Thus the final ANN classifier in this class seven speech emotion recognition problem outperformed other classifiers used in this work itself and those reported in English.

IV. CONCLUSION

In this paper, we proposed an efficient system for the automatic detection of seven emotions in English, at the segmental level itself using only the formants of stand-alone vowel utterances. The classification results of the KMeans, Naive Bayes and KNN classifiers for various emotions, based on single formant values

agreed with the results of the repeated measures ANOVA. The specific emotion recognition rates obtained by this approach varied with the emotion considered, order of the formant and the classification method. Very high recognition rate was obtained with the final ANN classifier. This approach can be adapted to implement a truly real time SER system.

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An Exploration of HCI Design Features and Usability Techniques in Gaming

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Abstract: *This Conference paper explores the human computer interaction design features relating to gaming industry. The HCI user design interface development and HCI Usability expectations are discussed in this paper. HCI design features of Simple Sudoku and Contemporary HCI Expectations are also discussed. And suggestions are given to develop the Simple Sudoku as per HCI standards and expectations.*

Keywords: *Brain Computer Interface, Gestures Recognition, Hand Gestures in 3D, Pattern Language Management Tool, Real Time Strategy Games*

I. Introduction

HUMAN COMPUTER INTERACTION in this world is currently working with software industries such as gaming industry to implement HCI user design features and usability techniques to develop usable and interactive games [1], [14]. Industry Practices expect design decisions, user interface designs and 'usability testing to be more collaborative' such that whole industry will gain and can move forward with confidence [8]. So with this HCI's importance or impact on software industry has been identified [1], [14].

Though few years back or few decades back HCI and games were not working together as they would fall under different set of development strategy's, as games were more practical based with more graphical user interface designing with less user centric design features as they were designed according to developers strategy & game play. While Human computer interaction was more of theoretical based architecture which studies the usability and design features of the games [1].

II. HCI Usability, Design Process, 3d Real Time Games With Gestures

2.1 Routes for Designing Games with Usability

HCI usability was Key to modify the interface and to redesign the features of computer games. But uniting HCI and computer games lead to few architectural changes and they are as follows:

2.1.1 Development on keen watching.
2.1.2 Effective gaming with effortless community.

Customizing according to users perspective which is also known as deep customizing, which gives power to the users to set & play the game according to their one's own desire. For example setting the stages or levels of game play by skipping previous stages or even changing the graphical user interface by changing backgrounds, colors, use of tools, screen layout, playing game in a window screen or full screen game play etc.

Usability levels of games are redefined with visual experience which relies on design features.

HCI technique Fluid System is helpful in designing a game which makes sure that any other events such as system messages or error messages or focusing to other application which resume's from a sleep doesn't disturb the game of play. This technique needs to be adopted for keeping alive gamers interests, to have a continuous game play without interruptions [1].

2.2 Real time 3D games

The gaming industry with the interaction of HCI is developing new standards such as user visual experience for the games by designing screen layout, developing more realistic 3 dimensional images, true graphics, navigation, selection of commands or buttons used in game play [2].

Now a days as Real time games are concentrating more on user experience and for this user experience industry is developing, modifying or redesigning the interfaces of the game with the real time strategies in role play of the game with the introduction 3 dimensional design interfaces [2].

Certain design principles were followed while developing a usable but at the same time also an enjoyable interface in real time gaming. In real time 3D games user experience is important, so a practical interpretation of user ideas & one's desires are considered while developing a 3D interface. Visual techniques

are used to dramatize the events in the game (such as adventure games) to get a new feel with the interface. So visual techniques are adopted and play a very important role in designing a 3d real time games and have become the primary goal for the developers [9].

3D games are scenario based games with 3 dimensional environments due to its typical behavior a behavioral model is developed which is known as GSOMS. GSOMS model stands for Goal Scenario Operator Methods Selection Rule. This model is used as a base to develop a 3D game [2].

The rules or guidelines to follow in developing a 3D user interface in a Real time 3D game by using a scenario based behavior model GSOMS are:

Check Figure 2.2.1 Command & Conquer 3D Interface for Real-time Strategy Games [2]

2.2.1 The architecture of the game is Constructed in such way that it should have a compact & clear screen layout with a main window in it with Picture type frames (B-frames, I-frames, P-frames) with good video acceleration support(hardware support). In short interface needs to meet the standards set by GSOMS.

2.2.2 Enhancement of audio for 3D gaming purposes known as 3D audio.

2.2.3 Emphasis on background, screens, cursors and picture frames, which resembles visual experience.

2.2.4 Provision for instant feedback which leads to an efficient development [2].

2.3 Hand Gestures in 3D Real Time Gaming Using HCI

Human computer interaction's introduction of hand gestures generates interest in the industry, while hand gestures are used to 'play a natural and intuitive communicational mode of all human dialogs' [3].

In this figure 2.3 [3] shows that hand gestures are used as commands to control the games instead of keyboards or mouse. In order use these gestures as commands for the computer games, a software is used to detect the 3D positions of the gestures such as hand gestures, finger pointing gestures of thumb & index finger and 3D position of user's head. For Utilization of these 3D positions a visual gesture interface is developed to interact with the game. This visual gesture interaction between human operator & computer environment has been enabled with the help of a theory known as sign language recognition along with kalman filter based prediction [3], [7] and [20].

Researchers consider Hand gestures further leading to the introduction of pointing gestures is 'one of the most natural & intuitive HCI approach' [7].

Combination of these techniques in HCI leads to better user interface design. There are few concepts or approaches developed for betterment of user interfaces they are:

Intelligent user interfaces

User interface design is achieved by adapting to the concepts such as 'intelligent user interfaces which provides the knowledge of background information for designing [4].

Adaptive user interfaces

It is the interface developed from collective feedback received from users or multiple gamers, this feedback is used to utilize the knowledge of users to design or configure the interface [4].

User interface management systems

In order to develop the application as a whole designing needs to be separated from the application by following the concept of DCT (Design, Coding, Testing) this separation of designing from application is done under user interface management systems (UIMS) [4].

Multimedia user interfaces

These are used to provide rich environment for user while playing the games [4].

2.4 Gestures Recognition with WII Controller

Latest current technology which is also triggering gaming industry is Wii controller which is also called as Wii remote. This technology is most widely used in game consoles such as Nintendo, Xbox360 etc. This HCI technology is a remote optical sensor technology with which a game console can be provoked with the input commands. With the introduction of this technology there is a regulatory change in interface design for the games [10].

2.5 Implementation of a 3-Dimensional Game Using BCI

BCI (Brain wave computer interaction) which is a part of HCI and is the one of the research areas on which everyone are concentrating nowadays [5].

Brainwave computer interaction concentrates more on how the research has been conducted for the implementation of HCI techniques. This research affects the user interface design and triggers a new interface with fresh new ideas [5].

BCI research spells out on pattern recognition mechanism which helps in adding flexibility to the interfaces [5].

Pattern recognition is built using Pattern Language Management Tool (PLMT). This PLMT is used to manage constructed languages in HCI, it is an automated tool searches for pattern's present in HCI language, and this also helps in adding patterns such as interface design patterns to the HCI languages and also helps in modifying existing interfaces [11].

BCI's research on new interface has amazed gamers and not only gamers but also gaming companies are surprised with the new interface coming up. BCI's new interface is a kind of interface where all important guidelines or research information from HCI are taken into consideration such as user centric designing, issues, visual experience etc [5].

Finally Brain wave computer interaction finally ousted with the interface developed which is more specific to user centric and the features of interface are as listed below:

2.5.1 Brain computer interface (BCI) is used along with special devices from BCI.
2.5.2 BCI interface is an unique and new concept where brain works as virtual game controllers rather than any strategies deployed or used by the developers.
2.5.3 BCI Devices are used to control the computer and the devices are controlled by brains of the user or gamer.
2.5.4 Thoughts of user are being transformed to the games virtually by the BCI devices.
2.5.5 This technology has created shivers in the gaming industry. In fact not only gaming industry but also doctors & Scientists are worried with the introduction of this brain to game interface and its effects on gamers [5], [11], [21] and [22].

2.6 GUI vs. User Centric Interfaces

Graphical user interfaces which are very important in developing the games, but developed with no thought or respect for user's interest or ideas [6], [16]. But now a day's developers are keen to know the user's view point or perspective due to the complex nature of GUI's. This provoked for the introduction of user centric interfaces which resolves any complexity issues in interfaces. This shows that user centric interfaces are no different from GUI's but seem to be the superset of GUI's with few architectural changes in designing or developing the interfaces [6], [16].

III. HCI Design Features Of Simple Sudoku

A Simple Sudoku has a number based logic puzzle consisting of 9x9 grids which are further divided into 3x3 grids containing digits or numbers from 1-9 [12].

Initially Sudoku was known as 'Number place' but after gaining recognition it was renamed to Sudoku which is a Japanese word originated from Japan where 'Su' means number and 'Doku' means single [12].

Important Design features such as search space heuristics to arrive at problem initialization and neighborhood, which speeds up the solution with the implementation of Hill climbing algorithm for finding the unsolved puzzles or grids. Some more important features are hints to solve the puzzles, various complexity of playing levels, Multi language GUI which shows that the GUI used in the development of Simple Sudoku is an User Centric GUI [12], [15].

Algorithmic approaches used in the development of Sudoku are recommend from the research studies of HCI and is good enough to solve complex rated puzzles with reduced problem search place [12].

Algorithms are constructed in combination of logistics and a code written in a programming language for execution of pre-defined tasks, Along with this algorithm HCI standards implemented with heuristics search based approaches are designed for reducing the unsolved grids in the puzzle [12].

N-P complete puzzle of Sudoku which is solved using a stochastic search based algorithm which is also known as SA algorithm helps in discovering type of instances [13].

Various algorithmic approaches are applied throughout the development of Simple Sudoku in order to meet HCI expectations [13].

IV. CONTEMPORARY HCI EXPECTATIONS

4.1 User Interface Meet Contemporary HCI Expectations

Simple Sudoku interface meets the contemporary HCI expectations as

Simple Sudoku has followed the User Centric design interfaces such as:

4.1.1 Designing game according to one's logical thinking.
4.1.2 Easy, Standard, Hard, Extreme, Expert levels are introduced by keeping various gamers perspective in mind.
4.1.3 Hints are given to solve the puzzle.
4.1.4 Multi languages GUI support etc.

These design features are user centric as they are made available keeping in mind the interests of different users such as when an expert is playing he will choose the Expert mode, where as a starter can choose the easy mode [15].

4.2 User Interface Does Not Meet Contemporary HCI expectations

The contemporary HCI expectation for Simple Sudoku's interface which doesn't meet are:

4.2.1 3Dimensional interface.
4.2.2 Introduction of various new technologies to the interface.

4.3 Suggestions for Improving Simple Sudoku HCI

Well though as stated there are few Technologies lacking in the development of Simple Sudoku's interface such as

4.3.1 Introduction of 3 Dimensional interfaces.
4.3.2 User visual experience.

Still I think it's a well-crafted application or software to be played on normal computer platforms without expecting much support from hardware such as video acceleration, 3D support from the video card etc.

So final words on Simple Sudoku's interface is that though it lacks the introduction of few new technologies, it still meets all the Basic Contemporary HCI expectations such as User centric designing, use of different algorithmic approaches for solving puzzles of Simple Sudoku etc. This explains that Simple Sudoku's development has done as per HCI standards & expectations.

V. FIGURES AND TABLES

Figure 2.2.1 Command & Conquer 3D Interface for Real-time Strategy Games [2]

Figure 2.3 [3]

VI. CONCLUSION

HCI plays a major role in developing the games with good design interface and usability. Design interface in HCI is important whereas User Centric Design Interface is key to success. Many developers don't have the user's idea & perspective in mind while developing a GUI. So it's important to develop an User Centric Design Interface.

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Clustering Algorithm Based On Correlation Preserving Indexing

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Abstract: *Fast retrieval of the relevant information from the databases has always been a significant issue. Different techniques have been developed for this purpose; one of them is Data Clustering. In this paper Data Clustering is discussed along with the applications of Data Clustering and Correlation Preserving Indexing. We proposed a CPI (Correlation Preserving Indexing) algorithm and relate it to structural differences between the data sets.*
Keywords*: Data Clustering, Data Mining, Clustering techniques, Correlation Preserving Indexing.*

I. Introduction:

Cluster analysis is a convenient method for identifying homogenous groups of objects called clusters. Objects (or cases, observations) in a specific cluster share many characteristics, but are very dissimilar to objects not belonging to that cluster.

The most important task of clustering gave important attention to various branches such as machine learning and artificial intelligence. The clustering has the broad appeal and usefulness as basic steps in exploratory data analysis are an unsupervised learning method that constitutes a corner stone of an intelligent data analysis process. The analysis used for exploiting the various inters relationships among a collection of patterns which are divided and organized in homogeneous clusters. With a good clustering method the computers, automatically organized in a meaningful clustering hierarchy.

In many traditional approaches to machine learning, a target function is estimated using labeled data.

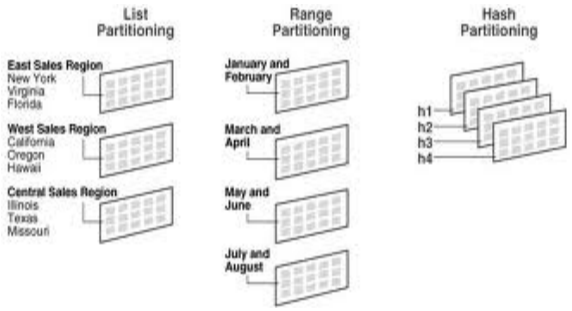
II. Existing System & Analysis :

Document clustering is one of the most crucial techniques to organize the documents in an unsupervised manner. It has received a lot of attention in recent years.

2.1 PARTITIONING MATHODS:

Partitioning methods are divided into two major subcategories, the centroid and the mediod algorithms. The centroid algorithms represent each cluster by using the gravity Centre of the instances. The mediod algorithms represent each cluster by means of the instances closest to the gravity Centre.

The most well-known centroid algorithm is the k-means. The k-means method partitions the data set into k subsets such that all points in a given subset are closest to the same Centre. In detail, it randomly selects k of the instances to represent the clusters. Based on the selected attributes, all remaining instances are assigned to their closer Centre. K-means then computes the new centers by taking the mean of all data points belonging to the same cluster. The operation is iterated until there is no change in the gravity centers. If k cannot be known ahead of time, various values of k can be evaluated until the most suitable one is found. The effectiveness of this method as well as of others relies heavily on the objective function used in measuring the distance between instances. The difficulty is in finding a distance measure that works well with all types of data. There are several approaches to define the distance between instances.



Knowing how to optimally use the space available in your computer hard disk can be the difference between enjoying your personal computer or not. Computer hard disks come in different sizes, and it is possible to divide the hard disk into different sections, slices or storage units -- a process commonly referred to as partitioning. A

computer can have a fixed or dynamic partition. A fixed partition has a constant size while a dynamic partition can change its size based on the need. Most operating systems have methods and software inbuilt for the managing of fixed partitions.

1.1.1 PREVENT DATA LOSS:

One of the advantages of fixed partitions is that you can prevent data loss when there is a software malfunction or loss of power. Fixed partitions also help you increase your chances of data recovery in worse situations. The computer hard disk should be partitioned into at least two major sections to enjoy this advantage. One partition should have the programs installed while the other partition should have the data. In the event of a program malfunctions when working on your computer, you can access, retrieve or recover your data intact from the data partition.

2.1.2 RESRICTIONS:

A disadvantage of fixed partitions is the severe restriction that comes through the fixed or allocated space in the particular partition. This means you cannot install a file, folder or program that is bigger than the space provided in the partition. This, therefore, limits the operation or work you can do in any given partition.

2.1.3 LOSS OF SPACE:

Another disadvantage of fixed partitions is the loss of disk space from the total disk space available when operating different operating systems in the same hard disk. This especially happens when you are forced to duplicate various files, folders or programs from one operating system to another operating system in order to perform certain work or functions in that particular operating system. This duplication of content from one partition to another reduces the overall space you can use in the computer hard disk for other files, folders or programs.

2.2. HIERARCHICAL CLUSTERING:

The hierarchical methods group data instances into a tree of clusters. There are two major methods under this category. One is the agglomerative method, which forms the clusters in a bottom-up fashion until all data instances belong to the same cluster. The other is the divisive method, which splits up the data set into smaller cluster in a top-down fashion until each cluster contains only one instance. Both divisive algorithms and agglomerative algorithms can be represented by dendrograms.

Both agglomerative and divisive methods are known for their quick termination. However, both methods suffer from their inability to perform adjustments once the splitting or merging decision is made.

Other advantages are:
1) Does not require the number of clusters to be known in advance
2) Computes a complete hierarchy of clusters
3) Good result visualizations are integrated into the methods
4) A "flat" partition can be derived.

Hierarchical clustering techniques use various criteria to decide "locally" at each step which clusters should be joined (or split for divisive approaches). For agglomerative hierarchical techniques, the criterion is typically to merge the "closest" pair of clusters, where "close" is defined by a specified measure of cluster proximity. There are three definitions of the closeness between two clusters: single-link, complete-link and average-link.

The single-link similarity between two clusters is the similarity between the two most similar instances, one of which appears in each cluster. Single link is good at handling non-elliptical shapes, but is sensitive to noise and outliers. The complete-link similarity is the similarity between the two most dissimilar instances, one from each cluster. Complete link is less susceptible to noise and outliers, but can break large clusters, and has trouble with convex shapes. The average-link similarity is a compromise between the two.

Some of the hierarchical clustering algorithms are:
Balanced Iterative Reducing and clustering using Hierarchies - BIRCH, Clustering Using representatives - CURE and CHAMELEON.

2.2.1 ADVANTAGES OF HIERARCHICAL CLUSTERING:

It is sometimes meaningful to cluster data at the experiment level rather than at the level of individual genes. Such experiments are most often used to identify similarities in overall gene-expression patterns in the context of different treatment regimens—the goal being to stratify patients based on their molecular-level responses to the treatments. The hierarchical techniques outlined earlier are appropriate for such clustering,

which is based on the pairwise statistical comparison of complete scatterplots rather than individual gene sequences. The data are represented as a matrix of scatterplots, ultimately reduced to a matrix of correlation coefficients. The correlation coefficients are then used to construct a two-dimensional dendrograms in the exact same way as in the gene-cluster experiments previously described.

The overall process of constructing a two-dimensional dendrograms using hierarchical clustering data is depicted. The example in the figure embodies all the principles of the technique but in a vastly simplified form; expression-profile experiments typically include hundreds, sometimes thousands of genes, and the analysis is almost always more complex than this illustration.

Construction of a two-dimensional dendrograms representing a hierarchical cluster of related genes. Each column represents a different experiment, each row a different spot on the microarray. The height of each link is inversely proportional to the strength of the correlation. Relative correlation strengths are represented by integers in the accompanying chart sequence. Genes 1 and 2 are most closely regulated, followed by genes 4 and 5. The regulation of gene 3 is more closely linked with the regulation of genes 4 and 5 than any remaining link or combination of links. The strength of the correlation between the expression levels of genes 1 and 2 and the cluster containing genes 3, 4, and 5 is the weakest (relative score of 10).

Messenger *RNA* profiling techniques have become a cornerstone of modern disease classification. These advances are especially significant in areas such as oncology and neuroscience, where complex phenotypes have recently been found to correlate with specific changes in gene expression, the result being more precise patient stratification both for clinical trials and treatment. A significant example that illustrates the utility of hierarchical clustering involves the identification of distinct tumor subclasses in diffuse large B-cell lymphoma (*DLBCL*). Two distinct forms of *DLBCL* have been identified using hierarchical clustering techniques, each related to a different stage of B-cell differentiation. The fact that the cluster correlates are significant is demonstrated by direct relationships to patient survival rates

2.2.2 DISADVANTAGES OF HIERARCHICAL CLUSTERING:

Despite its proven utility, hierarchical clustering has many flaws. Interpretation of the hierarchy is complex and often confusing; the deterministic nature of the technique prevents reevaluation after points are grouped into a node; all determinations are strictly based on local decisions and a single pass of analysis; it has been demonstrated that the tree structure can lock in accidental features reflecting idiosyncrasies of the clustering rules; expression patterns of individual gene sequences become less relevant as the clustering process progresses; and an incorrect assignment made early in the process cannot be corrected . These deficiencies have driven the development of additional clustering techniques that are based on multiple passes of analysis and utilize advanced algorithms borrowed from the artificial intelligence community. Two of these techniques, k-means clustering and self-organizing maps (SOMs), have achieved widespread acceptance in research oncology where they have been enormously successful in identifying meaningful genetic differences between patient populations.

When discussing clustering algorithms, it is essential to recognize the limitations of two- and three-dimensional representations of individual gene-expression values across a collection of experiments depicts a simple analysis composed of two experiments. Each experiment is represented by a dimension in the grid, and clusters of the genes are readily apparent. Visual representation of two gene-clustering experiments. For each transcript, the fluorescence ratio (Cy5/Cy3) is plotted on one of the two axes; y-axis for experiment 1 and x-axis for experiment 2. Genes with high fluorescence ratios in both experiments appear farthest from the origin. Genes with similar behavior across the two experiments are closely clustered on the graph. Three different clusters are evident in diagram. Representations of two or three experiments are relatively straightforward to visualize because they can be plotted on the axes of a simple graph (either x and y axes or x, y, and z axes).

Results from more than four experiments are difficult to represent because they cannot be visualized in three dimensions. which depicts the results from three experiments, represents the most complex case that can be easily visualized on the axes of a graph. As in the two-dimensional case, each gene occupies a unique position on the graph determined by its fluorescence ratio in each of the three experiments. For example, a gene that exhibits Cy5/Cy3 fluorescence ratios of 3,5, and 4.5 in the three experiments would be represented by a single point plotted at the coordinate 3,5,4.5 in the graph. As in the two-experiment model, absolute distance from the origin correlates with the Cy5/Cy3 ratio, and the distance between points in three-dimensional space is representative of the likelihood that the genes they represent are regulated across the three experiments.

A 3D(three experiment) gene-clustering analysis containing ten different sequences. Each axis in the drawing represents a different experiment, and each set of expression levels is represented by a single vector defined in three dimensions. As in the two-dimensional case, grouping of the sequences is accomplished by determining the geometric distance between each vector. Higher-dimensional models representing more than three experiments cannot be visualized as single vectors, and so different graphical techniques must be used.

The ten genes used in these experiments are clustered into readily recognizable groups. As mentioned previously, higher-dimensional representations, those containing more than three sets of experimental results, are much more complex to imagine because absolute distances between individual genes and gene clusters do not lend themselves to visual representation. However, despite the complexities associated with visual representation of microarray data across large numbers of experiments, it is always possible to calculate a single vector to represent all the expression values for any gene sequence regardless of the number of dimensions/experiments. It is the distance between these vectors that determines the degree to which a pair of genes is regulated.

2.3 DENITY-BASED CLUSTERING:

Density-based clustering algorithms try to find clusters based on density of data points in a region. The key idea of density-based clustering is that for each instance of a cluster the neighborhood of a given radius (*Eps*) has to contain at least a minimum number of instances (*minpts)*. One of the most well-known density-based clustering algorithms is the DBSCAN.

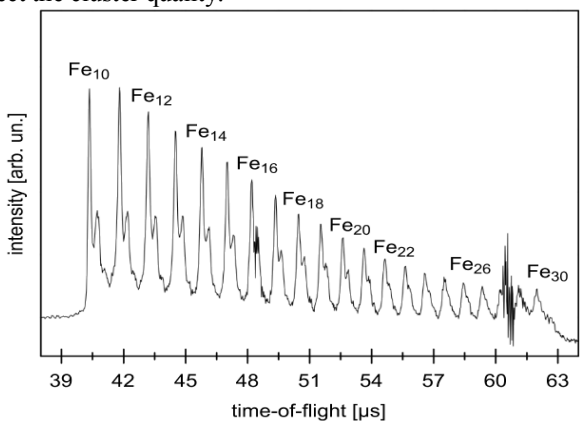
DBSCAN separate data points into
Three classes:
• Core points. These are points that are at the Interior of a cluster. A point is an interior point if there are enough points in its neighborhood.
• Border points. A border point is a point that is not a core point, i.e., there are not enough points in its neighborhood, but it falls within the neighborhood of a core point.
• Noise points. A noise point is any point that is not a core point or a border point

To find a cluster, DBSCAN starts with an arbitrary instance (*p*) in data set (*D*) and retrieves all instances of *D* with respect to *Eps* and *minpts*. The algorithm makes use of a spatial data structure - R*tree [24] - to locate points within Eps distance from the core points of the clusters.

2.4 GRID-BASED CLUSTERING:

Grid-based clustering algorithms first quantize the clustering space into a finite number of cells (hyper-rectangles) and then perform the required operations on the quantized space. Cells that contain more than certain number of points are treated as dense and the dense cells are connected to form the clusters. Some of the grid-based clustering algorithms are: statistical information Grid-based method - STING, wave cluster, and clustering Inquest - CLIQUE.

STING first divides the spatial area into several levels of rectangular cells in order to form a hierarchical structure. The cells in a high level are composed from the cells in the lower level. It generates a hierarchical structure of the grid cells so as to represent the clustering information at different levels. Although STING generates good clustering results in a short running time, there are two major problems with this algorithm. Firstly, the performance of STING relies on the granularity of the lowest level of the grid structure. Secondly, the resulting clusters are all bounded horizontally or vertically, but never diagonally. This shortcoming might greatly affect the cluster quality.



CLIQUE is another grid-based clustering algorithm. CLIQUE starts by finding all the dense areas in the one-dimensional spaces corresponding to each attribute. CLIQUE then generates the set of two-dimensional cells that might possibly be dense, by looking at dense one-dimensional cells, as each two-dimensional cell must be associated with a pair of dense one-dimensional cells. Generally, CLIQUE generates the possible set of k-dimensional cells that might possibly be dense by looking at dense (k - 1) dimensional cells. CLIQUE produces identical results irrespective of the order in which the input records are presented. In addition, it generates cluster

descriptions in the form of DNF expressions [1] for ease of comprehension. Moreover, empirical evaluation shows that CLIQUE scales linearly with the number of instances, and has good scalability as the number of attributes is increased.

Unlike other clustering methods, wave cluster does not require users to give the number of clusters. It uses a wavelet transformation to transform the original feature space. In wavelet transform, convolution with an appropriate function results in a transformed space where the Natural clusters in the data become distinguishable. It is a very powerful method; however, it is not efficient in high dimensional space.

III. Proposed System:

Now, introducing the

- Correlation Preserving Indexing (CPI).
- Clustering algorithm based on CPI.

CPI ALGORITHEM

INPUT: Consistent ontology 0 ←(c, p, I, a, F) 01 U 02.axiom **a** representing the current integration candidate (e.g. (c1 out equivalent class c2)), initial similarity score for alignment candidate **a** (e.g. the similarity score between c1 & c2)

Output: New similarity score normalized with respect to the consequences of inference **0** if the candidate alignment causes an inconsistency.

1. A←A U {a}
2. f ← 1
3. For I ←1 to N do
4. **If a** is a class equivalence/Subsumption axiom **then**
5. **P** ←choose a property incident to one of the class in **a**
6. **else if a** is a property equivalence/subsumption axiom then
7. **P**←choose a property referenced by **a**
8. **else if** a is an instance equivalence axiom **then**
9. P←choose a property incident to an instances in **a**
10. **End if**
11. Choose an axiom $^{ar} \neq$ a from A that involves **p**
12. $(\mu^i, e^i) \leftarrow \Delta (\mu^{i-1}, e^{i-1})$ by applying Δ for a^t
13. **if** there is an inconsistency **then**
14. **Return** 0
15. End if
16. Recompute the effected instance set closure
17. For all pairs of X, Y € I that have become equivalent do
18. f ← f similarity(x, y)/ 1-similarity(x, y)
19. **End for**
20. **End for**
21. **Return** min (1, f, score)

CPI ALGORITHEM

Input: Consistent ontology 01 and 02

Output: Integration of 01 and 02.

1. Compare 0 ← 01 and 02
2. Initialize clusters to single classes, properties and individuals in 0
3. Compute initials similarity scores for all pairs of clusters
4. Repeat
5. Determine equivalence/Subsumption axioms for all pairs of clusters with similarity greater than μ
6. Run **CPI** interference in parallel for all pairs of clusters with similarity greater than λt
7. Choose pair of clusters with best similarity measure and merge them into a single cluster
8. Recompute similarity scores for affected clusters
9. Until there are no clusters with similarity measure greater than λt
10. Return 0

Scope:

- Can be applied on blog analysis.
- Can be applied on web pages classification.
- Can be applied on news classification.

IV. Conclusion:

With the further advancements of the data mining algorithms, the efficiency of analyzing large amounts of the data must be improved for achieving further efficiency. The demand for less retrieval period of data extraction from a large data warehouses points the efficiency of data retrieval of present clustering techniques, here we must use further advancements to the present clustering techniques. And the new clustering algorithms have to improve for a good efficient data handling using clustering techniques.

- CPI method is the better approach than of LSI and CPI.
- CPI method is better than of traditional K-means.
- CPI method has good generalization capability.

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VLSI Implementation of High Speed & Low Power Multiplier in FPGA

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Abstract : *We known that different multipliers consume most of the power in DSP computations, FIR filters. Hence, it is very important factor for modern DSP systems to built low-power multipliers to minimize the power dissipation. In this paper, we presents high speed & low power Row Column bypass multiplier design methodology that inserts more number of zeros in the multiplicand thereby bypass the number of zero in row & Column as well as reduce power consumption. The bypassing of zero activity of the component used in the process of multiplication, depends on the input bit data. This means if the input bit data is zero, corresponding row and column of adders need not be addition & transfer bit in next row and column adder circuit. If multiplicand having more zeros, higher power reduction can be achieved. At last stage of Row & column bypass multiplier having ripple carry adder which are increase time to generate carry bit to transfer next adder circuit. To reduce this problem by using Carry bypass adder in place of ripple carry adder, then new modification of Row &column multiplier having high speed in comparison to simple row & column bypass multiplier, , the experimental results show that our proposed multiplier reduces power dissipation & High speed overhead on the average for 4x4, 8x8 and 16x16 multiplier.*

Keywords: *Low Power, Row & Column bypass Multiplier, Carry bypassing techniques, FPGA, Xilinx .*

I. INTRODUCTION

Multipliers are key components of many high performance systems such as filters, microprocessors, digital signal processors, etc. A system's capability is generally determined by the performance of the multiplier because the multiplier is generally the slowest element in the system. Multiplier required more hardware resources and processing time then addition and subtraction. In fact 8.74% of all instructions in a typical processing unit is a multiplier. In computer a typical central processing unit devotes a considerable amount of processing time in arithmetic operation, particularly multiplication operation. Multiplication is an important fundamental arithmetic operation. Multiplication based operation such as multiply and accumulate (MAC) are currently implemented in many digital signal processing application such as convolution, Fast Fourier Transform (FFT), Filtering and in microprocessor in its arithmetic and logic unit. Since multiplication dominants the execution time of most DSP application, there is a need to high speed multiplier. Currently multiplication time is still that dominant factor in determining the instruction cycle time of DSP chip. The multiplier is fairly large block in of computing system.

In the past many novel ideas for multiplier have been proposed to achieve high performance. Higher throughput arithmetic operations are important to achieve the desire performance in many real time signal and image processing application. On of the key arithmetic operation in such application is multiplication and the development of fast multiplier circuit has been a subject of interest over decades. Reducing the delay and power consumption is very essential requirement for many applications.

When we multiply binary numbers there are lots of zeros, whenever any of the multiplicand bit is zero and it gets multiplied by any bit it produces zero . In Braun's multiplier the resultant zeros are added and the corresponding full adders work and consume power. So Bypass techniques are employed to deactivate the full adders when multiplying with zeros. This will reduce the power consumption.

II. Previous Work And Related Research

The architecture view of a 4*4 Standard Braun multiplier is as shown in Fig.:1.Braun Multiplier is a simple parallel multiplier generally called as CSM (carry save multiplier). This parallel multiplier is used to perform the unsigned bit multiplication. The Braun multiplier structure makes of the array of array of AND gates and full adders. To implement the n*n multiplier n(n-1) full adders and n2AND gate are required[2]. The delay introduced by the Braun's multiplier depends on the delay of the full adders and also on the delay of the final adder in the last stage which is a ripple carry adder. The dynamic power dissipation of the multiplier resulting from the switching activities can be reduced via bypassing techniques like Row bypassing, column bypassing and Reversible Logic techniques [3].

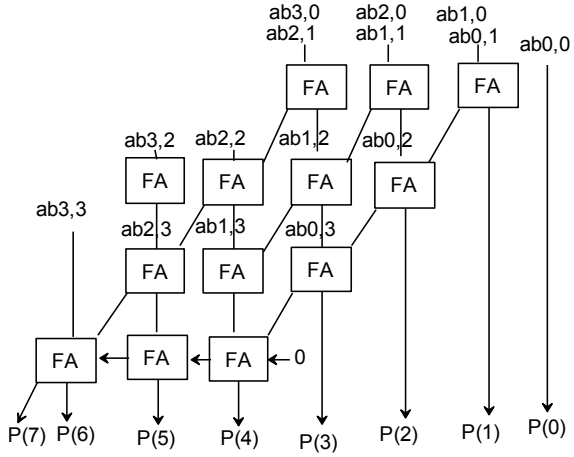


Fig. 1. Array multiplier

In Column Bypassing multiplier, if the multiplier bit ai is zero, then the addition operations in the i-th Column can be bypassed, thus providing directly (i-1)-th Column outputs directly to out at last satge. Thus, the switching activities in the i-th Column reduced and hence the power dissipation. The 4 bit Braun Multiplier with Column Bypassing technique is illustrated in Fig 2.

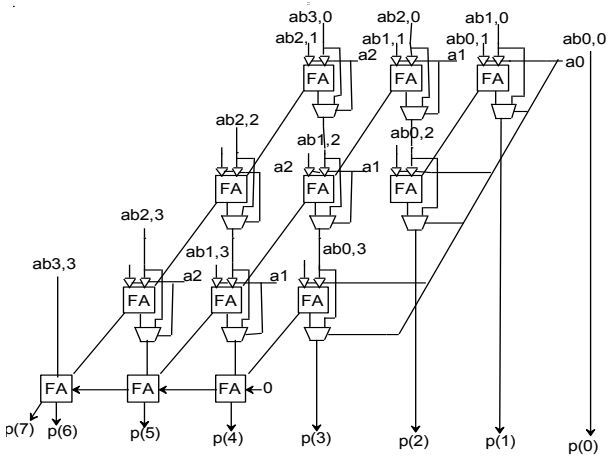


Fig. 2. Column bypass multiplier

In design of Reversible logic, has used as one of the most application approaches for the power optimization with its application in low power requirement of VLSI circuit design. Modification of Reversible logic circuits design have theoretically zero internal power dissipation because they do not lose information, the classical set of gates such as AND, OR, and EXOR are not reversible. TSG gate is used in place of Full Adder , capable of implementing all Boolean functions and can also work singly as a reversible Full Adder . The 4 bit Reversible logic Multiplier is illustrated in Fig 3.

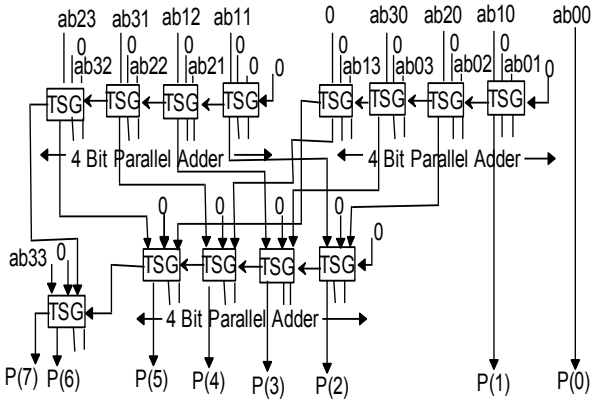


Fig. 3. Reversible Multiplier

III. PROPOSED WORK

In all the multipliers discussed above, According to the bypassing features in the previous low-power multipliers, the addition operations in the (i+1)-th column or the j-th row can be bypassed for the power reduction if the bit, ai, in the multiplicand is 0 or the bit, bj, in the multiplier is 0. On the other hand, the extra correcting circuits in the row-bypassing multiplier are applied to add the bypassed carry results into the multiplication result. Therefore, the addition operation in the (i+1, j) FA can be bypassed in our proposed bypassing multiplier if the product, aibj, is 0 and the carry bit, ci,j-1, is 0, that is, as the product, aibj, is 1 or the bit, ci,j-1, is 1, the addition operation in the (i+1, j) FA can be executed. It is known that the (i+1, j) FA only executes the A+1 addition as the product, aibj, is 1 and the bit, ci,j-1, is 0, or the product, aibj, is 0 and the bit, ci,j-1, is 1. On the other hand, the (i+1, j) FA only executes the A+2 addition as the product, aibj, is 1 and the bit, ci,j-1, is 1. Hence, the carry bit in the (i+1, j) FA can be replaced by the AND result of the product, aibj, and the bit, ci,j-1, and the (i+1, j) FA, n > j > 1, can be replaced with the half adder, A+B+1, in the proposed low-power multiplier. For the HAs in the first row of CSAs, the HAs are also replaced with the incremental adder, A+1, because of the 2-dimensional bypassing process. Besides that, each simplified adder, A+1, in the CSA array is only attached by one tri-state buffer and two 2-to-1 multiplexers and each simplified adder, A+B+1, in the CSA array is only attached by two tri-state buffers and two 2-to-1 multiplexers. In Fig. 5, the logical circuits of the different adders, A+1, A+B and A+B+1 are shown. A 8X8 Braun multiplier with row and column bypassing can be illustrated in Fig. 5.

Example- 11101011 8-bits

10101111 8-bits

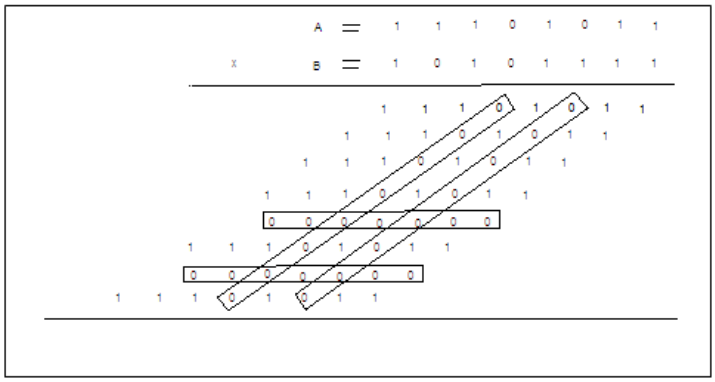


Fig. 4. A 8×8 multiplication of bit ai =bj= 0 corresponds to Row & column i = 0,j=0

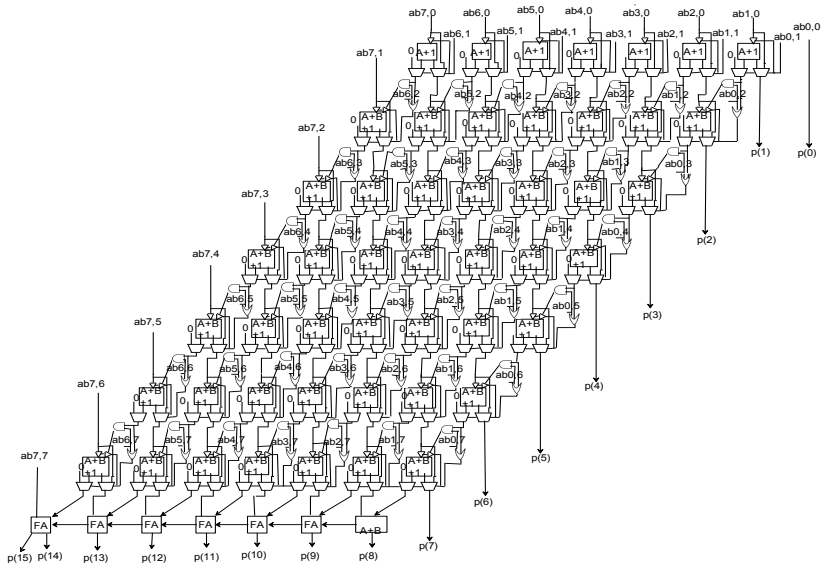


Fig. 5. Row & Column Bypass Multiplier

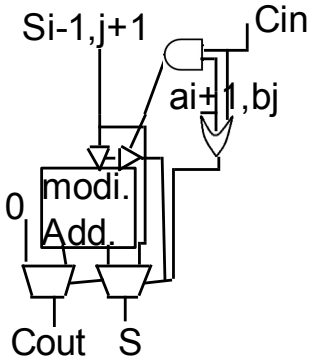


Fig. 6. Adder cell (CA)

But the last stage of Row & Column Bypass Multiplier has been used a ripple carry adder. The main drawback of this multiplier is that because of the ripple carry adder in the last stage glitching problem occurs and also the delay of the multiplier will be high. The ripple carry adder is constructed by cascading full adders (FA) blocks in series. One full adder is responsible for the addition of two binary digits at any stage of the ripple carry. The carryout of one stage is fed directly to the carry-in of the next stage. Even though this is a simple adder and can be used to add unrestricted bit length numbers, it is however not very efficient when large bit numbers are used. One of the most serious drawbacks of this adder is that the delay increases linearly with the bit length. The worst-case delay of the RCA is when a carry signal transition ripples through all stages of adder chain from the least significant bit to the most significant bit, which is approximated by:

$$t = (n-1)\,tc + ts \qquad \text{Eq (1)}$$

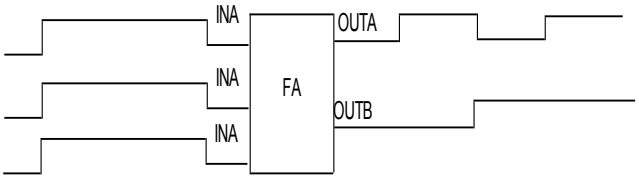


Fig. 7: Glitching on an adder

where tc is the delay through the carry stage of a full adder, and ts is the delay to compute the sum of the last stage. The delay of ripple carry adder is linearly proportional to n, the number of bits, therefore the performance of the RCA is limited when n grows bigger. The advantages of the RCA are lower power consumption as well as compact layout giving smaller chip area. The design schematic of RCA is shown in Figure (2).

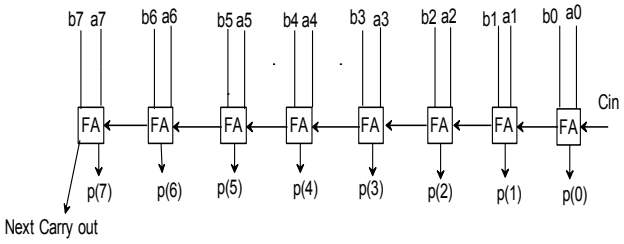


Fig. 8. Ripple Carry adder

Ripple Carry adder is a combination of several full adders. The carry input of full adder is dependent on the carry output of the previous full adder, and the present full adder should wait until the previous full adder has completed producing the outputs. Hence, the delay is more for the ripple carry adder. If the number of bits increases, then the delay also increases more for a ripple carry adder.

The delay and power of the multiplier can be reduced by replacing the ripple carry adder with fast adders like Carry bypass adder.

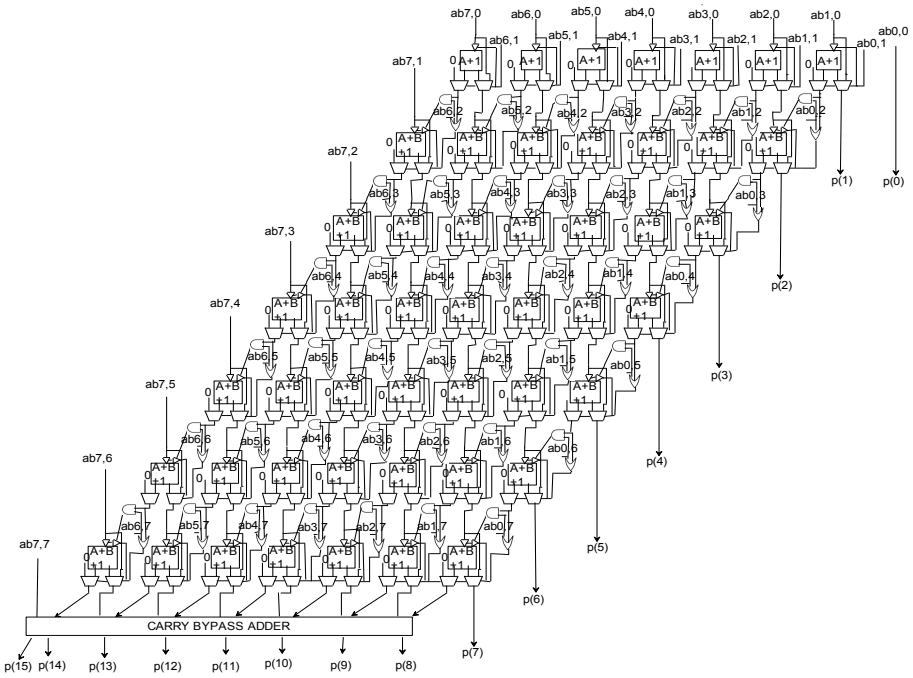


Fig. 9. Modify Row & Column Bypass Multiplier

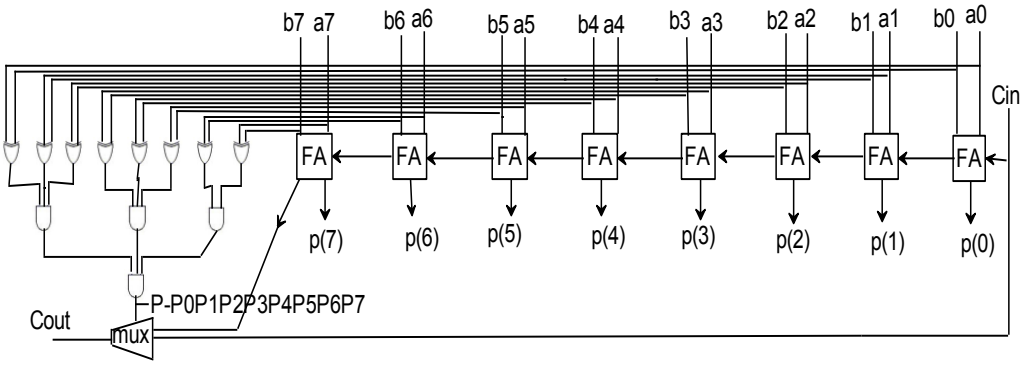


Fig .10. Carry bypass Adder

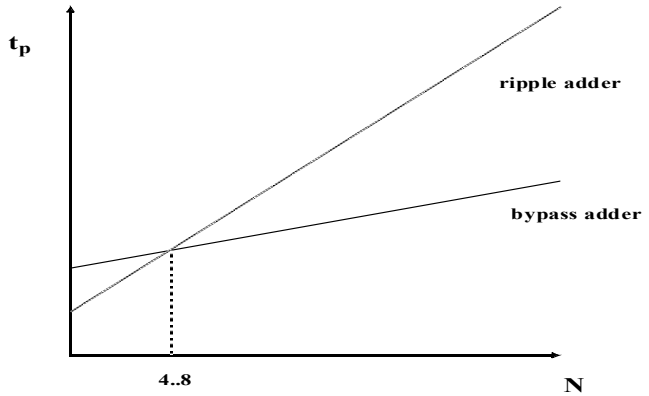


Fig. 11. Carry Ripple versus Carry Bypass

IV. Experimental Results

A. Analysis On Area Overhead of Slices :-

In all the multiplier designs, to give us an idea of the area that will be used, the number of transistors used in the circuit is counted since this directly affects the area. The results are shown in Table 1.

S.N.	Multiplier	No. Of Slice Uses
1	Simple Multiplier	76
2	Bypass Row Multiplier	86
3	Bypass Column Multiplier	84
4	Bypass Row & Column Multiplier	85
5	Modify Bypass Row & Column Multiplier	87

Table 1. No of Slices use in different multiplier (8x8)

B. Analysis Power Dissipation :-

The average dynamic power of each test case were measured and tabulated in Table 2(mw).

S.N.	Multiplier	Dynamic	Quiescent	Total(mw)
1	Simple Multiplier	136.85	15.13	151.99
2	Bypass Row Multiplier	137.46	15.14	152.60
3	Bypass Column Multiplier	133.86	15.10	148.96
4	Bypass Row & Column Multiplier	133.32	11.90	145.22
5	Modify Bypass Row & Column Multiplier	133.88	11.90	145.79

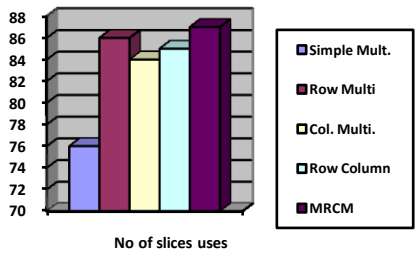
Table 2. Power dissipation in different multiplier (8x8)

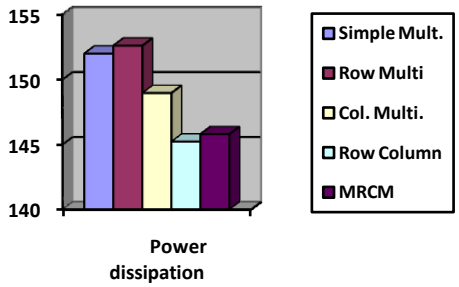
C. Propagation Delay

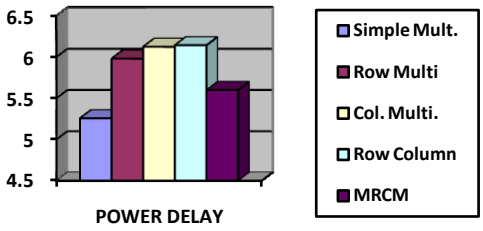
For the propagation delay, the critical path delay is measured which occurs in the middle of the array. The test cases used travel along this path. The propagation delay measured for each of the multiplier architecture is shown in Table 3.

S.N.	Multiplier	Power Delay
1	Simple Multiplier	5.256
2	Bypass Row Multiplier	5.981
3	Bypass Column Multiplier	6.125
4	Bypass Row & Column Multiplier	6.143
5	Modify Bypass Row & Column Multiplier	5.60

Table 3. Delay in different multiplier 8x8 (ns)







V. Conclusion

We have introduced low-power multiplier design and High speed bypass method in this paper. Our proposed modify Row & Column Bypass multipliers are useful for all multipliers. To reduce the power and increase speed, From the obtained results in Xilinx and Cadence, it can be concluded that if the multiplier is to be used for high – speed applications, then a Carry Bypass adder can be used with the multiplier design but the area as well as the dynamic power increases.

Vi. Future Work

In this paper, the proposed work has been done for 8*8 and 16*16 bit unsigned multipliers. The bypassing techniques with the architectural modifications can also be applied to signed array multiplier architectures. Proposed multiplier using conventional Adder (Full Adder) can be replaced by new Fast Adder & change of Multiplication algorithm. In this paper, the proposed work has been done for using tri state buffer which having floating point problem ,can be modify by using transistors.

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A Survey of Image Segmentation based on Artificial Intelligence and Evolutionary Approach

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Abstract : *In image analysis, segmentation is the partitioning of a digital image into multiple regions (sets of pixels), according to some homogeneity criterion. The problem of segmentation is a well-studied one in literature and there are a wide variety of approaches that are used. Different approaches are suited to different types of images and the quality of output of a particular algorithm is difficult to measure quantitatively due to the fact that there may be much correct segmentation for a single image. Image segmentation denotes a process by which a raw input image is partitioned into nonoverlapping regions such that each region is homogeneous and the union of any two adjacent regions is heterogeneous. A segmented image is considered to be the highest domain-independent abstraction of an input image. Image segmentation is an important processing step in many image, video and computer vision applications. Extensive research has been done in creating many different approaches and algorithms for image segmentation, but it is still difficult to assess whether one algorithm produces more accurate segmentations than another, whether it be for a particular image or set of images, or more generally, for a whole class of images.*

In this paper, The Survey of Image Segmentation using Artificial Intelligence and Evolutionary Approach methods that have been proposed in the literature. The rest of the paper is organized as follows. 1. Introduction, 2.Literature review, 3.Noteworthy contributions in the field of proposed work, 4.Proposed Methodology, 5.Expected outcome of the proposed research work, 6.Conclusion.

Keywords: *Image Segmentation, Segmentation Algorithm, Artificial Intelligence, Evolutionary Algorithm, Neural Network, Fuzzy Set, Clustering.*

I. Introduction

Digital image processing is one of most important area of research and has opened new research prospects in this field. Digital image processing refers to processing digital image by means of digital computer. Image processing [23] is a very profound key that can change the outlook of many designs and proposals. Fundamental steps in digital image processing are image acquisition, image enhancement, image restoration, color image processing, compression, image segmentation and recognition. Image segmentation [9] has become a very important task in today's scenario. An importance of segmentation is, segmentation is generally the first stage in any attempt to analyze or interpret an image automatically. Segmentation provides bridges the gap between low-level image processing and high-level image processing. The any application involving the detection, recognition, and measurement of objects in images make use of segmentation techniques like. Application area of Segmentation is include, Industrial inspection, Optical character recognition (OCR), Tracking of objects in a sequence of images, Classification of terrains visible in satellite image, Detection and measurement of bone, tissue, etc., in medical images.

Image segmentation is part of image processing. The task of Image segmentation [1 4] is to group pixels in homogeneous regions by using common feature approach. Features can be represented by the space of colour, texture and gray levels, each exploring similarities between pixels of a region. Segmentation [5] refers to the process of partitioning a digital image into multiple regions. The goal of segmentation is to simplify and change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. In the present day world computer vision has become an interdisciplinary field and its applications can be found many like area be it medical, remote sensing, electronics and so on. Recently image segmentation based on [31][32] rough set and fuzzy set and genetic algorithm have gained increasing attention. The result of image segmentation is a set of regions that collectively cover the entire image, or a set of contours extracted from the image. Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, or texture.

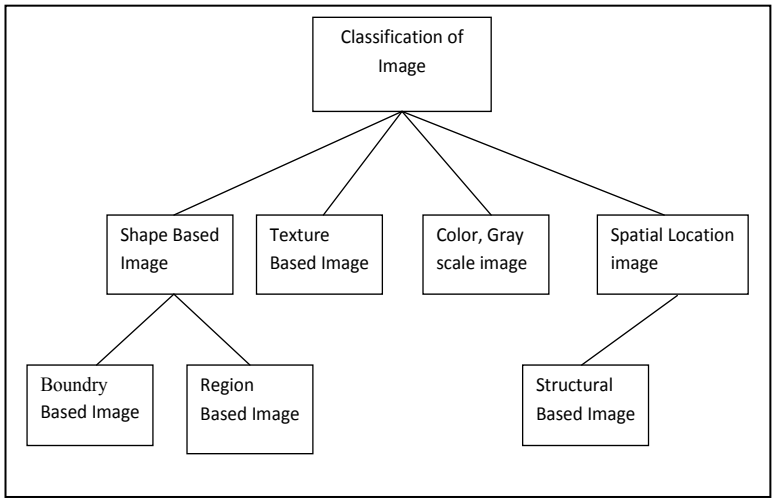

Fig. 1 Classification of image

Segmentation is based on the measurements taken from the image based on the attributes like grey level, colour, texture, depth or motion. Image segmentation techniques are categorized into three classes: Clustering, edge detection and region growing. Edge [2 26] detection is an essential pre-processing step for image segmentation which is used to transform the input image to a binary image, which indicates either the presence or the absence of an edge. Edges are sets of pixels and are an important contour features where distinct intensity changes or discontinuities in the corresponding image occur. In Digital image [3] brightness characteristics of a pixel has an influence of background noise hence imaged pre-processing become necessary. Most noise in the image is discrete noise. Median filter can eliminate the discrete noise, inhibition of salt and pepper noise and overcome the image blur. The aim of noise [4] reduction is to suppress the noise while preserving the important fine details and edges which are the boundary tow different regions. Image segmentation has been done based on the Artificial Intelligent (neural network, fuzzy set, and rough set) [40] and Evolutional approach (ant colony optimization, PSO) as a filter on both noisy and noise free images.

II. Literature Review

Image segmentation has been a topic of interest for the research as it can be associated with different research areas like data mining, soft computing etc. Many researchers have published research papers related to the above mentioned image segmentation related fields. Jan-Marco Bremer, Michael Gertz, [7] where the image segmentation has been done based on the relative differential box-counting algorithm and the gliding-box algorithm, which is a novel method for estimating the lacunarity features of greyscale digital images. The authors have used four nature texture images to test the performance of the novel lacunarity measure. Wang Lian, David Wai-lok cheung, Nikos Mamoulis, Siu-Ming Yiu, [8] present a novel method to detect plural kinds of shapes such as lines, circles, ellipses, and parabolas have been proposed. It is based on improved Genetic Algorithm (GA). .Rahm,Philip A Bernstein, [9] in which author talk about image segmentation result in a set of segments that collectively cover the entire image, or a set of contours extracted from the image. Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, or texture. Due to the importance of image segmentation a number of algorithms have been proposed but based on the image that is inputted the algorithm should be chosen to get the best results. The paper [9] the author gives a study of the various algorithms that are available for color images, text and gray scale images.

They [9] have been put forward different types of segmentations which are, Point-based or pixel-based segmentation, pixel based segmentation results in a bias of the size of segmented objects when the objects show variations in their gray values. Darker objects will become too small, brighter objects too large. Edge-Based Segmentation, Edge-based segmentation is based on the fact that the position of an edge is given by an extreme of the first-order derivative or a zero crossing in the second-order derivative. Region-based methods focus attention on an important aspect of the segmentation process missed with point-based techniques. There a pixel is classified as an object pixel judging solely on its gray value independently of the context. This meant that isolated points or small areas could be classified as object pixels, disregarding the fact that an important characteristic of an object is its connectivity. Model-Based Segmentation all segmentation techniques discussed so far utilizes only local information. The human vision system has the ability to recognize objects even if they

are not completely represented. It is obvious that the information that can be gathered from local neighbourhood operators is not sufficient to perform this task.

The [10][23] proposed Ant Colony Optimization (ACO) is proposed which is a group of algorithms inspired by the foraging behaviour of ant colonies in nature. Like their biological counterparts, a colony of artificial ants is able to adapt to the changes in their environment, such as exhaustion of a food source and discovery of a new one. In this paper, one of the basic ACO algorithms, the Ant System algorithm, was applied for edge detection where the edge pixels represent food for the ants. A set of gray scale images obtained by a nonlinear contrast enhancement technique called Multiscale Adaptive Gain is used to create a variable environment. As the images change, the ant colony adapts to those changes leaving pheromone trails where the new edges appear while the pheromone trails that are not reinforced evaporate over time. Although the images were used to create an environmental setup in which the ants move, the colony's adaptive behaviour could be demonstrated on any type of digital habitat.

Hong-Hai Do, Sergey Melnik, Erhard Rahm , [11] paper presented a new approach for image segmentation by applying k-means algorithm. In image segmentation, clustering algorithms are very popular as they are intuitive and are also easy to implement. The [22][27] K-means clustering algorithm is one of the most widely used algorithm in the literature, and many authors successfully compare their new proposal with the results achieved by the k-Means. Amarintrarak N, R. Sailkean K., Tongsima S. Wiwatwattana N, [12] proposed a method for automatic detection of root crowns in root images, are designed, implemented and quantitatively compared. The approach is based on the theory of statistical learning. The root images are preprocessed with algorithms for intensity normalization, segmentation, edge detection and scale space corner detection. Survey paper [13 14] proposes a method for automatic 3D segmentation of human brain CT scans using data mining techniques. The brain scans are processed in 2D and 3D.

III. Noteworthy Contributions In The Field Of Proposed Work

A lot of research work is going on in the field of image segmentation and it has found considerable interest in both research and practice Many researchers have put forward many aspects of image segmentation. Radim Burget, Vaclav Uher, Jan Masek [15] presents an innovative algorithm combining theory of artificial intelligence and knowledge of human eye anatomy. Ping Chen , Zhisheng Zhang, Yanxiang Han , Fang Chen ,Bei Tang [16] proposed based on separating the coke microstructures from coke microscopic image is a crucial task for automatic recognition by using digital image analysis technology. The author Yang Gui, Xiang Bai, Zheng Li, Yun Yuan, [17] proposed novel approach is presented for color image segmentation. By incorporating the advantages of mean shift (MS) segmentation and spectral clustering (SC) method, the proposed approach provides effective and robust segmentation. Yanan Fu, Wei Zhang, Mrinal Mandal, and Max Q.-H. Meng, Fellow [18], talk about on Wireless capsule endoscopy (WCE) can directly take digital images in gastrointestinal (GI) tract of a patient. It has opened a new chapter in small intestine examination. Jamshid Sourati, Dana H. Brooks, Jennifer G. Dy, Deniz Erdogmus , [19] published by have disuses about Constrained spectral clustering with affinity propagation in its original form is not practical for large scale problems like image segmentation. The paper [19] author has employed novelty selection sub-sampling strategy, besides using efficient numerical Eigen decomposition methods to make this algorithm work efficiently for images. In addition, entropy-based active learning is also employed to select the queries posed to the user more wisely in an interactive image segmentation framework. Gajanan K. Choudhary and Sayan Dey, their paper [20] presents fuzzy logic and artificial neural network based models for accurate crack detection on concrete. Features are extracted from digital images of concrete surfaces using image processing which incorporates the edge detection technique. The properties of extracted features are fed into the models for detecting cracks. G.Subha Vennila, L.Padma Suresh, their paper [21] used image segmentation and classification on dermoscopy which is the method of examining the skin lesions. It is especially used for Diagnosing melanoma, a type of skin cancer. Image segmentation and classification are important tools to provide the information about the Dermoscopic images clinically in terms of its size and shape. Chaloemchai Lowongtrakool and Nualsawat Hiransakolwong [22], their paper proposes AUCCI, the Design of Image Segmentation Using Automatic Unsupervised Clustering Computation Intelligence, a novel automatic image clustering algorithm based on Computation Intelligence. V. Senthil, R. Bhaskaran, [24] talk about analyzes the robustness of watermarking method in still images using Haar, Daubecheies and Biorthogonal wavelets. The embedding process uses a canny edge detection method and hides the watermark with the perceptual considerations on different modalities of images. Rubén Salvador, Andrés Otero, Javier Mora, Eduardo de la Torre, Teresa Riesgo and Lukas Sekanina,, [25] presents an evolvable hardware system, fully contained in an FPGA, which is capable of autonomously generating digital processing circuits, implemented on an array of Processing Elements (PE). R. Harinarayan,R. Pannerselvam,M. Mubarak Ali,Dhirendra Kumar Tripathi, [26] their paper present a FPGA-based architecture for edge detection algorithms has been proposed. Mei Yeen Choong, Wei Leong Khong, Wei Yeang Kow, Lorita Angeline, Kenneth Tze Kin Teo, [27] represents a graph-based image segmentation method. Vaishnavi

Ganesh, Sandhya Vaidyanathan, Eswer K, [28] talk about digital image segmentation with sensor.-With the help of sensors and image processing technique giving artificial intelligence another limb to work with. The applications of such a combined mechanism are limitless and this can be further brought to practical usage if given the right resources. Ms.K.Kavi Niranjana, Ms.M.Kalpana Devi and Ms.L.Mary Marshaline ,[29] paper presents a new approach for image segmentation by applying Marker Controlled Watershed Algorithm (MCWS). The proposed approach [29] for image segmentation by comparing with Pillar - K means algorithm [30] [33] [35] and involving RGB color space. Amiya Halder , Avijit Dasgupta, their paper [30] describes a rough set approach for gray scale image segmentation that can automatically segment an image to its constituents parts. The method mainly consists of spatial segmentation; the spatial segmentation divides each image into different regions with similar properties. T. J. Ram´irez-Rozo, J.C.Garc´ia,Alvarez,C. G. Castellanos-Dom´inguez,[33] where the Expectation Maximization Clustering (EM-Clustering) segmentation is evaluated for IR images, using as reference watershed transform-based segmentation. A major challenge in segmentation [35] evaluation comes from the fundamental conflict between generality and objectivity. As there is a glut of image segmentation techniques available today, customer who is the real user of these techniques may get obfuscated. Wenbin Zou, Kidiyo Kpalma and Joseph Ronsin ,[36] where the used new concept image segmentation by using region bank. Images are hierarchically segmented leading to region banks. Local features and high-level descriptors are extracted on each region of the bank. Vasiliy N Vasyukov, Nikolay and Sysoev, [37] introduce a new image texture segmentation algorithm, based on wavelets and the hidden Markov tree model Hidden Markov tree model provides a good classifier for distinguishing between textures. Mei Wang, Hsiung-Cheng Lin, Xiao-Wei Wu, Jian-Ping Wang, [39] proposed a new image segmentation approach using the proportion of foreground to background method.

IV. Segmentation Algorithm

Segmentation algorithms are based on one of two basic properties of color, gray values, or texture: discontinuity and similarity. First category is to partition an image based on abrupt changes in intensity, such as edges in an image. Second category are based on partitioning an image into regions that are similar according to a predefined criteria. Histogram thresholding approach falls under this category.

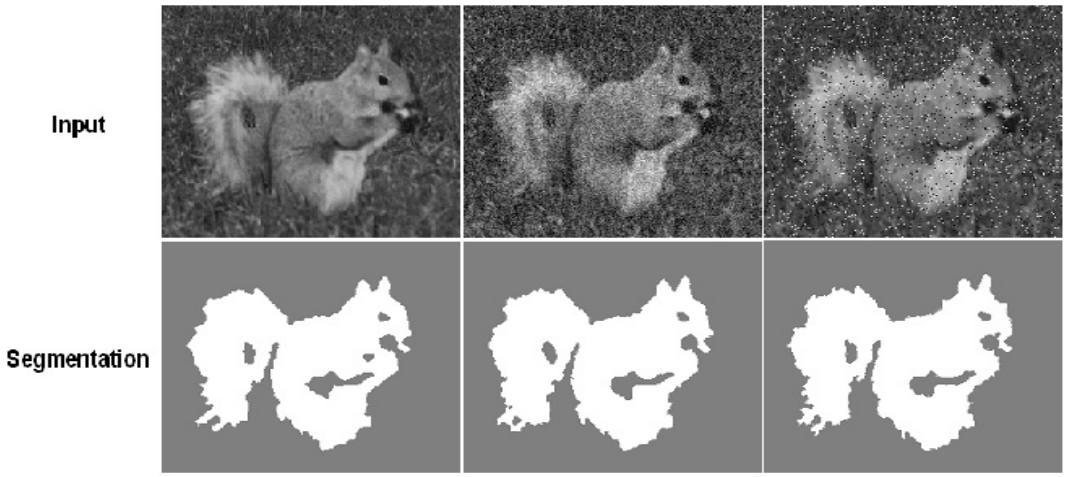

Fig. 2 Segmentation

4.1 Thresholding

The simplest method of image segmentation is called the thresholding method. This method is based on a clip-level (or a threshold value) to turn a gray-scale image into a binary image. The key of this method is to select the threshold value (or values when multiple-levels are selected).Finding histogram of gray level intensity.

- Basic Global Thresholding
- Otsu's Method
- Multiple Threshold
- Variable Thresholding

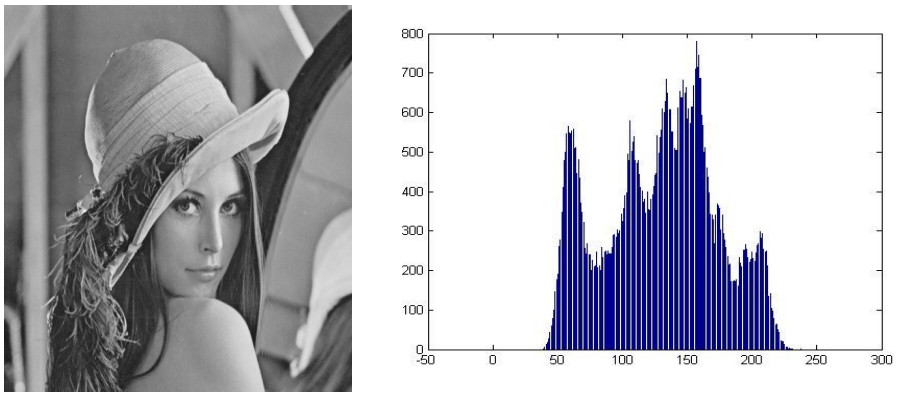

Fig. 3 Original image with thresolding

4.2 Edge-based segmentation

Using mask to detect edge in image by convolution.

- Basic Edge Detection
- The Marr-Hildreth edge detector(LoG)
- Short response Hilbert transform(SRHLT)
- Watersheds

Fig. 4 original image with Edge Based Segmentation

4.3 Region-based segmentation

Finding region, but not finding edge.

- Region Growing
- Data Clustering (Hierarchical clustering)
- Partitional clustering
- Cheng-Jin Kuo`s method

Fig. 7 original image with Region Based Segmentation

V. Proposed Methodology

The propose work will Develop and implement of A Novel algorithm for image segmentation which used concepts of Data mining techniques. A investigate the applications and improvements in the field of image segmentation. The following proposals can be taken forward during the tenure of the research work.

- The paper [34] given by author proposed a new method for neural network training patterns using fuzzy concepts which cannot be applied directly to medical image because medical image as it does not distort the objects shape and is able to retain the important features. So it is required develop improved matching algorithm that can be applied directly on the medical images.
- The paper [35] compares the performance of a few clustering based image segmentation methods. Fuzzy c-Means clustering algorithm, particle swarm optimization and Darwinian PSO are discussed. It is required proposed to work on the performance analysis will be based on some newer optimization techniques as well as the algorithms and comparison will be extended to wide range of applications.
- In paper [9] author has explained and suggested a few application specific segmentation algorithms which also take into consideration the type of image inputted like color, gray scale and text. So it is required to calculate performance of new optimization techniques on different types of inputted image.
- The propose algorithms criteria are, First of all, we need to be aware of the target image which we would like to segment out. Second, the background image has to be blurred and the colour of the target image should be different to that of background image as much as possible. They expect the appendages of the target image to cross over each other as least as possible. The approach work is to obtain segment of the target image and boundary extraction separately and simultaneously. The proposed methodology used concepts artificial intelligence [34 4] (Neural network, fuzzy logic and rough set theory) and evolutionary approach [2 23] of the pixels of the target image. The propose work use Matlab to extract the segment of image. Then they will perform final modification and remove the noise. Then these processes applied for different types of image and calculate the performance of algorithm.

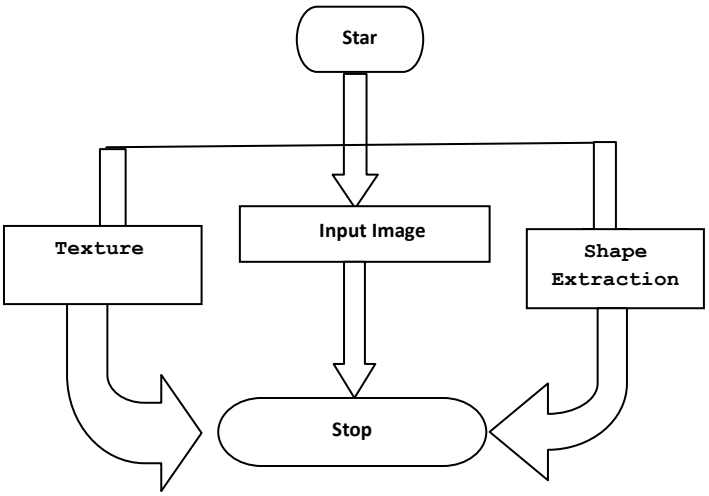

Fig. 8 Flowchart of the proposed algorithm

VI. Expected Outcome Of The Proposed Research Work

Using the proposed methodology following outcomes is expected in due course of research work. They include after picking a numbers different types of images which fit the criteria from the website, some images are selected and partially segmented from the original image. The processed images are posted as follows:

- Images are blurred can be segmented with nice quality.
- Images with clear boundary would be extracted.
- Only clear foreground images would be left.
- The information of the pixels which reside in the extracted boundaries.

VII. Conclusion

In image analysis, Segmentation is an important pre-processing step in the areas of image analysis and image compression. It is a critical and essential component of image recognition system and usually determines the quality of the final result. Segmentation is the partitioning of a digital image into multiple regions (sets of pixels), according to some homogeneity criterion. The problem of segmentation is a well-studied one in literature and there are a wide variety of approaches that are used. Different approaches are suited to different

types of images and the quality of output of a particular algorithm is difficult to measure quantitatively due to the fact that there may be much "correct" segmentation for a single image. From the analysis, there has been done in creating many different approaches and algorithms for image segmentation, but it is still difficult to assess whether one algorithm produces more accurate segmentations than another, whether it be for a particular image or set of images, or more generally, for a whole class of images.

The performance of the segmentation algorithm is measured by their Speed, Shape Connectivity, and System reliability.The second major problem became readily apparent from the literature, which is that most of the method based on neural network training patterns using fuzzy concepts which cannot be applied directly to medical image because medical image as it does not distort the objects shape and is able to retain the important features. So it is required develop improved matching algorithm that can be applied directly on the medical images.

Another important problem, specific segmentation algorithms which also take into consideration the type of image inputted like color, gray scale and text. So it is required to calculate performance of new optimization techniques on different types of inputted image.

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A Quantified Approach for large Dataset Compression in Association Mining

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Abstract: *With the rapid development of computer and information technology in the last several decades, an enormous amount of data in science and engineering will continuously be generated in massive scale; data compression is needed to reduce the cost and storage space. Compression and discovering association rules by identifying relationships among sets of items in a transaction database is an important problem in Data Mining. Finding frequent itemsets is computationally the most expensive step in association rule discovery and therefore it has attracted significant research attention. However, existing compression algorithms are not appropriate in data mining for large data sets. In this research a new approach is describe in which the original dataset is sorted in lexicographical order and desired number of groups are formed to generate the quantification tables. These quantification tables are used to generate the compressed dataset, which is more efficient algorithm for mining complete frequent itemsets from compressed dataset. The experimental results show that the proposed algorithm performs better when comparing it with the mining merge algorithm with different supports and execution time.*

Keywords*: Apriori Algorithm, mining merge Algorithm, quantification table.*

I. Introduction

Data compression is one of good solutions to reduce data size that can save the time of discovering useful knowledge by using appropriate methods, for example, data mining [5]. Data mining is used to help users discover interesting and useful knowledge more easily. It is more and more popular to apply the association rule mining in recent years because of its wide applications in many fields such as stock analysis, web log mining, medical diagnosis, customer market analysis, and bioinformatics. In this research, the main focus is on association rule mining and data pre-process with data compression. Proposed a knowledge discovery process from compressed databases in which can be decomposed into the following two steps [2].

The exponential growth in genomic data accumulation possesses the challenge to develop analysis procedures to be able to interpret useful information from this data. And these analytical procedures are broadly called as "Data Mining". **Data mining** (also known as Knowledge Discovery in Databases - KDD) has been defined as "The nontrivial extraction of implicit, previously unknown, and potentially useful information from data"[10] .The goal of data mining is to automate the process of finding interesting patterns and trends from a give data. Several data mining methodologies have been proposed to analyze large amounts of gene expression data. Most of these techniques can be broadly classified as Cluster analysis and Classification techniques. These techniques have been widely used to identify groups of genes sharing similar expression profiles and the results obtained so far have been extremely valuable. [3, 5, 7] However, the metrics adopted in these clustering techniques have discovered only a subset of relationships among the many potential relationship possible between the transcripts [9]. Clustering can work well when there is already a wealth of knowledge about the pathway in question, but it works less well when this knowledge is sparse [11]. The inherent nature of clustering and classification methodologies makes it less suited for mining previously unknown rules and pathways. We propose using another technique - **Association Rule Mining** for mining microarray data and it is our understanding that Association-rule mining can mine for rules that will help in discovering new pathways unknown before.

The efficiency tradeoffs between saving space and CPU (machine "thinking" time) are explored. Examples of the level of possible space savings are presented. The Goal is to provide fundamental knowledge in order to encourage deliberate consideration of the COMPRESS: option. Storage space and accessing time are always serious considerations when working with large data sets. compression, provide you with ways of decreasing the amount of space needed to store these data sets and decreasing the time in which observations are retrieved for processing. It offers several methods for decreasing data set size and processing time, considers when such techniques are particularly useful, and looks at the tradeoffs for the different strategies. Data set compression is a technique for “squeezing out” excess blanks and abbreviating repeated strings of values for the purpose of decreasing the data set’s size and thus lowering the amount of storage space it requires. Due to an increased awareness about data mining, text mining and big data applications across all domains the value of

data has been realized and is resulting in data sets with a large number of variables and increased observation size[15]. Often it takes a lot of time to process these datasets which can have an impact on delivery timelines. When there is limited permanent storage space, storing such large datasets may cause serious problems. Best way to handle some of these constraints is by making a large dataset smaller, by reducing the number of observations and/or variables or by reducing the size of the variables, without losing valuable information.

II. Related Work

The Apriori [1] algorithm is one of the classical algorithms in the association rule mining. It uses simple steps to discover frequent itemsets. Apriori algorithm is given below, Lk is a setof k-itemsets. It is also called large k-itemsets. Ck is a set of candidate k-itemsets. How to discover frequent itemsets? Apriori algorithm finds out the patterns from short frequent itemsets to long frequent itemsets. It does not know how many times the process should take beforehand. It is determined by the relation of items in a transaction. The process of the algorithm is as follows: At the first step, after scanning the transaction database, it generates frequent 1-itemsets and then generates candidate 2-itemsets by means of joining frequent 1-itemsets. At the second step, it scans the transaction database to check the count of candidate 2-itemsets [1]. It will prune some candidate 2-itemsets if the counts of candidate 2-itemsets are less than predefined minimum support. After pruning, the remaining candidate 2-itemsets become frequent 2-itemsets which are also called large 2-itemsets. It generates candidate 3-itemsets by means of joining frequent 2-itemsets. Therefore, CK is generated by joining large (K-1)-itemsets obtained in the previous step. Large K itemsets are generated after pruning. The process will not stop until no more candidate itemset is generated.

```
1)  L_1 = {large 1-itemsets};
2)  for ( k = 2; L_{k-1} ≠ ∅; k++ ) do begin
3)     C_k = apriori-gen(L_{k-1});  // New candidates
4)     forall transactions t ∈ D do begin
5)        C_t = subset(C_k, t);  // Candidates contained in t
6)        forall candidates c ∈ C_t do
7)           c.count++;
8)     end
9)     L_k = {c ∈ C_k | c.count ≥ minsup}
10) end
11) Answer = ⋃_k L_k;
```

Since most data occupy a large amount of storage space, it is beneficial to reduce the data size which makes the data mining process more efficient with the same results. Compressing the transactions of databases is one way to solve the problem. [1] Proposed a new approach for processing the merged transaction database. It is very effective to reduce the size of a transaction database. Their algorithm is divided into data preprocess and data mining. Sub-process transforms the original database into a new data representation. It uses lexical symbols to represent raw data. Here, it's assumed that items in a transaction are sorted in lexicographic order. Another sub-process is sorting all the transactions to various groups of transactions and then merges each group into a new transaction. For example, *T*1= {A, B, C, E} and *T*2 = {A, B, C, D} are two transactions. *T*1 and *T*2 are merged into a new transaction *T*3= {A2, B2, C2, D1, E1}.

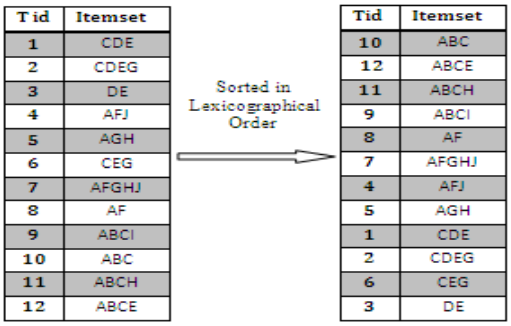
```
// Phase one
  D^M = compressed database
  L_1^M = {large 1-itemsets in compressed database};
  for(k = 2; L_{k-1}^M ≠ Ø; k++) do begin
    C_k^M = merging-gen(L_{k-1}^M);
    forall transactions T_M^* ∈ D^M do begin
      C_t^M = subset(C_k^M, t^*);  // Candidate contained in t^*
       forall candidates c^* ∈ C_t^M do begin
          c^*.count = c^*.count + min-frequency(c^*); // the smallest item frequency in Candidate
    end
      L_k^M = {c^* ∈ C_k^M | c^*.count ≥ minsup}
    end
    Answer = ∪_k L_k^M;
// Phase two
D = original database
    forall transactions T_M ∈ D do begin
       L_t^M = subset(L_k^M, t) // Large itemset contained in t
    forall large itemsets l^* ∈ L_k^M do begin
       l^*.count++;
    end
    L_k = {l^* ∈ L_k^M | l^*.count ≥ minsup}
    Answer = ∪_k L_k;
```

II. Proposed Method

The description of the proposed algorithm focuses on compressing the dataset through building a quantification table. The dataset is sorted in lexicographical order and then this sorted dataset is use to create desired number of groups of the dataset, now we built the quantification table for each group and then by reading the postfix items from the table we get the compressed dataset. Finally, an example is provided to show the processes of our method. To simplify the description, it assumes the items in each transaction are presented in a lexicographical order.

Procedure:
Step 1: Read the original database.
Step 2: Sort the database in lexicographical order.
Step 3: Group the sorted database.
Step 4: Identify maximum length Transaction in each groups.
Step 5: Built quantification table
Step 6: Read postfix items from each quantification table
Step 7: Combine postfix items in table.
Step 8: Compressed datasets.
Step 9: Discover frequent itemset

Figure 1 shows an example of the proposed algorithm. We have a dataset shown in Figure (a) with transaction id and itemsets. Figure (b) shows the sorted dataset.



Tid	Itemset
1	CDE
2	CDEG
3	DE
4	AFJ
5	AGH
6	CEG
7	AFGHJ
8	AF
9	ABCI
10	ABC
11	ABCH
12	ABCE

(a)

Tid	Itemset
10	ABC
12	ABCE
11	ABCH
9	ABCI
8	AF
7	AFGHJ
4	AFJ
5	AGH
1	CDE
2	CDEG
6	CEG
3	DE

(b)

Figure 1: Example of Proposed Algorithm

Now the given sorted dataset is grouped into desired number of groups as shown in Figure 3 with group id and item set.

Gid	Itemset
101	ABC
	ABCE
	ABCH
	ABCI

(a)

Gid	Itemset
102	AF
	AFGHJ
	AFJ
	AGH

(b)

Gid	Itemset
103	CDE
	CDEG
	CEG
	DE

(c)

Figure 2: Groups of sorted dataset

Now we built quantification table for all these groups .The approach starts working from the left –most item, called prefix item. After finding the length of the input transaction as *n*, it records the count of the item sets appearing in the transaction under the respective entries of length Ln, Ln-1,.. L1. A quantification table is composed of these entries where each Li contains a prefix-item and its support count. Quantification table of each group is shown in
Figure 3.

L4	L3	L2	L1
A3	A4	A4	A4
	B3	B4	B4
		C3	C4
			E1
			I1

(a)

L5	L4	L3	L2	L1
A1	A1	A3	A4	A4
	F1	F1	F2	F3
		G1	G2	G2
			H1	H2
				J2

(b)

L4	L3	L2	L1
C1	C3	C3	C3
	D1	D3	D3
		E2	E4
			G2

(c)

Figure 3: Quantification Tables

Now by reading the postfix items of each quantification table we get the compressed dataset.

G id	Compressed Dataset
101	A4 B4 C4 E1 H1 I1
102	A4 F3 G2 H2 J2
103	C3 D3 E4 G2

Figure 4: Compressed Dataset

```
                Array of transactions,
p: set of items,
smin: int) : int
var i: item;
s: int;
n: int;
b; c; d: array of transactions;
begin
n := 0;
while a is not empty do
b := empty; s := 0;
i := a[0].items[0];
while a is not empty
and a[0].items[0] = i do
s := s + a[0].wgt;
remove i from a[0].items;
if a[0].items is not empty
then remove a[0] from a and append it to b;
else remove a[0] from a; end;
c := b; d := empty;
 while a and b are both not empty do  merge step
if a[0].items > b[0].items
then remove a[0] from a and append it to d;
else if a[0].items < b[0].items
then remove b[0] from b and append it to d;
else b[0].wgt := b[0].wgt +a[0].wgt;
remove b[0] from b and append it to d;
remove a[0] from a;
end;
end;
while a is not empty do
remove a[0] from a and append it to d; end;
while b is not empty do
```

Figure 5: Proposed Algorithm

Figure 5 describes the proposed algorithm. The overall architecture of the algorithm is shown in the figure 6.

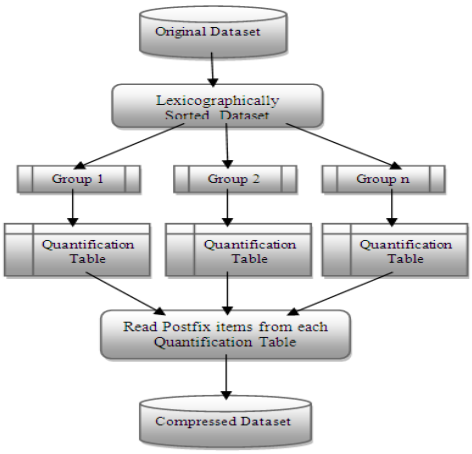


Figure 6: Architecture of Proposed Algorithm

III. Experimental Results

We implement the algorithm in Microsoft Visual Studio 2010 to evaluate the performance of our design and all experiments run on a PC of Intel Pentium 4 3.0GHz processor with DDR 400MHz 4GB main memory. Synthetic datasets are generated by using the items for our experiment. To the best of our knowledge, no research work has been dedicated to discovering frequent items for large data compression. We compare our approach with mining merge approach to show its effectiveness for the overall system performance evaluation. The table I representing the minimum support and execution time for mining merge and proposed algorithm.

TABLE IAlgorithms Comparison

Minimum support	Time taken to execute (In seconds) **Mining merge Algorithm**	Time taken to execute (In seconds) **Proposed Algorithm**
2	165	117
3	141	95
4	125	83
5	107	65

The performance of algorithms are analyzed in our experiment from Fig 6, it shows that the proposed algorithm performs better than the mining merge algorithm because it is possible to reduce more I/O time in the proposed algorithm. In general, the performance of using a quantification table is better than without using it. The proposed algorithm takes less time to compress the data than the mining merge algorithm for the varying minimum support.

Graph representing the comparison of mining merge and proposed algorithm when minimum support varying. Algorithms are analyzed on the basis of minimum support and execution time. The graph shows that for every value of support the proposed algorithm takes less time to execute than the mining merge algorithm. Graph shows that performance of proposed algorithm is better than mining merge algorithm.

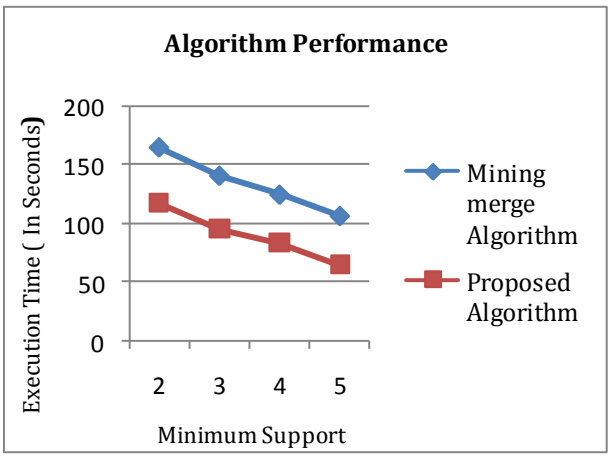


Figure 7: Proposed Algorithm

IV. Conclusion

We have proposed an innovative approach to generate compressed dataset for efficient frequent data mining. The effectiveness and efficiency are verified by experimental results on large dataset. It can not only reduce number of transactions in original dataset but also improve the I/O time required by dataset scan and improve the efficiency of mining process.

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Energy Conservation in Wireless Sensor Networks: A Review

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Abstract: *A wireless sensor network consists of a large number of sensor nodes which are deployed over an area to perform local computations based on information gathered from the surroundings. Each node in the network consists of a battery, but it is very difficult to change or recharge batteries. So the question is how to enhance the lifetime of the network to such a long time. Therefore, in order to maximize the lifetime of the network, the consumption of energy must be minimized. This is an important challenge in sensor networks as sensors can not be easily replaced or recharged due to their ad-hoc deployment in hazardous environment. In this paper, the main techniques used for energy conservation in sensor networks are discussed which include duty cycling scheme, data driven approaches, mobility-based schemes, energy efficient MAC protocols and node self scheduling scheme. These schemes can be used to improve the energy efficiency of the wireless sensor network so that the network can work with greater efficiency and high battery lifetime.*

Keywords : *Energy conservation, energy consumption, sensor nodes, wireless sensor networks.*

I. INTRODUCTION

A sensor network is a group of specialized transducers with a communications infrastructure intended to monitor and record conditions at diverse locations. Commonly monitored parameters are temperature, humidity, pressure, wind direction and speed, illumination intensity, vibration intensity, sound intensity, power-line voltage, chemical concentrations, pollutant levels and vital body functions [1].

1.1 Sensor Network and its components

A sensor network consists of multiple detection stations called sensor nodes, each of which is small, lightweight and portable [2]. It has the following components:

- **Sensing subsystem:** A sensing subsystem includes one or more sensors (with associated analog-to-digital converters) for data acquisition from the physical surrounding environment. It acts as a link to the outside world.
- **Processing subsystem:** It is used for local data processing and storage. It consists of a processor and memory.
- **Wireless communication subsystem:** It enables the sensor nodes to communicate with each other and with the base station. Basically, it is used for the transmission of data.
- **Power Subsystem:** A power source is required so that the device can perform various tasks uninterruptedly.

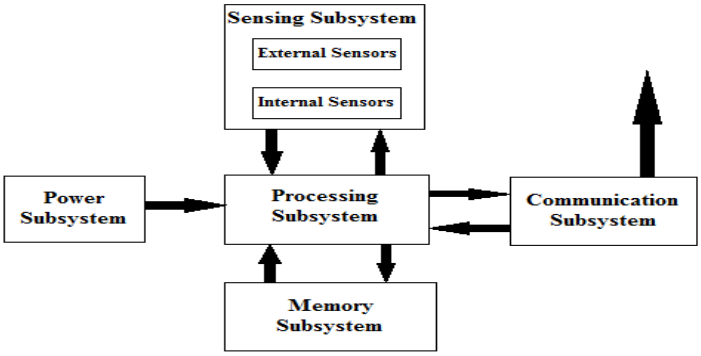

Fig. 1 Sensor Network Architecture

1.2 Sensor Node and its components

A sensor node is a tiny device which is equipped with a transducer, microcomputer, transceiver and power source [2].

- **Transducer:** The transducer generates electrical signals based on sensed physical effects and phenomena.
- **Microcomputer:** The microcomputer processes and stores the sensor output.
- **Transceiver:** The transceiver, which can be hard-wired or wireless, receives commands from a central computer and transmits data to that computer.

- **Power:** The power for each sensor node is derived from the electric utility or from a battery.

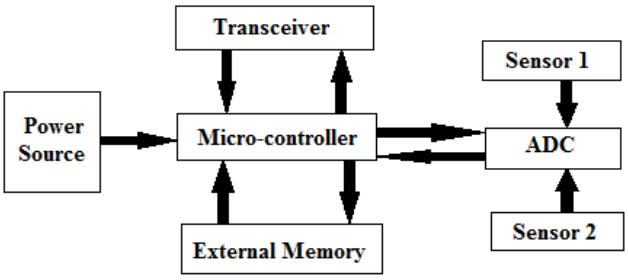

Fig. 2 Sensor Node

Energy conservation in sensor networks deals with reducing the consumption of energy among various intermediate nodes in the network so that the network life can be extended. A power source is required so that the device can perform various tasks uninterruptedly which usually consist of limited energy budget battery. Although it is easy to recharge the battery from time to time, but it may become impossible or inconvenient to recharge the battery in case if some sensor node is placed at very hostile or unpractical environment. The lifetime (in terms of months or years etc.) of sensor networks should be long enough to fulfill the application requirements. In some cases, energy can be scavenged from external environment e.g. solar power, but these resources are non-continuous in nature. So, energy conservation is the key issue in designing the systems based in wireless sensor networks.

II. MAJOR SOURCES OF ENERGY WASTAGE IN SENSOR NETWORKS

In sensor networks, energy can be consumed either usefully or wastefully. Useful energy consumption includes sending and receiving data, processing and forwarding queries and data to other nodes. On the other hand, wasteful energy consumption may include the facts, like [4]

- **Idle listening:** It includes listening to an idle channel in order to receive possible traffic.
- **Collision**: The packets have to be resent after a collision has discarded the packets.
- **Over-hearing:** It includes receiving the packets that are destined to other nodes.
- **Over-emitting:** The packets that over-use the network are over-emitted.

2.1 Issues in energy wastage in sensor network

Energy in sensor networks is wasted in one or the other form. The major energy wastage occurs in the following subsystems as explained below.

2.1.1 Communication Subsystem: The communication subsystem has energy consumption much higher than the computation subsystem. It has been shown by experiments that transmitting one bit over the communication channel may consume as much as executing a few thousands instructions. Therefore, communication should be traded for computation.

2.1.2 Radio Consumption: The radio consumption is of the same order of magnitude in the reception (receiving the data), transmission (sending the data), and idle states (when no communication is taking place, i.e. no sending and receiving of data), while the power consumption drops of at least one order of magnitude in the sleep state. The sleep state of the node indicates that the node may generate packets but it will not transmit or receive any packet.

2.1.3 Sensing Subsystem: Depending on the specific application, the sensing sub-system might be another significant source of energy consumption, so its power consumption has to be reduced as well.

III. ENERGY CONSERVATION IN SENSOR NETWORKS

Based on the above issues, several approaches have to be exploited, even simultaneously, to reduce power consumption in wireless sensor networks. At a very general level, we identify five main enabling techniques, namely, duty cycling, data-driven approaches, mobility based schemes, energy efficient MAC protocols for sensor networks, and node self-scheduling scheme.

3.1 Duty Cycling

It is mainly focused on the networking subsystem. The most effective energy-conserving operation is putting the radio transceiver (transceiver that transmits and receives at the radio frequency, i.e. in the range of about 3kHz to 300 GHz) [3]) in the (low-power) sleep mode whenever communication is not required. In this way nodes alternate between active and sleep periods depending on the network activity. This behavior is usually referred to as duty cycling, and duty cycle is defined as the fraction of time nodes are active during their lifetime [2].

A sensor node has 4 operating modes: transmission, reception, idle listening and sleep. The most power consumption is due to transmission. Idle mode and receiving mode has approximately same power consumption. Sleep mode has the least power consumption. In duty cycling, the nodes that are currently not required can go to sleep and thus save energy. They need not to maintain the radio frequency regularly. Instead, they can switch off the radio when there is no network activity, thus alternating between sleep and wake-up periods [5].

3.2 Data-driven approaches

The goal of data driven approaches is to provide continuous data. It uses the concept of data sensing i.e. to sense the continuity of data. Data sensing impacts on energy consumption of the sensor nodes in two ways [2]:

- **Unneeded samples:** They lead to useless energy consumption. Sampled data generally has strong spatial and temporal correlation, so there is no need to communicate the redundant information to the sink.
- **Power consumption:** The power consumption of the sensing subsystem is not negligible .Energy wastage cannot be reduced only by reducing the communication.

Based on these two ways, data-driven approaches are divided into data reduction and energy efficient data acquisition schemes.

3.2.1 Data Reduction schemes: These schemes address the case of unneeded samples.

Data reduction can be divided into:

- In-network processing
- Data Prediction
- Data Compression

In-network processing: It consists in performing data aggregation (e.g., computing average of some values) at intermediate nodes between the sources and the sink. In this way, the amount of data is reduced while traversing the network towards the sink.

Data prediction: It consists in building an abstraction of a sensed phenomenon, for example a model describing data evolution. The model can predict the values sensed by sensor nodes within certain error bounds and reside both at the sensors and at the sink. If the needed accuracy is satisfied, queries issued by users can be evaluated at the sink through the model without the need to get the exact data from nodes.

Data compression: It is applied to reduce the amount of information sent by the source nodes.

3.2.2 Energy-efficient data acquisition schemes

They mainly focus on reducing the energy spent by the sensing subsystem. A sensor node's lifetime is fundamentally linked to the volume of data that it senses, processes and reports. Sensor Network allows environmental monitoring at extremely high spatial and temporal resolutions. But when raw data is to be extracted, certain problems arise, e.g. batteries may get drained due to excessive transceiver operation or data quality may deteriorate due to packet loss caused by congestion. To solve these problems, spatial correlation is maintained between the sensor nodes. In this method, instead of every node transmitting individually, a subset of nodes called correlating nodes are appointed that transmit the messages and act as representative of all the remaining nodes. It continues sending its own readings until a change in correlation is detected. When a change is encountered, it transmits an updated correlation message [2].

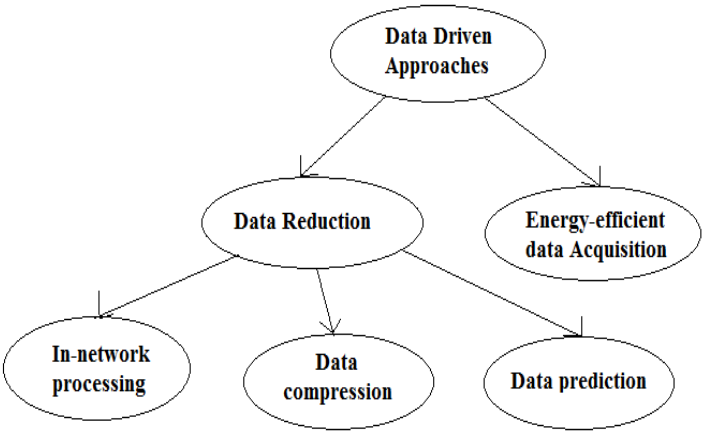

Fig. 3 Taxonomy of Data driven approaches

3.3 Mobility based schemes

The mobility is defined as to describe the movement pattern of mobile nodes, location, velocity and acceleration change over time [4].Mobility based schemes define how the designer of the sensor network will control the mobility of the sensor nodes. Mobility can be random, predictable/deterministic or controlled. Mobility based schemes can be classified into two categories depending on the type of mobile entity:

- **Mobile-sink schemes:** Mobile-sink schemes include mobile sink nodes which offer transient shorter routes for relaying data, and offering connectivity to disconnected areas of network during any unfavorable situation, e.g. in case of fires, when some of the sensor nodes are destroyed due to fire, mobile sink nodes can provide connectivity with the other nodes of the network.
- **Mobile-relay schemes:** In this scheme, the relay stations can intelligently relay data between the base stations, i.e. the base station receiver automatically tunes on the base station transmitter and retransmits all signals received by the base station receiver. Mobile relays have the potential to provide performance improvements under high speed user mobility and heavy load conditions.

Mobile nodes can be divided into two broad categories. They can be specifically designed [2]

- **As part of the network infrastructure:** When they are part of the infrastructure, their mobility can be fully controlled and are, in general, robotized. Infrastructure refers to the architecture of the sensor network. When the mobile nodes are within the infrastructure, their movement can be controlled because they are still not transmitted over the network.
- **As a part of the environment:** When mobile nodes are part of the environment they might not be controllable. If they follow a strict schedule (e.g. strict space and timing relationship), then they have a completely predictable mobility (e.g., a shuttle for public transportation). Otherwise they may have a random behavior so that no reliable assumption can be made on their mobility. Finally, they may follow a mobility pattern that is neither predictable nor completely random. For example, this is the case of a bus moving in a city, whose speed is subject to large variation due to traffic conditions. In such a case, mobility patterns can be learned based on successive observations and estimated with some accuracy.

3.4 Energy efficient MAC (Media Access Control) protocols for Sensor Networks

Media access control (MAC) data communication protocol is a sub-layer of the data link layer. The MAC sub-layer provides addressing and channel access control mechanisms that make it possible for several terminals or network nodes to communicate within a multiple access network that incorporates a shared medium, e.g. Ethernet. Its functions generally include receiving and transmitting frames, appending, removing, padding the bits, etc.

Various types of MAC protocols used for energy conservation can be categorized as: contention-based, TDMA-based and hybrid MAC protocols [8].

3.4.1 Contention-based MAC protocols

They are based on CSMA (Carrier Sense Multiple Access) or CSMA/CA (Carrier Sense Multiple Access/Collision Avoidance). It does not require any co-ordination among the nodes. Nodes will send the data and in case of collision, they will wait for a random duration of time before re-sending it again. The typical contention-based MAC protocols are S-MAC (Sensor-MAC) and T-MAC (Timeout-MAC) [5].

- **S-MAC:** There are two states in a time frame: active state and sleep state. S-MAC adopts an effective mechanism to solve the energy wasting problems, that is periodical listening and sleeping [6]. When a node is idle, it is more likely to be asleep instead of continuously listening to the channel. S-MAC reduces the listen time by letting the node go into periodic sleep mode.
- **T-MAC:** T-MAC is an extension of the previous protocol which adaptively adjusts the sleep and wake periods based on estimated traffic flow to increase the power savings and reduce delay [7]. TMAC also reduces the inactive time of the sensors compared to S-MAC. Hence, it is more energy efficient than S-MAC.

3.4.2 TDMA based MAC protocols

They assign a unique time-slot for each node to send or receive data thereby making it collision-free. It avoids collisions and thus saves energy which would otherwise be wasted due to resending of data due to collisions and discarding [9].

3.4.3 Hybrid contention based

It has advantages of both contention based and TDMA-MAC protocols. It offers better scalability and flexibility and thus has high energy savings.

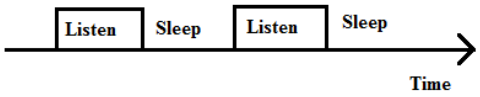

Fig. 4 Periodic listen and sleep

3.5 Node Self-scheduling Scheme

This technique is divided into two problems. The first problem is the rule that each node should follow to determine its work status. The second is the time when nodes should make such decision [10]. The assumptions of this work are as follows:

1) Each node knows its own location, which can be obtained at low cost from GPS or some localization system, and presumably is already available due to the needs of wireless sensor network applications. Also, each node knows who its neighbors are and where they are located, which is obtained through a simple neighbor information exchange process.

2) Each node knows the size of its sensing area. We assume that all nodes are deployed on a 2-dimensional plane and a node's sensing area is a circle centered at this node with known radius. The rule described there is also applicable to a 3-dimensional space.

3) The sensing range of each node can be identical or different. All the nodes in the network are time-synchronized.

4) After node-scheduling, some nodes are assigned off-duty state. Off-duty is a power saving sleep mode, compared to normal on-duty mode.

Off-duty may be implemented by following three ways:

- Powering off the sensing unit and communication unit
- Powering off the sensing unit
- Ignoring detected events without powering off any unit

Among the four methods, the first one consumes the least energy and the last one does the most. Therefore, the first one is the most desirable from the energy saving perspective. However, which method is used in practice depends on the intelligence owned by sensors and the cost for sleeping and waking up the sensing unit and communication unit [10].

The main objective of this scheme is to minimize the number of working nodes, as well as maintain the original sensing coverage. To achieve this goal, sensing area of each node is calculated and then compared with its neighbours'. If the sensing area of one node is fully embraced by the union set of its neighbours', i.e. neighbours can cover the current node's sensing area, this node falls asleep without reducing the system overall sensing coverage.

IV. CONCLUSION

The emergence of wireless sensor networks can finally bridge the gap between physical and digital worlds. But the basic problem in sensor networks is the higher energy consumption. While transmitting data, a lot of energy is wasted in the various subsystems of the sensor network. For decreasing this loss of energy various methods are explained in this article. By implementing these methods, the wastage of energy in sensor networks can be reduced to a great extent. This will surely enhance the working of sensor network and hence greater outputs can be achieved from the same.

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