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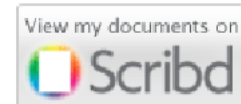
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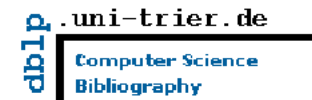
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Al-Balqa Applied University (BAU), Jordan

TABLE OF CONTENTS

1. Paper 31051522: A Variability Modeling Method for Facial Authentication (pp. 1-13)

Obaidul Malek, Center for Biometrics and Biomedical Research Virginia, USA

Mohammad Matin, Electrical and Computer Engineering University of Denver, Colorado, USA

Rabita Alamgir, Center for Biometrics and Biomedical Research Virginia, USA

Laila Alamgir, Howard University, DC

Abstract — Most biometric authentication methods have been developed under the assumption that the extracted features that participate in the authentication process are fixed. But the quality and accessibility of biometric features face challenges due to position orientation, illumination, and facial expression effects. This paper addresses the predominant deficiencies in this regard and systematically investigates a facial authentication system in the variable features' domain. In this method, the extracted features are considered to be variable and selected based on their quality and accessibility. Furthermore, the Euclidean geometry in 2-D computational vector space is being constructed for features extraction. Afterwards, algebraic shapes of the features are computed and compared. The proposed method is being tested on images from two public databases: the "Put Face Database" and the "Indian Face Database". Performance is evaluated based on the Correct Recognition (CRR) and Equal Error (EER) rates. The theoretical foundation of the proposed method along with the experimental results are also presented in this paper. The results obtained in the experiment demonstrate the effectiveness of the proposed method.

Index Terms—CRR, EER, Euclidean geometry, and facial biometric.

2. Paper 31051534: Multi-Channel User Authentication Protocol based on Encrypted Hidden OTP (pp. 14-19)

Ashraf Aboshosha, NCRRT, Atomic Energy Authority, Cairo, Egypt

Kamal A. ElDahshan, Faculty of Science, Al-Azhar University, Cairo, Egypt

Eman K. Elsayed, Faculty of Science (Girls), Al-Azhar University, Cairo, Egypt

Ahmed A. Elngar, Faculty of Science, Al-Azhar University, Cairo, Egypt

Abstract — Remote user authentication plays the most fundamental procedure to identify the legitimate users of a web service on the Internet. In general, the password-based authentication mechanism provides the basic capability to prevent unauthorized access. Since, many researchers have proposed a number of password based authentication schemes which rely on a single channel for authentication. However to achieve a better security, it is possible to engage multi-channels for authenticating users. In this paper, we propose an efficient one time password (OTP) based authentication protocol over a multi-channels architecture. Where, the proposed protocol employing the RC4-EA encryption method to encrypt the plain-OTP to cipher-OTP. Then, Quick Response Code (QR) code is used as a data container to hide this cipher-OTP. Also, the purpose of the protocol is to integrate a web based application with mobile-based technology to communicate with the remote user over a multi-channels authentication scheme. The main advantage of the proposed protocol is to highly secure the authentication system by preventing the OTP from eavesdropping attack. Also, by integrating a Web-based application with mobile-based technology as a multi-channels scheme; the proposed protocol helps to overcome many challenging attacks such as replay attack, DoS attack, man-in-the-middle (MITM) attack, real-time phishing (RTP) and other malware attacks.

Keywords-Authentication; Multi-Channel Authentication (MCA); Data hiding; Quick Response Code (QR) code; Encryption.

3. Paper 31051543: A framework for future application of RFID technology for school and vocational trainings on Internet of Things (pp. 20-24)

Ahmad Shaker Abdalrada, Faculty of Art, University of Wasit, Wasit, Iraq

Abstract — Radio Frequency Identification (RFID) is programmed ID innovation without contact, support motions via radio recurrence programmed ID which give pertinent destination information, without requirement direct mediation of distinguish school children for learning an assortment to study surroundings. Since schools and vocational institute are providing training framework stream through unmatched data, cannot fulfill more reasonable for upcoming study interest. Internet of Things (IoT) overwhelmed customary flaw for structure code, which support to university, school or worldwide group of vocational training greatest concern and examination.

Keywords: RFID Innovation, Internet of Things, Future Application

4. Paper 30041526: Towards Understanding User Perceptions of Biometrics Authentication Technologies (pp. 25-33)

*(1) Abdullah Rashed and (2) Nancy Alajarmeh
(1) Independent Reseacher, (2) Tafila Technical University*

Abstract - Human misbehaviors cause security systems breaches. One of the reasons behind this fact is neglecting human acceptance. For that reason, new technologies are usually faced with rejection or acceptance issues. Technology Acceptance Model (TAM) is one of the well-known models used to predict the acceptance of new technologies. Biometrics as an authentication direction is still under development. Relying on Bi-ometrics for authentication has some important characteristics; mainly, being faster and easier due to the fact that users will not be involved with unfamiliar interfaces, such as typing password, signing or even de-liberate exposing to some part of the body. This study investigates the users' intention to use biometrics as an authentication tool among young Arab people. A survey involving 74 individuals was conducted. The results reveal that perceived ease of use and perceived usefulness are significant drivers of the behavior of intention to use biometrics as an authentication tool. In addition, results show that perceived usefulness is the most crucial factor in making a decision whether or not to adopt new technologies.

Keywords: Intention to Use, Biometrics Technology, Authentication.

5. Paper 30061412: Novel Usage of Gujarati Tithi in Weather Analysis of Surat, India (pp. 34-37)

*D. P. Rana, COED, SVNIT, Surat, India
P. Chaudhari, COED, SVNIT, Surat, India
N. J. Mistry, CED, SVNIT, Surat, India
M. M. Raghuvanshi, COED, RGCER, Nagpur, India*

Abstract — Vikram samvat Gujarati Calendar is the well known and ancient calendar used by Gujarati's in India which is following the time period of the successive return of the moon in conjunction or opposition to the sun in relation to the earth. The data mining technique retrieves the knowledge from the data without any pre hypothesis. This research is to apply computer intelligence to analyze the association of one of the weather parameter temperature according to this calendar using temporal association rule mining. The experiment result proves that there exist the special associations between weather parameters and this calendar which can provide new insight to the researchers of this area and does not require any extra expertise in weather.

Keywords- Temporal association rule mining; weather prediction; Gujarati tithi

6. Paper 31051508: A Distinct Technique for Facial Sketch to Image Conversion (pp. 38-41)

*Prof. Prashant Dahiwale, Dept. of Computer Science & Engineering, Rajiv Gandhi College of Engineering & Research, Wanadongri, Nagpur, India.
Madhura S. Bombatkar, Dept. of Computer Science & Engineering, Rajiv Gandhi College of Engineering & Research, Wanadongri, Nagpur, India.
Dr. M. M. Raghuvanshi, Dept. of Computer Science & Engineering, Rajiv Gandhi College of Engineering & Research, Wanadongri, Nagpur, India*

Abstract — A liberal amount of software applications are in market for generating a sketch out of an image, the vice-versa though is unacquainted. Whereas such an implementation will prove to be purposive to the crime investigation departments. Such a youthful approach for generating an image from a sketch is suggested in this paper by following a process of, breaking down the sketch into constituent or component of face, matching or comparing these features with the available database, selecting the best match followed by registering or pasting these image components on a blank face image, performing filtering algorithm in order to perform smoothening of image.

Index Terms—*Feature detection, feature extraction, facial components, filtering algorithms, fiducial points, smoothening image.*

7. Paper 31051511: Safeties on the Web Development (pp. 42-48)

Geraldo Cesar Cantelli, Department of I.T. Research, Fatec Ourinhos (Technology College), Ourinhos, São Paulo - Brazil

Abstract— The present work shows in its introduction to the importance of information security in the current environment of digital culture, especially after the occurred on September 11, 2001 in the United States. The subject involves not only information technology-related companies but can verify this concern in the daily life of the companies and therefore specific laws Governments. This can be verified in building distributed systems (including operating systems and managerial), in the infrastructure of networks of companies and organizations and web sites. This study analyzes the mechanism of the servers of Internet pages because many attacks exploit these vulnerabilities. Programming of web sites (mainly dynamic content) can also be used to circumvent the security and enable an occurrence of illegal access. Programmers should note some important features to avoid the predatory action of invaders, because no one can build web sites without taking into account the hosting and the creation of source code which is intended to reduce the vulnerability of the system to a minimum acceptable. Finally, comments on the ten most common types of vulnerabilities to be observed when making web sites according to the OWASP (The Open Web Application Security Project) aims to create awareness about security in programming sites.

Keywords-*Security, information, network infrastructure, distributed systems.*

8. Paper 31051512: Analysis of Activities and Operations in the Current E-Health Landscape in Tanzania: Focus on Interoperability and Collaboration (pp. 49-54)

Alfred Kajirunga, Computation and Communication Science & Engineering, Nelson Mandela African Institution of Science and Tech, Arusha, Tanzania
Khamisi Kalegele, Computation and Communication Science & Engineering, Nelson Mandela African Institution of Science and Tech, Arusha, Tanzania

Abstract — Although the basic application of Information and Communication Technologies (ICT) in the Tanzanian health care systems started years ago, still fragmentation of Information Systems (IS) and limited interoperability remain to be big challenges. In this paper, we present an analysis done on the present health care delivery service, HIS and on some of existing eHealth solutions focusing on interoperability and collaboration. Through interviews, questionnaires and analysis on e-health implementations in relation to interoperability and collaboration we have established that, the lack of standard procedures to guide the lifecycle of eHealth systems across the health sector and poor willingness to collaboration among health stakeholders are key issues which hinders the manifestation of the benefit of ICT use in the health sector of Tanzania. Based on the findings, we provide some recommendations with a view to improve interoperability and collaboration.

Keywords: eHealth; healthcare; eHealth adoption; interoperability.

9. Paper 31051514: A Review on Triangle Based Techniques in Biometric Gait Recognition (pp. 55-59)

Monika Jhapate, Lalitesh Choudhary, Ravi Singh Pippal
Radharaman Engineering College, Bhopal

Abstract - Biometric system is an analysis of unique biological features of human being. The purpose is used for human security and identification. Different conventional biometric (such as face recognition, iris, fingerprint, etc.)

methods are used for security and identification purpose, but they can capture only by physical control or at a close distance from record search. Gait on a behavioral biometric has attracted more attention recently because it can capture at a distance with requiring the earlier consent of the observed object. This survey paper covers the current trends and method of Gait based surveillance system using triangle methods and compare them.

Keywords: Biometric, Gait Recognition, Image Processing, Triangle methods, Pattern Recognition.

10. Paper 31051515: Methodology of Assigning Musical Notations to Sanskrit Verse (pp. 60-67)

*Pranjali Deshpande, Pune Institute of Computer Technology, Savitribai Phule Pune University, Pune, India
Pravin Game, Pune Institute of Computer Technology, Savitribai Phule Pune University, Pune, India*

Abstract — Sanskrit literature is unique in its overwhelmingly poetic character. The subjects like science, engineering, medicine, grammar and law are mostly written in the form of poetry which makes them easy to memorize. The Sanskrit poetry, comprised of Shloka or Verse, is classified in terms of unique meter or Vrutta. Vrutta is the unique pattern formed by the categorization of letters as long and short syllables. Depending on the rule based Vrutta identification in the verse, the rhythmic enchanting of the Shloka is facilitated. This paper discusses the method of identification of Vrutta in Sanskrit Shloka and suggests the musical notations based on identified Vrutta, for singing the Shloka. The designed system “Sangit Vrutta Darshika” can be used as a guide to learn the construction of Sanskrit verse. It also facilitates the systematic singing of Sanskrit Shloka which has applications in areas like Music Therapy.

Keywords- Grammar, Long syllable, Meter, Metrical classification, Short syllable, Natural Language Processing, Sanskrit, Shloka, Vrutta.

11. Paper 31051517: Designing High Bandwidth Connected E-H and E-Shaped Microstrip Patch Antennas for S-band Communication (pp. 68-73)

Muhammad Afsar Uddin, Dept. of Computer Science & Engineering, University of Development Alternative, Dhaka, Bangladesh

Dr. Mohammed Humayan Kabir, Dept. of Computer Science & Telecommunication Engg., Noakhali Science & Technology University, Noakhali, Bangladesh

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Dr. Md. Ashikur Rahman Khan, Dept. of Information & Communication Technology, Noakhali Science & Technology University, Noakhali, Bangladesh

Abstract —This paper represents designing & analysis of high bandwidth Connected E-H and E shaped microstrip patch antennas. RT Duroid 5880 dielectric substrate material is used to design these antenna. A simulation tool, Sonnet Suites, a planar 3D electromagnetic simulator is used in this work. To fed patch antennas, co-axial probe feeding technique is applied. The proposed antenna can provide impedance bandwidths are of 50% and 56.25% of the center frequency. The result shows that return loss is under -10dB. Applications for proposed antennas are specially in the satellite communications.

Keywords- Bandwidth, Connected E-H shaped Patch antenna, Dielectric Thickness, E-shaped Patch antenna, Return Loss Curve, S-Band, Space communication.

12. Paper 31051524: Deployment of Matrix Transpose in Digital Image Encryption (pp. 74-76)

Okike Benjamin, Department of Computer Science, University of Abuja, Nigeria.

Prof. Garba EJD, Department of Mathematics, University of Jos, Nigeria.

Abstract — Encryption is used to conceal information from prying eyes. Presently, information and data encryption are common due to the volume of data and information in transit across the globe on daily basis. Image encryption is yet to receive the attention of the researchers as deserved. In other words, video and multimedia documents are exposed to unauthorized accessors. The authors propose image encryption using matrix transpose. An algorithm that would allow image encryption is developed. In this proposed image encryption technique, the image to be encrypted

is split into parts based on the image size. Each part is encrypted separately using matrix transpose. The actual encryption is on the picture elements (pixel) that make up the image. After encrypting each part of the image, the positions of the encrypted images are swapped before transmission of the image can take place. Swapping the positions of the images is carried out to make the encrypted image more robust for any cryptanalyst to decrypt.

Keywords- Image Encryption; Matrices; Pixel; Matrix Transpose

13. Paper 31051527: Using Handheld Mobile System to Address Illiteracy (pp. 77-84)

M. Samir Abou El-Seoud, Faculty of Informatics and Computer Science, The British University in Egypt – BUE, Cairo, Egypt

Amal Dandashi, Dept. of Computer Science and Engineering, Qatar University, Doha, Qatar

Jihad Al Ja'am, Dept. of Computer Science and Engineering, Qatar University, Doha, Qatar

AbdelGhani Karkar, Dept. of Computer Science and Engineering, Qatar University, Doha, Qatar

Islam Taj-Eddin, Academic Researcher and Computer Science Specialist, Cairo, Egypt

Abstract — Handheld device systems have been used as tools for teaching people with special needs due to cognitive function enhancement by utility of multimedia, attractive graphics and user-friendly navigation. Can a handheld device system, such as cellular phone, be used for teaching illiterate people? This paper explores and exploits the possibility of the development of an educational mobile system to help the illiterate people in Egypt.

Index Terms—*Graphical User Interface; Audio; Graphics; Video, Wireless; Mobile System; Arabic alphabet; Arabic speaking illiterate people; illiteracy.*

14. Paper 31051538: A Road Map of Urdu Layout and Recognizing its Handwritten Digits, Table of Contents and Multi-font Numerals from Scanned and Handwritten Text Images Using Different Techniques (pp. 85-91)

Eliza Batool, Hafiza Onsa Mustafa, Maryam Fatima, Aliya Ashraf Khan

Department of Software Engineering, Fatima Jinnah Women University The Mall, Rawalpindi

Abstract - Friendly interface is necessary to make the system more efficient and effective. The development of Urdu recognition is key element of research as it provides an efficient and natural way of input to the computer. This paper presents a framework based on Urdu layout and recognition of handwritten digits and text images by using different techniques. After the survey on Urdu documents the following conclusion is made regarding the Data set, Techniques and algorithms that the most widely used technique is HMM and Data set involves the training set which contains different image styles and sizes and also hand written text.

Keywords: HMM, Urdu documents, Rule based Approach

15. Paper 31051540: Hybrid Genetic Based Multi Dimensional Host Load Aware Algorithm for Scheduling and Optimization of Virtual Machines (pp. 92-102)

Mr. T. Thiruvankadam, Asst. Professor, Department of Computer Science, K.S.Rangasamy College of Arts and Science, Tiruchengode, Tamilnadu, India.

Dr. V. Karthikeyani, Asst.Professor, Department of Computer Science, Thiruvalluvar Govt., Arts College, Rasipuram, Tamilnadu, India

Abstract - Mapping the virtual machines to the physical machines cluster is called the VM placement. Placing the VM in the appropriate host is necessary for ensuring the effective resource utilization and minimizing the datacenter cost as well as power. Here we present an efficient hybrid genetic based host load aware algorithm for scheduling and optimization of virtual machines in a cluster of Physical hosts. We developed the algorithm based on two different methods, first initial VM packing is done by checking the load of the physical host and the user constraints of the VMs. Second optimization of placed VMs is done by using a hybrid genetic algorithm based on fitness function. Our simulation results show that the proposed algorithm outperforms existing methods and enhances the rate of resource utilization through accommodating more number of virtual machines in a physical host.

Index Terms: Virtual Machine, Physical Machine Cluster, VM Scheduling, Load Rebalancing, Load Monitoring.

16. Paper 31031501: Biometric Bank Account Verification System In Nigerian: Challenges And Opportunities (pp. 103-117)

*Omogbhemhe Izah Mike, Department Of Computer Science, Ambrose Alli University, Ekpoma Edo State Nigeria
Ibrahim Bayo Momodu, Department Of Computer Science, Ambrose Alli University, Ekpoma Edo State Nigeria*

Abstract - Due to the need for strong security for customer financial information in the banking sector, the sector has started the introduction of biometric fingerprint measures in providing securities for banking systems and software. In this paper, we have carefully explained the methodology of using this technology in banking sectors for customer verification and authentication. The challenges and opportunities associated with this technology were also discussed in this paper.

Keywords: Security, Biometric, Fingerprint, Bank

A Variability Modeling Method for Facial Authentication

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Abstract—Most biometric authentication methods have been developed under the assumption that the extracted features that participate in the authentication process are fixed. But the quality and accessibility of biometric features face challenges due to position orientation, illumination, and facial expression effects. This paper addresses the predominant deficiencies in this regard and systematically investigates a facial authentication system in the variable features' domain. In this method, the extracted features are considered to be variable and selected based on their quality and accessibility. Furthermore, the Euclidean geometry in 2-D computational vector space is being constructed for features extraction. Afterwards, algebraic shapes of the features are computed and compared. The proposed method is being tested on images from two public databases: the "Put Face Database" and the "Indian Face Database". Performance is evaluated based on the Correct Recognition (CRR) and Equal Error (EER) rates. The theoretical foundation of the proposed method along with the experimental results are also presented in this paper. The results obtained in the experiment demonstrate the effectiveness of the proposed method.

Index Terms—CRR, EER, Euclidean geometry, and facial biometric.

I. Introduction

The rapid evolution of information technology has caused the traditional token-based authentication and security management system to no longer be sophisticated enough to handle the challenges of the 21st century. As a result, biometrics has emerged as the most reasonable, efficient, and ultimate solution to authenticate the legitimacy of an individual [1-3]. Biometrics is an automated method of authenticating an individual based on their measurable physiological and behavioural characteristics. The common biometric traits in this characterization process are fingerprint, face, iris, hand geometry, gait, voice, signature, and keystrokes [1],[2]. Fingerprint, face, and iris traits are widely used in the field of biometric technology. Government and law enforcement organizations including military, civil aviation, and secret service often need to track and authenticate dynamic targets under surveillance. Organizations are also required to ensure that an individual in a room or crowd is the same person who had entered it.

As a result, a step in the direction of facial biometrics is regarded as a conclusive solution in this area. This technology makes it possible to facilitate the extraction of unique and undeniable physiological and behavioural characteristics without having the target's (subject) intrusion or knowledge [1-4].

There are many different methodologies that have been studied for biometric authentication systems, including shape of the facial features, skin color, and appearance. Among them, the feature-based method is the most efficient due to its measurability, universality, uniqueness, and accuracy. This approach is becoming the foundation of an extensive array of highly secure identification and personal verification solutions. The most commonly used facial features are the nose, eyes, lips, chin, eyebrows, and ears [5]. The system's performance and robustness are largely dependent on the features localization and extraction process. This process can be defined as the selecting of the relevant and useful information that uniquely identifies a subject of interest. The overall processing of the system must also be computationally efficient. However, the human face is a dynamic object with a high degree of variability in its position orientation and expression. Noncooperative behaviour of the user and environmental factors including illumination effects also play an unfavourable role in the facial feature extraction process. These effects contaminate the extracted features. Consequently, accessibility to the same biometric features with the expected quality is obstructed because of these unavoidable challenges. Therefore, a vital issue in facial biometrics is the development of an efficient algorithm for a biometric authentication in order to overcome the aforementioned challenges [1-7].

This paper addresses the predominant deficiency of facial biometric. Afterward, it systematically investigates the facial biometric systems under the assumption that facial geometry is influenced by position orientation, facial expression, and illumination effects. This method addresses the two challenging issues of the facial biometric, quality and accessibility. In the proposed method, a new facial authentication algorithm is being developed to address

these issues. Furthermore, in this method, feature selection, extraction, and authentication systems have been processed in 2-D geometrical space. Each candidate facial feature is considered to be a collection of geometrical coordinates in the Euclidean domain. The Euclidean distance between the candidate feature coordinates is estimated and stored as a vector to create the biometric template. It is then compared to the stored template to authenticate the legitimacy of the subject of interest.

The motivation of this method is its ability to select biometric features based on their quality and accessibility, then extract them to create the biometric template. Importantly, the variabilities of feature selection and extraction are processed without sacrificing efficiency in terms of computing time and memory usage. For the experimental evaluation of the proposed method, facial images are used from two public databases: the “Put Face Database” and the “Indian Face Database”. The performance of the proposed method is evaluated based on Correct Recognition (CRR), False Acceptance (FAR), and False Rejection (FRR) rates. An Equal Error Rate (EER) of 3.49% and CRR of 90.68% have been achieved by the proposed method. The experimental results demonstrate the superiority of the proposed method in comparison to its counterparts.

The remainder of the paper is organized as follows: Section II presents the literature review related to the proposed method; the theoretical background is presented in Section III; Section IV represents the detailed analysis and algorithmic formulation of the proposed variability method; the results and analysis are presented in Section V; and discussions and conclusions are included in Section VI.

II. Literature Review

The effects of position orientation, facial expression, and illumination on facial features are the vital issues of biometric authentication. Several studies have been conducted to address these issues. S. Du et al. [8] presented a review of facial authentication methods and their associated challenges based on pose variations. Their methodologies were based on invariant features extraction in the multi-viewed and 3D range domain under different pose variations. However, the authors inadequately addressed the issue of variability due to the combined effects of facial orientation, expression, and illumination. One study conducted by the National Science and Technology Council [9] proposed a Linear Discriminant Analysis (LDA) method for facial authentication. The author used LDA to maximize the inter-class and minimize the intra-class variations, since PCA performance deteriorates if a full frontal face can't be presented. Unfortunately, this model was designed for linear and homogeneous systems and faces challenges working with the underlying assumptions if there are an inadequate number of data samples in the received dataset. L. Chan et al. [10] proposed a linear facial biometric authentication system using PCA in conjunction with LDA. In that

approach, the author used PCA for dimension reduction, while LDA was used to improve the discriminant ability of the PCA system. The main challenge with this method is that it is inadequate to deal with the combined effects of position orientation, facial expression, and illumination. E. Vezzetti et al. [11] presented a geometric approach to show the intra-class similarity and extra-class variation between different faces. This was an interesting study; however, its main objective was to formalize some facial geometrical notations, which can be used to analyze the behaviour of faces, hence the authentication system. B. Hwang [12] et al. constructed a facial database with different position orientations, facial expressions, and illuminations. Here the authors used PCA (Principal Component Analysis), Correlation Matching (CM), and Local Feature Analysis (LFA) algorithms to evaluate the performance and limitations of the facial authentication systems. However, they did not consider the variability in their feature selection method. F. Sayeed et al. [13] presented a facial authentication using the segmental Euclidean distance method. They used a variant of the AdaBoost algorithm for feature selection and trained the classifier to enhance the performance of the facial detection process. Afterwards, each face was segmented into nose, chin, eyes, mouth, and forehead as a separate image; then the Eigenface, discrete cosine transform, and fuzzy features of each segmented image were estimated. Finally, segmental Euclidean distance and Support Vector Machine (SVM) classifiers were used in the authentication process. Variability due to different facial poses has been considered in this method, however, it is inadequate to address the issues associated with the combined effects of facial expression and illumination.

J. Li et al. [14] proposed a facial authentication system using adaptive image Euclidean distance. In this adaptive method, both spatial and gray level information were used to establish the relationship between pixels. Furthermore, two gray levels—namely, distance and cosine dissimilarity—were considered between pixels. The authors claimed that their proposed method achieved a promising authentication accuracy using adaptive image Euclidean distance in conjunction with PCA and SVM. But, the authors did not adequately discuss the challenges encountered due to position orientation, facial expression, and illumination effects that need to be overcome without sacrificing efficiency and processing time. J. Kalita et al. [15] proposed an eigenvector features extraction method in conjunction with the estimation of minimum Euclidean distance method to authenticate the facial image. This is a very interesting and straightforward approach and the authors considered the challenges associated with facial expression. More importantly, this method would be able to detect the resultant facial expression of the input image. Unfortunately, the combined effects of expression, orientation, and illumination were not sufficiently addressed in this method. C. Pornpanomchai et al. [16] proposed

a human face authentication method using the Euclidean distance estimation process along with the neural network. In this method, a Correct Recognition Rate (CRR) of 96% at a cost of 3.304 sec (per image) processing time has been achieved. However, this method also did not address possible contamination from facial expression, orientation, and illumination effects. H. Lu et al. [17], presented a new PCA algorithm in an uncorrelated multilinear PCA domain using unsupervised subspace learning of tensorial data. This system offered a methodology to maximize the extraction of uncorrelated multilinear biometric characteristics. But it is an iterative process and is not sophisticated enough to deal with the combined effects of position orientation, facial expression, and illumination without compromising the computation complexity. The challenges associated with accessing the same biometric features weren't also addressed properly in that method. A Bayesian Estimator was conducted by M. Nounou et al. [18], addressing the problem associated with the MLE and PCA algorithms. Unfortunately, this method was developed under the assumption that the system is not vulnerable to the combined effects of illumination, expression, and position orientation. J. Suo et al. [19] developed a gender transformation algorithm based on hierarchy fusion strategy. In that approach the authors used a stochastic graphical model to transform the attributes of a high-resolution facial image into an image of the opposite gender with the same age and race image. The main objective is to modify gender attributes while retaining facial identity. This is an interesting model, however the authors did not consider the challenges of accessing the same biometric features, due to the associated heterogeneous nature. L. Lin et al. [20] proposed a hierarchical regenerative model using an "And-Or Graph" stochastic graph grammar methodology. In that model, a probabilistic bottom-up formulation was used for object detection, and a recursive top-down algorithm was used in the verification and searching process. Here, objects with larger intra-variance were broken into their constituent parts, and linking between the parts was modeled by the stochastic graph grammar technique. The authors also addressed the localization challenges due to the background clutter effect. But, the proposed verification process was developed in a homogeneous and controlled environment. In this method, the authors inadequately presented the challenges associated with the accession and extraction of the same features.

Therefore, in most cases, the biometric features used in the authentication process are fixed. Consideration of variability during the feature selection and extraction process is necessary, since accessibility of the same biometric features may be difficult due to facial expression, position orientation, and illumination effects. In this paper, a new biometric authentication method is presented that addresses these effects and their impacts on accessibility and quality. Variability is being considered in this process

to overcome the accessibility issue. Sequential Subspace Estimation [SSE] method studied in [21] has been used to ensure the quality of the extracted features. Furthermore, Euclidean geometry in 2-D computational vector space is being constructed for biometric features extraction [22]. Afterwards, the algebraic shape of the facial area, as well as the relative positions and size of the eyes, nose, and lips, have been estimated in order to encode and create the biometric templates. This encoded template is then stored in the biometrics database in order to be compared with the live input encoded biometrics in Euclidean vector space.

III. Theoretical Background

Unlike other facial authentication methods, the proposed method is developed in the Euclidean domain under the assumption that the quality and accessibility of the extracted biometrics face challenges due to position orientation, facial expression, and illumination effects. Therefore, this section presents a theoretical background before getting into a detailed analysis of the proposed method.

A. Euclidean Vector

The Euclidean vector measurement is a widely used method for representing points in geometrical space. In this case, both a vector and a point (scalar quantity) in n -D space can be represented by a collection of n values. But the difference between a vector and a point lies in the way the geometrical coordinates are interpreted. A point might be considered as a scalar way of visualizing a vector. The transformation between a vector and a point in the 2-D geometrical coordinate system is shown in Fig 1(a). A Euclidean vector can be represented by a line segment with a definite magnitude and direction. The algebraic manipulation process of the Euclidean vector in 2-D geometrical space is shown in Fig. 1(b). In fact, all points in the Cartesian coordinate system can be defined in Euclidean vector space where a geometrical quantity is expressed as tuples splitting the entire quantity into its orthogonal-axis components. These points are scalar quantities that can also be used to estimate the algebraic relationship among the objects (images).

Now, consider if n -tuple points in n -space can be represented by \mathbb{R}^n , then two vectors, $\mathbf{u} = u_1, u_2, u_3, \dots, u_n$ and $\mathbf{v} = v_1, v_2, v_3, \dots, v_n$, shown in Fig 1(b) are equal if $u_1 = v_1, u_2 = v_2, u_3 = v_3, \dots, u_n = v_n$. Their other

properties can be presented as follows [23],[24]:

$$\mathbf{u} + \mathbf{v} = u_1 + v_1, u_2 + v_2, u_3 + v_3 \dots u_n + v_n$$

$$k(\mathbf{u} + \mathbf{v}) = k\mathbf{u} + k\mathbf{v}$$

The distance between two points \mathbf{u} and \mathbf{v} :

$$\mathbf{v} - \mathbf{u} = (v_1 - u_1, v_2 - u_2, v_3 - u_3, \dots, v_n - u_n)$$

$$\|\mathbf{u} - \mathbf{v}\| = \sqrt{(\mathbf{u} - \mathbf{v}) \cdot \mathbf{u} - \mathbf{v}}$$

$$\mathbf{d}(\mathbf{u}, \mathbf{v}) = \|\mathbf{u} - \mathbf{v}\|$$

$$\sqrt{\sum_{i=1}^n (v_i - u_i)^2} = \sqrt{(v_1 - u_1)^2 + (v_2 - u_2)^2 +$$

$$\sqrt{(v_3 - u_3)^2 + \dots + (v_n - u_n)^2}$$

The magnitude:

$$\|\mathbf{u}\| = \sqrt{\mathbf{u} \cdot \mathbf{u}} = \sqrt{p_1^2 + p_2^2 + p_3^2 + \dots + p_n^2}$$

where k is a scalar quantity.

The geometrical representation of \mathbf{u} and \mathbf{v} in \mathbb{R}^n is shown in Fig. 1.

In the proposed method, using the same analogy, a Euclidean vector in 2-D geometrical space is being constructed for a feature extraction, estimation, and authentication process. In particular, each assigned point of the candidates' biometric features is considered to be a 2-D geometrical coordinate in the Euclidean vector space [22]. This feature extraction, estimation, and authentication process are presented in Section IV-B.

B. Facial Anatomy

Facial authentication is an everyday task, as humans can identify faces without extra effort. Typically, the face has inherent characteristics with distinguishable landmarks, different peaks, and approximately 80 nodal points [25]. Building an automated system to authenticate an individual using facial geometry can be done by extracting facial biometric features; including size or shape of the eyes, lips, nose, cheekbone, and jaw, as well as their relative distances (or positions) and orientation. Authentication typically uses an algorithm that compares input data with the biometrics stored in the database. The authentication process based on facial features is fast and accurate under favorable constraints, and as a result this technology is evolving rapidly. Unlike biometric authentication using other traits, authentication using facial biometrics can be done easily in public or in noncooperative environments. In this case, the subject's awareness is not required. A typical facial biometric pattern in 2-D geometrical space is shown in Fig. 2 [26],[27].

Face Databases

In this method facial images from the two public databases, the "Put Face Database" and the "Indian Face Database", are used [29],[30]. The sizes of the two databases are presented in Table I. The "Put Face Database" is a highly nonlinear and heterogeneous 3D

facial database. It contains approximately 20 images per person with a total of 200 people, and stores 2048×1536 pixel images [30]. The main motivation for using the "Put Face Database" is that the diversity of the image subsets allows them to be easily used for training, testing, and cross-validation processes. This can occur because the images in this database have more than 20 orientations for an individual using various lightings, backgrounds, and facial expressions. In addition, the images in this database contain 2193 landmarked images [31]. A sample of the facial images from the "Put Face Database" is shown in Fig. 3.

On the other hand, images in the "Indian Face Database" are less influenced by the facial expression, position orientation, and illumination effects. There are 40 subjects, each having 11 images with the same homogeneous background. The size of each image is 640×480 and 256 gray level per pixel. The main reason for using two types of databases is to find out the combined effects of two different environments. As well, it is important to show that the proposed method is the optimal solution for not only the images highly influenced by the underlying challenges, but also for the images that are less obstructed by the same reason. A sample of the facial images from the "Indian Face Database" is given in Fig. 4.

TABLE I: The Details of Two Databases

Databases	Original Image Size (Pixels)	Modified
Put Face	2048x1536 (color)	256x256 (gray)
Indian Face	640x480 (gray)	256x256 (gray)

IV. Variability Modeling Method

The studies of many facial biometric authentication methods have been based on the geometrical features extraction and selection process. As previously mentioned, most of those algorithms have been developed under the assumption that the extracted candidate features for the authentication process are fixed. However, there are challenges in accessing the same facial geometric features, caused by effects due to facial orientation in the time domain. In addition, even if the facial features are accessible, their quality is contaminated by expression and illumination, due to the dynamic properties of the human face and environmental factors, respectively. Some studies have also been conducted based on variabilities in the features extraction and selection process; but that method didn't consider the combined effects of facial expression, orientation and illumination. As well, in most cases, these variabilities were introduced at the cost of processing time, storage, and memory. The proposed authentication method is developed under the assumption that the extracted facial biometrics are vulnerable to position orientation, facial

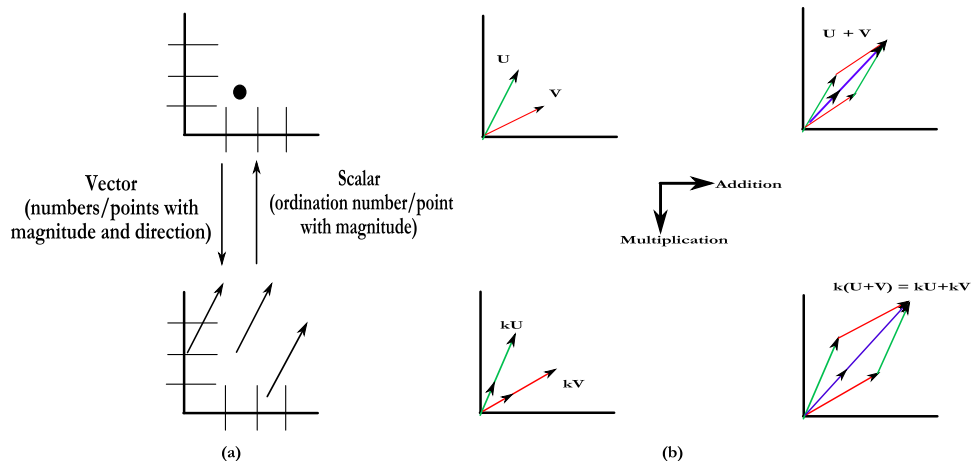


Fig. 1: Euclidean Vector in 2-D Geometry.

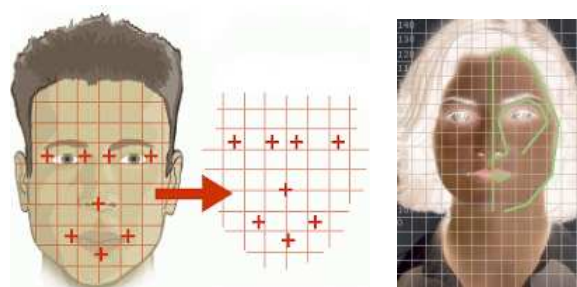
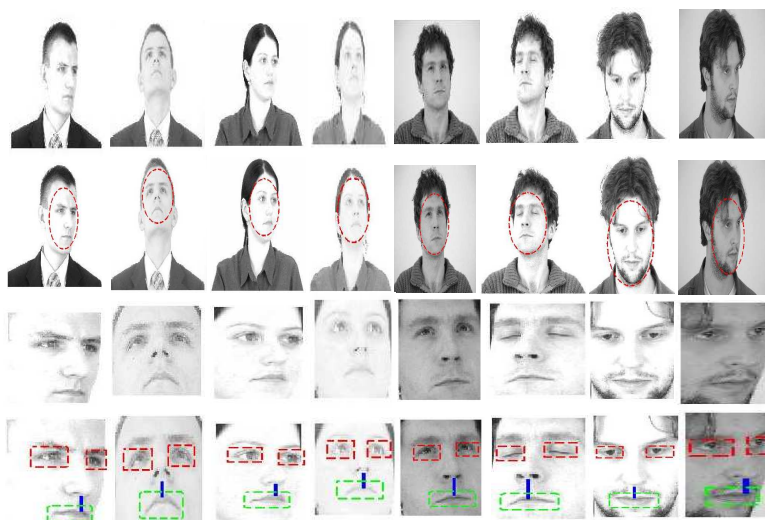
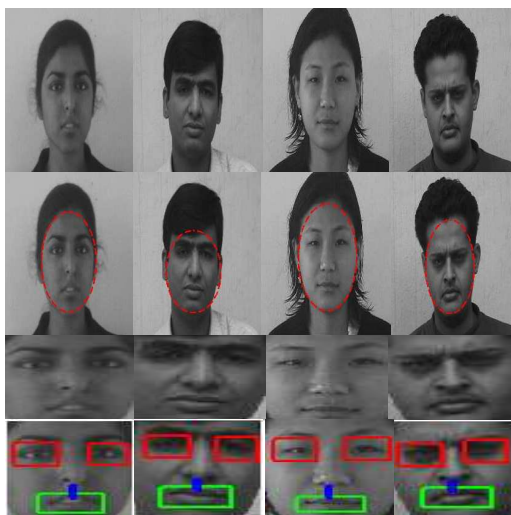


Fig. 2: Features in 2-D Geometrical Space [26],[27].



a. First Row - Original Image b. Second Row - Computation of Facial Boundaries c. Third Row - Extracted Face d. Fourth Row - Extracted Features

Fig. 3: A Sample Facial Images - Put Face Database.



a. First Row -Original Image b. Second Row - Computation of Facial Boundaries c. Third Row - Extracted Face d. Fourth Row - Extracted Features

Fig. 4: A Sample Facial Images - Indian Face Database

expression, and illumination effects. More importantly, it is considered that these effects could cost the quality and accessibility of the desired features. Therefore, the proposed variability method is the compilation of two challenging issues: quality feature extraction (i.e. desired features) and variability of the authentication process (i.e. feature selection and its desired estimate).

A. Quality Feature Extraction

The challenges associated with position orientation, facial expression, and illumination effects are the vital issues for the exploitation of facial biometrics. These effects obstruct the accessibility and deteriorate the quality of the biometric features. The Sequential Subspace Estimator (SSE) method studied in [21],[23] addressed the challenges of finding quality facial biometrics that are contaminated by these effects. In that method, a recursive sequential estimator algorithm is being developed in the image subspace. The system performed a sequential recursive filtering process in order to ensure that the biometrics are of good quality. The SSE approach is based on the minimization of noise and maximization of information contained in the received data, in MSE sense.

Now, consider that the facial images have been received as vectors of matrix \mathbf{x} . Each row and column of the received dataset \mathbf{x} represents an observation and a particular type of datum, respectively. If the received dataset is contaminated by noise, then the received images can be written as:

$$\mathbf{x} = \mathbf{s} + \mathbf{n} \quad (1)$$

where \mathbf{n} is the noise matrix, and \mathbf{s} is the noise-free or desired dataset.

Principal components can be derived from the \mathbf{x} dataset,

and these derived components can be written as [32],[33]:

$$\mathbf{z} = \mathbf{w}^T \mathbf{x}$$

Therefore using Eq. (1):

$$\mathbf{z} = \mathbf{w}^T \mathbf{s} + \mathbf{w}^T \mathbf{n} \quad (2)$$

where \mathbf{w} represents weight vectors which map to each row vector of \mathbf{x} , \mathbf{z} is considered to be inherited (data) with maximum possible variance from the \mathbf{x} dataset, and each of the weight vectors \mathbf{w} is constrained to be a unit vector [34].

The MSE between the desired features and the processor output can be defined as follows [21],[23]:

$$\mathbf{e}(t) = \mathbf{d}(t) - \hat{\mathbf{y}}(t) \quad (3)$$

$$\min_{\|\hat{\mathbf{w}}_c\|=1} MSE = \mathbb{E}[|e(t)|^2] \quad (4)$$

The main objective is to determine the minimum value of the Mean Squared Error (MSE), i.e. Minimum Mean Squared Error (MMSE). With this, one would be able to decode the desired biometric features from the underlying noise environment to maximize the mutual information. The detailed analysis and formulation of the SSE algorithm has been studied in [21],[23].

B. Variability Method in Authentication Process

The consideration of variability during the feature selection and extraction process is unavoidable. The accessibility of the same biometric features is a complex task since the human face is a dynamic object with a high degree of variability. In this case, Euclidean distance measurement is being used to formulate the proposed variability measure. In this method, images are transformed into vector spaces and maintain a direct relationship between objects

in geometrical spaces. The main reason for using the Euclidean measurement in the proposed method is because it has the ability to represent these points as a collection of real numbers. Afterwards, these points are used to establish an algebraic relationship among the objects in the vector space, which are then transformed into linear scalar quantities. These quantities are flexible to manipulate and have the ability to respond to variabilities during the features' selection, extraction, and estimation processes.

In the proposed Euclidean geometrical method, the detected face is represented in the 2-D geometrical domain. Afterwards, biometric templates are created from the extracted facial area, eyes, lips, and nose, along with their relative positions. In this case, the proposed Euclidean geometrical method in conjunction with the Sequential Subspace Estimator (SSE) are used to overcome the challenges associated with feature quality and accessibility due to facial expression, orientation, and illumination effects. More specifically, each extracted feature is considered to be a separate image. Thus four biometric templates are created from one facial image which can then be stored as a single template in the database system. This single template is treated as a template set for an individual and contains 4 subsets of templates. Furthermore, the features are transformed into a Euclidean metric where an estimate of the distance of a set of vectors is performed against a reference point '0' shown in Fig. 5. In this case, if $\mathbf{p} = [p_1 \ p_2 \ p_3 \dots p_n]$ and $\mathbf{q} = [q_1 \ q_2 \ q_3 \dots q_n]$ are considered to be in \mathbb{R}^n and in the 2-D vector space, then the transformed metric \mathbf{P} in the Euclidean domain satisfies the following condition:

$$\begin{aligned} \mathbf{P}\mathbf{P}\mathbf{P}\mathbf{q} &= \mathbf{p}\mathbf{q} \\ \text{Such that: } \mathbf{P}\mathbf{P}^T &= \mathbf{I} \end{aligned} \quad (5)$$

where \mathbf{P}^T is the transpose of \mathbf{P} and \mathbf{I} is an identity matrix.

Euclidean Distance

Consider two images that can be written as the vectors $\mathbf{p} = [p_1 \ p_2 \ p_3 \dots p_n]$ and $\mathbf{q} = [q_1 \ q_2 \ q_3 \dots q_n]$. According to Section III-A, the distance between the two images in the Euclidean domain can be stated as follows:

$$\begin{aligned} \mathbb{D} &= \sqrt{\sum_{i=1}^n (q_i - p_i)^2} \\ &= \sqrt{(\mathbf{q} - \mathbf{p})^T (\mathbf{q} - \mathbf{p})} \\ \text{Normalized outcome:} \\ \mathbb{N} &= \sqrt{(\mathbf{v} - \mathbf{u})^T (\mathbf{v} - \mathbf{u})} \end{aligned} \quad (6)$$

A Euclidean metric matrix \mathbf{Q} is being developed based on the normalized spatial distances (i.e. spatial relationships between two points) between the pixels of the respective biometric features. Therefore, the according to Eq. (5) and Eq. (6), the Euclidean geometrical formula for the

proposed method in 2-D vector space can be stated as follows:

$$\begin{aligned} \mathbb{M} &= \sqrt{(\mathbf{v} - \mathbf{u})^T \mathbf{Q} (\mathbf{v} - \mathbf{u})} \\ \text{Subject to: } \mathbf{Q}\mathbf{Q}^T &= \mathbf{I} \end{aligned} \quad (7)$$

where \mathbb{M} is the desired estimate.

C. Biometric Template Matching

The proposed method is developed under the assumption that the extracted biometric features are highly influenced by position orientation, facial expression, and illumination effects. More importantly, it has been assumed that the candidate biometric features to be extracted are not fixed and accessing them may be difficult due to this assumption. As a result, four biometric features including facial area, eyes, lips, and nose, along with their relative positions (i.e. O as reference point -Fig. 5) have been extracted from the facial image of an individual. Each is considered a separate image. These four templates are then stored (enrolled) as a single biometric template in the biometric database system. Therefore, the set contains four subsets of templates created from an individual's facial image. On the other hand, during the matching process, any two accessible biometric features along with their relative positions have been extracted from the live input facial image (i.e. test input or image). These two extracted images are used to create two subsets of biometric templates. Two test subsets have been selected and extracted based on the accessibility and quality of the features in the live input image. These two templates and their relative positions are then compared with the corresponding two of the four stored templates (i.e. 2 of the 4 subsets) in the database.

Therefore, the biometric databases contain one set of templates for each individual, and each template contains four subsets of templates constructed from the extracted facial area, and size of the eyes, nose, and lips along with their relative positions. In this case, each set of biometric templates uniquely represents an individual's identity, as each subset identifies a specific feature of that individual. The system diagram of this process is shown in Fig. 6.

D. Computational Complexity

Computational complexity is an important issue for the proposed method. Starting with Eq. (4), computational complexity for the vector operation (matrix of vectors) is $O(N^2)$, and for Eqs. (5) and (6) is also $O(N^2)$.

V. Results and Analysis

The variability method for the authentication (identification and verification) system was tested on the images from two public databases: the "Put Face Database" and the "Indian Face Database". In the experiment, we used the "Put Face Database" to create two sets of image databases: $dB1$ and $dB2$, containing 30 and 50 subjects, respectively. Each database contains 10 images of each subject; thus

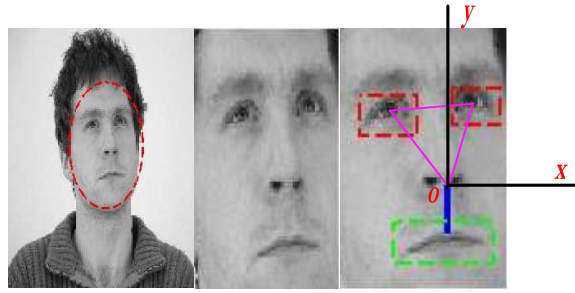


Fig. 5: Extraction of Facial Features - Put Face Database.

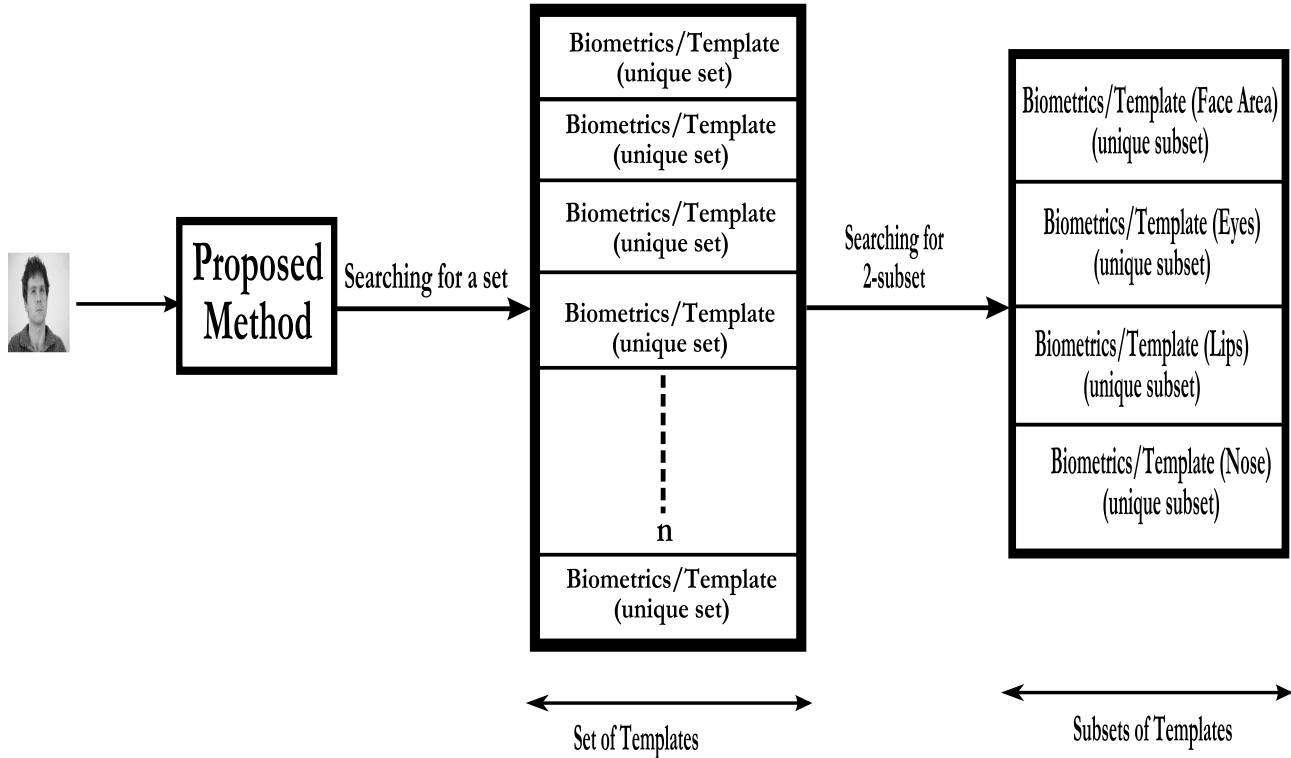


Fig. 6: Searching and Matching Process

there were 300 and 500 images in databases $dB1$ and $dB2$, respectively. In this process, 7 out of 10 facial images from each subject were used to train the system. The rest of the three subjects' images were used for testing purposes. The "Indian Face Database" was also used to create two sets of image databases: $dB3$ and $dB4$, containing 10 and 20 subjects, respectively. Each database contains 6 images of each subject; thus there were 60 and 120 images in databases $dB3$ and $dB4$, respectively. In this process, 4 out of 6 facial images from each subject were used to train the system. The rest of the two subjects' images were used for testing purposes.

In both cases, we stored four biometric templates for an individual that were created from the facial area and size of the eyes, lips, and nose, along with their relative positions. However, comparisons between the input and

the stored biometrics were done with any two available features along with their relative positions. Images were taken of different orientations and facial expressions, as well as under different lighting conditions. The maximum size of the training dataset was approximately 17.5 MB. Since the proposed biometric authentication method has two modes, identification and verification, the performance evaluation of the proposed method was conducted based on these two modes.

A. Identification

The experiment for the identification process was conducted using databases $dB1$, $dB2$, $dB3$, and $dB4$. In this process, the received image was compared with all of the stored images in the database. There were 300, 500, 60, and 120 images in databases $dB1$, $dB2$, $dB3$,

and $dB4$, respectively; therefore there were 300, 500, 60, and 120 sets (two templates for each set) of identification attempts. The performance of the identification process was evaluated using CRR, and their averages were recorded. Comparisons of the proposed method to the state-of-the-art algorithms PCA, LDA, and MLE were also recorded and are shown in Table II and Fig. 7.

TABLE II: Performance Evaluation in (%) - CRR Comparison

Methods	$dB1$	$dB2$	$dB3$	$dB4$	Average
Proposed Method	88.30	86.25	94.50	93.65	90.68
PCA	66.45	59.80	78.65	74.80	70.19
LDA	72.25	67.35	81.50	78.45	74.89
MLE	70.85	66.05	80.20	76.65	73.44

B. Verification

The verification of a genuine person was conducted by comparing the facial image of each person with the other facial images of the same person. Imposter processing was conducted by comparing the facial image of one person with the facial images of other persons. There were 90, 150, 20, and 40 testing samples for databases $dB1$, $dB2$, $dB3$, and $dB4$, respectively; therefore there were 90, 150, 20, and 40 sets (two templates for each set) of genuine matches. The verification performance was evaluated using the False Acceptance Rate (FAR), False Rejection Rate (FRR), and Equal Error Rate (EER). The percentages of FAR and FRR and the corresponding EER points were determined and the experimental results were recorded. Comparisons of the proposed method to the state-of-the-art algorithms PCA, LDA, and MLE were also collected and shown in Tables III – V, and Figs. 8 – 11. The average execution time for each database is given in Table VI.

VI. Discussions and Conclusions

The proposed variability method addressed two important issues of facial biometrics—quality and accessibility—for biometric authentication. In this experiment, it is assumed that the associated challenges during the feature selection and extraction process are due to the combined effects of position orientation, facial expression, and illumination on the biometric features. A variability method for

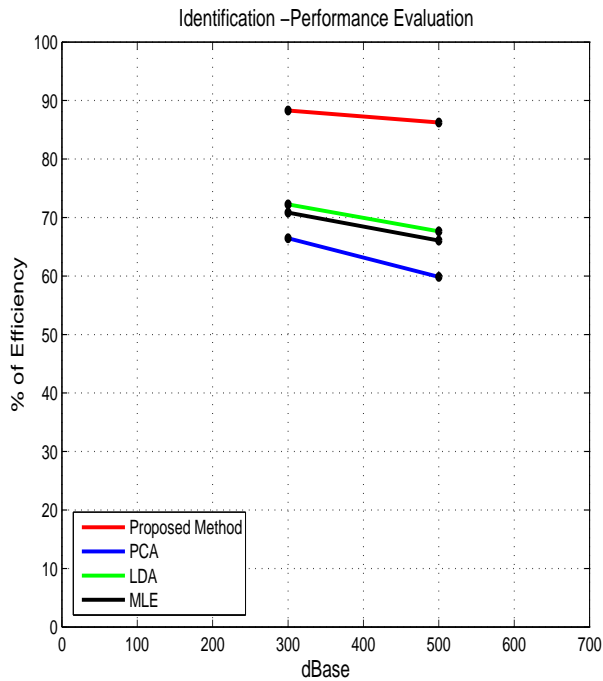
TABLE III: Performance Evaluation in (%) - FAR, FRR, and EER Comparison

Methods	$dB1$			$dB2$		
	FAR	FRR	EER	FAR	FRR	EER
Proposed Method	0.87	6.10	3.65	3.75	8.70	5.80
PCA	8.60	9.25	10.1	9.50	13.40	15.65
LDA	7.65	5.30	8.20	4.55	12.85	12.37
MLE	7.20	8.90	9.50	8.75	12.65	14.25

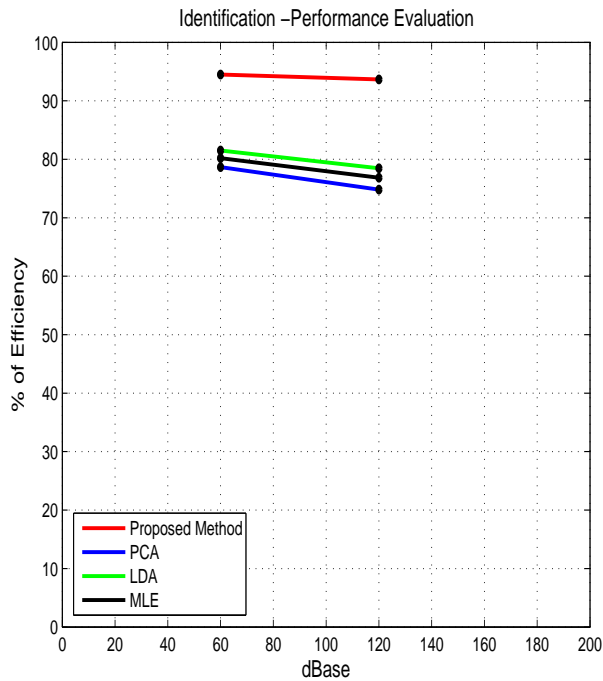
TABLE IV: Performance Evaluation in (%) - FAR, FRR, and EER Comparison

Methods	$dB3$			$dB4$		
	FAR	FRR	EER	FAR	FRR	EER
Proposed Method	0.82	3.55	1.85	0.84	3.85	2.65
PCA	2.15	4.25	5.15	3.25	5.30	7.45
LDA	1.50	3.85	3.75	3.85	4.60	5.90
MLE	1.35	3.75	2.50	3.25	4.15	6.50

facial authentication has been developed in the Euclidean 2-D vector space. The extracted biometrics are being considered as a collection of points in the 2-D geometrical coordinate system. In this experiment, two different databases $dB1$ and $dB2$ have been created from the “Put Face Database”, which contains 30 and 50 subjects, each with 10 images. As well, two databases $dB3$ and $dB4$ have been created from the “Indian Face Database” that contains 10 and 20 subjects, each with 6 images. The “Indian Face Database” is less influenced by the effects from various lightings, backgrounds, and facial expressions. The main reason for using two different public databases is to test the proposed variability method under two different environmental conditions and discover the average effect of the facial authentication process. Furthermore, in both cases, four biometric templates (from an individual image) using extracted facial area, eyes, lips, and nose features were created, respectively, and stored in the database as a single template for an individual, each set with 4 subsets of templates. During the comparison process, two templates have been created from the extracted live input biometrics. These templates were compared with two of the four

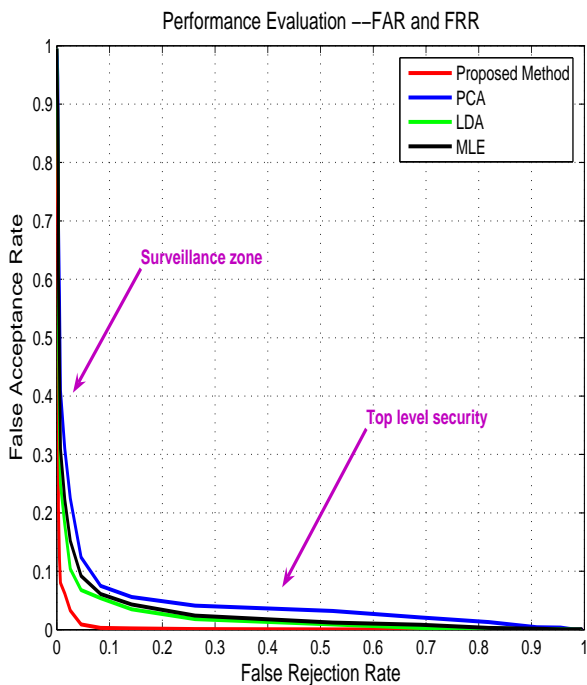


(a) PUT Face Database

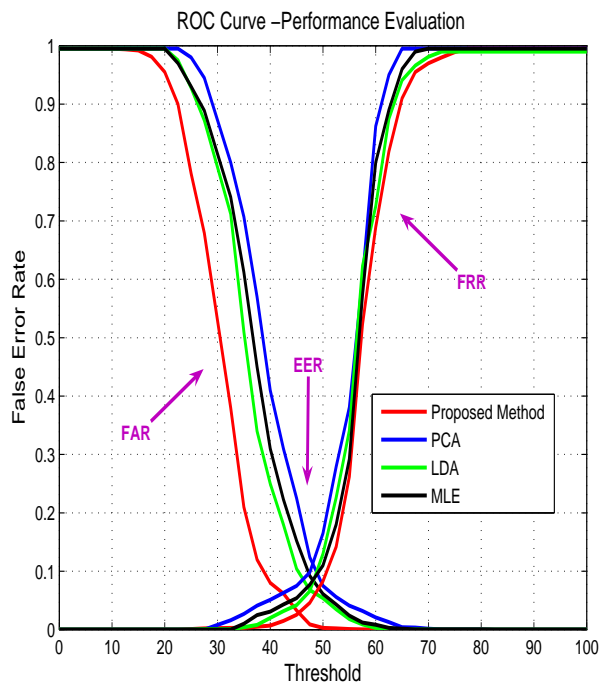


(b) Indian Face Database

Fig. 7: Identification - Performance Comparison

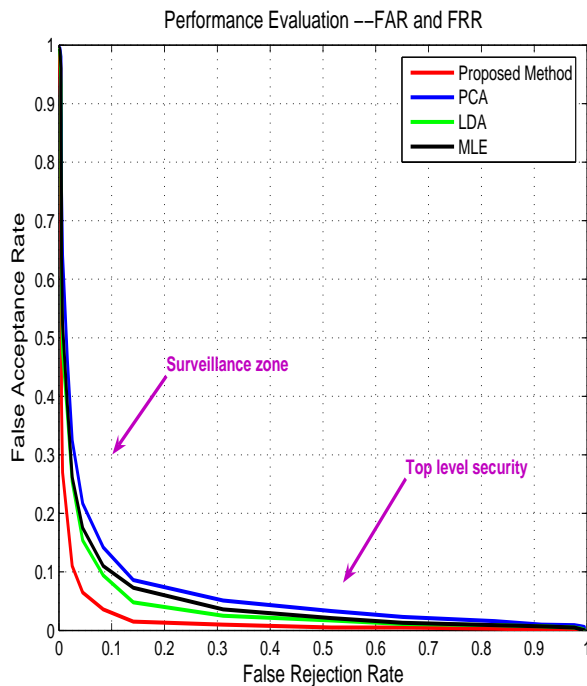


(a) FAR and FRR -dB1

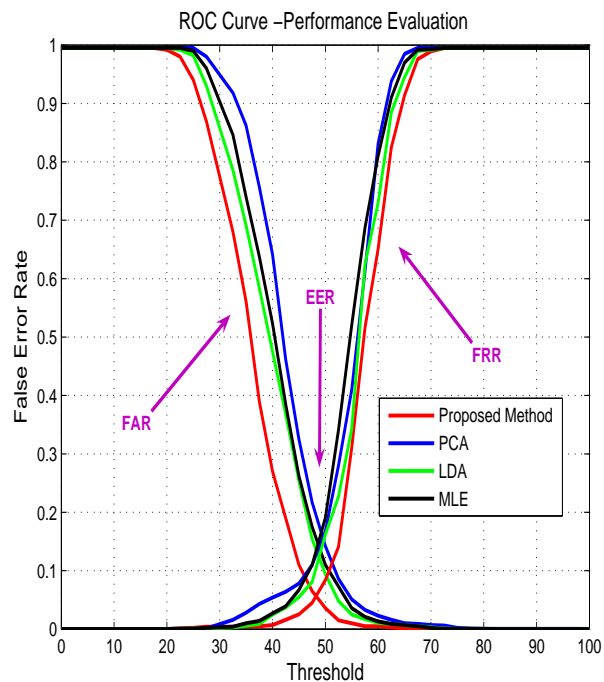


(b) ROC -dB1

Fig. 8: Verification - Performance Evaluation.

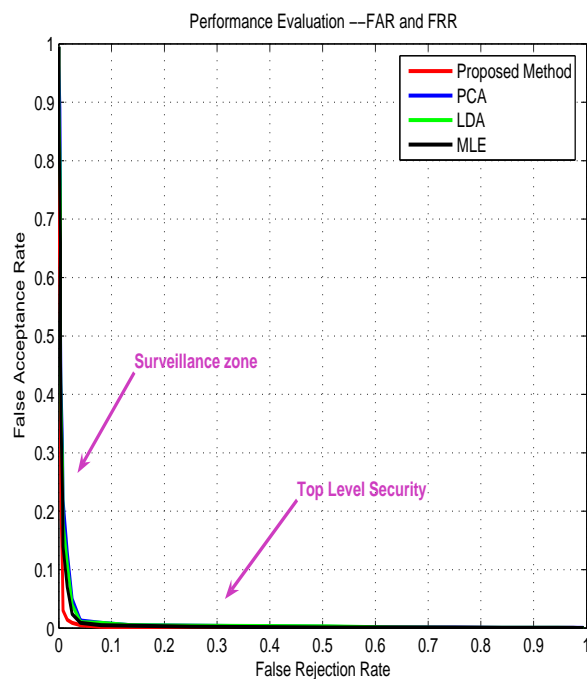


(a) FAR and FRR -dB2

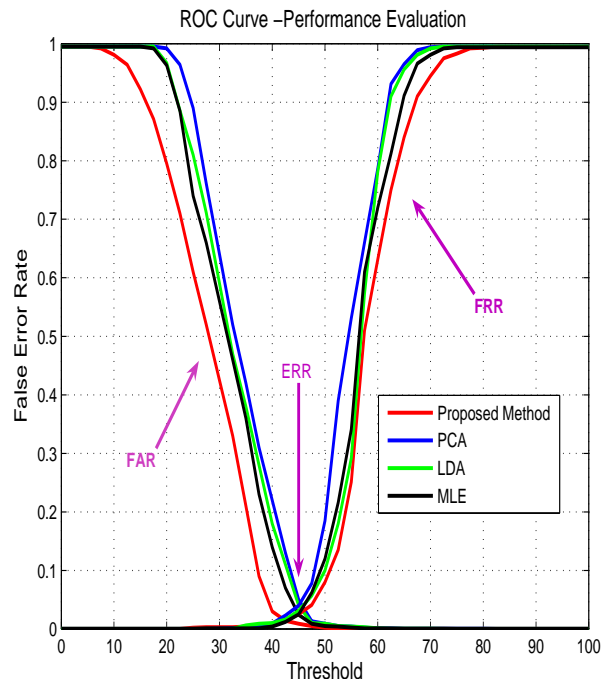


(b) ROC -dB2

Fig. 9: Verification - Performance Evaluation.



(a) FAR and FRR -dB3



(b) ROC -dB3

Fig. 10: Verification - Performance Evaluation.

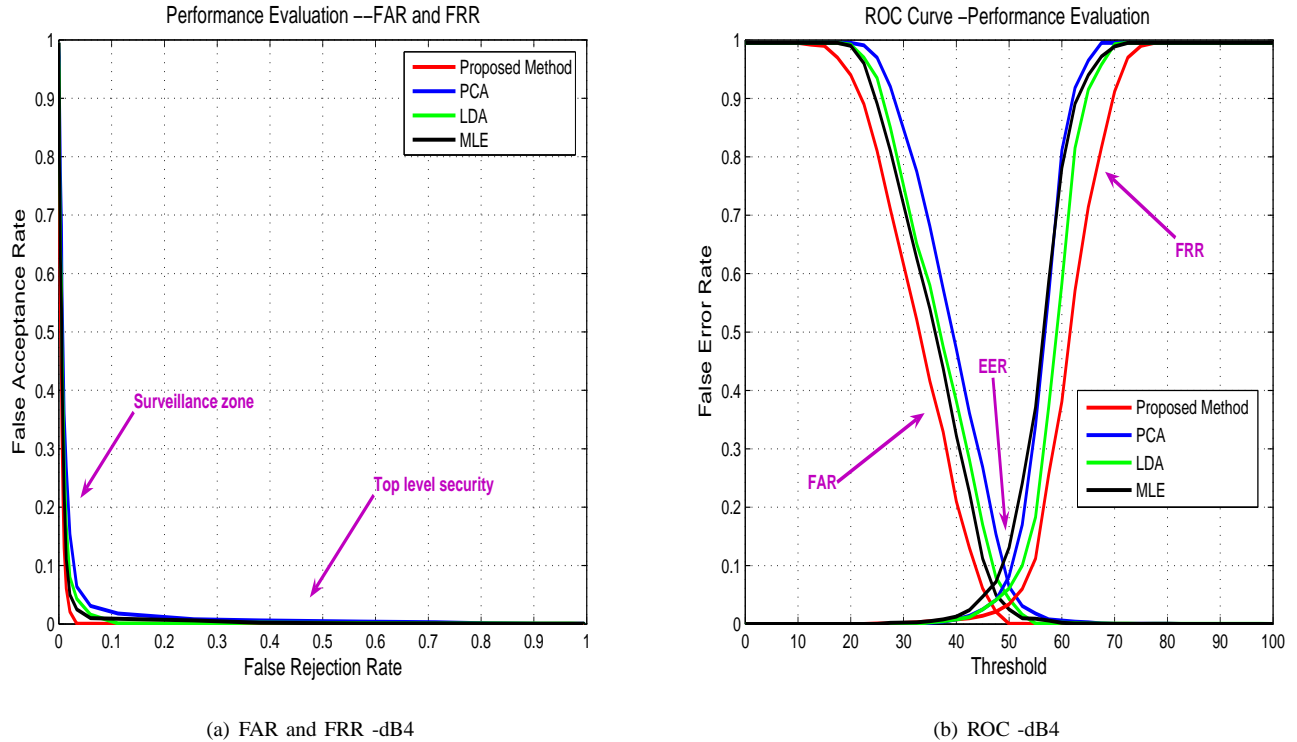


Fig. 11: Verification - Performance Evaluation.

TABLE V: Performance Evaluation in (%) -EER Comparison

Methods	Put Face	Indian Face	Average
Proposed Method	4.73	2.25	3.49
PCA	12.88	6.30	9.59
LDA	10.29	4.83	7.56
MLE	11.88	4.50	8.18

TABLE VI: Average Execution Time in Seconds

Authentication	dB1	dB2	dB3	dB4
Identification	35.40	57.16	12.52	19.39
Verification	4.34	5.41	2.57	3.25

corresponding stored subsets of templates.

The experimental results of the authentication process are recorded in Tables II – VI, and the Receiver Operating Characteristics (ROC) curves of the proposed method based on the four databases are also included. This ROC curve

measures the performance of the verification system. FAR and FRR presented in the ROC curves characterize the verification accuracy, and the point EER represents the performance of the verification system. The experimental results of the verification process are recorded in Tables III – V. In addition, the performance of the identification process for the proposed method is evaluated based on CRR, and these results are also recorded in Table II. Furthermore, the simulation outcomes for the identification and verification are presented in Figs. 7 – 11. More importantly, the performance of the proposed method is analyzed and compared with three state-of-the-art algorithms, namely PCA, LDA, and MLE. The experimental results show that the proposed method outperforms its counterparts with a promising CRR of 90.68% and an EER of 3.49%.

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Multi-Channel User Authentication Protocol based on Encrypted Hidden OTP

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Abstract—Remote user authentication plays the most fundamental procedure to identify the legitimate users of a web service on the Internet. In general, the password-based authentication mechanism provides the basic capability to prevent unauthorized access. Since, many researchers have proposed a number of password based authentication schemes which rely on a single channel for authentication. However to achieve a better security, it is possible to engage multi-channels for authenticating users. In this paper, we propose an efficient one time password (OTP) based authentication protocol over a multi-channels architecture. Where, the proposed protocol employing the RC4-EA encryption method to encrypt the plain-OTP to cipher-OTP. Then, Quick Response Code (QR) code is used as a data container to hide this cipher-OTP. Also, the purpose of the protocol is integrate a web based application with mobile-based technology to communicate with the remote user over a multi-channels authentication scheme. The main advantage of the proposed protocol is to highly secure the authentication system by preventing the OTP from eavesdropping attack. Also, by integrating a Web-based application with mobile-based technology as a multi-channels scheme; the proposed protocol helps to overcome many challenging attacks such as replay attack, DoS attack, man-in-the-middle (MITM) attack, real-time phishing (RTP) and other malware attacks.

Keywords-Authentication; Multi-Channel Authentication (MCA); Data hiding; Quick Response Code (QR) code; Encryption.

I. INTRODUCTION

Internet has become the most convenient environment for businesses, education, bill-paying and E-commerce around the world [1]. Thus, internet security is an important issue to prevent the confidential information from being accessed by unauthorized users [2]. Remote authentication of users is recently one of the most important service on the internet. Where, remote user authentication is the process of identifying a legitimate user of a particular web service on the internet[3].

Most authentication schemes using a smart card, debit card, or Asynchronous Transfer Mode (ATM) to restrict a resources [4]. These schemes are impractical due to their infrastructure requirements [5]. According to their low cost, efficiency and portability, Passwords are the most common and convenient way to authenticate the remote user [6]. However, such passwords become a sensitive target for

the attackers which lead to compromise the authentication schemes [7]. Thus, using one time password (OTP) is an efficient way to secure the authentication scheme. Where, OTP is the identity password of a user which changes with every user login [8].

This paper proposed one time password (OTP) authentication protocol for remote user login. Where, the plain-OTP is encrypted in the form of cipher-OTP using RC4-EA encryption method in order to keep it secret [9]. Since the crypt-systems have over grown, it would not be enough to encrypt the stuffed contents of the plain-OTP. Hence, we need to work on the inevitability that its existence should be kept secret. Thus, Quick Response code(QR) code is used as a data container to hide the cipher-OTP [10]. Also, to ensure safe and secure remote user authentication, multi-channels authentication (MCAs) is used [11]. Where, the idea behind using MCA is to ensure integrity and authenticity of user authentication [12]. So that, for an attacker to compromise a user account; different independent channels have to be compromised first before gaining full access to the user account [13].

The advantages of the proposed user authentication protocol are to prevent the OTP from eavesdropping attack by adopting the RC4-EA encryption method and the QR-code technique. Also, to overcome the drawback of the man-in-the-middle/browser (MITM/B), real-time phishing/pharming (RTP/P) and malware attacks; by integrating a Web-based application with mobile-based technology as a multi-channels.

The rest of this paper is organized as follows: Section II presents an overview of one time password technique (OTP), Dynamic RC4-EA encryption method, Data hiding using QR-Code and Multi-Channels based authentication. Section III introduces the proposed authentication protocol. Section IV gives the implementation and security analysis. Finally, Section V contains the conclusion remarks.

II. AN OVERVIEW

A. One Time Password Technique (OTP)

One Time Password (OTP) authentication is used to provide the security of websites and to minimize the potential of unauthorized access [14]. The concept behind OTP is that it can be used only one time, where it is only valid for one login session or for a very short period of time [15]. Even if an attacker is capable of obtaining this user credential OTP, it may either no longer be valid or be prohibited from additional use. OTP can help in mitigating a typical phishing attempt or a replay attack [16]. A variety of algorithms for the generation of OTPs are listed below [14]:

- 1) Based on time-synchronization between the authentication server and the client providing the password, where OTPs are valid only for a short period of time.
- 2) Using a mathematical algorithm to generate a new password based on the previous password, where OTPs are effectively a chain and must be used in a predefined order.
- 3) Using a mathematical algorithm where the new password is based on a challenge (e.g., a random number chosen by the authentication server) and/or a counter.

B. Dynamic RC4-EA Encryption Method

Cryptography plays a major role to prevent eavesdropping of sensitive information [17]. EIDahshan et al. proposed a dynamic RC4-EA method [18]. It is used for encrypting and decrypting the plaintext. The advantage of the RC4-EA method is to increase the security of the system, by generating the secret keys dynamically. Where, the Evolutionary Algorithm (EA) is adapted to generate a dynamic secret key as a seed used in the RC4 encryption algorithm. Hence, the final keystream can not be cracked by the attacker. Then, XOR operation is performed with this final keystream generated from the RC4-EA method on the plaintext to obtain the ciphertext and vice versa [18].

C. Data Hiding Using QR-Code

It is essential that in order to hide the information, we need a data container that may be used suitably according to the purpose. The data container may be an image, a video or a Quick Response Code (QR) code [7]. QR code is developed by Japanese Denso Wave corporation in 1994 [10]. It is a two-dimensional array. The QR code can hold a considerably greater volume of information: 7,089 characters for numeric only, 4,296 characters for alphanumeric data and 2,953 bytes of binary (8 bits) [19]. The QR code includes an encoding region and function patterns: the encoding region is used to store the data, and the function patterns include position detection patterns, separators for position detection patterns, timing patterns and alignment patterns [20].

To generate a QR code the string of bits are needed. This string includes the characters of the original message, as

well as some information bits that will tell a QR decoder what type of QR Code it is. After generating the string of bits; the Reed-Solomon technique is used to generate Error Correction [21]. The resultant data from string of bits and the Error Correction is used to generate eight different QR Codes, Each of which uses a different mask pattern. A mask pattern controls and changes the pixels to black 0 or White 1. Which makes sure that the QR code doesn't contain patterns that might be difficult for a QR decoder to read [21]. Finally, the QR Code which uses the best mask pattern is generated as shown in figure 1.

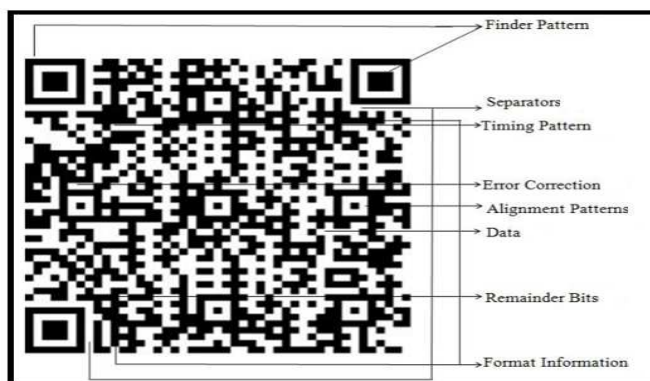


Figure 1. Structure of QR Code

D. Multi-Channels base Authentication (MCA)

Authentication is an important aspect of a secure systems, where a user proves his identity by revealing his certain secrets possesses [2]. Most authentication schemes have proposed using a single channel to authenticate users. These schemes have undoubtedly improved security but have not eliminated the possibility of some kinds of attacks such as; man-in-the-middle/browser (MITM/B), real-time phishing/pharming (RTP/P) and malware. Therefore, researchers have come up with other schemes to overcome these drawbacks such as multi-channels authentication(MCA) (i.e., web channel combined with mobile network channel)[13].

In theory, MCA offers superior security over single channel authentication schemes. That is, for an attacker to compromise user account, different independent channels have to be compromised first before gaining full access to the user account [13]. Also, MCA makes it impossible for non-targeted attacks to successfully compromise user's accounts; especially if the attacker is not geographically close enough to the user to gain access to designated devices used by some channels.

III. THE PROPOSED MULTI-CHANNEL USER AUTHENTICATION PROTOCOL

The major aim of the proposed protocol is to eliminate the drawbacks of password guessing attack. The proposed protocol uses OTP encrypted by RC4-EA method, then hiding cipher-OTP in QR code. Also, it integrates a web-based applications and mobile devices for user authentication over multi-channels. The proposed protocol involves two parties : a server (S) and a remote user (U). Each authorized U can request service from S with the granted access rights. In addition, each U got an electronic mail and hold a mobile device. The protocol consists of four phases : initialization phase, registration phase, login phase and authentication phase. The notations employed throughout this paper are shown in table I.

Table I
NOTATIONS

Notation	Description
U	Remote User
U_{ID}	User Identity
U_{PW}	User Password
U_{IP}	User IP Address
U_{WIP}	A White list of Allowed IP Addresses
U_{Proxy}	User Using Proxy
U_M	User Mobile
U_e	User Electronic Mail
S	The Server
$h(.)$	One-Way Hash Function
a	Secret Key Used in RC4-EA Method
$(E/D)_{RC4-EA}$	Encryption / Decryption Using RC4-EA Method
$(E/D)_{QR(.)}$	Function that Encodes/Decodes Data into (QR) Code
$ $	Concatenation
T	Time Stamp
r_1, r_2	Random Nonce Generated by the Server
T_c, T_{end}	Time Created, Ended of Random Nonce

A. Initialization Phase

In this phase, Internet Protocol Authentication (IPAuth) is a protocol suite for securing internet communications by authenticating each IP packet of a communication session. IPAuth takes place between two parties of a server and a user. The various steps of IPAuth will be explain below:

- 1) Assume that U request from S to join the system.
- 2) The S will check U_{Proxy} :
If U access the system using proxy.
then S block the U connection.
- 3) The S get U_{IP} .
- 4) The S check the white list of IP addresses.
if $(U_{IP} == U_{WIP})$.
then U authentic and open connection
else
Reject connection and block U

B. Registration Phase

In this phase, U registers with the S in order to use a service. U and S execute the following steps:

- 1) U chooses an identity U_{ID} , electronic mail U_e , mobile number U_M , and password U_{PW} . Then computes $X_U = h(U_{ID} || U_{PW})$. Then sends $\{U_{ID}, U_e, X_U, T_1\}$ to S via a secure channel.

$$U \rightarrow S : \{U_{ID}, U_e, U_M, X_U, T_1\} \quad (1)$$

- 2) S examine the time stamp T_1 . If it is invalid, then rejects it. Otherwise, checks whether U_{ID}, U_e, U_M is available for use. If it is, S computes $Y_U = h(X_U || U_{IP})$. Finally, S stores the values U_{ID}, U_e, U_M and Y_U in its database.

$$S \rightarrow DB : \{U_{ID}, U_e, U_M, Y_U\} \quad (2)$$

C. Login Phase

The Login phase is shown in the following steps:

- 1) U enter his U_{ID} and U_{PW} , and compute $X'_U = h(U_{ID} || U_{PW})$, then send U_{ID}, X'_U, T_2 to S .

$$U \rightarrow S : \{U_{ID}, X'_U, T_2\} \quad (3)$$

- 2) S examine the time stamp T_2 . If it is invalid, then rejects it. Otherwise, S computes $Y'_U = h(X'_U || U_{IP})$, then checks whether U_{ID} is valid and $Y'_U == Y_U$. If it is, allowed user login. Otherwise, S ask U a maximum 3 attempts to provide his correct U_{ID} and U_{PW} . If U exceed this threshold, then S consider U as an attack and block his account.

D. Authentication Phase

After U has a successful login. Now S wants to authenticate U upon multi-channels by generating One-Time QR (OTQR) and One-Time Password OTP. This phase is divided into two processes:

Authentication by Email channel process:

- 1) S generate a random nonce r_1 , then computes $K_U = E_{RC4-EA}(r_1)$, then computes $M_U = (E)_{QR}(K_U)$. Finally, S stores M_U, T_c, T_{end} , where M_U is OTQR.

$$S \rightarrow DB : \{M_U, T_c, T_{end}\} \quad (4)$$

- 2) S sends M_U, T_3 to U via mail channel.
- 3) U examine the time stamp T_3 . If it is valid, U send M'_U, T'_3 to S .
- 4) S checks whether $T_c \leq T'_3 \leq T_{end}$ and $M'_U == M_U$. If it is, then user is authentic. Otherwise, not authentic user.

Authentication by Mobil channel process:

- 1) S generate a random nonce r_2 , then computes $F_U = h(r_2)$. Finally, S stores F_U, T_c, T_{end} , where F_U is OTP.

$$S \rightarrow DB : \{F_U, T_c, T_{end}\} \quad (5)$$

- 2) S sends r_2, T_4 to U via mobile channel, then discards r_2 .
- 3) U examine the time stamp T_4 . If it is valid, U enter r_2 , then compute $F'_U = h(r_2)$ and send F'_U, T'_4 to S .
- 4) S checks whether $T_c \leq T'_4 \leq T_{end}$ and $F'_U == F_U$ is valid. If it is, then user authentic. Otherwise, not authentic user.

Now If OTQR and OTP holds, then server S is convinced that User U is validated. Otherwise, the request is rejected.

IV. IMPLEMENTATION AND SECURITY ANALYSES

Instead of using the traditional smart card for remote user authentication. The proposed user authentication protocol is adopting the RC4-EA encryption method to encrypt the plain-OTP, then it is hiding the cipher-OTP in QR code. The users electronic mail and mobile device takes the responsibility for receiving the OTQR and the OTP as a multi-channels to achieve mutual authentication between the U and S .

The performance of the proposed authentication protocol is tested using server 32 core AMD opteron processor 6376 with 32 GB of RAM and 4 RAID 1s, laptop (Intel i5, 1.80 GHz processor, 2 GB RAM) and simple mobile phone. The experiments have been implemented using PHP-MySQL language environment.

A. Implementation

The proposed user authentication protocol is very robust, secure, reliable and very hard for illegitimate users to crack. By implementing the OTQR/OTP techniques, it can help in mitigating a typical phishing attempt. Whenever user wishes to login the website, first step is that the U coming from white list of Allowed IP Addresses U_{WIP} . Second step is to enter U_{ID} and U_{PW} for remote User authentication. Once U is login and gets the OTQR/OTP by Email/SMS on his registered an electronic mail and a mobile number respectively. The server will store the OTQR/OTP and the date created (DC). The OTQR/OTP with status value 1 is valid which signifies that it can still be used by U . The moment U uses the generated OTQR/OTP. The OTQR/OTP expires and its status value changes from 1 to 0 then the register OTQR/OTP date used (DU). But, whenever U not uses the OTQR/OTP after a period of 5 minutes it will expire and its status value changes from 1 to 2 as shown in tables II, III, IV.

Table II
USER LOGIN TABLE FOR ONE TIME PASSWORD

U.N	Password	Email	Mobil No.
aqwers	895*/66!	aqwers@egywow.com	96895635810
twerffr	P**2334	twerffr@egywow.com	96890125612
yuhfrd	Ad2*!98	yuhfrd@egywow.com	96695254523

Table III
LOGIN TABLE TO THE MAIN WEBSITE WITH OTQR VIA EMAIL




U.N	OTQR	DC	Status	DU
aqwers		2015-05-24 18:50:15	1 (Valid)	Ready to Use
aqwers		2015-05-24 17:47:43	0 (Expired)	2015-05-24 17:49:15
aqwers		2015-05-23 18:31:38	2 (Expired)	Not Used

Table IV
LOGIN TABLE TO THE MAIN WEBSITE WITH OTP VIA SMS

U.N	OTP	DC	Status	DU
aqwers	F21P40Ui	2015-05-24 18:50:15	1 (Valid)	Ready to Use
aqwers	nH8XxG62	2015-05-24 17:47:43	0 (Expired)	2015-05-24 17:51:15
aqwers	B0Ej0PF6	2015-05-23 18:31:38	2 (Expired)	Not Used

B. Security Analyses

The security of the proposed protocol is analyzed under the possibilities of the types of attacks listed below:

- 1) **Prevent Replay Attack** : In this type of attack, the intruder gathers the communication messages exchanged between the U and S ; then tries to replay the same messages acting as a legitimate user. In the proposed authentication protocol, the random nonce values r_1, r_2 , and a with time stamp T are generated for each session, and the parameters in all the messages are all related to them. Those values are verified by S as in equations 4,5 . The S checks at what time interval T the request is received. If the time stamp are not within the time interval, the server S will reject the intruder's attempt to access the service. Therefore, the proposed protocol is secure against replay attack.
- 2) **Prevent Man-in-the-middle Attack** : In this type of attack, the malicious user listens to the communication channel between S and U . In proposed authentication protocol, the intruder may intercept the web/mobile communication messages, but he will never be able to

compute the OTQR and the OTP. Since, it is based on random nonce values, which is chosen fresh for each new session. Hence, the protocol is secure against man-in-the-middle attack.

- 3) **Prevent Denial of service attack (DoS) :** At DoS attack, the attacker may flood a large number of illegal access request to S . The DoS attacks aim is to consume S critical resources. By exhausting these resources, the attacker can prevent S from serving legitimate U . In the proposed authentication protocol, for every access request from any user U to S ; S checks the U_{Proxy} and U_{IP} as explain in III-A. Thus, the proposed protocol does not suffer from DoS attacks.
- 4) **Prevent Website Manipulation:** One of Website Manipulation attack is SQL Injection. SQL Injection attack is a hacking technique which attempts to pass SQL commands through a web application; to be executed by the back-end database. SQL Injection is useless in the proposed authentication protocol, since the proposed protocol uses the "`mysql_real_escape_string()`" command. Thus, the proposed protocol is secure against SQL Injection attacks.
- 5) **Prevent Phishing Attack Via the Web :** Phishing is a form of online identity theft that aims to steal sensitive information. In the proposed authentication protocol, if the intruder knows U_{ID} and can get the U_{PW} from the server by replacing the actual web page with a similar one, it would be difficult to get the OTQR and OTP because it send over multi-channel. Which has to be chosen within a specified time stamp as in equations 4,5.
- 6) **Prevent KeyLoggers Attack :** KeyLoggers are applications or devices that monitor the physical keystrokes of user computer. Then they are gathering the information for later retrieval or send it to a spyware server. KeyLoggers is useless in the proposed authentication protocol, since the proposed protocol uses the (Virtual Keyboard) which prevent the keylogger attacker to record the U sensitive data. Thus, the proposed protocol is secure against the keylogger attack.

V. CONCLUSIONS

The major contribution of this paper, is proposing a multi-channel user authentication protocol. The proposed protocol enhances the security of a remote user login. The proposed protocol adopted the one-time password (OTP) which is

encrypted using the RC4-EA encryption method, then hiding the cipher-OTP using the QR code technique. Therefore, the data can not be easily retrievable without adequate authorization. Also, the purpose of the paper is to integrate a web based application with mobile-based applications to make it more secure than the general authentication methods. The integration of web and mobile-based applications is a multi-channel authentication scheme that is better than a single-channel authentication. Thus, the proposed authentication protocol is more convenient, because the burden of carrying a separate hardware token is removed. Moreover, this protocol helps to overcome many challenging attacks such as replay attack, DoS attack, man-in-the-middle attack and other malware attacks.

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A framework for future application of RFID technology for school and vocational trainings on Internet of Things

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Abstract— Radio Frequency Identification (RFID) is programmed ID innovation without contact, support motions via radio recurrence programmed ID which give pertinent destination information, without requirement direct mediation of distinguish school children for learning an assortment to study surroundings. Since schools and vocational institute are providing training framework stream through unmatched data, cannot fulfill more reasonable for upcoming study interest. Internet of Things (IoT) overwhelmed customary flaw for structure code, which support to university, school or worldwide group of vocational training greatest concern and examination.

Keywords: RFID Innovation, Internet of Things, Future Application

I. INTRODUCTION

Internet of Things (IoT) [1, 2] are characterized as combination of RFID [3, 4], infrared sensors, laser scanners, worldwide situating frameworks, and supporting data detecting gadget, as per the concurred convention, to any article joined with the Internet up to data trade and correspondence, keeping in mind the end goal to accomplish shrewd distinguish, find, track, screen and deal with a system. IoT ideas are set advancing in 1999 [5, 6]. IoT is the "material articles joined with the Internet". It has two implications: initially, the center of systems administration and framework keeps on being the Internet, within the Internet premise of the expansion, development of the system; another client-end stretched out till extended to some articles, data trade and correspondence.

RFID's are an innovation for critical educational training esteem and tremendous prospective. RFID guarantees for supplant ancient scanner tag besides adds ongoing deceivability of analyzing, paying little heed to the area of the school network. We discover RFID applications in different fields, yet its

fundamental utilization is in following student RFID (resources). This can be used for university, school and vocational training for examining stream with IoT.

- To promote the objectives of the whole education community IoT.
- To highlight opportunities for research and innovation for educational or vocational training.
- To identify the current state of technology and identify future requirements for school.
- To introduce the future application for school community to new era of RFID using IoT.

II. LITERATURE RIVIEW

In its easiest structure, RFID [7, 8] is an idea like standardized identification innovation, yet without obliging an immediate perceivability of the checked substances as presented in Figure 1. Much the same as standardized tag frameworks oblige a legitimate optical peruser and unique labels connected on RFID's, RFID needs a peruser hardware and exceptional labels or cards appended to the student's RFID's all together for the readers to be followed

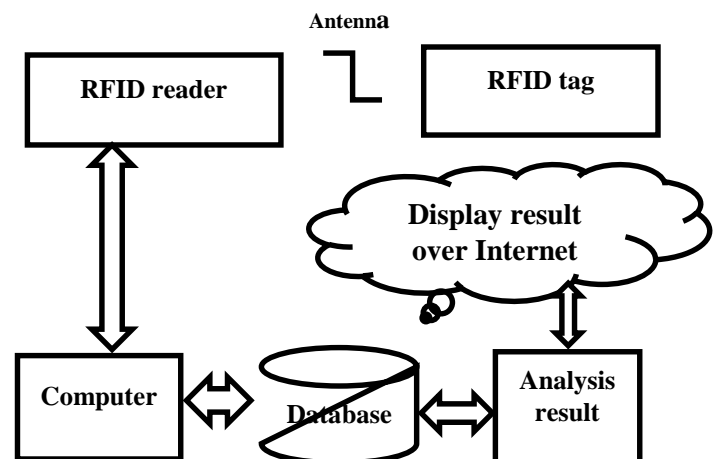


Figure: 1 Conceptual diagram of RFID Reader

RFID's have an extensive history for a piece to mechanical transformation together present besides historical [9, 10]. RFID empowers brisk installment for rings in addition speedy ID of things. Furthermore, RFID gives advantages, for example, following resources, checking conditions for wellbeing, and serving to anticipate duplicating. RFID has indispensable influence in the innovative insurgency alongside the Internet in addition cell phones that have been associating the world collected wholly RFID frameworks, which comprise three fundamental segments. The primary of RFID's labels, which are appended to a benefit otherwise thing. The label (tag) encompasses data approximately, which advantage otherwise thing furthermore possibly will consolidate sensors and devices [11].

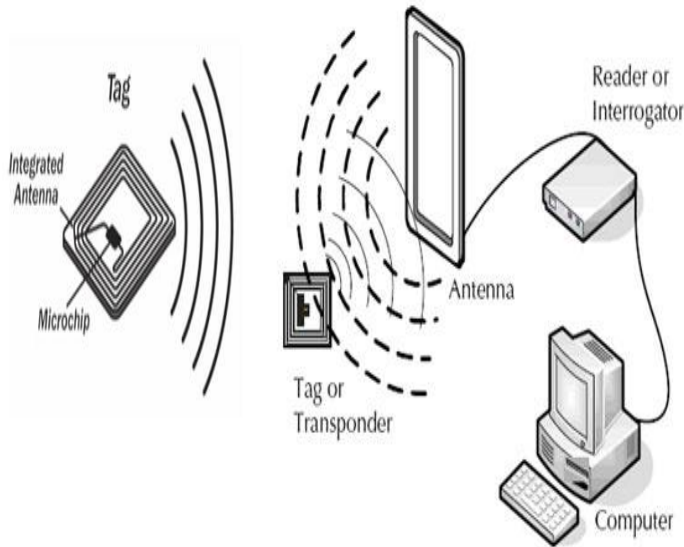


Figure 2: RFID Tag, RFID Reader or Interrogator and Computer connected with Internet.

The next part of RFID's cross examiner that corresponds through (likewise entitled questioning) RFID's labels [12]. The last part is the software backend framework that provide interfaces RFID's investigators with an incorporated database of schools [13]. This unified database encompasses extra data, for example, cost, on behalf of RFID labeled thing.

RFID's advances might be grouped keen on three classes: inactive RFID's, dynamic RFID's, and last semi aloof RFID's [14, 15]. Taking into account the radio recurrence utilized, the uninvolved RFID advances are generally classified keen on low recurrence (LF – Low frequency) RFID, high recurrence (HF – High Frequency) RFID, microwave RFID and ultra-high recurrence (UHF- Ultra High Frequency) RFID [16, 17].

RFID innovation has been boundless and these days, this could be originate popular numerous uses. Approximately of RFID's used to be present RFID scanner, RFID printer, RFID radio wire and RFID peruser. Radio recurrence recognizable proof or also called RFID depict a framework, which communicates the character on an article that individual remotely utilizing waves of radio as a part of the type for special number of serials [18].

A RFID framework could encompass a few segments: labels transponders, label perusers, reception apparatus, and interface [19]. In an ordinary RFID framework, individual

articles are outfitted with a little, reasonable tag for device. This encompasses a transponder through an advanced chip for memory, which agreed an interesting electronic item code for tag. This questioner, a reception apparatus bundled through a handset in addition decoder, which transmits sign enacting RFID's label for reading and compose information on this. At the point while a RFID's label goes over this electro-magnetic region, which identifies peruser's actuation indication [20]. The peruser interprets coming encoded information with label's coordinated circuit of device and encoded information forwarded to end computer. This process of application's programming arranged at end computer forms the information, which execute different separating procedures to lessen various frequently excess peruses similar tag and label for littler in addition more helpful information sets of information [21].

III. THE APPLICATION OF RFID IN IOT

Despite the fact that RFID technologies have been about almost three decades, this is just as of late that this innovation has been increasing critical energy because of the merging of cost cutting, which expanded capacities on labels of RFID [22]. At present, RFID is rising as a vital innovation for changing an extensive variety of utilizations, including store network administration, retail, air ship upkeep, hostile to forging, stuff taking care of, and health awareness [23]. It additionally proclaims the rise of economical and profoundly viable pervasive PCs that will have emotional effects on people, associations, and social orders. Numerous associations are arranging or have effectively misused RFID in their fundamental operations to exploit the capability of more mechanization, productive learning procedures, and exam perceivability [24]. Case in point, late news demonstrates that top retails corporations have lessened by 30 percent stock out and large in the wake of dispatching its RFID program. Numerous forecasts concur, which RFID's provide new era of ventures with billions worth.

Future application of IoT undertakings could oversee each item continuously, and deal with their school building design. They not just manage the course in store network and offer data, additionally break down the data produced from each method and figure. By determining the data from the present system of students RFIDs, the future pattern and likelihood, which mischance occurs is evaluated, cure methods could be received and move ahead to notice. It could enhance ventures' capacity for reacting at school business [25].

IoT could influence entire school network. Firstly this could streamline content network administration; besides this could mark sources which are utilized viably; thirdly this could create entire content network obvious, which enhance coming data on store network straight forwardness; fourthly this store network could be overseen continuously; this conclusion can make the content network high spryness and complete joining for study environment [26].



Figure 3: Internet of Things schematic demonstrating the end clients and application zones taking into account information.

IoT influences the inventory network administration in assembling connection, warehousing connection, transportation connection and offering connection [27]. This creates schools almost entire learning transformation reaction for differed academic business rapidly, which provide versatility for school network to academic business check variations is moved forward.

IV. METHODOLOGY

However RFID are already looking forward viewed as an innovation, this selection over many mixture of commercial enterprises has seen it turn into a great deal more typical. As RFID is as a rule more predominant over an assortment of commercial enterprises, school associations looking to pick up an upper hand are now using the innovation in a mixture of creative ways the school has not seen some time recently [28]. The inquiry that numerous schools are presently asking is: which places are RFID tags moving? This may be answered as it appears that innovation splendid future through extra esteem included components showing up at comparable expenses.

Presently, RFID's are changing utilities operations for utilizing shrewd patterns to gather in addition communicate the measure force devoured into family unit. Brilliant [28] meters are an illustration of an innovation that is in a general sense varying market procedures by recording utilization for electric utilities on normal interims besides conveying this utility used for checking then charging from back.

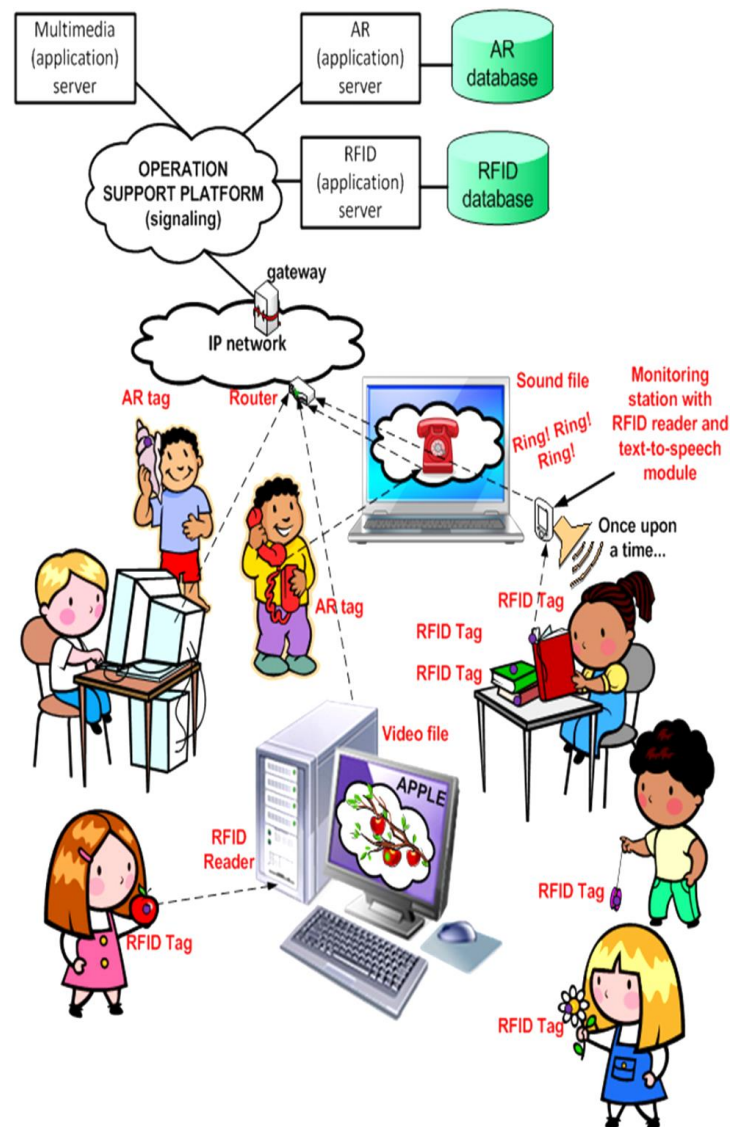


Figure 4: Future application scenario for school using RFID on IoT

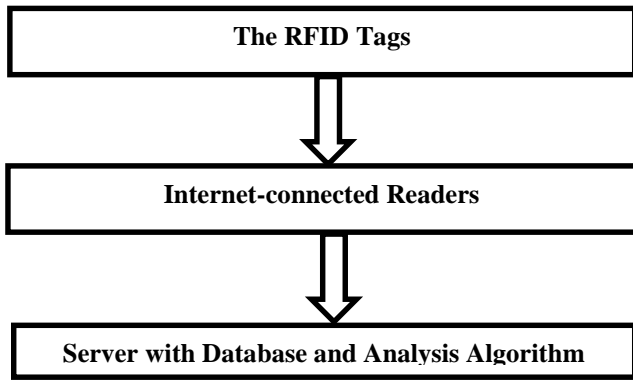


Figure 5: Framework of RFID application on IoT

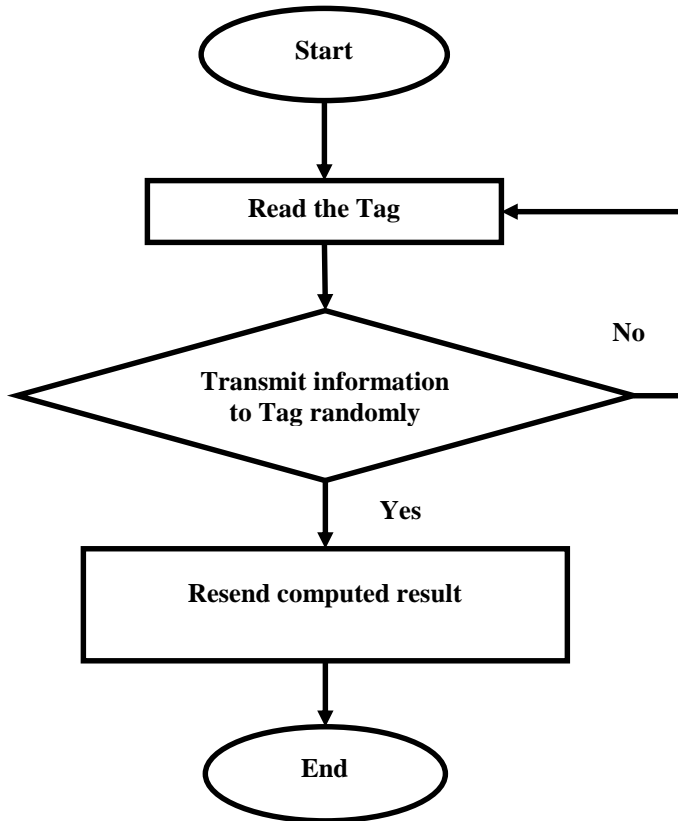


Figure 6: Functionality of RFID application on IoT

At the point when the students get the item with RFID hostile to forging name, they utilize the mark code for right of entry to school network against falsifying data administrations address through RFID-empowered cellular telephones or Internet-joined PCs furnished through read-compose labels of RFID, and afterward request administrations to achieve item correlated data for recognize this legitimacy on item. Compelling on RFID-empowered cell telephone to instance of demonstrate particular hostile to duplicating steps when the buyer needs to distinguish the realness of the item.

Primarily, the student acquires the school community against falsifying server address as of the study item portrayal or different recognizable pieces of proof straightforwardly. At the point when accepting the RFID-labeled items, the student uses the RFID-empowered telephone to stay on school Web site and keep a copy system records that school through main server taking after reminders. Subsequent to joining and running using the school server, the telephone drives keen on the intelligent procedure.

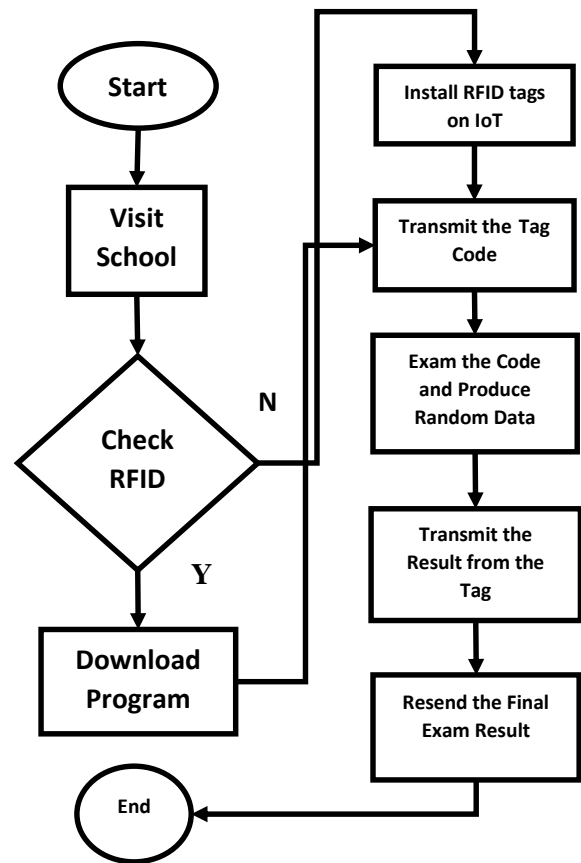


Figure: Process flow of RFID application

Also, the purchaser utilizes the telephone to peruse the item tag or label to accomplish RFID code for items and permission this to opposition to duplicating on school server. When encrypted code equals using the standard of RFID coding on school RFID's, the main server inquiries own security cryptographic calculation for creating its irregular information besides goes on student telephone, in meantime school server figures arbitrary information as per security cryptographic calculation besides monitors registering outcomes.

Thirdly, student telephone shows their arbitrary information on the label or tag while this get connected with the school server, afterwards label's interior computation, this outcome would be shown by the cell telephone lastly remain referred through the cellular telephone to check onto school server.

At long last, the school server might be checked student information, which got commencing own particular preservation beforehand, in addition to retransmit the data "the study content is honest to goodness" onto cellular telephone on the off chance's that they are steady.

V. CONCLUSION

RFID is an imminent programmed ID technique, being considered by numerous as a standout amongst the most pervasive registering advancements ever. RFID is in light of remotely recovering and putting away evidence operating appliances termed RFID transporters or RFID labels. A programmed distinguishing proof innovation, for example, an Auto-ID framework in light of RFID innovation is a vital

resource for learning frameworks for two reasons. As a matter of first importance, the perceivability gave by this innovation permits an exact learning of study level by wiping out the inconsistency between exam record and physical health. Also, RFID innovation can anticipate or diminish wellsprings of lapses. Advantages of utilizing RFID innovation incorporate the diminishment of work expenses, the improvement of school procedures and the lessening of learning mistakes.

As of late, through wide expansion in the next era of IoT, incorporating RFID innovation besides the IoT. It's utilizing application for observing with hostile to duplicating onto student RFID's running network request to more utilization of the upside onto RFID innovation. These endeavors might accomplish genuine perception administration in RFID's. Hence, our nation undertakings ought to effectively advance the advancement procedure onto RFID innovation with IoT to request as sponsors for the administration of schools and vocational trainings.

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Towards Understanding User Perceptions of Biometrics Authentication Technologies

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Abstract. Human misbehaviors cause security systems breaches. One of the reasons behind this fact is neglecting human acceptance. For that reason, new technologies are usually faced with rejection or acceptance issues. Technology Acceptance Model (TAM) is one of the well-known models used to predict the acceptance of new technologies. Biometrics as an authentication direction is still under development. Relying on Biometrics for authentication has some important characteristics; mainly, being faster and easier due to the fact that users will not be involved with unfamiliar interfaces, such as typing password, signing or even deliberate exposing to some part of the body. This study investigates the users' intention to use biometrics as an authentication tool among young Arab people. A survey involving 74 individuals was conducted. The results reveal that perceived ease of use and perceived usefulness are significant drivers of the behavior of intention to use biometrics as an authentication tool. In addition, results show that perceived usefulness is the most crucial factor in making a decision whether or not to adopt new technologies.

Keywords: Intention to Use, Biometrics Technology, Authentication.

1 Introduction

In this digital world, we become computer slaves (Lao, 2005). While this makes life much easier, compromised security raises as an issues at high concern (Sukhai. 1998). Information overloading continues to increase due to the expansion of applications that require authentication. For individuals, it is often difficult to remember the user names and PINs they rely on for authentication

purposes to their confidential data. Thus, many users select relatively easy passwords to remember (Coventry, 2003); this act is looked at as a security trade-off. Therefore, information security is in a serious need for more advanced techniques that ultimately aim at improving its performance. Biometrics, as an option, brings good solutions for most authentication problems (Bala, 2008) and (Rashed, 2010a). There are three types of authentication according to (Boatwright, 2007), (Coventry, 2003) and (Jones, 2007):

1. Information related to something an individual knows; for example a PIN or a password.
2. Information related to something an individual has (i.e., posses); for example a passport, a smart card, a key or a cell-phone (Herzberg, 2003).
3. Information related to something that uniquely identifies an individual (i.e., Biometrics); for example, fingerprints, signature, ear shape, odour, key-stroke, voice, finger geometry, iris, retina, DNA, and hand geometry (Gleni, 2004) and (Prashanth, 2009).

Using a PIN, also referred to as a password, is the most widespread technique (Skaff, 2007). In spite of its ease of use, relying on PINs has a critical observed vulnerability. This vulnerability comes as a result of the difficulties associated with the individual's capability to memorize several passwords/PINs. In addition, user practices are very difficult to be policed (Rose, 1998). Therefore, relying on biometrics rises to be the best solution or practice for authentication. On the one hand, users can uniquely authenticate themselves without being asked for PINs. On the other hand, users are not required to remember any piece of information in the authentication process (Coventry, 2003). This in turn makes users more comfortable (Sukhai, 1998).

Biometrics as an authentication tool may appropriately fit as an authentication tool in all sensitive organizations (Rashed, 2010b). However, user acceptance is a concern when it comes to adopting biometrics for authentication. Customer acceptance is highly critical as new technologies are prone to rejection in an unexpected way. For example, the first mechanical cash issuer was removed after six from its initial installation because it fell short in front of customer acceptance (Rashed, 2010c). As acceptance of technology is a milestone (Szajna, 1996), this study investigates and examines the intention to use biometrics as an authentication tool among young Arab people.

The rest of the paper is organized as follows. In section 2 we overview the previous studies as literature review and address the problem statement. In section 3 we demonstrate our methodology and discussion. We conclude and present future work in section 4.

2 Literature

Many researchers have validated TAM using different tools with regard to a variety of cultures. Chen et al. (2009) studied the determinants of consumer acceptance of virtual stores. Their results indicated that their proposed theoretical model was sufficiently able to explain and predict consumer acceptance of virtual stores substantially. They presented a theoretical model that could explain a large portion of the factors that lead to a user's behavioral intention to use and actual use of a virtual store. Their model also could supply virtual stores with a number of operative critical success factors to remain competitive in the volatile electronic marketplace.

Kripanont overviewed the literature concerning prominent theories and models of authentication and Information Technology (IT) acceptance. His thesis focused on internet usage behavior and behavior intention. IAM was supposed to explain and predict user behavior and might help practitioners to analyze the reasons for resistance to technology and also help them to take efficient measures to improve user acceptance and usage of the technology.

Twati studied the cultural norms and beliefs within multi-national organizations in two regions. The first region covered Arab countries in North Africa (i.e., Libya). The second region covered Arab countries in the Persian Gulf (i.e., Kuwait, Oman, Saudi Arabia, and United Arab Emirates). The results revealed that the two regions were not homogeneous. In addition, the study conveyed that age, gender, and education levels are factors contributing to the success of Management Information Systems (MIS) adoption in both regions. Furthermore, the study showed differences in organizational cultures that have impacts upon MIS adoption in both regions. The Persian Gulf region was dominated by an adhocracy culture that values the adoption of MIS, whereas the North Africa region was dominated by the hierarchy culture type that favors a centralized management style, which negatively impacts MIS adoption. The Persian Gulf region did not show any significant effect of technology acceptance variables. However, in the North Africa region, technology acceptance played a vital role in MIS adoption.

Rose and Straub studied technology acceptance in five Arab cultures: three Asian countries including Jordan, Saudi Arabia, and Lebanon; and two African countries including Egypt and Sudan. They examined the ease of use and perceptions of usefulness. Furthermore, they studied the role of the two factors in influencing actual usage and perceptions of usefulness to mediate the effect of perceptions of ease of use on actual usage. Their findings were consistent with the majority of TAM findings in the US.

Ramayah et. al. examined the intention to use an online bill payment among part time MBA students in University Sciences Malaysia, Penang. They

developed and later modified the extended Technology Acceptance Model and Social Cognitive Theory to identify the factors that would determine and influence the intention to use an online bill payment system. They found that perceived ease of use and perceived usefulness are the significant drivers of intention to use the online bill payment system. They also found that subjective norm, image and perceived ease of use were the key determinants of perceived usefulness whereas perceived risk was found to be negatively related to usefulness. Moreover, they found that computer self-efficacy played a significant role in influencing the perceived ease of use of the online bill payment system.

Coventy et. al. (2003) addressed consumer-driven usability and user acceptance of biometrics. They focused on finding out how iris can be used with Automatic Teller Machines (ATM) user interfaces. Their findings showed that 90% of their study participants were satisfied with iris verification method and they would select it over signatures or PINs.

Rashed et. al. (2010c and 2010d) wondered about the feasibility and future of odour authentication. They presented odour as a user authentication interface. They discussed its usage, advantages, disadvantages and user acceptance as well. They applied and tested TAM on the Arab culture and their findings were consistent with previous studies (Ramayah, 2005). They concluded that it may be used in odour ATM (OTM) and they studied that in two different cultures.

Rashed et al. (2010a) studied the importance of applying biometrics in the financial sector to overcome user problems (e.g., recalling PINs and carrying cards) and to insure information security. Their idea depends on using biometrics as an interface in ATMs. They presented their idea with challenges. They suggested replacing ATM machine by OTM machines. They concluded its capacity to user acceptance and called for more researches in this field.

Using biometrics as an authentication tool may not be expected by users. The biometric technologies create the challenge of avoiding attacks before they take place (Rashed ,2010b). We think that the problem resides in how we could present the biometrics in a form that overcomes the worries about users expectations.

3 Methodology and Discussion

Seventy four printed questionnaires were collected from the study participants. Our sample consisted of eighty four respondents. The main findings can be summarized as follow:

Table 1. Sample Profile

Variable		Frequency	Percentage
Age	21-30	50	0.68
	31-40	18	0.24
	41-50	4	0.05
	51-60	2	0.03
Specialization	IT	22	0.30
	Social Sc.	8	0.11
	Engineering	16	0.22
	Others	28	0.38
Education level	Student	1	0.01
	Secondary School	8	0.11
	BSc	49	0.66
	College	10	0.14
	MSc	5	0.07
	Ph.D.	1	0.01

- Table 1 shows that the majority of the questionnaire respondents were within the age interval [21-30] which represents young people with 68%. From the same table we can see that 30% of the respondents were IT specialists. Moreover, the table shows that most of the respondents were B.Sc. holders.
- 19% of the questionnaire respondents did not like the idea of using biometrics in authentication, whereas 47% of them liked the idea, 23% did not decide and 0.01%.
- 69% found biometrics as an authentication system would improve their efficiency and effectiveness in life. Performance and 77% found it would enhance their productivity in life.
- The majority, representing 58% of the questionnaire respondents found it easy to use biometrics as authentication system.
- The majority, representing 54%, of the questionnaire respondents indicated that they would frequently use this type of authentication technique if it were available. Most of the respondents who intended to use this technique were young people. Table 2 shows that there is a strong relationship be-

tween age and intention to use. Young people have a strong attitude to accept new biometric interface.

- 38% of the respondents showed willingness to use biometrics as authentication system, whereas 14% confirmed that they would not use if it was available. Most of the respondents, representing 49%, did not decide (i.e. they were not certain).

Table 2. Statistical Analysis of the Study

	DF	SS	MS	F	Signifi- cance F			
Regres- sion	1	800.33333 33	800.33	21.438	0.04361792 9			
Residual	2	74.666666 67	37.333					
Total	3	875						
	Coeffi- cients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Inter- cept	55.466666 67	4.9387357 81	11.231	0.0078	34.2170016 8	76.71633 165	34.2	76.716 33
X Varia- ble 1	- 6.533333333	1.4110673 66	-4.6301	0.0436	-12.6046662	- 0.46200048	-12.6	-0.462

Figure 1 that illustrates our proposed model shows that both perceived usefulness and perceived ease of use are significant drivers for the intention to use new technologies. Thus, both perceived effectiveness and performance, pillars of perceived usefulness, play an important role to intend to use new technologies.

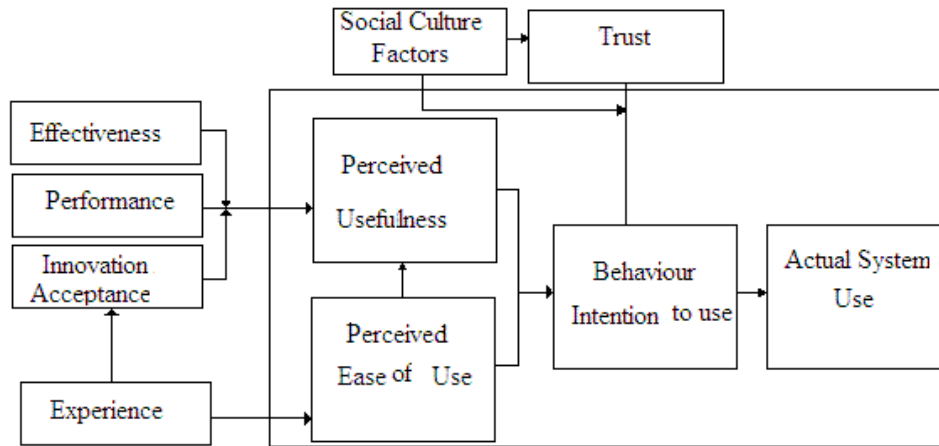


Fig. 1. Applying TAM on Biometrics

4 Conclusions

We distributed a bilingual questionnaire to study the potential of accepting biometrics as an authentication tool. Respondents to this study found it a good idea and indicated an intention to use it in the future if it happened to be available. Obviously, our findings confirm the previous results. Results reveal that perceived ease of use and perceived of usefulness are significant drivers of the behavior of intention to use biometrics as an authentication tool. In addition, this study results revealed perceived usefulness to be the most crucial factor in the decision to adopt new technologies. According to this study, security remained as a significant factor to affect the behavior of users. Moreover, we found a tight relationship between acceptance and age; young people showed more appetite to accept new biometrics interface.

Presenting the underlying concept in an acceptable form would accelerate the acceptance and adoption of this tool. This would raise the user's concerns about this approach security levels. Many users thought that hacking this approach would be easy and thus it needs to be strengthened by another supplemental approach for enhancing the overall performance. In addition, biometric data can be stored in a smart card that owns a microprocessor and micro biometrics sensor. Micro-sensor can obtain the data from the user and directly communicate with machines to authenticate the card holder. The card should have a storage space for storing biometrics data (i.e., encrypted digitized format stored in the card).

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Novel Usage of Gujarati Tithi in Weather Analysis of Surat, India

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Abstract— Vikram samwat Gujarati Calendar is the well known and ancient calendar used by Gujarati's in India which is following the time period of the successive return of the moon in conjunction or opposition to the sun in relation to the earth. The data mining technique retrieves the knowledge from the data without any pre hypothesis. This research is to apply computer intelligence to analyze the association of one of the weather parameter temperature according to this calendar using temporal association rule mining. The experiment result proves that there exist the special associations between weather parameters and this calendar which can provide new insight to the researchers of this area and does not require any extra expertise in weather.

Keywords- *Temporal association rule mining; weather prediction; Gujarati tithi*

I. INTRODUCTION

The Gujarati Hindu calendar is the ancient calendar prepared mainly by considering the sun, moon and earth position. This relative position is the main source of day and night and season on the earth [1]. To predict the temperature, the weather forecasters use the history of the weather parameters, current status of various parameters received by satellite or instruments and different complex models simulation. Not only these, but whatsoever the result is generated they have to apply their expertise to provide the final prediction [2], [3], [4].

Data Mining does not require any prior knowledge and provides techniques to discover interesting patterns from large amounts of data from databases, data warehouses, or other information repositories. It is an interdisciplinary field, mining knowledge from all the different areas like statistics, machine learning, data visualization, information retrieval, high-performance computing, neural networks, pattern recognition, spatial data analysis, image databases, signal processing, and from many application fields, such as business, economics and bioinformatics [5], [6], [7]. These days it is utilized in weather forecasting also using temporal data. Temporal association rule mining is the one of the area of data mining which discovers the associations from the time stamped data. Association rule mining is nowadays used in the area of prediction [8].

Here, as mentioned earlier due to the importance of Gujarati Hindu calendar this research is to contribute the analysis of temporal association rule mining using "tithis" to derive novel associations of weather parameters with the "tithis". The next section 2 is describing the Gujarati Hindu calendar, the section 3 is reviewing the association rule mining utilized in the environment forecasting. The next section 4 proposes the framework to discover the association between the temperature and "tithis". The next section 5 discusses the achieved result followed by the conclusion and future scope.

II. GUJARATI CALENDAR TITHI

In India, the Gujarati Hindu (Vikram Samwat) calendar is the most ancient calendar and part of Gujarati's life to identify promising days and holy schedules. Other than this, to deal with the global world English calendar known as Gregorian calendar is followed [1]. The Gujarati Hindu calendar is following the time period of the successive return of the moon in conjunction or opposition to the sun in relation to the earth. This is the time period from new moon to new moon, or full moon to full moon, measured as the lunar month. So, in this calendar, months are as per the moon and days as per both the sun and the moon. Lunar days or "tithis" can have various lengths of hours. But sometimes a "tithi" is absent or sometime two continuous days share the same "tithi". This is because in Gujarati Calendar the days are calculated using the difference of the longitudinal angle between the position of the sun and moon.

This Gujarati Hindu calendar is according to the lunar year consists of 12 months. Two fortnights are coming in a lunar month that begins with the new moon called "amavasya". Each lunar month has 30 tithis of 20 - 27 hours. During the wax/bright phases of moon, tithi is identified as "Shukla", beginning with the full moon night called "purnima" also known as auspicious fortnight. During the diminishing phases of the moon tithi is identified as "Krishna" or "Vad" or the dark phase, which is also known as the inauspicious fortnight [1]. Here, in India, in general there are three seasons like winter, summer and monsoon. According to this calendar seasons are as per the sun position.

This relative position of sun, moon and earth relation motivates us to analyze their relation on the environment weather. Very next section is illustrating the usage of data

mining technique mainly association rule mining for the weather environment.

III. ASSOCIATION RULE MINING AND ITS ENVIRONMENT APPLICATION

Association rules are an important and a fundamental data mining task. The objective is to find all co-occurrence relationships, called associations, among data. It has attracted a great deal of attention and extensively studied by the database and data mining community [5]. Many efficient algorithms, extensions and applications have been reported.

Most of the data analysis methods are based on classification or clustering algorithms to categorize the data to the specific group or to establish groups of correlated data respectively. These algorithms are quite winning but, they have some limitations like a data record has to be grouped in one and only one group and no relationship or association can be inferred between the different members of a group.

The association rule mining overcomes such problems. This is an unsupervised data mining technique that discovers descriptive rules from very large datasets. This technique has many merits like any data item can be assigned to any number of rules as long as its expression fulfills the assignment criteria, without limitation. And rules are orientated (If ... then ...) and thus to a certain extent describe the direction of a relationship. Last but not the least, by focusing on strong rules, the decision maker does not have to browse and study a huge number of redundant rules.

The strength of a rule is measured by thresholds support and confidence [6], [7]. The support of a rule, $X \rightarrow Y$, is the percentage of transactions in T that contains $X \cup Y$, and can be seen as an estimate of the probability, $\Pr(X \cup Y)$. Let n be the number of transactions in T , then the support of the rule is computed as follows:

$$\text{Support} = (X \cup Y). \text{Count} / n \quad (1)$$

The confidence of a rule, $X \rightarrow Y$, is the percentage of transactions in T that contain X also contain Y . It can be seen as an estimate of the conditional probability, $\Pr(Y | X)$. It is computed as follows:

$$\text{Confidence} = (X \cup Y). \text{Count} / X. \text{Count} \quad (2)$$

For the given a transaction set T , the objective of the association rule is to discover all association rules in T that have support and confidence greater than or equal to the user-specified minimum support and minimum confidence.

The application area of association rule mining is very huge and used in various areas like Marketing and Sales [5], Documents / Text, Bioinformatics [6] and Web Server [7].

Weather forecasters predict weather mainly from numerical and statistical models simulation which requires intensive computations, complex differential equations and computational algorithms where the accuracy is bound by

constraints, such as the adoption of incomplete boundary conditions, model assumptions and numerical instabilities, etc. [9].

The variety of environmental applications and its data of type multi disciplinary, multi-sensor, multi-spectral, multi-resolution, spatio-temporal, high-dimensional provide a rich platform for the practice of data mining [2]. It is also helpful to decision maker or non-computation person for the environmental data as followings:

- The author presented the method for prediction of daily rainfall from meteorological data from the atmospheric parameters temperature, dew point, wind speed, visibility and precipitation (rainfall) of 1961-2010. They applied basic Apriori algorithm of association rule mining to predict the rainfall [10].
- Association rule mining is used to identify rules that indicate the relations between atmospheric parameters like day, time, year, temperature, pressure, humidity, etc. and air pollutant data like date, time, CH_4 , CO , CO_2 [11].
- The author derived the close relationship between environmental factors and ecological events the Red tide phenomena occurred during 1991 and 1992 in Dapeng bay, South China Sea using temporal association rules and K-means clustering analysis on the time, sea water temp, salinity, DOxygen, pH, etc. [12].
- The relationships between the trajectories of Mesoscale Convective System (MCS) called thunderstorm and the environmental physical field values are analyzed using spatial association rule mining technique to predict the heavy rain fall [13].
- To discover the weather for the specified region, patterns of similar region weathers for British Columbia were analyzed using association rule with the data like temperature, precipitation, wind velocity, etc. [14].
- Due to the increasing number of earthquakes, tornados and Tsunami waves, the incremental mining of association rules used to discover the shocking patterns at current time with respect to the previously discovered patterns rather than exhaustively discovering all patterns of the earthquakes [15].
- The author analyzed historic salinity-temperature data to make predictions about future variations in the ocean salinity and temperature relations in the waters surrounding Taiwan using inter-dimensional association rules mining with fuzzy inference with spatial-temporal relationships where traditional statistical models fails to relate spatial and temporal information [16].
- The author tried to extract useful knowledge from weather daily historical data at Gaza Strip city by applying basic algorithms of clustering, classification and association rules mining techniques to know the importance of them in meteorological field to obtain useful prediction and support the decision making for different sectors [17].

- The author analyzed the usage of association rule for discovering the relationships between stream flow and climatic variables in the Kizilirmak River Basin in Turkey [18].

As discussed above the number of applications is dealing with association rule, it justifies the study of association rule mining for the traditional and special applications which deals with environmental data and here we are discussing them with the Gujarati Hindu calendar as upto the knowledge of author it is not utilized which is novel.

IV. PROPOSED APPROACH

The system is proposed to utilize temporal association rule mining to associate temperature with “tithis”. The proposed system is as shown in the following Figure 1. For the temporal association rule mining, used is intertransactional association rule mining to mine the association across the transactions instead the intra transactions.

The proposed system steps are as follows:

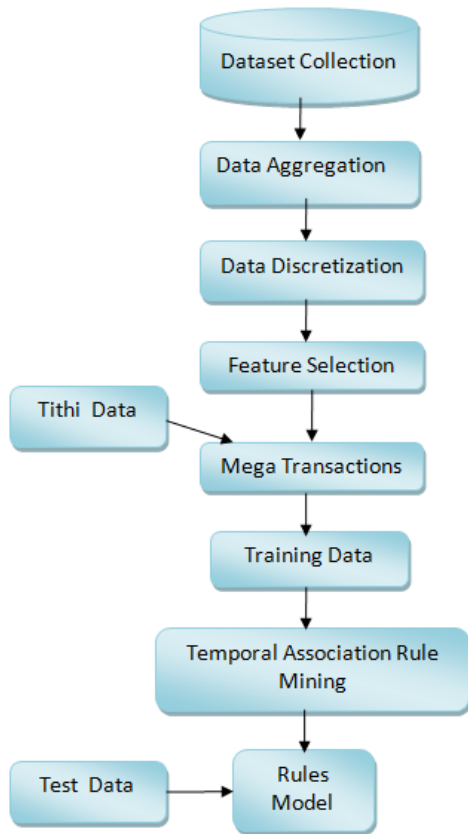


Figure 1. Proposed System

The main part of the system is the data preparation. In the first step, the weather data is collected consisted of Temperature, Sea level Pressure, Dew Point, Humidity, Wind Speed, Visibility and Precipitation. The author found from their analysis that instead of yearly data, the predictability is efficient if the data is prepared according to seasons [19]. So, in

data aggregation part data is separated and aggregated as per three seasons. Then discretization is applied on this data. From the feature selection, only selected features data are kept for the further processing. Now, here “tithi” data are included with the transaction data and prepared the mega transactions to discover the associations not within the “tithi” but among the “tithis”. Next part is to separate the data for the training and testing data. Temporal association rule mining is applied using Apriori algorithm from training data and Rules model is prepared to test the data for the “tithi” association with temperature.

V. EXPERIMENTAL ANALYSIS

We evaluated the temporal association rules generated from real databases. The data is collected from the weather website <http://wunderground.com/-/history/station/42840> for the Surat, India station. We aimed to discover rules that demonstrate the association between temperature and “tithi” that can be used for prediction of temperature.

The data is collected for the three years from 16th Feb 2008 to 15th Feb 2011. For these days, “Tithi” information is collected from <http://melbourne-jainsangh.org/useful-links/activity-tithi-calendar/>. From these seasons information data are separated and aggregated for these three years together and mega transaction information is prepared with the help of “tithis”. The system is tested with Support=20% and Confidence=20%. From the megatransactions information 70% training data is taken and 30% data is used for testing. Generated temporal association rules from the training data is applied to the testing data for the future day prediction and achieved 61% accuracy for the summer and monsoon seasons with integration of “tithis” to the parameters. Sample of generated temporal association rules are as shown in the following Table 1.

TABLE I. SAMPLE RULES WITH DISCRETIZED INTERVAL VALUES FOR SUMMER SEASON

Rule 0:	[25.5-26.5)Sud3	→	[25.5-26.5)Sud4	S=0.04	C=0.21
Rule 1:	[29.5-30.5)Vad3	→	[29.5-30.5)Vad4	S=0.09	C=0.51
Rule 2:	[28.5-29.5)Vad3	→	[28.5-29.5)Vad4	S=0.12	C=0.36
Rule 3:	[27.5-28.5)Sud15	→	[28.5-29.5)Vad1	S=0.18	C=0.53
Rule 4:	[28.5-27.5)Vad15	→	[26.5-27.5)Sud1	S=0.02	C=0.31

The outcome of the temporal association rules for the summer season is as follows:

The Rule 0 says that in “Sud tithis”, the temperature value stays in low range.

The Rule 1 and Rule 2 say that in Vad tithis, the temperature above the average is stay in the same temperature range.

The Rule 3 says that if “Sud tithi” is changing to “Vad tithi” then temperature is increasing. But, here if Wind Speed increases then there will be no change in temperature.

The Rule 4 describes that “Vad tithi” is changing to “Sud tithi” then the temperature is decreasing.

According to these numbers of other rules are generated and can help in analysis of weather further.

VI. CONCLUSION

The integration of “tithi” with weather parameters can provide fruitful information to forecast the weather parameter temperature. The system is uncomplicated compare to the other complex weather forecasting system. Experiment results show that these rules model can generate automatic result which does not require extra proficiency in the weather forecasting area and complex models. In future like to examine the feasibility of this integration of “tithi” with other seasons and with the other data mining techniques together.

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A Distinct Technique for Facial Sketch to Image Conversion

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Abstract— A liberal amount of software applications are in market for generating a sketch out of an image, the vice-versa though is unacquainted. Whereas such an implementation will prove to be purposive to the crime investigation departments. Such a youthful approach for generating an image from a sketch is suggested in this paper by following a process of, breaking down the sketch into constituent or component of face, matching or comparing these features with the available database, selecting the best match followed by registering or pasting these image components on a blank face image, performing filtering algorithm in order to perform smoothening of image.

Index Terms— Feature detection, feature extraction, facial components, filtering algorithms, fiducial points, smoothening image.

I. INTRODUCTION

A liberal amount of software's and applications are available to convert a image to a sketch and are well known the vice-versa tough is not yet induced, that is there exists no methodology that would support the conversion of a sketch to an image.

The paper presents a layout for a similar idea, foregoing on which this plan is distributed into four parts Detection and Extraction of features, Matching of features, Registering features to form image, Smoothening and finish to form an image. Using the developed technique for Detection and Extraction of features, using the data obtained from the same performing matching of features. The input will consist of matched features which will be pasted on the face mask so as to obtain the desired output image.

Detecting features is the objective of the first module where facial features are detected and extracted, a database of which is generated for further use. The second module demands a facility of being able to compare two inputs which are a sketch and its feature on a variant platform the approach

takes a path of conversion of both the inputs to a similar platform say black and white and then performing feature matching algorithms like PCA Algorithm. The execution of this algorithm is performed on the database and the test image on which conversion is to be performed, automatically without providing separate compatible image to perform matching multiple times with different image inputs. Module three leads to extracting desired features of input sketch and matching them with image equivalents from the database registering all the components together forming an output. Concluding module performs image smoothening algorithm for giving a finishing to the output obtained.

II. LITERATURE SURVEY

A detailed approach on various techniques of merging images is presented. The reference [1] provides various unswerving methods for achieving the objective are introduced along with their result giving capacities. On the basis of which analysis report is also deployed in the given paper. The authors are focusing on a smoothly finished image that is obtained by merging few other images.

The basics of recognizing the similarities between two faces are denoted in reference [2]; the approach used is based on facial expressions that are beneficial to our project from the point that we consider the facial features. The expressions used as a distinguishing point in this paper are the similar aspect we intend to use in our project. Thus the identification of features is taken in consideration and thoroughly observed from this paper.

Pattern recognition and face recognition is the main objective in reference [3] , which not only introduce variant methodology for recognizing a face and producing result in form of acceptance and rejection but also gives a determined percentage of the face match. No limiting is done for

displaying the percentage thus every input is considered as a valid input and thus a valid output.

The CMU pose and illumination is a base of the 3D imaging where the expressions are identified and compared using a three dimensional aspect which did not prove to be much of use with respect to our project point of view but the identification methodologies used can be replicate by simply avoiding the three dimensional part. Reference [4] introduces comparison method that produces highly dependable results and thus can be useful.

Feature identification and recognition methodologies with an improvisation that it also presents the identification of these facial expressions or features or faces in first place even in disguise. Reference [5] enlightens any temperament to the original face image can be identified separately and considered and avoided according to the input and the recognition is done.

In order to imply a combination of nonlinear diffusion and bilateral filtering refining image and edge detection technique is proposed. Citation of two well established methodologies in image processing community is done in order to get a base to the model, which makes understanding and implementing the method very easy. Execution of numerical experiments exhibits that the proposed model can achieve more accurate reconstructions from noisy images, in comparison to other popular nonlinear diffusion models in the literature. Reference [6] briefs a diffusion stopping criterion, established from the second derivative of the correlation between the noisy image and the filtered image which can be introduced as new and simple. Prevention of the diffusion process is done by this indirect measure that depicts a close to the point of maximum correlation between the noise-free image and the reconstructed image, when the former is removed. The stopping criterion is sufficiently general to be applied with most nonlinear diffusion methods normally used for image noise removal.

Literature survey of methodologies of face matching and feature matching is done in this paper. All present techniques for the same are studied and a detailed analysis of the same is presented in reference [7]. Analyzing approach is based on the study of all these techniques under the similar databases and inputs such that the obtained outputs are visually identified to be similar or not and to what extent documents represented as vectors.

III. PROPOSED WORK

A simplified methodology that proposes the conversion of sketch into image with an appropriate approach such that the originality of all the features is retained. The basic approach is to identify the prominent features of a face and then searching for an appropriate or equivalent image equivalent of the same,

then by replacing the image equivalent of the feature on the face mask performing proper pasting and smoothening such that the image looks genuine..

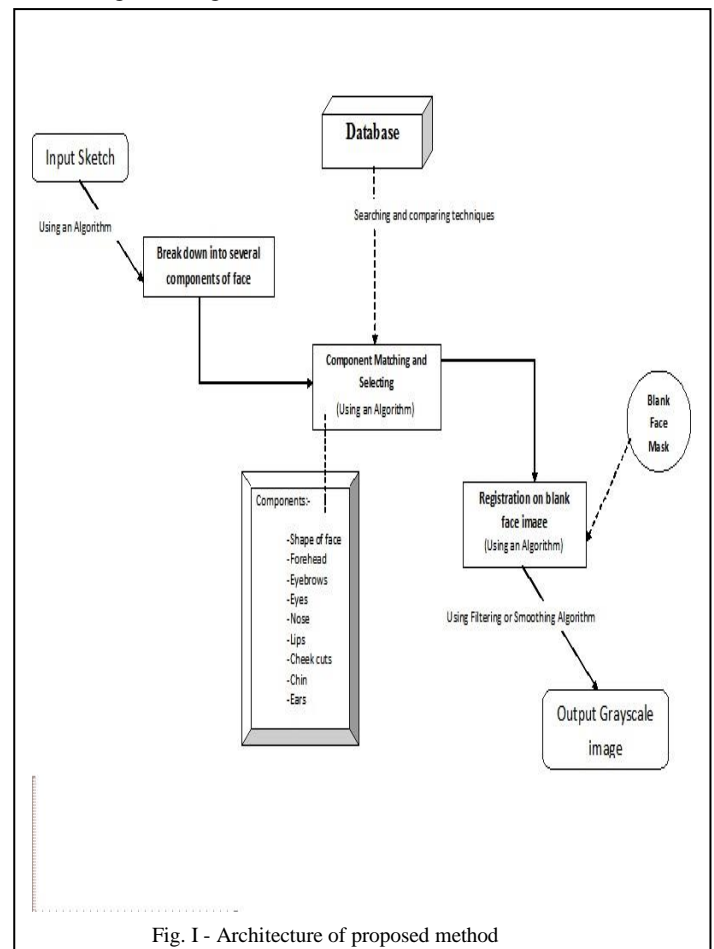


Fig. I - Architecture of proposed method

A. Method of Data Collection

Standard image and its equivalent sketch database are collected from authenticated collection. The database collected consists of more than fifty sketches and its equivalent images. The sketches will be the test inputs, all these sketches need to be of specific dimensions or précised size.

B. Preprocessing

Database collected from authenticated database collections is processed to obtain a database of components of face or facial features of only the image format, as the processing on sketch is done during execution of the code. Separate collection of these features is stored and retained for use during the code execution. The various feature database consist of the following,

- Eye database.
- Nose Database.
- Mouth Database.
- Blank Face Database.

C. Methodology

The entire process is summarized into four modules which are elaborated below the modules namely are as stated,

- Feature Detection and Extraction.
- Feature Matching.
- Registering image equivalents.
- Smoothing and finishing output

D. Feature Detection and Extraction

When an input is passed to the method the primary task is to use feature detection methodologies and detect the prominent facial features. In order to generate patterns from time series data for classification purposes several feature extraction methods have been introduced. A statistical measure of the amplitude of the time series is provided by the well known kurtosis method. Another method displays construction of a feature vector using the spectrum, where the power spectral density and the wavelet coefficients are used along with PCA for feature extraction.

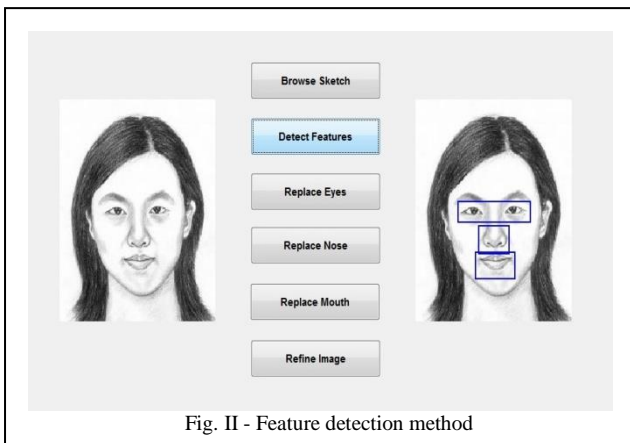


Fig. II - Feature detection method

For extracting the phase information Hilbert transform requires conversion of the real-valued signal into complex-valued analytic signal. Time series data is predefined in the SDF-based feature extraction, which is first converted into symbol sequences, and then probabilistic finite-state automata are constructed from these symbol equines for compressing the pertinent information into low-dimensional statistical patterns. DF-based feature extraction from (wavelet-transformed) time series has been proposed by Jin et al. (2012) for target detection and classification in border regions. The time-frequency localization and demonizing of the underlying sensor time series leads for the use of rationale wavelet-based methods. However, this method requires selection and tuning of several parameters (e.g., wavelet basis function and scales) for signal pre-processing in addition to the size of the symbol alphabet that is needed for SDF. Use of Cascade object detector is done in order to detect and extract the features.

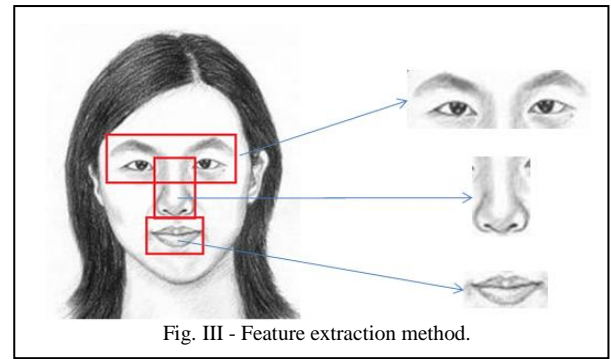


Fig. III - Feature extraction method.

E. Feature matching

Application of principal component analysis is done on each image by the Eigen Object Recognizer class, the results of which will be an array of Eigen values which can be recognized by a Neural Network which is trained. PCA is a frequently used method of object recognition as its results, can be fairly accurate and resilient to noise.

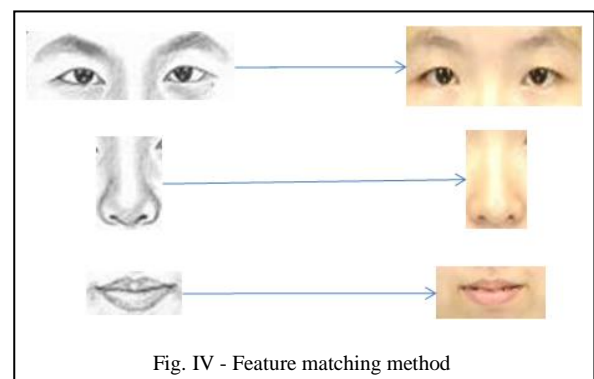


Fig. IV - Feature matching method

The method of which PCA is applied can vary at different stages so what will be demonstrated is a clear method for PCA application that can be followed. It is up for individuals to experiment in finding the best method for producing accurate results from PCA. To perform PCA several steps are undertaken:

- Set extracted feature as test image.
- Consider train database of particular feature.
- Perform PCA detect output.
- Display output.

F. Registering Features and Smoothing Image

The previous mode of feature matching provides several image outputs viz. Eyes, nose, mouth, blank face. The objective now switches to registering all these components together in proper dimensions at proper location. In order to detect exact location of every feature their original landmarks are revised from the input sketch, this simplifies the task of dimensional repositioning of the features. Facial points are detected to register the location of every component specifically at its precise dimensions.

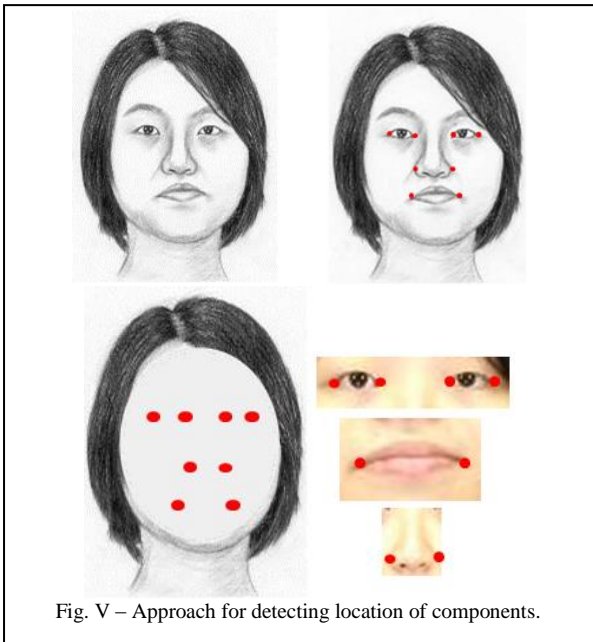


Fig. V – Approach for detecting location of components.

The outcome of all will be a patched form of image which will have all the image components in their appropriate locations but the facial appearance of the image may not be as pleasant as expected. Resizing the components and realigning them is thus a necessity, for which application of certain filtering and smoothening algorithms is conducted.

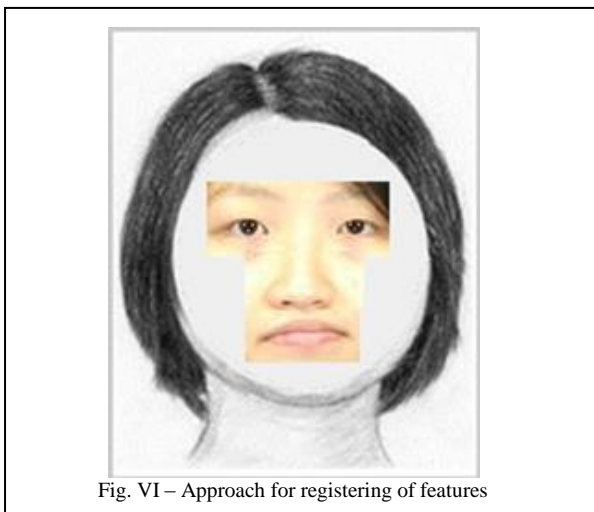


Fig. VI – Approach for registering of features

The output is finalized by performing gradient smoothening on the image and image blending algorithms are executed for obtaining a perfect outcome, the output is a visually pleasant image form as shown below,

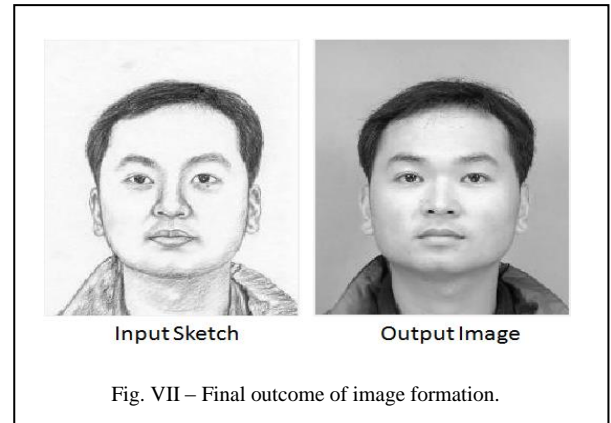


Fig. VII – Final outcome of image formation.

IV. ACKNOWLEDGMENT

This paper proposes a distinct technique for creating an image output from a sketch input. It is presented successfully in the paper, an approach that is used to improvise a unique method for developing a novel technique and presenting a satisfying output.

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SAFETIES ON THE WEB DEVELOPMENT

The Server Side

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Abstract—The present work shows in its introduction to the importance of information security in the current environment of digital culture, especially after the occurred on September 11, 2001 in the United States. The subject involves not only information technology-related companies but can verify this concern in the daily life of the companies and therefore specific laws Governments. This can be verified in building distributed systems (including operating systems and managerial), in the infrastructure of networks of companies and organizations and web sites. This study analyzes the mechanism of the servers of Internet pages because many attacks exploit these vulnerabilities. Programming of web sites (mainly dynamic content) can also be used to circumvent the security and enable an occurrence of illegal access. Programmers should note some important features to avoid the predatory action of invaders, because no one can build web sites without taking into account the hosting and the creation of source code which is intended to reduce the vulnerability of the system to a minimum acceptable. Finally, comments on the ten most common types of vulnerabilities to be observed when making web sites according to the OWASP (The Open Web Application Security Project) aims to create awareness about security in programming sites.

Keywords-Security, information, network infrastructure, distributed systems.

I. INTRODUCTION

Acquainted with the need to maintain the Confidentiality, Availability and Information Integrity which is processed on the websites of their clients, the networks professional (obviously including the Internet) need to get acquainted with the functioning of the requests and responses that interact with the client software (browsers) and Web servers.

The code of this Web Server is written in the Java language, initially developed by the Sun Microsystems company which was acquired by Oracle.

The source code of this server (Daswani; Kern; Kesavan, 2007)[1] is in the Annex I.

The methodology on this paper is to compile and run this local server and access it through a browser program (eg Microsoft Internet Explorer) which requests HTML pages receiving and displaying them as if they were connected to the

Internet or to an Intranet; inasmuch as the computer to be held this process has no link with another computer.

Thus, the address of the requested page will be initially `http://localhost:8080/index.html`. The explanation for this URL is as follows: `http` is the Internet protocol with which the WWW service works (World Wide Web). The term "localhost" indicates that the server is local, thus exempting external connection.

The communication port used for this purpose is 8080, which is informed immediately after localhost and separated from it by ":" (colon). It is common the use of this same port for Web applications (eg Apache Tomcat, which is a container for Java Web applications).

This example shows that the web server will only process the requests GET type. When the address of a page is entered directly into a browser, it starts to search for the IP address through page servers (by DNS table - Domain Name Service).

When the server that responds and hosts the page is found, the browser sends a request GET type and informs the file name (which can be static - .html - or dynamic - .php, .asp or .jsp for example). Given the software presented here, it does not consider other request since the focus of this paper is the safe development of Internet pages. One of the security measures is to prevent a user try to execute malicious code within the hosted site. This type of threat is done by entering the beginning of the URL address, followed by a parameter that points to another page (with this malicious code).

For example:
`http://www.meusite.com.br?pag=www.invadir.jsp`

This happens when the site above uses parameters to call internal pages which will fill frames or divs; and instead of calling a file from the appropriated server that hosts the URL it ends up pointing another page from another server (which belongs to the hacker). Thus, a security breach occurs.

On lines 56-57 of the present server code, a block of the try type is created (try {...} catch (...)) trying to read the requested file (FileReader(pathname)) and, if an exception occurs, it is handled in the catch block which sends to the client browser the following message: "HTTP/1.0 404 Not Found\n\n", which will display the error 404, meaning that the page was not found

because the server searched on the site and the file is not there physically.

The exception of the Java language as concerned is `FileNotFoundException`. However, other might occur, for example, not be possible to read the file. To cover all these and other cases, the catch command (Exception `e`) brings written "Exception" which is the superclass, mother of all exceptions, thus accepting to treat anyone and not only `FileNotFoundException`. If the developer wanted to specify to the final user what the problem was, he could test every problem, but generally in the web environment, the default message is displayed that the browser expects.

In addition, little good would be done (and would be even dangerous, for security) to show to the Internet user, the internal server error structure.

Still observed in this code was that if the final user just types in the address bar `http://www.meusite.com.br`, the server notices that a specific page was not requested and shows the `index.html`.

Another vulnerability that the server cannot allow is the user to type `../../../../etc/shadow` instead of the inside page. This way generating the browser GET request `../../../../etc/shadow HTTP / 1.0` that will show the machine's passwords file which is hosting the site, if it is the Linux or Unix standard. A caution that can be exerted is not allowing users to read the shadow file.

II. THE DEVELOPMENT ENVIRONMENT – PROGRAMMING

On the programmer stand, there are precautions to be taken and `FrameWorks` to be implemented to minimize the threats to the system. In this chapter, concepts of programming environment will be presented, the MVC design pattern (been its importance explained) and finally, the PHP language will receive attention.

Programmers have contributed greatly to design patterns for having realized that certain solutions for programming would be interesting for other developers, leading to a greater flexibility, organization and code efficiency. These patterns can be used in more than one programming language and have become basic requirements in large development companies, including the to the Web and to the Information Security.

The full name of the MVC pattern is Model-View-Controller and each of these words is a development layer, respectively, Model - Visualization - Control.

"MVC is a development concept (paradigm) and design that tries to separate an application into three distinct parts. On one hand there is the Model which is related to the current job that the application manages, on the other hand, there is the View, which is related to display data or information on this application and there is a third part, Controller, which coordinates the two previous parts displaying the correct interface or performing some work that the application needs to complete." (Gonçalves, Edson - 2007) [2]

The Model (model layer) represents the application data (database) with its tables (relational model) and its definitions, such as stored procedures, for example. Those latter ones are

procedures stored directly in the database using the DBMS own language (Database Management System); its advantages are the greatest working speed (as they are already compiled functions and in the internal language) and safety, since they cannot be performed by any user.

Developers should not use the "root" account and password for page services, especially on the Web. Unfortunately, many do not follow this caution and when the software is ready, they do not change the database user settings for an appropriate account and their limited rights.

On those applications that are not divided into layers, it might happen to exist SQL commands (Structured Query Language) that, although not shown in the code ".html" returned by the server to the client browser, pose a danger if they fall into the hands of hackers entering on the server and have access to the page "php" for example.

To understand the information flow in the navigation, it is necessary to explain that everything begins with the page request by the final user; when the server is found, it returns back a page to the requester, and if there is a dynamic code (program) that is accomplished. As an example take the grades and absences checking for a particular student (web system user) on a College website: when the registration number and password are entered, the Web server sends it to the database server concerned and it performs the query and returns only the data resulting to the Web server (eg Apache), which in turn assembles a page formatting these data and returns it to the final user (student), delivering it on its browser program (on its IP and proper communication port).

The separation of layers is important for each address their specific functions. The view does not need to know what the SQL statement executed in the bank and the Model must provide the data requested without any of its authority to presentation and formatting them.

Been the flow of information in a Web request understood, it is possible to explain what the View layer (view) is, which is the user data presentation layer. The separation of layers is important so that each one take care of its specific functions. The visualization does not need to know which SQL command was executed in the database and the Model must provide the data requested, no matter if it is its competence the presentation and formatting them.

Not only for safety reasons but also to make codes more readable and possible to be developed separately; in a company there may be a page design sector, independent of programming sector (PHP, Java, .Net). So employees can become more efficient, been their processes more specific (each one in their area).

To control the information procedures between the Model and the Visualization there is the Controller layer (Control); the user's request made through the web site (visualized by customer) needs to communicate/change/query the database (model) and the Control will determine how this will be done and how the information will be addressed before and after the database been contacted ("before" to check security and business

rules for example, and "after" to send them to the final user in an appropriate format in the Visualization).

As stated earlier, this solution can be implemented in PHP language which is a combination used by developers seeking, among other advantages the characteristics gainful of the paradigm of Object Oriented Programming.

This language can be worked in the Structured paradigm as well as in the Object Oriented. The characteristics of the past few ones are: encapsulation, inheritance, polymorphism, composition and the use of so-called "interface."

According to Niederauer, Juliano (2005) [3]: "PHP is a language dedicated to the Web, so there must be a Web server which receives the requests of pages, do the processing through PHP returning to the browser (browser) a result."

As using APACHE or MySQL (combined with PHP) both settings require configurations made in the server through text lines in configuration files from each of them. When an Internet provider is hired for hosting services, the programming language must be specified as well as the page server program and the database used in the preparation of the site in question.

III. VULNERABILITIES TO BE OBSERVED ON PREPARING "SITES"

The following question is plausible for this paper: What is a secure site? A large proportion of people would answer that it is a site where there is no risk of losing money. In other words, if it is a shopping site which really sends exactly the product asked; if it is a bank via Internet which no one can perform operations in the account or cause injury. Others, more informed, would say that those are sites with a padlock at the bottom of the browser, but the lock is one but not the only way for security.

The padlock which is shown in the browser means that the communication channel between the browser and the site is secure against interception. An intermediary can even clip the line, but since the data is transmitted in code, he cannot understand them. Once clipping the line, an attacker cannot get to know the account number, or password, or that exact pages are visiting. One would choose sites on which the lock is shown and avoid sites where they do not appear, especially in the case of financial transactions and shopping sites. It may seem enough, but there are several other threats and vulnerabilities which could be used as means of compromising the security of a web site in many different aspects. The OWASP project (The Open Web Application Security Project) describes what is considered the ten most common types of technical vulnerabilities in web systems:

- A1: Injection
- A2: Cross-Site Scripting (XSS)
- A3: Broken Authentication and Session Management
- A4: Insecure Direct Object References
- A5: Cross-Site Request Forgery (CSRF)

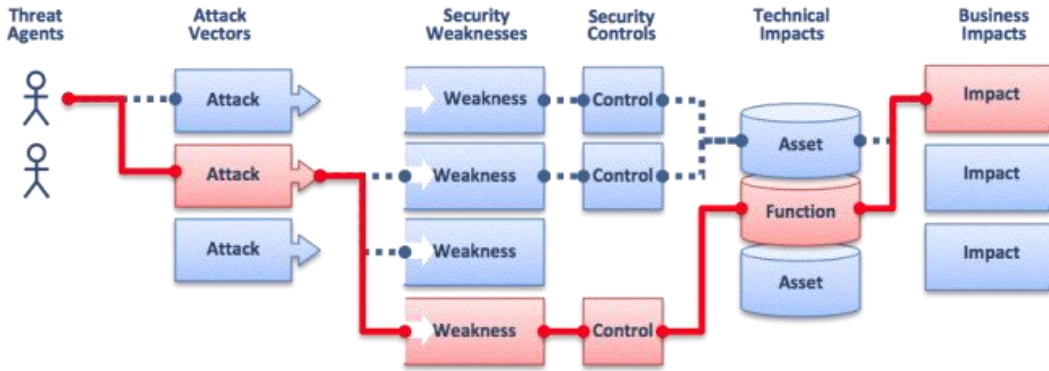
- A6: Security Misconfiguration
- A7: Insecure Cryptographic Storage
- A8: Failure to Restrict URL Access
- A9: Insufficient Transport Layer Protection
- A10: Unvalidated Redirects and Forwards

Within these ten, the "closed padlock" is the A9 item. There are nine other large groups of vulnerabilities to which a site may be subject. Nowadays, there are some standards and best practices for building web sites with the intention of letting them resistant to vulnerabilities and threats that plague applications of this nature.

This project (OWASP - Top 10) [4] has as its aims to create awareness about safety in applications by identifying some of the most critical risks that haunt organizations.

Attackers can potentially use different routes through an application to damage the business of an organization. Each one of these routes is a risk that may or may not be sufficiently serious to receive attention.

Figure 1 - Attacks on Web Applications Source:



Font: https://www.owasp.org/index.php/Top_10_2010-Main, viewed at: 05/08/2015.

In this paper will be explained and exemplified solutions in PHP language for the first two vulnerabilities including source code display and interpretation to the reader.

A1 - INJECTION

Injection flaws occur when non trusted data is sent to an interpreter as part of a command or query. The attacker's hostile data can trick the interpreter and executing unintended commands or accessing unauthorized data.

When the site requests an ID from the user, they can enter malicious code to gain unauthorized access to sensitive information. The source code can be written, for example:

```
$ Query = "SELECT * FROM customers WHERE username = '$user_name'";
```

In this example (in PHP), the information in the table "customers" will be selected for a particular user that on a previous moment of the application, must have informed the correct password and thus obtained access to the system.

However, for an attacker, even not having the correct password, it is possible to exploit a weak point that less experienced programmers leave in the system: enter part of a SQL code to fraud security.

Instead of typing a name the hacker types "or 1".

Opening and closing quotation marks with nothing inside, the code does not inform the user name as expected. The next step is to make the site in PHP run "or 1" meaning 'or 1'. In the truth table, when an expression has two logical operators connected by "or", it is sufficient that one of them is true for the entire expression to become true, returning "true".

Then when the SQL "Select * from customer where..." it gets the true in the where clause, it returns the data of the referred table to the attacker.

It is also true when a password is requested, since the malicious code described herein can work with a SQL whose where has more parameters such as: "Select * from customers where username = '\$user_name' and password = '\$password'."

Another danger is the hacker to delete the table records, if he types: "; DELETE FROM customers WHERE 1 or username = ". As shown in this example, the "where" clause would also return "true" (true) for all records in order to erase them by the delete command.

The solution in both cases is different for Java and PHP. In Java, it is recommended the use of PreparedStatement object with a question mark in the SQL command in the space of the data:

```
"Select * from customers where username = ? and password =? "
```

And then identify each question item separately (objeto.setString (name) and objeto.setString (password)).

Now, in PHP it is necessary to create a function that eliminates this possibility, either by SQL command like "from, alter table, select, insert, delete, update, where, drop table, show tables," or turning them in a string (text type) that cannot be performed. In this transformation commands are recorded in the database as plain text (in columns name and password).

That function is described in the following lines of the source code (taken from the site <http://www.htmlstaff.org/ver.php?id=18528>, accessed 03/07/2012).

```
:  
1. <?  
2. function anti_injection ($field, $adicionaBarras = false)  
3. {  
4. // remove words that contain syntax sql
```

```
5. $field = preg_replace ("/ (from | alter table | select | insert  
6. | delete | update |  
7. where | drop table | tables show | # | \ * | - | \\\\) / i" "",  
8. $field);  
9. $field = trim ($field); // clean empty spaces  
10. $field = strip_tags ($field); // strip html tags and php  
11. if ($adicionaBarras || ! get_magic_quotes_gpc ())  
12. $field = addslashes ($field); // Add slashes a string  
13 return $field;  
14.}  
15. ?>
```

```
13. }  
14. else {  
15.     $ref = $ref.".php" ;  
16. }  
17. }  
18. ?>
```

For this example, if the URL you entered does not bring a parameter with existing file name in the Fatec server, it will assume the value index.php thus showing the home page of the Site.

In case the page is found on the server, then it will be displayed immediately.

A2 – CROSS-SITE SCRIPTING (XSS) (COMMANDS SEQUENCE IN CROSSED SITES)

Failures XSS occur each time an application takes non trusted data and sends it to the web browser without validation and proper coding. XSS allows attackers to execute a command sequence in the victim's browser which can hijack user sessions, destroy web sites or direct the user to a malicious site, for example (fictitious):
<http://www.meusite.com?page=http://www.sitehacker.com>.

At this point there was an internal parameter of the site called page, whose content (which should show a page of MySite domain) that was counterfeited to show the hacker site.

Once accessed, the malicious site can execute commands directly on the server which is hosting the site being "attacked."

The solution is to check each parameter as requested (on the page address, which appears after the question mark and is separated by "&") to identify before running if it is reliable.

On the website of Fatec Ourinhos (<http://www.fatecou.edu.br>) this precaution was taken with the following code:

```
1. <? php  
2.  
3. $ref = $_GET['content'];  
4. if ($ref == "") $ref = "index";  
5 $gets = split ("\", $ref);  
6. if (count ($gets) > 1) {  
7.     $ref= $gets [0];  
8.     for ($i = 1; $i < count($gets); $i++){  
9.         eval ("\$var".$i."= \" \".$gets[$ i].\" \";");  
10.    }  
11.    if (!is_file ($ref.".php")) {  
12.        $ref = "index.php";
```

IV. CONCLUDING REMARKS

Through researches for preparing this work and from personal experience on developing Web sites it is possible to conclude that it is very important to take proper precaution and use efficiently the tools to create and maintain a secure environment in computer networks.

It is be seen that the attacks might come from the World Wide Web or even from the companies Intranet. The network environment enables collaboration and significant results and currently indispensable to production and business, for example industries and service providers.

Defense tools might be free or owner software and less experienced developers are at high risk if they do not know them.

Their education must be extensive since caring for the safety range from the pages of server configuration, database server, the choice of programming languages with better resources and less vulnerabilities and even in the workplace (with appropriate practices which will avoid for example Social Engineering attacks).

On concluding, it is essential to point out that after making these choices, it is necessary to improve the programming techniques, seeking to avoid breaches in the source code of pages which constitute websites, especially those of vital importance in the dynamics of the operation of enterprises, no matter if they are internal or in competition and/or collaboration with others in a globalized environment.

V. ANNEX I

- 1./*****
2. SimpleWebServer.java
3. This toy web server is used to illustrate security vulnerabilities.
4. This web server only supports extremely simple HTTP GET requests.

5. This file is also available at
<http://www.learnsecurity.com/ntk>

```
6. /*****  
7. package com.learnsecurity;  
8. import java.io.*;  
9. import java.net.*;  
10. import java.util.*;  
11. public class SimpleWebServer {  
12. /* Run the HTTP server on this TCP port. */  
13. private static final int PORT = 8080;  
14. /* The socket used to process incoming connections  
15. from web clients */  
16. private static ServerSocket dServerSocket;  
17. public SimpleWebServer () throws Exception {  
18. dServerSocket = new ServerSocket (PORT);  
19. }  
20. public void run() throws Exception {  
21. while (true) {  
22. /* wait for a connection from a client */  
23. Socket s = dServerSocket.accept();  
24. /* then process the client's request */  
25. processRequest(s);  
26. }  
27. }  
28. /* Reads the HTTP request from the client, and  
29. responds with the file the user requested or  
30. a HTTP error code. */  
31. public void processRequest(Socket s) throws  
Exception {  
32. /* used to read data from the client */  
33. BufferedReader br =  
34. new BufferedReader (  
35. new InputStreamReader (s.getInputStream()));  
36. /* used to write data to the client */  
37. OutputStreamWriter osw =  
38. new OutputStreamWriter (s.getOutputStream());  
39. /* read the HTTP request from the client */  
40. String request = br.readLine();
```

```
41. String command = null;  
42. String pathname = null;  
43. /* parse the HTTP request */  
44. StringTokenizer st =  
45. new StringTokenizer (request, " ");  
46. command = st.nextToken();  
47. pathname = st.nextToken();  
48. if (command.equals("GET")) {  
49. /* if the request is a GET  
50. try to respond with the file  
51. the user is requesting */  
52. serveFile (osw,pathname);  
53. }  
54. else {  
55. /* if the request is a NOT a GET,  
56. return an error saying this server  
57. does not implement the requested command */  
58. osw.write ("HTTP/1.0 501 Not Implemented\n\n");  
59. }  
60. /* close the connection to the client */  
61. osw.close();  
62. }  
63. public void serveFile (OutputStreamWriter osw,  
64. String pathname) throws Exception {  
65. FileReader fr=null;  
66. int c=-1;  
67. StringBuffer sb = new StringBuffer();  
68. /* remove the initial slash at the beginning  
69. of the pathname in the request */  
70. if (pathname.charAt(0)=='/')  
71. pathname=pathname.substring(1);  
72. /* if there was no filename specified by the  
73. client, serve the "index.html" file */  
74. if (pathname.equals(""))  
75. pathname="index.html";  
76. /* try to open file specified by pathname */  
77. try {  
78. fr = new FileReader (pathname);  
79. c = fr.read();
```

```
80. }
81. catch (Exception e) {
82. /* if the file is not found, return the
83. appropriate HTTP response code */
84. osw.write ("HTTP/1.0 404 Not Found\n\n");
85. return;
86. }
87. /* if the requested file can be successfully opened
88. and read, then return an OK response code and
89. send the contents of the file */
90. osw.write ("HTTP/1.0 200 OK\n\n");
91. while (c != -1) {
92. sb.append((char)c);
93. c = fr.read();
94. }
95. osw.write (sb.toString());
96. }
97. /* This method is called when the program is run from
98. the command line. */
99. public static void main (String argv[]) throws
100. Exception {
101. /* Create a SimpleWebServer object, and run it */
102. SimpleWebServer sws = new SimpleWebServer();
103. sws.run();
104. }
105. }
```

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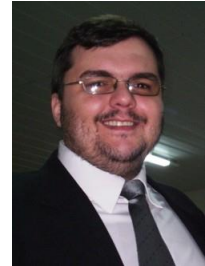
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Analysis of Activities and Operations in the Current E-Health Landscape in Tanzania: Focus on Interoperability and Collaboration

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Abstract— Although the basic application of Information and Communication Technologies (ICT) in the Tanzanian health care systems started years ago, still fragmentation of Information Systems (IS) and limited interoperability remain to be big challenges. In this paper, we present an analysis done on the present health care delivery service, HIS and on some of existing eHealth solutions focusing on interoperability and collaboration. Through interviews, questionnaires and analysis on e-health implementations in relation to interoperability and collaboration we have established that, the lack of standard procedures to guide the lifecycle of eHealth systems across the health sector and poor willingness to collaboration among health stakeholders are key issues which hinders the manifestation of the benefit of ICT use in the health sector of Tanzania. Based on the findings, we provide some recommendations with a view to improve interoperability and collaboration.

Keywords: *eHealth; healthcare; eHealth adoption; interoperability.*

I. INTRODUCTION

It is widely accepted that the application of information and communication technologies (ICT) in health has enhanced provision of health services across the world [1], [2], [3]. The World Health Organization defines eHealth as “the cost-effective and secure use of information and communications technologies (ICT) in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research” [4]. Regardless of its importance the adoption of eHealth standards in many African countries is still a challenge [5], [6], [7]. Tanzania, like other many African countries, its health care system has been facing almost similar problems [8], [9]. Due to the need of good health care delivery services in the society, these problems cannot be avoided and will require fundamental changes in the current health care arrangements [10]. Tanzanian government through the ministry in charge of health sector and social welfare (MoHSW) has developed its strategic plan called the Health Sector Strategic Plan III to guide priority setting and deployment of resources in the health sector [11]. The already initiated Tanzania National eHealth Strategy (2013 – 2018) of the health care system aims to integrate all fragmented

information systems (IS) and offer a complete solution that will benefit all interested parties. To achieve this the issue of eHealth standards, systems interoperability and collaboration between different eHealth stakeholders must be given a serious consideration. Taking into account that it is within achieving systems interoperability, agreement on the data standards to be used must be reached. This results to efficient collaboration among different eHealth stakeholders in accomplishing a number of goals like the improvement of the quality of patient care, reduction of medical errors, and therefore savings in terms both of human and financial costs [5]. A recent study by Lawrence explains the issues, challenges and opportunities towards EHR interoperability in Tanzania hospitals; the main concerns were privacy, security and confidentiality issues when considering information sharing and data sharing [12]. Hence it was important to know how far we are in eHealth standards adoption, systems interoperability and collaboration among eHealth stakeholders in our health sectors.

However, a well formation of the Tanzania health care system should provide opportunities for high quality and professional work with patients and long-term development, whereas relevant and reliable economic, administrative and medical data provided by eHealth should facilitate better quality planning, control and management of individual health care organizations and health care system in general. The focused question answered in this research is: what is currently existing in the Tanzania eHealth landscape? The main objectives of the paper is on analysis of activities and operations in the current eHealth landscape in Tanzania focusing on systems interoperability and collaboration between eHealth stakeholders. After the introduction, the second section of the paper presents the healthcare system of Tanzania’s mainland where we see the challenges in adapting eHealth standards in Tanzania. Our study and methodology is in the third section. Fourth section outlines analysis where findings deduced from analysis of activities and operations in the current e-health landscape in Tanzania is presented. Section five provides discussion. The last section is conclusion and recommendation where we provide some

recommendations for more effective further development and implementation of eHealth in Tanzania.

II. HEALTHCARE SYSTEM OF TANZANIA'S MAINLAND

Tanzanian mainland health infrastructure and healthcare services are categorized into four levels; primary level (village health posts, dispensaries, and health centers) to district hospitals, regional hospitals and finally, consultant /specialized hospitals [13]. About 90% of the population live within five kilometers of a primary health facility [10]. The first line care in rural areas is provided by Clinical Officers with 3 years of medical training or Assistant Medical Officers with additional 2 years medical training [14]. The introduction of mandatory health-insurance schemes for formal-sector employees, offering comprehensive health care benefits to their members, the largest being the National Health Insurance Fund covers civil servants, and on the other hand The National Social Security Fund for private formal-sector employees [15].

A. Challenges in Adapting E-Health in Tanzania

While the integration of ICT and healthcare has brought a lot of potential benefits, there are many challenges which affect its adoption in Tanzania. Different studies show that inadequate ICT infrastructure, unreliable electric power, low ICT budgets, Lack of coordination on ICT matters among ministries, departments, and agencies (MDAs), as well as partners, poor e-healthcare systems design, inadequate ICT skills on the healthcare workers to mention few, are the bottlenecks to the adoption of eHealth in Tanzania [8], [9]. As stated in the action plan report by the Ministry of Health and Social Welfare [10] current challenges to eHealth in Tanzania includes:

- A fragmented landscape of eHealth pilot projects and stakeholders
- Numerous data and health information systems (HIS) silos
- Lack of ICT infrastructure
- Lack of ICT workers, in particular those who are well trained
- Lack of coordination on ICT matters among ministries, departments, agencies (MDAs), and the lack of an architecture to guide the development of HIS bottlenecks.
- Lack of compliance with eHealth standards and systems interoperability

With these challenges the analysis of activities and operations in the current e-health landscape in Tanzania was inevitable.

III. OUR STUDY AND METHODOLOGY

A. Area of Study

This study was carried out in Dar es Salaam and Arusha, Tanzania. We consider more Dar es Salaam since it has more healthcare facilities as well as key informants from health care workers, preferably supervisors or staff in-charge in health institutions [16]. The analysis on HIS was carried out in

hospitals, dispensaries (health institutions) and some company that are involved themselves in developing health management systems.

B. Sampling and Data Collection

A cross-sectional study was deployed in eight hospitals, seven dispensaries and some company that are involved themselves in developing health management systems. Data collection included the use of structured questionnaires and interviews. Data was collected in order to analyze the current activities and operation in eHealth. Guided questionnaires were used to measure the intensity and strength of the factors associated with the current activities and operation in eHealth. Review of existing documents such as journal articles and official reports related to the topic under study was done.

C. Data Analysis

Statistical Package for Social Sciences (SPSS) was used for data analysis. We present the findings in tables for easy readability and interpretation of data. The significance was tested using a p-value of $p = 0.05$ with a confidence interval of 95%.

IV. ANALYSIS / RESEARCH FINDINGS

The analysis done on current health care delivery service, applicability of eHealth components and on some of existing eHealth solutions and systems focusing on collaboration and system interoperability, resulted into key findings that are presented in category wise as follows:

A. Existing eHealth Solution and Health Information Systems

Health service, particularly when considering eHealth (a case of applications and systems) involves several tasks (Reporting, collection, management, knowledge transfer or analysis of data to mention a few). Our examination, reveals the existence of various systems that are concentrating on collection, management and analysis of data, but which are not interconnected and inter-operable.

AllseeEHR system which is implemented in government hospitals in Kinondoni Municipal in Dar es Salaam, it is more about recording of patient information on reporting, but the emphasis is more on recording cash flow from different sectors, although patient history can be viewed once he/she provides his/her registered id but also it is neither inter-operable nor interconnected among the implementing partners. On the other hand, some open source software like OpenMRS and Care2x have been implemented in some areas for various purpose like management of HIV/AIDS, and for registration. LIS, JIVA, LMIS, DHIS2 and CTC2 are present health systems that are implemented in various health institutions but, they are not interoperable or interconnected either.

B. Distribution of eHealth Services between Rural and Urban Areas

In recent years there has been an increase in the number of health facilities in the country, so that the majority of the population lives within 5 km from a health facility. However, there are still geographical inequalities in access to health services [16].

In relation to geographical inequalities in access to health services (Between rural and urban areas) there is relatively higher support from various stakeholders in urban areas than in the rural areas [8]. This is in line with our findings where a number of health stakeholders prefer to settle their business in urban due to infrastructure problems present in rural areas. This increases the gap we see in access to health services and eHealth applicability between these two areas. As this stands, there is less effort by the government or other stakeholders in health to resolve the situation the challenge being inadequate resources.

C. Collaboration Among eHealth Stakeholders

Health sector involves a number of stakeholders covering from government, public/user, policy maker, healthcare professionals, Funders etc, who may be categorized differently. In this study, especially when considering collaboration among eHealth stakeholders, we have presented four categories as: developer, implementers, clinicians (Health care provider) and users.

The study revealed that collaboration among the mentioned categories do exist, however the lack of a standardized way (agreed upon tool) for collaboration among the eHealth stakeholders was found to be a big challenge. The result of chi-square test shows that collaboration among eHealth stakeholders level is significant ($p = 0.026$). Also we found out that, there is poor willingness towards collaboration among private companies or vendors who are involved themselves with developing of health management systems (when considering developers). Some of the reasons to this are due to business issues, and there is no initiative so far trying to call those companies together so that they can seat and reach an agreement on how to collaborate, tools for achieving such collaboration, business issues and policy to guide them in their collaboration. This would help to solve the two prior challenges. On that perception we asked the stakeholders (participants) about collaboration and tools used in achieving such collaboration. The results were as follows:

Table 1: Stakeholder's response towards collaboration and tools used in achieving such collaboration (N=102)

Category	Interviewed stakeholders	Number of collaborating stakeholders	Tools used (Per percentage % representation)				Total %
			Phone	Email	Phone and Email	Git / any CVS	
Developers	16	13	43.75	25	✓	12.5	81.75
Implementers	7	7	71.43	28.57	-	-	100
Clinicians	22	22	54.55	45.45	✓	-	100
Users	57	51	80.7	8.77	✓	-	89.47

Unreliability of the internet in most of the hospitals regardless of the presence of National ICT Broadband Backbone (NICTBB), results in information exchange by using emails to be less preferred compared to use of mobile phones. Looking into another angle, collaboration among private hospitals or private to government was found poor, that is the willingness of those parts to collaborate is poor. Some argued that they are doing business in which they compete thus it is difficult to collaborate with your competitor; nevertheless we present the view of health stakeholders on how collaboration is in their respective organizations.

	Frequency	Percent
Satisfy	42	41.2
Poor	36	35.3
Normal	24	23.5
Total	102	100.0

Table 2: Health stakeholder views on collaboration in their respective organization (N=102).

D. System Interoperability

As stated in a report by the Ministry of Health and Social Welfare (2013-2018) [10] that: Tanzania's HIS are faced with system interoperability problems. We found out that almost 62.5% of complexity in data integration and hence interoperability were in line with our hypothesis that "Interoperability fails because of lack of coordination at all levels of systems development. A well designed collaboration

architecture will facilitate coordination which, in turn, will lead to interoperable systems development". Also, the common use of open source systems which were not specifically designed according to our context and environment (Varying in health culture) being a source of fragmentation and lack of interoperability.

Lack of compulsory governance structure and standards to guide the development of eHealth systems across the health sector (an architecture, Security and Data dictionary) top up to interoperability problem [10]. With this remark, we observe different systems with different design and data structure which also add to system interoperability problem. Although the creation of a common data warehouse through integration of the diverse information systems into DHIS2 which deals with more data collection and analysis processes is the current focus, the awareness of interoperability and data standard adoption is still low among the health and ICT workers. As 55.9% of interviews personnel when asked about these two parallel things, their response was poor and the result of chi-square test shows that system interoperability is significant with $p = 0.004$.

V. DISCUSSION

This study reveals that the current eHealth activities in Tanzania mainland's are still faced with a lot of challenges involving systems interoperability and collaboration among eHealth stakeholders. Although there is an eHealth policy to direct what to be done and how, the situation is quite different in most health centers and hospitals. In most cases the reasons being inadequate ICT infrastructures, inadequate resources, poor ICT skills among health workers and budget limitation. These findings support the findings in previous studies [8], [9].

System interoperability is an important aspect towards achieving good health care service delivery [5]. As that fact stands, in our study, we found out that almost 86.3% of the systems are not capable of sharing information (or not interoperable). Several factors were recognized that are concerned with this situation, the common one being most of the systems are designed as per hospital needs and they differ a lot in their data structure or formats. However, querying multiple data sets with different format requires mediated schema which in turn requires scientists to have knowledge of the query syntax [17] that awareness to most of our health IT stuff is still low. We also found out that security and privacy concerns are associated with most of the organizations not willingly to share their data. This is in line with [12] who said that "Tanzania health consumers should be made comfortable by ensuring that the issue surrounding privacy and security of their health records are clearly addressed before taking any further step towards the implementation of interoperable EHRs for health information exchange". In order to deal with interoperability problems a common data standard must be agreed upon. "At the most basic level, the data standards are about the standardization of data elements: (1) defining what to collect, (2) deciding how to represent what is collected (by designating data types or

terminologies), and (3) determining how to encode the data for transmission" [18]. So where there is no data standards and data quality, interoperability is becoming a big challenge to handle.

On the other hand, our study reveals that 91.18% of interviewed eHealth stakeholders based on the level of collaboration as defined in this study are capable of collaborating regardless of what tools they are using to achieve such collaboration as shown in Table 1. When rating the existence of collaborating in their respective organization, the results were 41.2% are satisfied, 35.3% rate poor, 23.5% rate normal, respectively. Looking into tools for collaboration, we found out that phones were leading with 73% following with phone and emails 16%, emails 9% and 2% for version control specifically here we considered Git. These findings are consistent with some findings of previous study when giving an account on the adoption and use of ICT by healthcare workers, which report that "Over 93% of the health care institutions use mobile phones in this regard" [8].

Furthermore, we looked into the defined level of collaboration starting with developers from different health organizations (in most cases, they are under ICT department), we found out that they are aware of the existence of other tools like GIT or other versions control systems (VC) for collaboration, but there is no applicable tools so far among them for the purpose of collaboration due to a number of reasons mostly being issues surrounding privacy and security of their health records. This agrees with the study done by Ndume which reports that despite the existence of several collaboration tools naming them as Ning (aimed for network expansion), public library of science (knowledge expansion), Epic surveyors (remote functionality), Scribed (research promotion) as well as Skype, Wisser, Twitter and Facebook, some of the kits don't give researchers peace of mind with respect to security, intact and credibility of their work [17]. The situation is the same not only to researchers but also to other different health stakeholders. About 79% of interviewee showed that response, but this is a more traditional way of thinking that can be changed with proper knowledge on those tools and on how to customize them based on their requirements in terms of security and privacy. In the same way we considered the level of clinicians (Health care providers) and users, the interview with them revealed that they have an awareness concerning collaboration even though it is mostly done through mobile phones.

At this point we argued why mobile phones are more involved. The answers were obvious. Any member can buy a phone and found him or herself in one way or another using it as a tool for collaborating with other members in the field. Also, poor or inadequate ICT infrastructures in most of the hospitals resulting in the use of the mobile phone as a number one tool for collaboration. In addition, the "Tanzanian health sector is characterized by a fragmented landscape of ICT pilot projects and numerous data and health information system (HIS) silos with significant barriers to the effective sharing of information between healthcare participants" [10]. Hence it is clear that we have the problem of system interoperability and it was observed

during the study that in some cases collaboration out of using mobile phones or emails as a tool for achieving collaboration ,it was hindered simply because systems were not capable of sharing information and poor willingness towards collaboration among different health stakeholders due to some reasons revealed in this study. But regardless of several challenges under this area, the need of collaboration and connection of a widespread network of stakeholders within the health care system and between the different health stakeholders level is important, as it was reported in [19] that “Realization of health care sector goals of the vision 2025 needs collaboration of all the key stakeholders involved in health”.

This calls for proper technology improvements, especially when dealing with interoperability, collaboration, security and privacy issues, as health data information is highly sensitive and different health organizations have their own orientation, rules and policy. Although agreement on a mechanism for ensuring privacy and security of their health records, technological means and policy to be used may be reached, we must take into account that collaboration is something that cannot be forced but can be agreed upon.

VI. CONCLUSION AND RECOMMENDATION

In this paper we report about an analysis of current operation and activities in Tanzania mainland’s eHealth landscape focusing on interoperability and collaboration. Taking into account that analysis of activities and operation in eHealth landscape is an ongoing activity that needs time and resources, we selected key areas and features in order to meet the objectives and the reality of the situation on the field which was very important in this study. We found that it is important that the introduction of ICT curriculum or ICT training sessions targeting eHealth in health training institutions to health workers has to be considered. By doing this the awareness and effectiveness use of ICT among the health staffs will increase and facilitate its adoption by leveraging the presence of National ICT Broadband Backbone (NICTBB). There is a need for more effort by the government through the ministry in charge of the health sector towards collaboration by promoting this tradition among different health stakeholders. Also, different seminars regarding interoperability issues are to be organized aiming at increasing its IT literacy among health professions. On the other hand, inadequate support, budget limitation, security concerns and unreliable power supply were found to be the most common challenges facing the eHealth activities, a proper attention must be given to these challenges.

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A Review on Triangle Based Techniques in Biometric Gait Recognition

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Abstract: Biometric system is an analysis of unique biological features of human being. The purpose is used for human security and identification. Different conventional biometric (such as face recognition, iris, fingerprint, etc.) methods are used for security and identification purpose, but they can capture only by physical control or at a close distance from record search. Gait on a behavioral biometric has attracted more attention recently because it can capture at a distance with requiring the earlier consent of the observed object. This survey paper covers the current trends and method of Gait based surveillance system using triangle methods and compare them.

Keywords: Biometric, Gait Recognition, Image Processing, Triangle methods, Pattern Recognition.

1. INTRODUCTION

As the world is getting advanced and computerized so the security system which were earlier human controlled [1] are being replaced by a computerized surveillance system. Which is based on image processing. It is used in this system to identify the unique physical property that means Biometric property of a person, Biometric characterized into two portion physiological properties (face, fingerprint, iris, DNA) and behavioral property (signature, voice, walking pattern).

Previously, biometric research concentrated on human authentication and authorization, utilizations face images, fingerprint, palm prints, shoe print, iris, images and handwriting. But these conventional biometric resources suffer from several limitations such as distance between the camera /scanner and people, people (user) co-operation will consider for authentication and authorization.

For visual surveillance applications, the conventional biometrics resources are difficult to utilize and gait provides in an interesting way. A gait describes the manner of a person's walking i.e. walking pattern recognition. It can be acquired at a same distance and it is necessary without the walker's co-operation or knowledge

that's why this method represents as a further security system. One of the methods which are used to make such examination is gait. It can be done by Genetic Algorithms (GA), Artificial Neural Network (ANN), and mathematical concepts (geometric) by using Gabor system. In a previous study [2] the body is divided into two parts the static or fix (upper part) and dynamic or more movable than upper part (Lower part). The upper body part is subdivided into three parts, the first part is the head, the second part is arm the third part is the chest and the lower body part is subdivided into 4 parts, the first part is thigh, which includes hip, second part is the front leg, the third part is back leg and the fourth part is feet. Gait has mainly worked done in the lower body part because the lower portion of the body moves more than upper part so study of moving parts is easy. The front-leg and back-leg are included as separate parts because of the bipedal (cycle) walking style. When a person walks the left leg and the right leg come to front/back by turns and create a cycle.

This survey paper is divided into five sections, one contains an introduction, the second contains an overview of biometric recognition system, section three contains literature contents studied, section four contains comparisons of the triangle techniques based on studied in literature survey and section five contains the conclusion.

2. OVERVIEW

An informative survey of the current analysis techniques to data regarding human movement has been outlined by Gavrla [3], In his work has done visual analysis, looking at gestures and whole body movement. His survey gives results to recognize human and their activities by computer to interact intelligently and effortlessly with a human inhabited environment.

In this basic biometrics surveillance system has following component:

Capture video: The video is captured by high quality digital cameras.

Convert into frames: Videos are converted into various gait frames in one cycle, according view here side view.

Analysis of each frame based on the approach: Each frame is analyzed depends upon the method which is used.

Correlate as a Triangle Feature: In this component new data are stored in the database and if existing values are found, then result is decided.

Correlate as a Triangle Feature: In this component new data are stored in the database and if existing values are found, then result is decided.

Database: Here the data are stored.

Result: Based on input, output is generated.

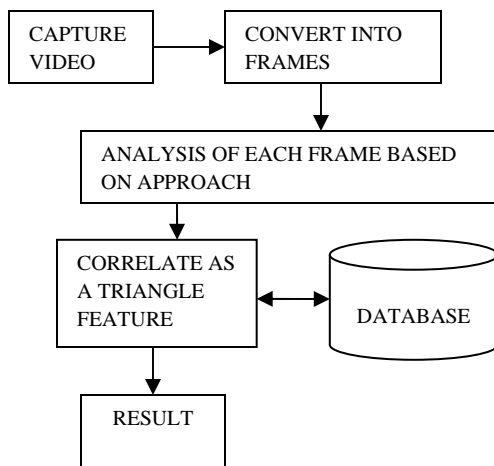


Fig.1 Basic biometrics surveillance system for triangle approach

3. LITERATURE SURVEY

In this section we are discussing an approach with different fields. Positioning body joints based approach, Angels based gait detection approach, area of triangle based approach, A Novel Method of Gait based recognition Using Fuzzy Inference, System Gait Geometric Characteristic and Fuzzy Logic based approach.

3.1 Position joint base human body detection: In [4] gait recognition means identify individual persons or subject by analysis of patterns generated in each frame of cycles. Gait recognition is to identify individuals by the way people walk in no consideration of the disturbance such as background, clothes and so on. In the view of biomechanics, the walking of people includes the synchronous movements of hundreds of muscles and joints. Gait is completely determined by the structure of muscle bones. By which all people's movements are based on

biped patterns, the gait of each one is different in relative time, step range and so on. So gait is believed to be particular for everyone and can be used as a feature in personal identity recognition, especially in the distance. In this paper they used simple gait recognition method which is based on different points on body joints. In this work they first extract the human or subject frames from of moving bodies in the form of silhouetted images from a given image. Silhouetted means the black or carbon images contain only black image [4]. In that image, 12 different body points identified by them and compute 9 different angles between those points. The angles are angles between trunk called the trunk angle, angle of left arm, angle of right arm, angle of left forearm, angle of right forearm, angle of left thigh, angle of right thigh, angle of left shank and finally angle of right shank.

Then they calculated limb angle. After that, made discrete Fourier transform for each cycle. Two different frequencies, amplitude, frequency and phase frequency of angles are chosen. Finally, apply the nearest neighbor classifier that is used to classify subjects from the database. In their work they used "SOTON" Dataset for simulates their results. The SOTON data set has 118 total images. From those images in their work they used 10 images and give Correct Classification Rate (CCR) 78%, which had better results than other methods which were presented that time like Body shape and template correlation (CMU) which correct classification rate was 45%, Static body parameters (Georgia Techniques) which CCR was 73%.

3.2 Angels based gait detection: In [5] gait recognition angle based gait detection is important and more efficient than other method. In this work they used two body part of the human as a feature extraction and according to those features of the human body the calculation is done. They had taken three lower parts of the body those all features were from lower because maximum movement is done in lower portion. Here in their work they took both the foot (left feet and right feet) to be more specific they used center point of feet from base as a third party hand which is visible in side view are taken and construct a logical angle. Forgiven angle gait recognition has been considered two features of the human body that is hand and feet for gait recognition is considered. To be more specific center point of base of both feet is taken as vertices of the triangle which will be found using the hand as a third vertex. They calculate [5] the formed angle by the slope method in that method they used tangent formula. They calculated three angles for each frame and after completion of one cycle mean value were calculated.

A cycle is a formed one when a person whose walking [11] posture is being captured reaches to the posture which is same as starting posture of the person. In this paper they focus on angle based analysis and appear the method on CASIA A database in which side view

images are given. They have taken some (17) subject images and calculate the angles for each frame for one cycle and after calculation there correct classification rate was 90% which is more efficient than other methods.

3.3 An approach for human gait identification based on the area of a triangle: In [6] biometric system data to be collected and given as a video input. So, in the preprocessing initial video is captured, and then converted into frames for that particular person. In this work they have considered side [10] view of particular subjects. Here they have considered three parameters of the human body for feature extraction. It is Left hand, right feet and left feet. They consider three feature points. The feature points are taken as a white dot point which represent high resolution. They create a triangle between extracted points. They calculated the length of each edge total three edges are captured [6] edge 1 (a), edge 2 (b) and edge 3 (c) and then for all the frames of one cycle, the mean values of edges are calculated and the stores to those values in database.

Here they calculate correct classification rates for both analyses. The First is for individual distance classification and second is for pair distance correct classification. This experiment demonstrated that a feature selected of a by pair distance gives better result than individual distance. The result shows the correct classification of the first method is 66.6% and the correct classification of the second method is 82.3%. It has been concluded that second analysis they have given better classification rate.

3.4: A Novel Method of Gait Recognition Using Fuzzy Inference System: In [4] this work they used body joint method. Here five different three body parts were taken. The body parts were left feet, right feet and hand. Total five feature points were extracting two points in left feet (toe and ankle) and two in right feet (again toe and ankle). They construct 2 triangles first are between left feet toe, hand and right feet toe and, second between the left foot ankle, the right foot ankle and hand. Here they observed that both triangles were intersecting and two intersecting points generate. They computed those intersection points by parametric line equation. They calculate those points for each frame for each cycle and find the mean value for each cycle and stores in the database. This experiment is all based on the condition of the outdoor gait database environment of various subjects using a side view of the walking direction. After applying the algorithm on this database the correct classification rate is 90%, which result is good as compared to other methods.

3.5 Gait Recognition with Geometric Characteristic and Fuzzy Logic: In [7] the definition of Gait is defined as "A particular way one person walks". It is a process which is divided into stages [8]. Analysis of walking pattern is a gait cycle. The style of walking or gait cycle of every person is unique. [9]. Human gait is the repeated motion of the body parts. Mostly there is no much more changes in head and shoulder motion as compare to hand and legs. The repeated motion part of the body forms a gait cycle. A Gait cycle or stride is defined as a movement when an initial position of a heel comes back again. The single gait cycle is further divided into two phases: In the proposed method two parameters of human bodies have been taken. The First component is hand and another component is feet. The Second parameter is subdivided into two portions it is toe (left and right feet) and (left and right feet). Total five extraction points were identified. The extraction points were decided by high resolution white points. Here two triangles were formed between these five points and those triangles constructed between the toe of left feet, hand and toe of right feet and heel of left leg, hand and heel of right leg. Here two intersection points were taken [7] for study and points are known as I and I'.

The triangle is constructed where point A represent Hand and point B, C represents toe of the left feet and toe right feet respectively, point D, C represents heel of left feet and heel right feet respectively. In this work they calculated the intersection points for each frame and then calculate for a complete cycle. Then mean values were calculated. These mean values were input of fuzzy inference systems. FIS compare and produces results with the database values according to the following fuzzy rules: Result analysis is done on CASIA dataset for gait recognition of the proposed method. In a proposed work 17 subjects had been taken with 23 frames, which complete the gait cycle, only one side is considered. 17 subjects of MPEG files are converted into JPEG frames, then white dots pixels are inputted on RGB frames of an individual subjects in a proposed gait system after that, these RGB frames are converted into gray scale for further processing, with the database value, if the value is greater than 85% then matching is excellent, value belongs between 75 to 85%, then matching is good, value lies between 60 to 75% and matching is average, if value is less than 60%, then matching is poor, these rules are decided by the fuzzy set and the result shows that the correct classification of this method is 88%.

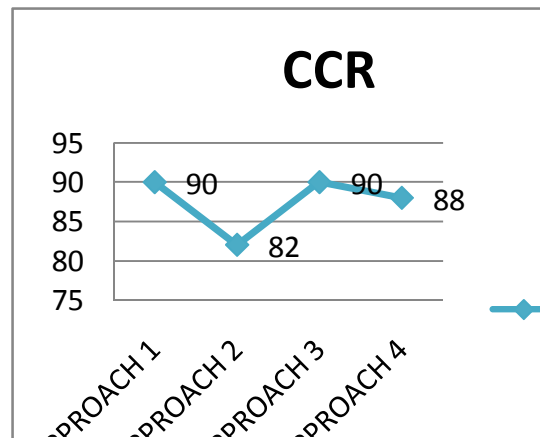
4. COMPARISON

After reviewing different papers and work on these approaches, the correct classification rate (CCR) obtained by different researchers in field of triangle based gait can be summarized as following table which results are shown in the table on the basis of their CCR rates and number of people under surveillance.

S.No.	Approach	No. of Persons under Surveillance	CCR
1.	Angels based gait detection	18	90%
2.	An approach for human gait identification based on area of triangle	18	82%
3.	A Novel Method of Gait Recognition Using Fuzzy Inference System	18	90%
4.	Gait Recognition with Geometric Characteristic and Fuzzy Logic	15	88%

Table 1: Comparison of Various Approaches

The table 1 indicates that the result of Method based on positioning body joints [4] A Novel Method of Gait Recognition Using Fuzzy Inference System and Angels based gait detection gives the same result which are best result among the above other mentioned methods basically these methods used the concept of fuzzy interface and angle based recognition respectively. At first, they verified the usefulness of the algorithm on the gait database established which includes 18 different subjects. Furthermore the experiment is all based on the condition of side view images. Other methods have also good results, but methods for calculating the area or angle change results. Here we are giving comparison chart between methods and their CCR rate in percentage where CCR is correct classification rate.



5. CONCLUSION

In this review paper, we present a comparison between different approaches the techniques which are based on triangle of different body parts. In this review paper, we discussed only lower body part analysis. Here we took those work which is based on common components. All techniques used triangle based method they construct triangle by feature extraction and then recognition is done by various methods. By this review paper, it has been observed that the angle based gait detection and novel method give the same results.

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Methodology of Assigning Musical Notations to Sanskrit Verse

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Abstract— Sanskrit literature is unique in its overwhelmingly poetic character. The subjects like science, engineering, medicine, grammar and law are mostly written in the form of poetry which makes them easy to memorize. The Sanskrit poetry, comprised of Shloka or Verse, is classified in terms of unique meter or Vrutta. Vrutta is the unique pattern formed by the categorization of letters as long and short syllables. Depending on the rule based Vrutta identification in the verse, the rhythmic enchanting of the Shloka is facilitated. This paper discusses the method of identification of Vrutta in Sanskrit Shloka and suggests the musical notations based on identified Vrutta, for singing the Shloka. The designed system “Sangit Vrutta Darshika” can be used as a guide to learn the construction of Sanskrit verse. It also facilitates the systematic singing of Sanskrit Shloka which has applications in areas like Music Therapy.

Keywords-Grammar, Long syllable, Meter, Metrical classification, Short syllable, Natural Language Processing, Sanskrit, Shloka, Vrutta.

I. INTRODUCTION

Of all the discoveries made in the course of human history, language has been the most significant. Without language, civilization could not have been progressed. Languages have been used as a means of communication since ancient times. Presently, the basic language structure has found a new horizon of machine-communication in the form of modern computer programming languages. Since digital computer is the only machine which requires some form of language construct for its efficient operation, Computational Linguistics, which deals with typical characteristics of such constructs, is a rapidly developing field. This scientific outlook at various language structures, led to the recognition of importance of Sanskrit by scientists world- wide. Sanskrit is one of the oldest and living languages on our planet. Research organizations like NASA have been looking at Sanskrit as a possible computer language [1]. Sanskrit is the systematized language of rich classical literature and its alphabets are impeccably arranged, easy to remember. The grammar and syntax of Sanskrit language are perfect, leaving little room for error. Sanskrit is the most efficient natural language for certain computer applications

development. The well-knit (i. e. syntactically and semantically strong) structure of this language, has encouraged current research. Sanskrit is a very scientific language. Its entire grammatical mechanism is perfected. From this perspective, Sanskrit grammar studies have received serious attention about the truthful representation of communication worldwide.

Fig.1. shows various areas of Sanskrit Literature addressed by computer.

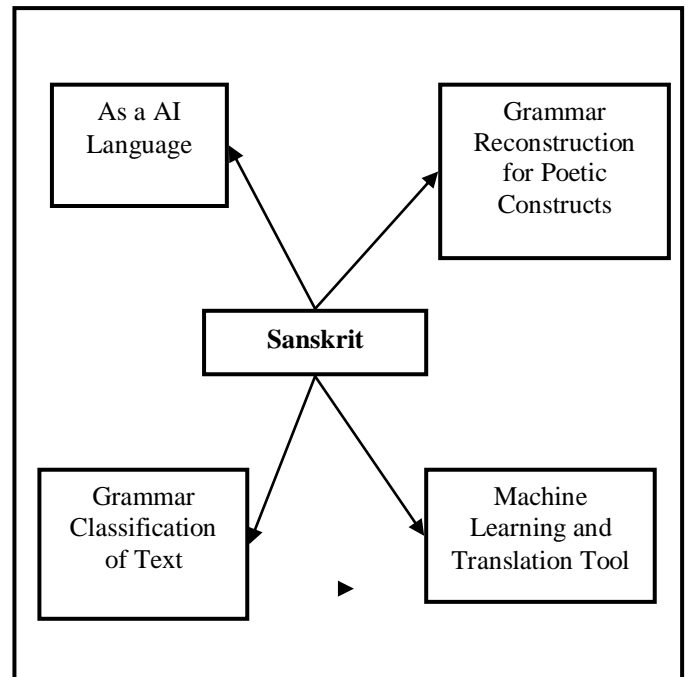


Fig.1. Various areas of Sanskrit addressed by computer

The legendary Sanskrit grammarian of 5th century BC, Panini is the world's first computational grammarian. Panini wrote Ashtadhyayi (the Eight-Chaptered book) [15], which is considered to be the most comprehensive scientific grammar ever written for any language. Many approaches were proposed by scientists and grammarians world-wide, to extract the richness of Sanskrit language in various contexts.

The Sanskrit poetry, comprising of Verse or Shloka is classified in terms of its Meter or Vrutta. Indian scholar and musical theorist Pingala, in his Chhanda Sutra, used the marks indicating long and short syllables to indicate meters or Vrutta

in Sanskrit poetry. More than 150 Vrutta exist in different poetic forms. Depending upon the rule based Vrutta identification in a given verse, the way in which the verse can be sung is decided.

Rhythmic chanting of the Shloka or Verse enhances the capability of memorizing the Shloka. According to Mantra therapy when the Shloka's are rhythmically chanted they have wonderful effect on our body. With this context difficulties are generally faced by common people who are unaware of these rules but want to sing the verse correctly.

Our research specially contributes for addressing this problem by providing a system which will facilitate the people who are unaware of the construction rules of verse but want to learn them and sing the verse correctly.

The paper is organized as follows: In section II we discuss related work in computational processing of Sanskrit language. Sections III and IV explain the designed system and implementation details along with the example. In section V we conclude the work and propose the future directions.

II. RELATED WORK

Rick Briggs [1] proposed how Sanskrit as a natural language can serve as artificial language also. He states comparison between semantic net and method used by ancient Indian Grammarians to analyze sentence. Parallelism between two is also analyzed. Consider the example of the sentence "John gave ball to Mary" The action involved is "to give", but there also exists the intermediate or auxiliary actions such as John is holding the ball in hand which is a starting point and the ball will go in Mary's hand which is the end point.

Auxiliary activities (karakas) are stated in Sanskrit by means of seven case endings. i.e. agent, object, instrument, recipient, point of departure and locality. Consider example sentence as "Out of friendship Maitra cooks rice for Devdatta in pot, over a fire".

In the triple form the sentence can be written as –

Cook, agent, Maitra

Cook, object, rice etc which is very similar to approach of computer processing. The Sanskrit sentence for the same is written as

Maitrah: Sauhardyat Devadattaya odanam ghathe agnina pachati.

Also in both the language representations the activities are considered as events. For ex. instead of cooking it is considered that activity is going on which is cooking.

Rama N. and Meenakshi Lakshamana [2] proposed the approach for the issue of rule based division of Shloka considering the fact that Sanskrit verse is sequence of four quarters. Each quarter is classified either by the number of syllables (akara-s) or the number of syllabic instants (matra-s). The determination of meters is based on either of these factors. Meters based on the first factor are called *Varna* meters, while those based on the second are termed *jati* meters. In *Varna* Meters, two types of syllables are present –the long (Guru)

and the short (Laghu). The algorithm is written which converts the Sanskrit verse into binary form considering only the long and short syllables in it. The second algorithm will classify the verse by splitting it in two parts and categorizing it in Sama, Ardhasama and Vishma meter. The disadvantage of this approach is, the number of meters in actual use across the literature is limited to a smaller number than the number theoretically possible. Hence, this work handles the meters in vogue, which indeed themselves constitute a sizeable quantity and pose non-trivial computational problems.

Aasish P., Ratna S. [3] proposed the approach of analysis of Sanskrit grammar for Machine Translation and Tokenizer which provides solution for "Samaas Vighraha". For parsing Sanskrit sentence two major factors are considered regarding complexity of words. "Sandhi" which is combination of two words to produce new word and "Samaas" which is combination of two words depending on their semantics.

While designing the parser, rules are to be defined which are based on some of the factors like Part of speech (POS), List of words, Case end and begin and Declension

Some of the actions or functions are

1) SetDecl (Declension case for specified token)

2) Add before (add a string before a specified token) etc. The rules are stated for dissolving Compounds. The input to the parser "Vaakkriti" is a Devnagri text and output of the system is the set of tokens produced after Compound Dissolving.

The above stated system will fail to produce the required output when a Sanskrit poem is given as input. A Sanskrit poem conveys more than one meaning and sometimes figure of speech is used, which makes it more complex.

G.Huet [7] has proposed the method for Sanskrit processing by computers. The software is proposed which analyses the Sanskrit sentence depending upon the possible interpretations of Sandhi analysis. Sanskrit lexical database is constructed Two-tape transducer is modeled for Sandhi analysis. In Sanskrit text, as the words are not separated by blanks and punctuation symbols, but are merged together by external Sandhi. Thus segmentation is done. Further lexicon directed segmenter is extended into a tagger.

Subhash Kak [9] describes the classification schemes for meters from Vedic age. Sanskrit meters are based on the system of short and long syllables, represented by 0 and 1. Meters has different lengths. In Chandashastra, Pingala have stated two basic schemes of representing meters which indicates the octal representation. The representation of verse-foot is given depending on number coding of three syllables, but order of bits is reversed from modern representation. In Katapayadi (KTPY) notation numerals are represented as letters of alphabet. It shows the irregularity of mapping the numerals above three, which is not present in Pingala's mapping. The author has given the construction of the mapping behind Pingala scheme, analogues with KTPY notation, called as Katyasadi (KTYs) notation.

Anoop M. Namboodiri, P.J. Narayanan and C.V.Jawahar [13] have proposed a framework to use rich metric and formal structure of classical poetic forms for post-processing a recognizer like OCR engine. They have proposed the algorithm for processing of poetry. The proposed algorithm can be used in conjunction with other post processing approaches and for correction of modifier symbols, difficult to recognize for OCR.

The existing approaches propose to mark Laghu and Guru but do not talk about the classification and generating musical notations for the input.

III. SANGIT VRUTTA DARSHIKA

In ancient Indian Poetry total dominance exists in oral tradition. The reason behind this is ease of memorizing verses. To compose the lines of Shloka the rules are designed. The set of these rules form set of structures. These rules are known as Vrutta. Each Vrutta can be identified by unique pattern of letters or *akshara*. The Vrutta are mandatory rules in the poetry. Sanskrit Shloka is comprised of quarters or Charan.

There are two broad categories of Vrutta which exists in Sanskrit Shloka: Gana Vrutta and Matra Vrutta.

In Gana Vrutta each Charan in Shloka has similar number of letters, having same number of Laghu and Guru so it is also known as Akshar Gana Vrutta.

In Matra Vrutta the number of letters in each Charan may not be identical, and each short syllable will be assigned value 1 and long syllable will be assigned value 2. Depending on sum of Matra in each Charan the Vrutta will be identified.

The designed system “SANGIT VRUTTA DARSHIKA” emphasize on the method of classification of Sanskrit Shloka depending upon identified Vrutta. The Vrutta we have considered falls in the category of Akshar Gana Vrutta. The functionality of the system can be understood by the block diagram given in Fig. 2.

As shown in the figure, the input to the system is a Sanskrit Shloka in Unicode format. The identified Vrutta and Musical notations in text and audio format will be displayed as an output.

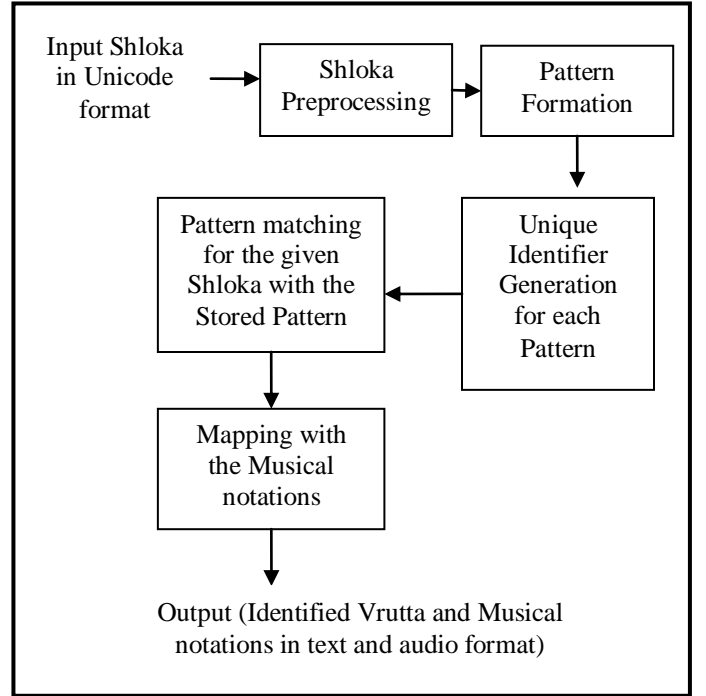


Fig.2. Block diagram of the system

Mathematically the system is presented of a function $f(x)$, where $f(x)$ is a function for Vrutta identification and determination of suggested Musical notation for given Shloka. The objectives of this function are to Search Akshar Gana Vrutta from Shloka and to specify the suggested musical notation according to the Vrutta identified. The input Shloka has constraint that it must contain Akshar Gana Vrutta as classification scheme. Consider S be the system that describes the problem

i.e. Let $S = \{ \{I\}, \{O\}, F_v, F_n, S_c, F \}$

Where

$I = \{ S_1, S_2, \dots, S_n \}$ ---- Set of Sentences

Each $S_i = \{ W_1, W_2, \dots, W_n \}$ ----Set of Words

$S_i \in I \quad \forall W_i$ separated by ‘ ‘

And $W_i = \{ L_1, L_2, \dots, L_n \}$ -----Set of letters

$\forall L$

$G_i = \{ L_{i+1}, L_{i+2}, L_{i+3} \}$ Where $i=0, 3, 6, 9, 12, 15$

Assign $L = 1$ for Guru or Long syllable

And $L = 0$ for Laghu or short syllable

$\forall L$

If $\exists L_i \in \{ \{LV\} \vee \{ \{SL\} \text{ with ‘ i ’} \} \vee \{ \{SL\} \text{ followed by ‘:’} \} \vee \{ \{SL\} \text{ followed by ‘\u0305’} \} \vee \{ \{SL\} \text{ followed by ‘ \u0309 ’} \} \}$

$L_i=1(\text{Guru})$

where $L_V = \{ \text{आ ओ ई ऊ ऐ } \}$

$L_S = \{ \text{क ख ञ } \}$

Else if $\exists L_i \in \{ \{SV\} \vee \{SV \text{ followed by ‘\u0305’} \} \}$

$L_i=0(\text{Laghu})$

where $SV = \{अ इ उ\}$

If Laghu letter is followed by Jodakshar then consider that Laghu letter as Guru.(example: In the word “जगदम्ब” “म्ब” is a “Jodakashar” and “ द ” is a Laghu letter. According to the rule stated it will be marked as Guru. “Jodakashar” is considered as Laghu and if followed by “visarga”, “anusvar”, “kana”, “dirgha velanti” should be considered as Guru.(for example: In the word “चन्द्रा”. “न्द्रा” will be marked as Guru as it contains Jodakshar followed by “kana”)
If Dg is database of ‘Gana’

$$D_{gi} = \{D_{g0}, D_{g1}, \dots, D_{g7}\}$$

Where

$$D_{g0} = \{000\} = न - 000$$

$$D_{g1} = \{001\} = ष - 001$$

$$D_{g2} = \{010\} = ज - 010$$

$$D_{g3} = \{011\} = य - 011$$

$$D_{g4} = \{100\} = भ - 100$$

$$D_{g5} = \{101\} = र - 101$$

$$D_{g6} = \{110\} = त - 110$$

$$D_{g7} = \{111\} = म - 111$$

$$\forall G \exists Gi \in G$$

$$\text{if } Gi \in \{Dg0VDg1VDg2V\dots VDg7\}$$

Where $i=0$ to 7

Let V is database of Vrutta names.

$$\text{Where } V = \{S_0, S_1, \dots, S_9\}$$

$$S_0 = \text{Shardulvikidit} = \{\text{Pattern of Shardulvikridit}\}$$

$$S_1 = \text{Mandakranta} = \{\text{Pattern of Mandakranta}\}$$

$$S_2 = \text{Bhujangprayat} = \{\text{Pattern of Bhujangprayat}\}$$

$$S_3 = \text{Prithvi} = \{\text{Pattern of Prithvi}\}$$

$$S_4 = \text{Shikharini} = \{\text{Pattern of Shikharini}\}$$

$$S_5 = \text{Stagdharma} = \{\text{Pattern of Stagdhara}\}$$

$$S_6 = \text{Hansagati} = \{\text{Pattern of Hansagati}\}$$

$$S_7 = \text{Vasantilaka} = \{\text{Pattern of Vasantilaka}\}$$

$$S_8 = \text{Malini} = \{\text{Pattern of Malini}\}$$

$$S_9 = \text{Indravajra} = \{\text{Pattern of Indravajra}\}$$

$$\text{if } \exists G \in V$$

$$G = \{S_0 \vee S_1 \vee S_2 \vee \dots \vee S_9\}$$

Let N be set of notations in Hindustani music notations in text and M is set of Music files having three different music files, wherein two files of different energy levels suitable for male and female voice recorded using violin and 1 vocal file of the popular Shloka or Subhashit in that particular Vrutta.

$$\text{Where } N = \{N_0, N_1, \dots, N_9\} \quad M = \{M_0, M_1, \dots, M_9\}$$

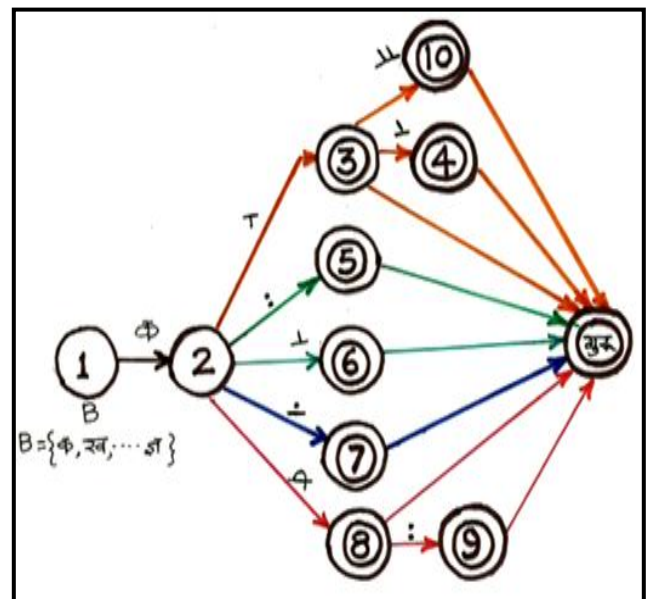
If $Gi = Si$, Display Si, Ni, Mi where $i=0, 1, 2, \dots, 9$

The sample words as examples of Gana are given in Table.1. “U” is the symbol used for marking Laghu letter and “_” is the symbol used for marking Guru Letter [14]

TABLE.1. LIST OF GANA WITH EXAMPLE

Gana Name	Gana Formation	Example
य	UU - (011)	यमाता
म	--- (111)	मातारा
त	--U (110)	ताराज
र	_U_ (101)	राजभा
ज	U_U (010)	जभान
भ	_UU (100)	भानस
न	UUU (000)	नसल
स	UU_ (001)	सलगा

Figure 3 illustrates a method of finding a Guru in the Sanskrit Shloka



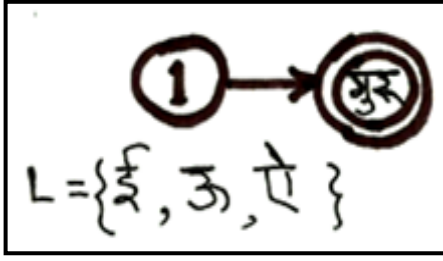


Fig.3. Rules of marking Guru

Figure 4 illustrates a method of finding a Laghu in the Sanskrit Shloka

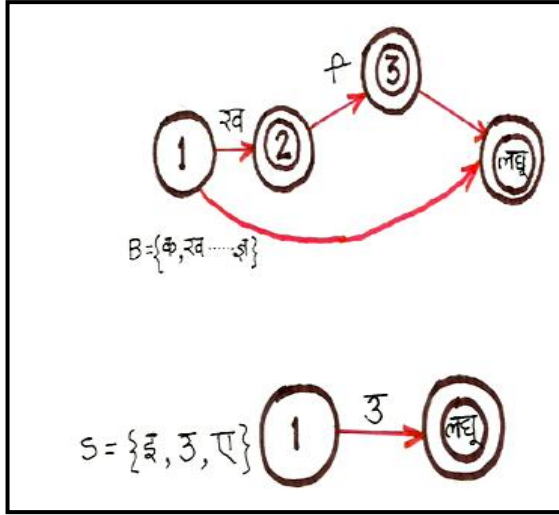


Fig.4. Rules of marking Laghu

IV. IMPLEMENTATION DETAILS

The overall flow of system implementation can be understood from the block diagram in Fig.5

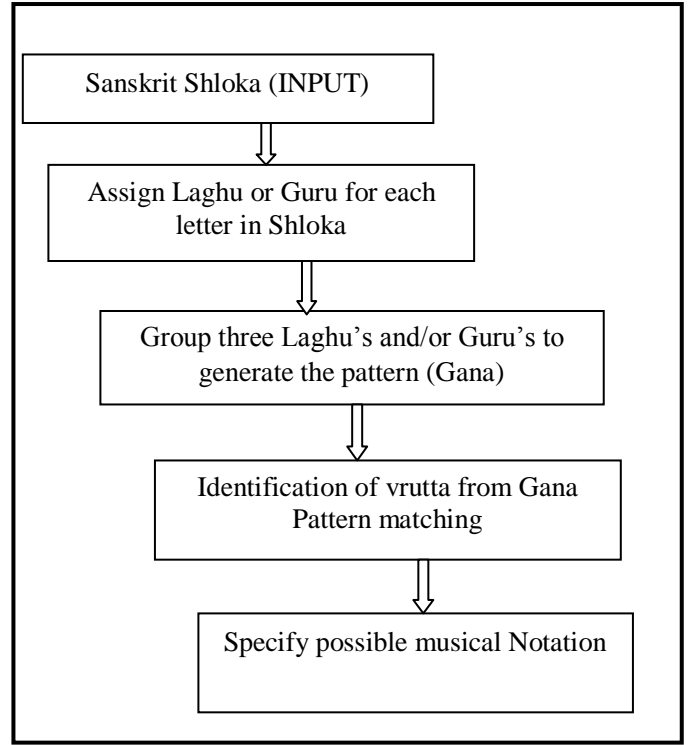


Fig.5. Implementation flow of the system

The designed system accepts Sanskrit Shloka in Unicode format. Unicode provides a unique number for every character irrespective of the platform and the language. UTF-8 encodes each Unicode character. Once the Shloka is stored in UTF-8 format, following process will be carried on:

1. Laghu or Guru is assigned to each letter according to grammar rules.
2. The Shloka is divided in groups called as Gana, where each group or Gana consists of combination of Laghu and/or Laghu and Guru. Depending upon the Laghu, Guru assignments within a Gana, each Gana will be assigned a unique identifier. The identifier is a unique alphabet or *akshara* for a specific gana.
3. Ones identifiers are assigned to Gana for input Shloka their pattern is checked with the specific Vrutta pattern.
4. If the pattern matches then it's a success case and the Vrutta is identified as an output. The system can be explained with the help of following example:

Consider the Shloka:

रामो राजमणिः सदा विजयते राम रमेशं भजे

The stepwise analysis of the above Shloka will be done as follows:

Step 1	रामो रा	जमणिः	सदा वि	जयते	रामं र	मेशं भ	जे
Step 2	- - -	UU -	U- U	UU -	- -U	- -U	-
Step 3	11 1	0 0 1	0 1 1	0 0 1	11 0	11 0	1
Step 4	म	स	ज	स	त	त	ग

TABLE.2. LIST OF CLASSIFIED VRUTTA

Sr. No.	Vrutta Name	Gana Pattern
1	Shardulvikridit	म स ज स त त ग
2	Bhujangprayat	य य य य
3	Prithvi	ज स ग स य ल ग
4	Shikharini	य म न स भ ल ग
5	Stagdhara	म र भ न य य य
6	Hansagati	न ज ज ज ज ज ल ग
7	Vasanttilaka	त भ ज ज ग ग
8	Malini	न न म य य
9	Indravajra	त त ज ग ग
10	Mandakranta	म भ न त त ग ग

1. In step 1 the input Shloka is divided into groups called as gana. Each gana consists of 3 letters.

2. In step 2 Laghu (U) and Guru (-) assignment for each gana is done according to following rules:

Rules for marking Guru

a. Short syllables (क . . . ङ) followed by {।, े, ः, ि, ै, ी, ी } are considered as Guru.

b. {इ ऊ ऐ } are considered as Guru.

Rules for marking Laghu:

a. Short syllables (क . . . ङ) are marked as Laghu.

b. Short syllables (क . . . ङ) followed by {ि } are marked as Laghu.

c. {इ उ } are also considered as Laghu.

3. In step 3 all Laghu's are assigned number 0, and Guru's are assigned number 1.

4. In the next step a unique alphabet or *akshara* is assigned to each gana according to the order of Laghu's and Guru's appeared in that group.

The occurrence of *akshara*'s in the fixed order yields to identification of particular Vrutta.

In the example explained above the Vrutta 'Shardulvikridit' exists, which can be identified by the fixed pattern of Gana identifiers

{ म स ज स त त ग }

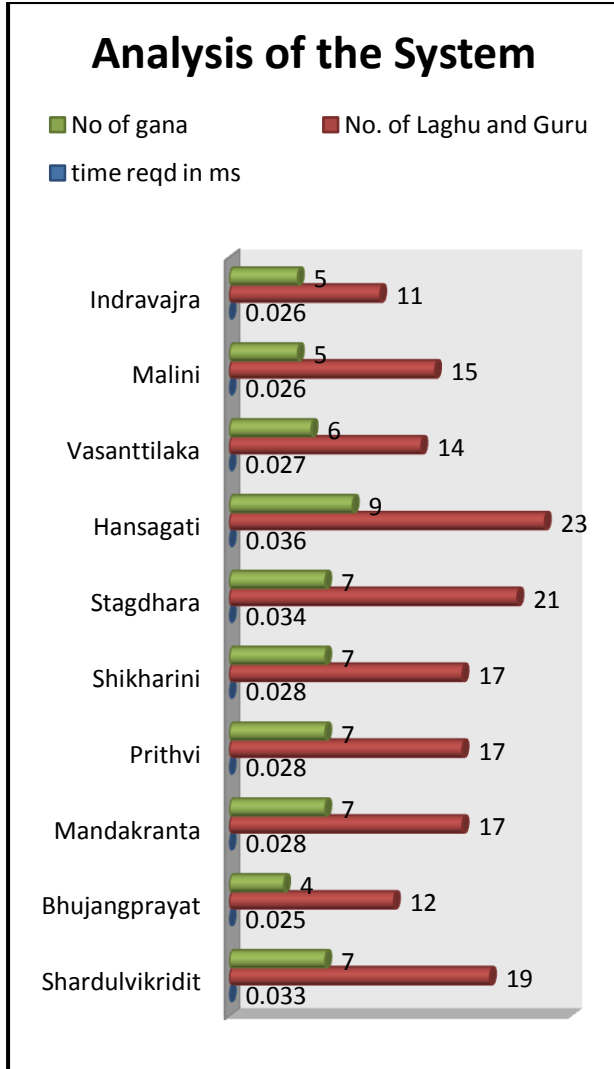
After identification of Vrutta the possible musical notation are displayed to the user and audio file is played according to choice of energy level of user.

In Sanskrit Literature more than 150 Vrutta exist. For illustration, analysis of ten Vrutta's by the designed system is shown in Table 2. The table shows the Vrutta

names and Gana patterns for that Vrutta.

The designed system will analyze the Vrutta and provide the output. The system gives the identified Gana, the Vrutta in Shloka. It also gives Musical Notations in Devnagri and according to choice of the user; the audio file of specific energy level will be played. The example of Vrutta identification is given below along with the snapshots.

TABLE.3.RESULT ANALYSIS



From the graph shown in Table.3 it can be observed that the time required for identification of particular Vrutta depends on the number of Laghu's and Guru's in the Shloka.

V. CONCLUSION

Besides being a mathematical and scientific language Sanskrit is also helpful in speech therapy. Rhythmic chanting of Shloka creates melodious effect in body, known as Neuro-linguistic effect. Also meaningful chanting generates the effect called as Psycholinguistic effect. In this paper, system for identification of Vrutta is stated along with the suggestions for possible musical notation for particular Vrutta. This would be useful for the users who are unaware of the construct of Sanskrit Shloka and relationship between Vrutta and singing pattern of Shloka. The system would also be considered as a guide to

understand Akshar Gana Vrutta identification by Gana formation. Ten Akshar Gana Vrutta's namely Shardulvikridit, Bhujangprayat, Prithvi, Shikharini, Stagdhara, Hansagati, Vasanttilaka, Malini, Indravajra, Mandakranta are focused on for identification. Along with identification of Vrutta possible musical notation, suitable for singing Shloka of particular Vrutta is suggested. The choice is given to the user to play the audio file according to his/her comfort of energy level of singing. The system can be further enhanced for other types of Vrutta.

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Designing High Bandwidth Connected E-H and E-Shaped Microstrip Patch Antennas for S-band Communication

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Abstract—This paper represents designing & analysis of high bandwidth Connected E-H and E shaped microstrip patch antennas. RT Duroid 5880 dielectric substrate material is used to design these antenna. A simulation tool, Sonnet Suites, a planar 3D electromagnetic simulator is used in this work. To fed patch antennas, co-axial probe feeding technique is applied. The proposed antenna can provide impedance bandwidths are of 50% and 56.25% of the center frequency. The result shows that return loss is under -10dB. Applications for proposed antennas are specially in the satellite communications.

Keywords- Bandwidth, Connected E-H shaped Patch antenna, Dielectric Thickness, E-shaped Patch antenna, Return Loss Curve, S-Band, Space communication.

I. INTRODUCTION

The rapid growing development in the area of wireless communication leads to the miniaturization of the device size along without compromising good operational capabilities. The antenna is one of the basic need for any wireless communication. To use antenna in the reduced sized communication device, the antenna structure should also be trimmed without affecting its quality of performance. In this regard, Patch antenna plays a vital role because of its low profile, light weight, low volume, conformability, low cost and easy to integrate with microwave integrated circuits [1]. The applications of patch antennas are many and they are Global Positioning System application, WiMax, mobile and satellite communication application, Radar and Rectenna applications etc. [2]. Microstrip patch antenna has also disadvantages are narrow bandwidth, excitation of surface waves, low efficiency etc. [1]. Many researches has already been done to improve the bandwidth and reduce the disadvantages of patch antenna. Different shaped patch antennas are proposed to overwhelm the limitations. This work designed two high bandwidth Connected

E-H and E-Shaped microstrip patch antennas for S-band communication covering 2-4 GHz [3] used for Communications satellites, especially used by NASA to communicate with the Space Shuttle and the International Space Station etc. [3] to achieve good bandwidth as well as mitigate the problems.

II. DESIGN PROCEDURE

In this research paper, the designing of Proposed Connected E-H and E-shape microstrip patch antennas has been designed with dimensions W (34.9 mm) × L (28.7 mm) and W (37.1 mm) × L (31 mm). The width and length of the microstrip antennas are determined as follows [4].

Width Calculation (W)

$$W = \frac{c}{2f_0 \sqrt{\frac{(\epsilon_r + 1)}{2}}} \quad (1)$$

Where C is the free-space velocity of light, ϵ_r is the dielectric constant of substrate, f is the antenna working frequency, W is the patch non resonant width, and the effective dielectric constant is ϵ_{reff} given as

Calculation of Effective dielectric constant (ϵ_{reff})

$$\epsilon_{reff} = \frac{\epsilon_r + 1}{2} + \frac{\epsilon_r - 1}{2} \left[1 + 12 \frac{h}{W} \right]^{-\frac{1}{2}} \quad (2)$$

Where the dimensions of the patch along its length have been extended on each end by a distance ΔL , which is a function of the effective dielectric constant ϵ_{reff} and the width-to-height ratio (W/h), and the normalized extension of the length, is

Calculation of the Effective length (L_{eff})

$$L_{eff} = \frac{c}{2f_0\sqrt{\epsilon_{reff}}} \quad (3)$$

Calculation of the length extension (ΔL)

$$\Delta L = 0.412h \frac{(\epsilon_{reff} + 0.3) \left(\frac{W}{h} + 0.264\right)}{(\epsilon_{reff} - 0.258) \left(\frac{W}{h} + 0.8\right)} \quad (4)$$

Calculation of actual length of patch (L)

The actual length of the patch can be determine as

$$L_{eff} = L + 2\Delta L \quad (5)$$

III. GEOMETRY OF PATCH ANTENNAS

A. GEOMETRY OF THE CONNECTED E-H SHAPED PATCH

The Connected E-H shaped microstrip patch antenna is simpler in construction. The geometry is shown in Fig. 1 with box wall port which is the most common types of port that use reference plane to removes the effects of the transmission line effect. Patch is designed and simulated over Sonnet Software is a planar 3D electromagnetic simulator.

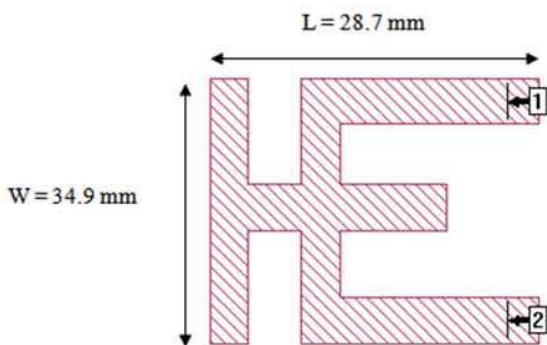


Figure 1. Top view of the Connected E-H shaped antenna

The proposed Connected E-H shape microstrip patch antenna design parameter is shown in Table I.

TABLE I: Proposed Connected E-H shape Patch Antenna Design Parameters

Antenna Design Parameter	Material / value
Dielectric Material	RT Duroid
Dielectric Constant(ϵ_r)	2.2
Loss Tangent	9.0e-4
Height of Substrate (Thickness) (h) (mm)	1.8161
Width of the Patch (W) (mm)	34.9
Length of the Patch (L) (mm)	28.7
Frequency of operation (GHz)	3.4

B. GEOMETRY OF THE E-SHAPED PATCH ANTENNA

The E-shaped microstrip patch antenna is also simpler in construction. The geometry is shown in Fig. 2. Patch is also designed and simulated over Sonnet Software.

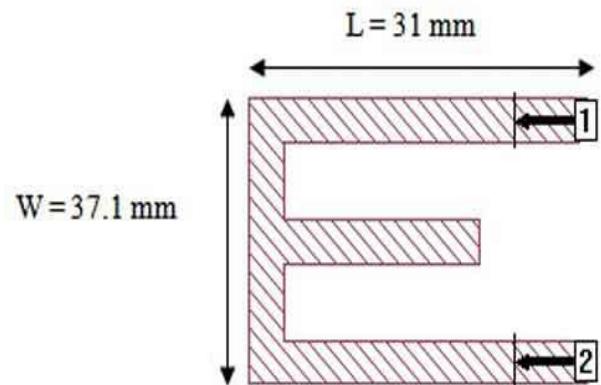


Figure 2. Top view of the E-shaped antenna

The proposed Connected E-H shape microstrip patch antenna design parameter is shown in Table II.

TABLE II: Design Parameters of the Proposed E-shape Patch Antenna

Antenna Design Parameter	Material / value
Dielectric Material	RT 5800
Dielectric Constant(ϵ_r)	2.2
Loss Tangent	9.0e-4
Height of Substrate (Thickness) (h) (mm)	1.04267
Width of the Patch (W) (mm)	37.1
Length of the Patch (L) (mm)	31
Frequency of operation (GHz)	3.2

IV. SIMULATION RESULTS

In this research, two broadbanding techniques are the Connected E-H shaped patch and the E-shaped patch presented. The simulation results are represent below. Finally, the results are discussed.

A. Proposed Connected E-H shape Patch Antenna

The results are explained in terms of the return loss, input impedance. The current density on the antenna is also showed.

1. Return Loss Curve

The first important parameter which is helpful to calculate the bandwidth of the antenna structure is its S11 in decibel versus frequency. During this antenna feeding has been done at the point where the return loss is minimized. The return loss curve of the designed antenna is presented in Fig. 3, and minimum S11 level of -30.39 dB is shown in m3 caption. The figure shows that the antenna resonates at 3.4GHz band.

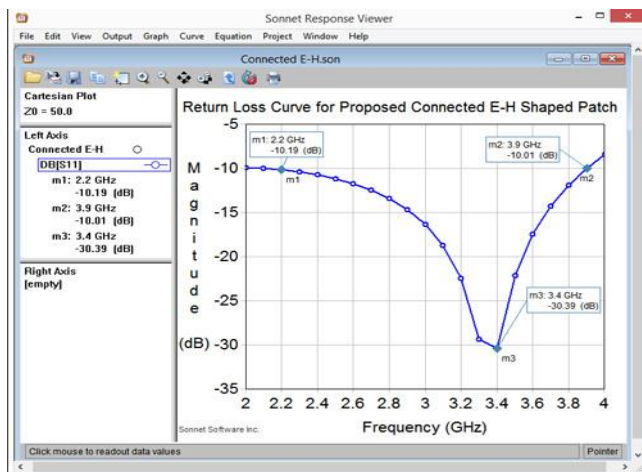


Figure 3. Simulated Return Loss curve of Connected E-H shaped patch antenna

The bandwidth can be described in terms of percentage of the center frequency of the band.

Calculation of Bandwidth

$$BW = \frac{F_H - F_L}{F_C} \times 100 \quad [5] \quad (6)$$

Where F_H =Higher Frequency, F_L = Lower Frequency and F_C = Center Frequency.

Here F_L = m1 = 2.2 GHz, F_H = m2 = 3.9 GHz and F_C = m3 = 3.4GHz. So the obtained bandwidth is 1.5 GHz which is nearly 50% of the center frequency.

2. Input Impedance Curve

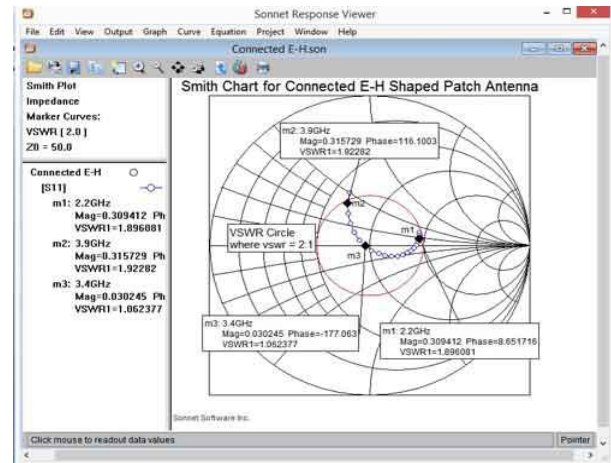


Figure 4. Input impedance curve of Connected E- H shaped patch antenna

The vswr circle is indicated by red circle where VSWR =2. The input impedance curve tells us the magnitude, phase angle and vswr of the input impedance of the antenna at the respective frequencies.

3. Current density Diagram

The physical meaning of current density distribution is that it is a measure how the antenna is producing a beam.

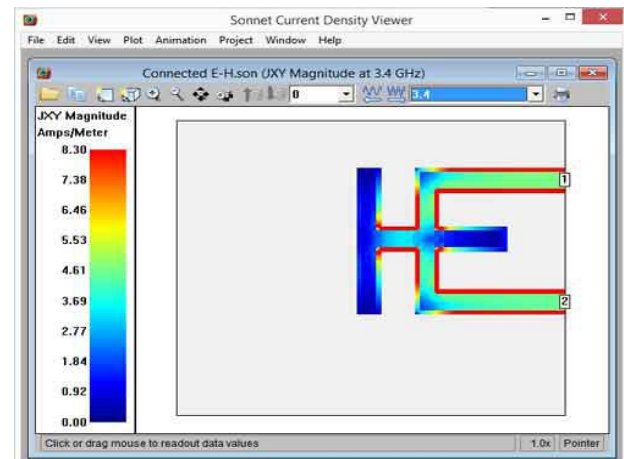


Figure 5. Current density diagram of the Connected E-H shaped patch antenna at 3.4 GHz

B. Proposed E-shape Patch Antenna

The following results are obtained for the proposed E-shape patch antenna. The results are explained in terms of the return loss, input impedance. The current density on the antenna is also displayed.

1. Return Loss Curve

During this antenna feeding has been done at the point where the return loss is minimized. The return loss curve of

the designed antenna is presented in Fig. 6, and minimum S11 level of -33.3 dB is shown in m3 caption. The figure shows that the antenna resonates at 3.2GHz band.

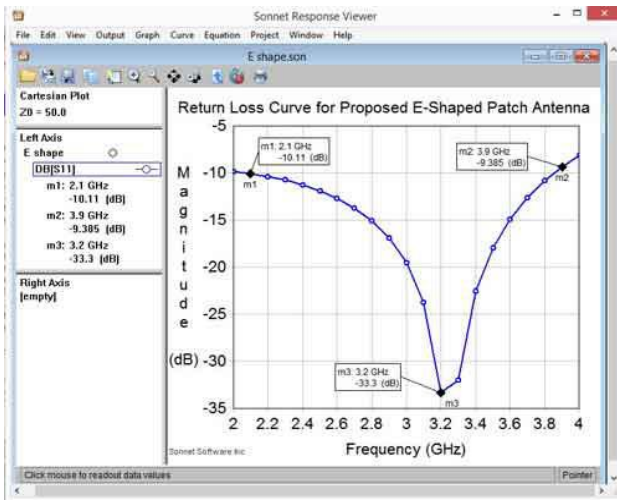


Figure 6. Simulated Return Loss of E-shaped patch antenna

Calculation of Bandwidth:

$$BW = \frac{F_H - F_L}{F_C} \times 100 \quad [5] \quad (6)$$

Here $F_L = m_2 = 2.1$ GHz, $F_H = m_1 = 3.9$ GHz and $F_C = m_3 = 3.2$ GHz. So the obtained bandwidth is 1.8 GHz which is nearly 56.25% of the center frequency.

2. Input Impedance Curve

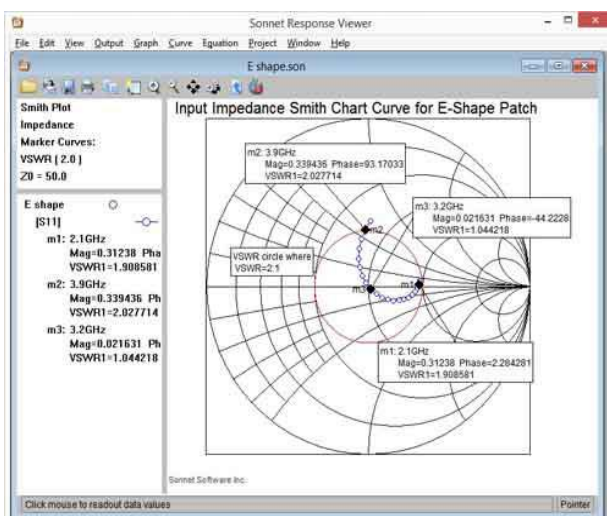


Figure 7. Input impedance curve of E-shaped patch antenna

3. Current density Diagram

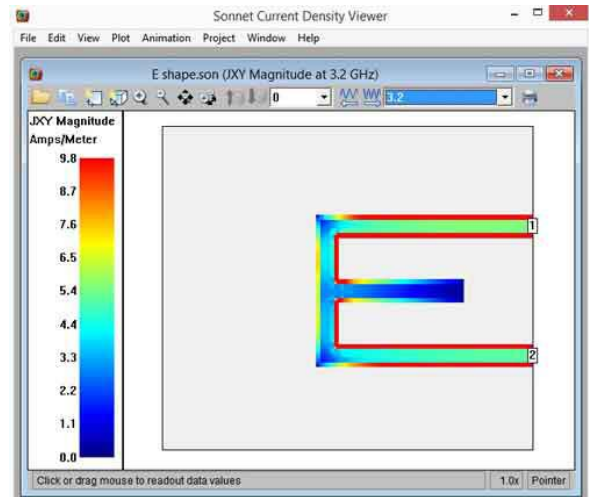


Figure-8: Current density diagram of the E-shaped patch antenna at 3.2 GHz

V. DISCUSSION

The bandwidth increases as the substrate thickness rises [4]. Here, Thickness of proposed Connected E-H shape patch is higher than Proposed E-shape but the E-shape patch antenna obtained higher bandwidth. The Size of the Patch increases as the frequency decreases [4]. In this regard, the resonating frequency of connected E-H patch is slightly higher than E-shape. So the size of the proposed Connected E-H shape is lower than E-shape. The substrate thickness increase results reduces conductor & dielectric losses [4]. In this case, the E-shape patch has some conductor & dielectric losses. As the substrate thickness increases, the surface-wave power increases, thus limiting the efficiency [4]. On the other hand, as the substrate thickness increases, the quality factor Q of the patch decreases [4] and it increases efficiency [1]. As a result, efficiency problem of Connected E-H shape has reduced slightly. As the substrate thickness decreases, the effect of the conductor and dielectric losses becomes more severe, limiting the efficiency [4]. For a substrate with a moderate relative permittivity such as $\epsilon_r = 2.2$, the efficiency will be maximized [4] and dielectric constant 2.2 is used in Connected E-H and E-shape patch antenna. Finally the efficiency of both shape is maximum and has no conductor and dielectric losses as well as surface-wave excitation.

VI. CONCLUSION

In this research paper, the intent was targeted at improving the bandwidth of microstrip antennas constructed with dielectric material with higher dielectric constant. Two different patch antennas are presented, simulated and discussed for wireless communications specially space communication covering 2.1-3.9GHz and the simulated results compare between them. Resonant frequencies are found at vswr = 1.06 and 1.044 of Connected E-H shape patch and of E-shape patch respectively. The results obtained bandwidth of

Proposed Connected E-H shape patch is higher than any existing Connected E-H shape and also Proposed E-shape patch is higher than any existing E-shaped patch antenna. It was seen that the bandwidth of that proposed E-shaped patch is better than Connected E-H shaped patch antenna.

VII. FUTURE SCOPES

1. Increase the bandwidth more by reducing the patch antenna size with using higher dielectric constant of the substrate.
2. Varying the feed elements to optimize the patch antenna.

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Deployment of Matrix Transpose in Digital Image Encryption

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Abstract— Encryption is used to conceal information from prying eyes. Presently, information and data encryption are common due to the volume of data and information in transit across the globe on daily basis. Image encryption is yet to receive the attention of the researchers as deserved. In other words, video and multimedia documents are exposed to unauthorized access. The authors propose image encryption using matrix transpose. An algorithm that would allow image encryption is developed. In this proposed image encryption technique, the image to be encrypted is split into parts based on the image size. Each part is encrypted separately using matrix transpose. The actual encryption is on the picture elements (pixel) that make up the image. After encrypting each part of the image, the positions of the encrypted images are swapped before transmission of the image can take place. Swapping the positions of the images is carried out to make the encrypted image more robust for any cryptanalyst to decrypt.

Keywords- Image Encryption; Matrices; Pixel; Matrix Transpose

I. INTRODUCTION

Image processing is a method used to convert an image into digital form and sometimes, some operations are usually performed on it. These operations include rotate, resize, transform, etc. The aim of carrying out some operations on an image is to get an enhanced image or to extract some useful information from it that may be further used for some other purposes. An image is a type of signal dispensation in which input is image, like photograph and output may be image or some characteristics associated with that image. Usually Image Processing system includes treating images as two dimensional signals while applying already set signal processing methods to them. Images like text can be encrypted.

Encryption transforms plaintext messages into ciphertext messages. In the earlier days, securing information is carried out on only text related information. But today, with the proliferation of video and multimedia documents on the Internet, there is need to also secure image documents from unauthorized access. Images are represented using pixel, which mathematically can be represented using matrices. In

image encryption, encryption algorithm transforms an image into a form that cannot be recognized to be the original image. The authors here propose a new image encryption technique that would deploy matrix transpose to encrypt image pixel.

II. RELATED LITERATURE

Reference [1] stated that all images consist of pixels. These pixels may have values in double or byte. An image is represented, for all mathematical purposes, as a matrix. The matrix equivalent of an image of size $N \times M$ pixels is a $N \times M$ matrix, where each pixel corresponds to an element of that matrix. This is a two dimensional image. For a typical colour image like RGB image, the matrix representation will be three dimensional. The additional dimension is for Red or Green or Blue proportions in a two dimensional Grayscale image.

Pixel is the smallest element of an image. Each pixel corresponds to any one value. In an 8-bit gray scale image, the value of the pixel is between 0 and 255 (2^8). The value of a pixel at any point corresponds to the intensity of the light photons striking at that point. Each pixel stores a value proportional to the light intensity at that particular location. In order to represent an image, pictures may be used to illustrate the meaning of a pixel. In a given picture, there may be thousands of pixels. These pixels add up together to form an image. When the image is zoomed, the image usually reveal some pixels division. Note that a digital image is composed of a finite number of elements, each of which has a particular location $f(x, y)$ and value. $F(x, y)$ represent the coordinates at x and y axis. These elements are called picture elements, image elements or pixels. Pixel is the term used most widely to denote the elements of a digital image [2].

III. IMAGE ENCRYPTION PROCESS

A picture can be encrypted in the same way that text is usually encrypted. A sequence of mathematical operations on the binary data that comprises an image may be deployed to

carry out an encryption processes. This can be achieved by changing the values of the numbers contained in the image in a given manner. This scrambles the image and renders it unrecognizable.

Reference [3] pointed out that a secure image encryption algorithm based on Rubik's cube principle uses two secret keys equal to the number of rows and columns of the plaintext image and that based on the principle of Rubik's cube, the image pixels are scrambled and then, XOR operator is applied on the rows and columns.

IV. IMAGE ENCRYPTION SOFTWARE

Today, some major computer operating systems come with some form of encryption software. For instance, Microsoft provides BitLocker as part of its encryption with Windows 7, while the Mac OS X comes with FileVault. Dropbox, PowerFoler, and Cloudfogger are online file storage systems that include encryption as part of their data security. Some encryption software allows images to be batch processed while others do not. Most encryption software can handle common image files such as BMP, TIF, RAW, PSD, and JPG. Some image processing software are open source and can be downloaded from the Internet freely. However, some are only available on payment of the marketer's agreed fee. One of the most popular image processing software is Matrix Laboratory (MATLAB). This is usually licensed. Reference [4] observed that the tried-and-true method of adding encryption to a picture is through steganography, which is the art of creating hidden images. In the digital world, this is done by methods like least-significant bits in bitmap images or flashing subliminal messages in a video stream. Steganography is very useful for putting digital watermarks in an image. Watermark is typically used to identify ownership of the copyright of such signal where it appears. It is most times used by software companies to prevent users from continuous free usage of such software.

As digital audio, video, images, and documents are transmitted through cyberspace to their respective destinations, some individuals may choose to intercept and take this content for themselves. Digital watermarking and steganography technology greatly reduces the instances of this by limiting or eliminating the ability of third parties to decipher the content of the information [5].

V. SELECTIVE IMAGE ENCRYPTION

In selective encryption, some contents of the image are encrypted. Encrypting only part of the entire image reduces the execution time. Consequently, selective encryption is sometimes called partial encryption. This algorithm provides security to the image and at the same time, some part of the image is visible [6].

Today, millions of images are transmitted in seconds across the globe and as such, the security of images is becoming a major concern to businesses across the world. Encryption is a solution to the security concern of transmitted images. The

security of image can be achieved by various types of encryption schemes. Different algorithms have been proposed. Among this, the chaotic based methods are considered to be more reliable and also promising. However, this technique is complex in nature. The chaotic image encryption can be developed by using properties of chaos including deterministic dynamics and unpredictable behaviour. There are three kinds of encryption techniques namely substitution, transposition or permutation techniques that include both transposition and substitution. Substitution schemes change the pixel values while permutation schemes just shuffle the pixel values based on the algorithm. In some cases both methods are combined to improve security.

VI. MATRICES IN DIGITAL IMAGE ENCRYPTION

Image encryption is a new phenomenon in the encryption process unlike text encryption which has been in existence from time immemorial. Several researchers have proposed some image encryption techniques. Digital images are recorded as many numbers. The image is divided into a matrix or array of small picture elements, or pixels. Each pixel is represented by a numerical value. Digital images have an advantage that they can be processed in many ways, by computer systems.

Here, we are proposing the deployment of matrices in digital image encryption.

Reference [7] pointed out that an identity matrix which is denoted as, I_n is characterized by the diagonal row of 1's surrounded by zeros in a square matrix. When a vector is multiplied by an identity matrix of the same dimension, the product is the vector itself, $I_n v = v$.

VII. USING MATRIX FOR IMAGE ENCRYPTION

Reference [8] noted that a transpose of a doubly indexed object is the object obtained by replacing all elements a^{ij} with a^{ji} . For a second- tensor rank tensor, a^{ij} the tensor transpose is simply, a^{ji} . The matrix transpose, most commonly written A^T , is the matrix obtained by exchanging A rows and columns, and satisfies the identity

$$(A^T)^{-1} = (A^{-1})^T.$$

The proposed algorithm for deploying matrix transpose in image encryption is as below:

- i. Divide the image into parts P_i , $i = 1, 2, 3, \dots, n$
- ii. Assign each part, p_i to matrices, m_i , $i = 1, 2, 3, \dots, n$
- iii. Read the picture element (pixel) of each matrix, M_i
- iv. Encrypt each matrix pixel by carrying out matrix transpose, M_i^T
- v. Swap the positions of transposed matrices

vi. $M_i^T = \sum_{t=1}^n (Mt)^T$

vii. Output M_i^T as an encrypted image

The decryption process is the reverse of the encryption algorithm as outlined above. This starts from the output and carries out the inverse of the individual matrix. After this, the pixel values are decrypted and reordered accordingly to arrive at the original matrix pixel values.

VIII. COMPARISON BETWEEN IMAGE ENCRYPTION USING MATRIX TRANSPOSE AND SELECTIVE IMAGE ENCRYPTION

Selective image encryption technique encrypts only some part of the image leaving other parts unencrypted. This gives an adversary the advantage to use the part of the unencrypted image to easily recognize the original image. There is no doubt that selective image encryption technique may be easier to implement, but since security of image is of utmost importance, the matrix transpose image encryption is more robust in terms of securing images to be transmitted across the globe.

IX. CONCLUSION

Encrypting images is as important as encrypting text messages. Today, text message encryption has had a fair deal in terms of researches carried out in that area. The same cannot be said of image encryption. For now, only few researchers are interested in image encryption and as such, there are limited literatures. The proposed image encryption technique that deploys matrix transpose allows the encryption of the entire image, unlike the selective image encryption that encrypts only part of the image.

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Using Handheld Mobile System To Address Illiteracy

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Abstract—Handheld device systems have been used as tools for teaching people with special needs due to cognitive function enhancement by utility of multimedia, attractive graphics and user-friendly navigation. Can a handheld device system, such as cellular phone, be used for teaching illiterate people? This paper explores and exploits the possibility of the development of an educational mobile system to help the illiterate people in Egypt.

Index Terms—Graphical User Interface; Audio; Graphics; Video, Wireless; Mobile System; Arabic alphabet; Arabic speaking illiterate people; illiteracy.

I. INTRODUCTION

Literacy can be defined in many ways. The U.N. defines a literate person as someone who can “...with understanding, both read and write a short simple statement in his or her everyday life” [19]. Learning the alphabetic letters could be more difficult than numbers for illiterate people [14].

Although the number of illiterate people around the world is estimated to be 800 million, they still can use the mobile appropriately. For the best knowledge of the authors, little research has been done to understand the reasons behind that. Most of them are from developing countries and females represent a high percentage of the 800 million [2].

In Egypt, the total number of illiterate people aged 10 years or more has exceeded 16 million in 2012, according to the Egyptian Central Agency for Public Mobilization and Statistics (CAPMAS) [7]. According to [8], there exist 112.81 mobile phones per 100 Egyptian citizens.

The flexible business model of mobile phone has proved to be viable particularly in developing countries. Despite infrastructural shortcomings, high cost of ownership, limited power available for charging devices, mobile devices had been widely penetrated the society at all levels [2].

The nature of current technological advances in the mobile phones domain generally suggests the future decrease of the cost of smart phones for customers in general. That includes the customers of developing countries. Recently, in the Egyptian market, there are cheap Chinese versions of Android based devices. In the future, it is expected to become more affordable to lower income segments.

With the international effort to eliminate illiteracy, the problems related to inequalities have deepened. For instance, in Egypt, children of different social backgrounds do not have equal opportunities to learn and reap benefits. Furthermore, they are trapped and cannot get out of the vicious circle of poverty.

Egypt has recognized that illiteracy is one of its core pillars to develop. Despite the effort that has been done in past decades under different governments, education remains a challenge. Even though the percentage of illiteracy is decreasing, the number of people struggling to

read and write is increasing. This is a sign or indication that there are a few issues regarding the implemented educational policies. One of these issues is the approach and the way they teach the students.

In a previous work of [15][16], the authors proposed a system to teach deaf people using Cell phones technology. In this paper, the authors will expand and re-use their previous work of teaching deaf people into teaching the Arabic alphabet to Egyptian illiterate people.

The authors found online products that teach Arabic alphabet to nonspeaking Arabic people [4][5][6]. To the best knowledge of the authors, they did not find studies centered on teaching the Arabic alphabet to Arabic speaking illiterate people using mobile systems. The authors realize that the problem of teaching the Arabic alphabet to Egyptian illiterate people should be divided into two steps:

- Gathering baseline data of how illiterates recognize and react with the mobile interface,
- Based on the information gathered from the previous step, a suggested system could be developed.

The study will concentrate on the first part and will pave the ground for the second part in a sequel paper.

II. DATA GATHERING

The objective of this section is to gather baseline data about the effectiveness and the usability of the mobile interface. The two experiments are conducted using a Samsung device, running an Android operating system that contains the ePhone application; see figure 1.

As authors mentioned at the introduction section, the target of this study is to gather baseline data of how illiterates recognize and react to the mobile interface. This empirical study involves five novice illiterate participants. All users have no previous background of using mobile phones. Some other empirical studies involve only seven novice participants [1]. For some empirical study investigations, the baseline data is more important than the number of participants. The baseline data will be used for further investigations that involve more participants. The profile of the five novice illiterate participants is shown in table 1.

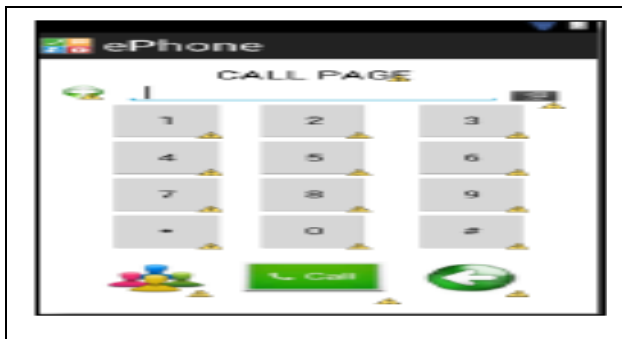


Figure 1. Smart phone mobile numbers call interface

TABLE I.

Participants	Experience level	Age group	Gender
P1	Novice	21-34	Male
P2	Novice	35-65	Female
P3	Novice	12-20	Female
P4	Novice	21-34	Male
P5	Novice	35-65	Female

A. First Experiment

The experiment will start with an introduction explaining what tasks needed to be performed by the participant. The tasks are:

- First, dialing a specific number,
- Next, talking for a few seconds,
- Last, exit the call.

The results of the tasks for the five participants, see table 1, are shown in figure 2. The results in figure 2 show the dialing and calling (i.e. talking) times in seconds for every participant plus the average. It is clear, from figure 2, that the dialing time is substantially greater.

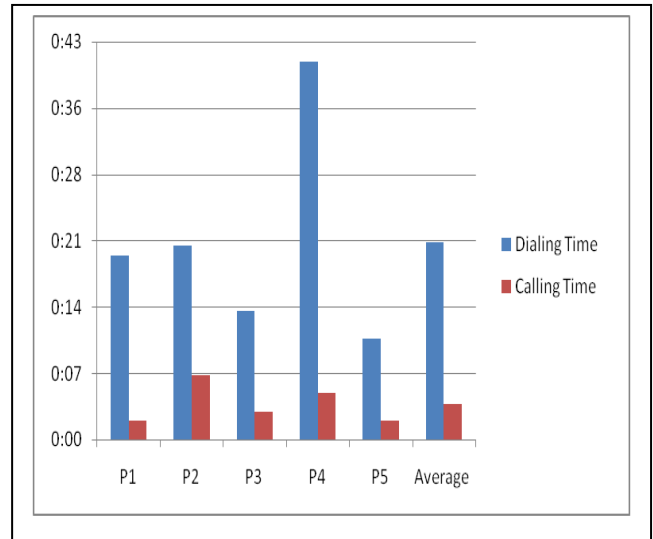


Figure 2. The results of the tasks for the five illiterate participants plus the average of the dialing time and calling (i.e. talking) time.

After the participant finishes the experiment, a general feedback will be discussed with the participants. The general feedback discussion will focus on:

- How well do participant read and understand icons?
- Which icons were problematic and why?
- What participant thinks of the overall performance of the application?

B. Second Experiment

The experiment will start with an introduction explaining what tasks needed to be performed by the participant. The tasks are:

- First, start a game,

- Next, go through the levels until reaching the results,
- Last, start another round.

After the participant finishes the experiment, a general feedback will be discussed with the participants. The general feedback discussion will focus on:

- How flexible is the navigation/usage of the developed application?
- Does it satisfy the needs and requirements of the test subject?
- Does it provide an understandable interface of minimal knowledge requirement?
- What possible usability/understanding errors could arise from the test?
- How tolerable are these errors, and how can they be fixed in favor of higher usability?
- Are the test subjects able to go through the application from start to finish seamlessly?

The results of the tasks for the five participants, see table 1, are shown in table 2, and table 3. The results in table 2 show the type of errors that every participant committed when performed a certain task. The type of error is described in table 3.

TABLE II. RESULTS OF THE SECOND EXPERIMENT

Participants	Tasks	Type of errors	Time of each interface (Approx.)
P1	Start The Game	0	1 second(s)
	Playing The Game	3	4 second(s)
	Reach Results Screen & Start Another Round	2	2 second(s)
P2	Start The Game	0	1 second(s)
	Playing The Game	0	10 second(s)
	Reach Results Screen & Start Another Round	0	3 second(s)
P3	Start The Game	0	1 second(s)
	Playing The Game	2	3 second(s)
	Reach Results Screen & Start Another Round	2	5 second(s)
P4	Start The Game	0	1 second(s)
	Playing The Game	0	5 second(s)
	Reach Results Screen & Start Another Round	0	2 second (s)
P5	Start The Game	0	1 second(s)
	Playing The Game	0	6 second (s)
	Reach Results Screen & Start Another Round	0	3 second(s)

Type	Error	Mitigation method	Level
1	Inefficient Click	the finger size of the participant are to be considered	Irritant
2	Wrong Answer	Installing a voice narrator that instructs the participants	Irritant
3	Rapid Clicks	Adding a sound effect to their clicks to quickly adapt to the program	Moderate

C. General Feedback

The general feedback discussion, of both experiment 1 and experiment 2 with the five participants, shows that:

1) *Small icon confusion*: The participants did not know where they should click on to create a new contact, after hesitating for a few seconds and searching for the icon due to its size, they finally identify the icon that will lead them to the new contact page.

2) *Multiple clicks*: The participants clicked twice on the send button in order to send the message. The first time the participants pressed on the button while the screen keypad was opened. The participants attempted once more after closing the keypad.

3) *Recognition delay*: The participants press on the image, thinking it is a button. However, they immediately realize what is it? Hence, they click on the actual call button. When participants were attempting on exiting the application, they took a while to recognize which icon performs such action. Since it is the only icon that has no a description.

4) *Small icon recognition*: Delay leading to hesitation. The icon made for creating a new contact is relatively small in comparison to other buttons. The participants invest quite some time to search for the icon in order to create a new contact. They are hesitating by going back and forth in the application page, in order to search for where the task should be performed?

III. PROPOSED SYSTEM

Users interact with mobile applications through different graphical user interface GUI components such as buttons, icons, or nested menus ... etc.

Controversial user interface (UI) topics include the issues of inclusion [18] or exclusion [3][10] of text labels. Moreover, they use drawings [9] instead of icons. Common UI components - the concept of soft-keys, vertical scrollbars, short text labels [11][12] and the concept of a focus in lists [20] - were described as hard to understand [2].

Chipchase's work [13] shows that illiterate users could perform tasks such as turn on their phones and accept

incoming calls, whereas dialing numbers to make outgoing calls proved difficult for some. However, simple tasks such as changing the clock or sending a message could be easy for some illiterate users by memorizing the steps. In that respect, it is important to understand the causes of all these problems while interacting with the mobile. We should take into consideration that the mobile devices will be rapidly penetrating the market of developing countries targeting the majority of population and could help support the education of illiterate people.

The participants in the experiment mainly faced critical errors which would either lead them to invest too much of their time in order to perform a particular task or even end up discarding the task. The time spent on each task exemplifies the delay that challenged participants face to perform a particular task.

To design an interface for illiterate Arabic speaking people, a number of changes need to be considered in the GUIs. It has been recommended to:

- Avoid long text, i.e. minimization of text reliance.
- Exposure to text in conjunction with audio
- The developer should state underneath the symbol or using yellow tool tip text to explain what this particular button does. That condition is suitable more for barely educated than illiterate.
- Excessive use of pictures, shapes, handwriting, special signs, and colors. Extremely value audio and graphic support in GUIs for illiterates
- Increase the size of the icon and clarify what each icon is used for. Illiterate persons may not understand the symbol of the icon. The users were able to read and recognize nearly all icons, except the “create new contact” icon, which resulted in quite some delay time to the user. The problem behind that icon was that it was too small and did not have a statement of some sort stating what this icon does.
- Aim to use more recognizable icons instead of menus; the proposed system should require the least possible amount of memorization for the illiterate users.

IV. DESIGN THE PROPOSED SYSTEM

Based on the previous results of [14] and [17], a mobile application will be designed. The mobile application consists mainly of five components as shown in figure 3:

- 1) *Page Loader*: contains the list of games;
- 2) *Data Keeper*: This is the Game Engine. It has a score counter that counts the time, number of mistakes and the number of correct answers. The game also stores if the user has selected the correct answer from the first time;

- 3) *Game Keeper*: which is responsible for reading the score achieved in the game and storing it in the database;
- 4) *Performance Tracker*: which is responsible for reading stored score information and displaying them according to the attempts made by the user;
- 5) *Audio Player*: which is responsible for playing suitable audio files related to the opened page, in addition to providing audio feedback to the user after playing the game? Without any loss of generality, from now on **all snapshots** of the mobile application will have audio interaction between the user and the mobile application, even if not explicitly mentioned.
- 6) *Multimedia Generator*: which takes as input Arabic text and utilizes Natural Language Processing techniques to classify the text and retrieve multimedia elements (i.e., images and videos) related to the text.



Figure 3. System components (need to add component of multimedia generator)

A. System Architecture

The system is composed mainly of two parts: the application server that contains all mobile resources (e.g., pages, games, database, etc.) and the mobile application which sends queries to the server to load the required resource elements, as shown in figure 4.

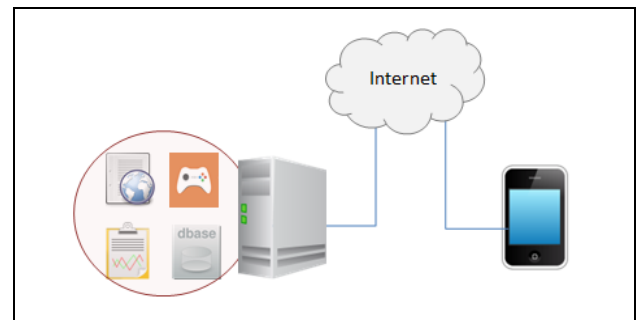


Figure 4. System architecture

B. Snapshots

- Snapshot-1

When the mobile application is launched, the following main screen will be displayed which allows the user to access the basic buttons and listen to the recorded voice associated with them, as shown in figure 5.



Figure 5. Snapshot-1

- Snapshot-2

By clicking the icon of the boy playing football; on the top row in Snapshot 1, the screen shown in figure 6, will be displayed. The icon in the upper row can be clicked to go back to the previous screen.



Figure 6. Snapshot-2

- Snapshot-3

When the user clicked the icon “possible” (Arabic: Momken), it is possible for him to click he icon “drink” (Arabic: Ashrab) located in the middle, therefore, a collection of drink flavors will be displayed to allow him to select the flavor he wants, as shown in figure 7.



Figure 7. Snapshot-3

- Snapshot-4

Various icons that have particular meaning will be displayed in the mobile application, if the user pressed and held any button for two seconds, a loading progress will appear on the button to play an explanation voice record which explains the usage of the button, as shown in figure 8.

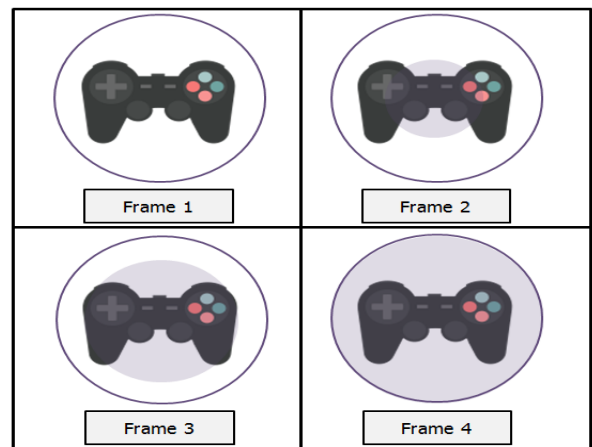


Figure 8. Snapshot-4

- Snapshot-5

When the user enters the learning mode in the application, it will load the progress of the user stored in the mobile. The mobile application starts by reading available options by playing audio files and waits for the user to choose one: 1) study the Arabic numbers; 2) study the Arabic letters; 3) input Arabic text to retrieve multimedia elements and 4) play games to evaluate what the user had learned, as shown in figure 9.



Figure 9. Snapshot-5

• Snapshot-6

Before starting the game, the user can watch an animated cartoon lesson to learn about the specified topic. Each lesson does not exceed three minutes duration to keep the user's attention. Snapshot 5, shown in figure 10, shows a mathematic lesson to perform basic objects enumeration.



Figure 10. Snapshot-6

• Snapshot-7

After watching the lesson, the user can play games related to the lesson for self evaluation. The following screens A and B , shown in figure 11, show two different game evaluation pages to evaluate what the user learned about the enumeration of objects. In screen A, the user is asked about selecting the appropriate number that is presented by the hand; in screen B, he is asked to sort numbers drawn on eggs in the right order.



Figure 11. Snapshot-7

• Snapshot-8

The following screens A and B, shown in figure 12, is another game pages to evaluate the user and what been learned about the order of the week days. In screen A, the user is asked to sort days by selecting the appropriate day written on the mushroom. In screen B, the user is required to see which day the boy is asking for, and select the appropriate day written on each leaf.



Figure 12. Snapshot-8

• Snapshot-9

The screens A and B, shown in figure 13, are pages used to teach the user Arabic letters. The application recite Arabic letters, as shown in screen A, then several examples are given for each letter, as shown in screen B.

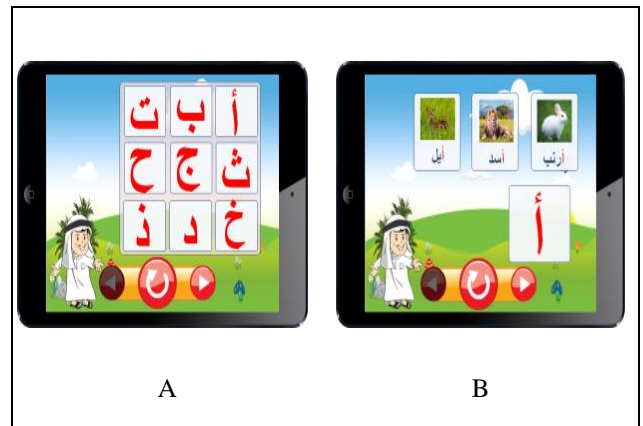


Figure 13. Snapshot-9

• Snapshot-10

The screens A and B, shown at figure 14, represents a game that evaluates the user through various questions in different styles about what had been learned about Arabic alphabetic letters. In screen A, the user is asked to select the image where its name starts with the presented letter. In screen B, the user is requested to connect the appropriate letter with its corresponding image that its name starts with the presented letters.

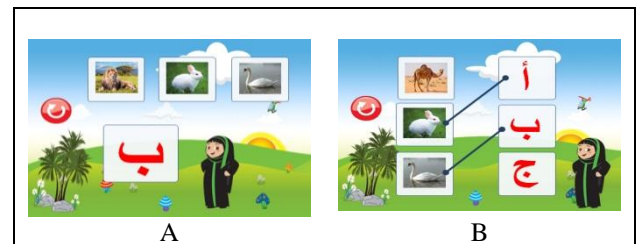


Figure 14. Snapshot-10

• Snapshot-11

After watching the adding process lesson, the user can play games related to that lesson for self evaluation, as

shown at figure 15. The user is asked to select the correct answer from the presented numbers.

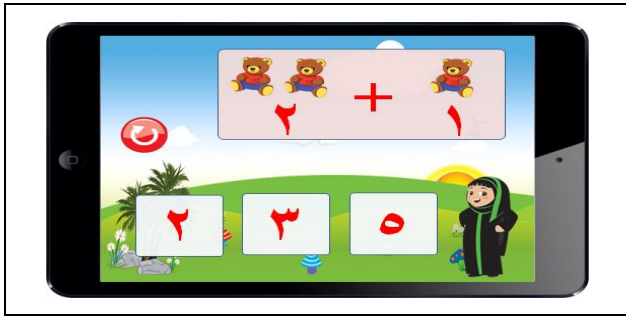


Figure 15. Snapshot-11

• Snapshot-12

In the snapshot 12, shown in figure 16, an animated cartoon lesson that teaches a lesson about week days. It gives full explanation how to pronounce days in order and how they are ordered. The lesson explains how days are sorted by constructing and connecting train parts in order according to the written day on each part.



Figure 16. Snapshot-12

• Snapshot -13

Snapshot 13, shown in figure 17, demonstrates an example of the feedback a user would get after entering Arabic text into the system that translates as, “A rabbit has brown or white fur. It eats carrots and moves around by jumping.”

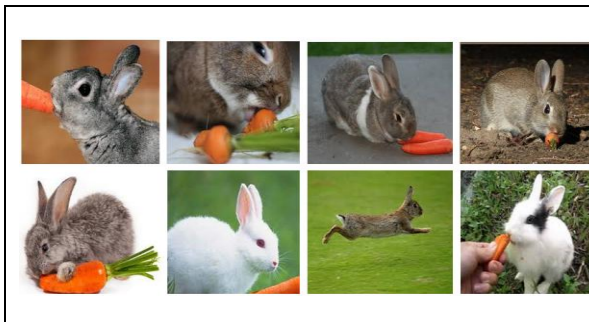


Figure 17. Snapshot-13

• Snapshot-14

After playing the game, feedback results will be displayed for the user in both written and audio forms as shown in figure 18. The score is divided into three fields:

- Completion time (in ms),
- Number of correct answers from first attempt,
- Number of wrong answers.



Figure 18. Snapshot-14

V. CONCLUSION

A number of researches concurred that the current mobile phone user interface design is not highly recommended or suitable for illiterate individuals [14]. They found that utilizing audio and graphic support in user interfaces is highly valuable for the enhanced cognition and usage friendliness for illiterate people [14].

The study of the relation between illiterate, semi-literate people and their society in the context of using mobile phones is still at its beginning stages. The rapid technical development and the changing market of mobile phones certainly increase opportunities for illiterate individuals in terms of cognition and communication.

The use of enhanced GUI systems, complemented with multimedia support such as audio, image and video enhance the usage experience for people with literacy related challenges. In this study, the authors paved the ground for the proposed system to be investigated in a sequel paper.

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A Road Map of Urdu Layout and Recognizing its Handwritten Digits, Table of Contents and Multi-font Numerals from Scanned and Handwritten Text Images Using Different Techniques

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Abstract: *Friendly interface is necessary to make the system more efficient and effective. The development of Urdu recognition is key element of research as it provides an efficient and natural way of input to the computer. This paper presents a framework based on Urdu layout and recognition of handwritten digits and text images by using different techniques. After the survey on Urdu documents the following conclusion is made regarding the Data set, Techniques and algorithms that the most widely used technique is HMM and Data set involves the training set which contains different image styles and sizes and also hand written text.*

Keywords: HMM, Urdu documents, Rule based Approach

I. INTRODUCTION

In order to make the system more and more efficient there should be friendlier interface so that the user can with no trouble intermingle with the computer. However many researches are made to make human computer interaction increasingly responsive. The improvement of Urdu recognition is the key element of the research as it provides an efficient and natural way of input to the computer. The natural language of Pakistan is also Urdu and is articulated in more than 22 states containing almost 60 million native speakers. It contains 38 alphabets out of which 17 have dots either above or beneath them. Urdu script is written from right to left. The most popular script of writing Urdu language is *Nastaleeq*, developed from two different scripts; Naskh and Taleeq. This paper presents a framework based on Urdu layout and recognition of handwritten digits and text images by using different procedures. The capability of a computer to understand handwritten and scanned document is important as it can yield efficient research.

The process of ascertaining layout arrangements by investigating page images is called "layout analysis". It can be physical or logical. Here we present a layout analysis system for Urdu documents images by extracting text line in reading order. The hand written numeral recognition has problem of similarity between handwritten numerals and dual style for Urdu.

Image understanding is concerned with the taking out of semantic information of a document. In order to steer through documents *Table of Contents (ToC)* is being used which enables a person to steer through large volume of scanned pages competently. This paper is offering a quick analysis on various approaches in the area

related to ToC extraction. ToC page detection, ToC parsing and to link the actual pages with these recognized parts are the three areas in which ToC research can be distributed.

In the paper we have presented different recognition techniques including Word-level, HMM, complete level, Annotation, for hand written text images. BPNN for offline hand written Urdu digits and for online STNN, OLUCR, and Tree based Dictionary Search, Intuous Wacom Board is used. Neural Network for OCR Urdu script and for pattern matching approach Morphology Technique has used. Smoothing Technique, bigram NER tagger are used for multi-font numeral recognition for Urdu script. Fuzzy linguistic, HMM, Hybrid Approach for extraction of named entities (NEs) from the text. *HMM* and *Hybrid* approaches are presented for both domains of multi-font numerals recognition. Database retrieval approach has used in word spotting in scanned Urdu documents. We have mentioned the problems in the recognition of handwritten and scanned text images in Urdu script and the solution by applying the above mentioned techniques in the proposed approach.

Remaining paper is prescribed as follows: Section II defines the associated work done on Urdu document, section III describes the analysis of all the research papers on which survey is conducted, section IV contains the conclusion and section V describe the future work and then at the end reference is provided.

II. LITERATURE REVIEW

This section encloses the brief explanation of all the research papers which are analyzed.

A) *Online Urdu Character Recognition System [1]*

New System is introduced which focuses on the Online Urdu Character Recognition using “Segmentation free Technique” that is the recognition of one complete word, in spite of every single word, these words when combined together formulates the complete sentence. The technique mainly involves BPNN (Back Propagation Neural Network) for training the dataset. Although the proposed system is very efficient, but there is a lot more to discuss, hence the future can still do better advancements in this field of Human Computer Interaction.

B) Optical Character Recognition System for Urdu (Naskh Font) Using Pattern Matching Technique [2]

This research paper focuses on the offline OCR for Naskh font in Urdu language. The new system is announced which works on corresponding pixel values of the models already put in storage with pixel values of those character-images to be renowned. The Pattern matching method for Optical Recognition, on which the dataset is trained, is described for the proposed system. The algorithms used for the Recognition System are listed, which are as follows, Chain Code Calculation, Line Segmentation and Character Segmentation.

C) A Framework for Word Spotting In Scanned Urdu Documents by Exploiting the Dot Orientation [3]

This paper presents a data reduction framework in Urdu scanned documents, based upon exploiting the dot orientation for word spotting. Due to the higher number of dots in Urdu alphabets (as compared to English) and the ease of calculation, the dots orientation was proved to be a good choice for word-spotting, which was demonstrated in the paper. The proposed algorithm for the system implements five phases, which are as follows: Document Tilt Removal, Dot Spotting, The Dot Character Database, Text Size Variation and Word Spotting. The algorithm was applied to different documents and results were generated.

D) OCR-Free Table of Contents Detection in Urdu Books [4]

This paper reports an initial struggle to address the task of identifying old documents’ TOC that cannot be operated using OCR technologies. The research presented in the paper is all about dealing the TOC page detection through OCR free algorithm. The suggested algorithm is a combination of rule-based techniques and machine learning and it feats the precise characteristics of a distinctive Urdu TOC page. The proposed algorithm is evaluated on Urdu books and digests. Submission of such algorithms may comprise off-line and/or on-line digital libraries of cursive writings.

E) Choice of Recognizable Units for Urdu OCR [5]

The research paper proposed a numerical examination of Urdu corpus to assemble and organize the Urdu cords. To reduce the class count, the ligatures with similar primary components are clubbed together. Initially the Urdu word is fragmented into ligatures and remote characters for character segmentation. The ligatures are then further segmented into characters. It is mentioned that for developing the complete ligature recognition system, there should be an identification of all likely main and subordinate associated components.

F) An Annotated Urdu Corpus of Handwritten Text Image and Benchmarking of Corpus [6]

The methodology proposed in this paper is to design and produce Urdu corpus consists of complete Urdu text sentences. Measurements of the Urdu corpus comprise database in handwritten text forms. To captures the supreme syntactic distinctions, forms will be occupied by different authors having varied upbringing and belonging to diverse geographical positions. The benefit of the Proposed corpus is that it would provide facilities to further add more words by same procedure of markup where all annotation information will be entered manually during the insertion of new handwritten text form.

G) Automatic Recognition of Offline Handwritten Urdu Digits In Unconstrained Environment Using Daubechies Wavelet Transforms[7]

For the handwritten Urdu Digits an OCR system has been presented in this paper. The approach used in this paper include the major function of a design recognition system is to produce decisions regarding the class membership of the designs with which it is challenged. In this work, various Daubechies Wavelet Transforms have been applied to excerpt the wavelet factors.

The recognition accuracy is enhance by the use of this approach

H) The optical character recognition of Urdu-like cursive scripts [8]

This paper establishes one of the infrequent exertions in amassing the works concerning Urdu-like script recognition with distinct reference to the Nasta'liq and Nashk script formats. We can summaries the whole survey of the paper as a huge set of characters and resembled-shaped-characters make the case of the Urdu-like scripts more multifaceted and puzzling. The offline character matching is perhaps difficult than its online counterpart as not more information is accessible. The approach established significantly precise results with many documents, such as newspapers and books. The advantage of the theory is that it may not only reduce the lexicon but also help us to build a multilingual OCR.

I) *N-gram and Gazetteer List Based Named Entity Recognition for Urdu [9]*

This paper has presented a statistical Named Entity Recognition (NER) system for Urdu language using two basic n-gram models, namely unigram and bigram. This work presents a statistical approach using n-gram for Urdu NER. The objective of this NER system is to recognize five classes of NEs; Person, Location, Organization, Date and Time. A transitory review of different procedures used for the NER task in diverse languages is shown. In this paper significant results have been produced even with a small sized training data.

J) *Multi-font Numerals Recognition for Urdu Script based Languages [10]*

The resemblances and differences between these two scripts old Arabic and Urdu has presented in this paper from the character recognition viewpoint. Rule based technique, HMM and Hybrid approach is presented to distinguish the online digit identification written in both Arabic and Urdu forms from both online and offline. The suggested technique work for numbers input. In this paper the difficulty of parting of Urdu and Arabic numeral has solved.

K) *Segmentation Based Urdu Nastalique OCR [11]*

To explore system based upon segmentation this is capable of recognizing Urdu Nastalique font. The main concern of this paper is on the development of OCR by using Hidden Markov Model, because it can accurately handle large data sets and can be qualified to grip noise plus distortion to some extent, and rule based post-processor. The system takes a monochrome scanned image. Few letters are not recognized accurately because the technique still needs to be tested on real data and extended to cover the entire set of Urdu letters at a variety of font sizes.

L) *An Efficient Method for Urdu Language Text Search in Image Based Urdu Text [12]*

A simple and healthy technique of discovering a character in Urdu text images is presented in this paper. The method which has proposed is independent of script. Initially image is matched with a set of example characters demonstrating each class. The space between every input image and each example character is calculated, and the character is allocated to the class of the trial product generating the perfect match. Results describe template matching technique can be applied to discover a character or whole ligature inside an image accurately.

M) *Combining Offline and Online Preprocessing for Online Urdu Character Recognition [13]*

In this research paper a new technique is offered for compiling of Urdu online text in which

equally online and offline sphere are applied to take out the variations and to enhance the competence for online input of the recognition system. In this paper different techniques are performed on the input hits from both offline and online views. This involves stroke segmentation, de-hooking, interpolation, combine strokes, smoothing and base line. The efficiency can be increased by using the joint processing for online and offline preprocessing strokes are converted into image to achieve offline preprocessing steps.

N) *Layout Analysis of Urdu Document Images [14]*

For Urdu documents a layout system is described in this paper. This method had shown as dealing perfect on Roman draft so it was modified to Urdu documents. The assessment of the algorithm is completed in two steps. The first step evaluates the errors which are in text-line, and the other part calculated the reading order algorithm. Newspaper documents demonstrated to be the hardest class giving several tasks as compared to others.

O) *Challenges of Urdu Named Entity Recognition: A Scarce Resourced Language [15]*

In this research paper a brief overview of Named Entity Recognition system is described. The process of searching the text to detect entities in a text and to categorize them into already defined classes such as the names of organizations, locations, expressions of times, persons, quantities is called NER. Urdu NER task has not been thoroughly investigated or experimented with due to scarce resources and the inherent complex features. Hence Urdu language demands detailed investigation regarding the application of different existing techniques employed for NE in different languages.

III. ANALYSIS

The research paper tabulates all the 15 research papers on the basis of following parameters. Training set, testing set, recognized set, strokes, letter's shape, font style, image style and type, image size and category of data. All these parameters are categorized under the heading of character set as they describe the question and specification of data used in research papers. Furthermore, the different other parameters are also evaluated which are smoothing, chain code generation, storing the calculated strings, segmentation, image transformation, filters, document skew angle removal and recognition algorithms. All of these are categorized under the heading of Algorithm, as they describe the method used for extracting the desired output needed for further evaluations. All these parameters with their possible values are tabulated in table I (Parameter Table).

Analysis describes the detail examination of different features in a system. Our paper analyses the surveyed research paper on the basis of different parameters listed above and their division is described in the above paragraph.

The first portion is Data set that describes the list of those parameters that form the data set for training and testing. The data set involves characters and images also. Hence their type, style and size are analyzed in this portion and are presented in Table II.

The second portion of parametric analysis divides parameters into a set of algorithm having different possible values for them in each research paper individually. Analysis presents the following algorithms to be used extensively Segmentation, Image Transformation, Filters and several recognition algorithms. These are tabulated in table III.

Obviously, there must be a proper way of carrying out a particular task, in term of Urdu document's recognition, it is specified as scientific procedure and generally categorized as Technique. Different research papers use different techniques to achieve the desired results, the techniques are listed algorithms their respective research papers in table II (a). On the basis of strokes, ligature and other parts of Urdu language's corpus; the recognition is difficult but the analysis shows an average precision of 65-70% for the given data sets of analyzed research papers. Similarly recognition accuracy's average is also difficult but its percentage is more than recognition rate, which is about 92-93%.

IV. CONCLUSION

After the survey on Urdu documents the following conclusion is made regarding the Data set, Techniques and algorithms, efficiency and effectiveness. Widely used Data set that involves training set, here is images in which character is defined [1], [6], [8] and [11], in which hand written text is focused [6], diacritics in [1], [3], [9], [10], [11], [12] and [15].font style Naksh used in [2] and [8] and Nastaleeq in [3],[4]. Letter's shape is also described in the [8]. In addition image type, style and size is also recommended. Overall gray scale image is widely utilized to give desired output. Segmentation is widely used. [2], [3], [6], [8], [10] and [13] defined many types of segmentation. Image transformation algorithm is also used along with recognition algorithms.

HMM is extensively used technique that uses hidden states to build a system in the given paper, it is used in four research papers [6],[10], [11] and [15].

For the storing of data most widely used technique is Rule-based technique. Hence in the paper experts only use it for building new styles too. This is executed in [4] and [15]. Similarly the

large focus is on the Matching technique too that implements the evaluation of effects of treatment by comparing different units. It enhances the concept of systems from training set to testing set and recognition is hence more authenticated.

As the spot light is on Urdu documents, the importance of Urdu is due to its characters. For that reason OCR cannot be neglected which is used to convert images of type written and printed text into machine encoded text.

V. FUTURE WORK

As the techniques discussed in this paper is just initial step of implementation but there is still a lot of work for future enhancement. A new approach by combining HMM or rule based approach with template matching technique can also be used to tackle all the problems in Urdu document recognition.

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TABLE I (PARAMETER TABLE)

S.No	Parameters	Value
1	Training Set	Ligatures, diacritics, partial words, unique words, handwritten text, isolated characters isolated words, handwritten Urdu digits, images (isolated digits, numeral strings, special symbols, isolated characters, financial Urdu words, different patterns), Named Entities, digits, samples, words, text lines
2	Recognized	Ligatures, words, partial words, unique words, Printed, Handwritten, Online, Offline
3	Letters' shape	isolated, initial, final, medial
4	Font Style	Naksh & Nastaleeq
5	Image Type, Style	monochrome scanned image, scanned, computer generated, handwritten, grayscale, binary
6	Image/Page Size	512*512(source image), 300-dpi, 150-dpi, 24*24(template), 1:3(Aspect ratio)
7	Segmentation	line segmentation (Horizontal, Vertical, Diagonal, Up, Down, Right, Left, Diagonal Right Downward, Diagonal Left Downward) & isolated character segmentation, stroke segmentation
8	Image Transformation	Grayscale to binary, Pre-processing Step (Sauvola's Method), Color Image to Binary
9	Filters	one dot, two dots, three dots
10	Recognition Algorithm	Handwritten Text Recognition Algorithm, Multilingual Cursive Script Character Recognition Algorithm, Statistical Named Entity Recognition (N-gram, Unigram, Bigram Algorithm)

TABLE II (ANALYSIS TABLE: DATASET)

Ref. No	Parameters					
	Data Set					
	Training Set	Recognized	Font Style	Letters' shape	Image Style/Type	Image/Page Size
S. A. Husain et.al.[1]	240 ligatures & 6 diacritics	864 ligatures & 50,000 words	N/A	isolated, initial, final, middle	N/A	N/A
Tabassam Nawaz et.al.[2]	N/A	N/A	Naksh	minimum 2, maximum 4	Grayscale	N/A
Muhammad Shafi et.al.[3]	215 partial words & 95 unique words	8714 partial words & 3615 unique words	Nastaleeq	N/A	N/A	N/A
Adnan Ul-Hasan et.al.[4]	N/A	N/A	Nastaleeq	N/A	Grayscale	N/A
Gurpreet Singh Lehal [5]	N/A	N/A	N/A	N/A	N/A	N/A
Prakash Choudhary et.al.[6]	343 handwritten text, 44 isolated characters & 57 isolated words,	N/A	N/A	N/A	Grayscale	300-dpi
Imtiaz Ahmed Ansari et.al.[7]	2000 samples	N/A	N/A	N/A	Color Image	64*64
Saeeda Naz et.al.[8]	109,588 images (60,329 isolated digits, 12,914	N/A	Nastaleeq/Naksh	isolated/ joined character	N/A	N/A

	numeral strings, 1705 special symbols, 14,890 isolated characters, 19,432 financial urdu words, 318 different patterns)					
Faryal Jahangir et.al.[9]	2313 Named Entities	N/A	N/A	N/A	N/A	N/A
Muhammad Imran Razzak et.al.[10]	3000 digits	N/A	N/A	N/A	N/A	N/A
Sobia Tariq Javed et.al.[11]	100 samples, 18600 words, 1692 ligatures	1569 ligatures	N/A	isolated, initial, final, middle	monochrome Scanned images	150-dpi
Khalil Khan et.al.[12]	200 samples	N/A	N/A	N/A	scanned, handwritten, computer generated image, grayscale	512*512(source image), 42*24(template image)
Muhammad Imran Razzak et.al.[13]	N/A	N/A	N/A	N/A		
Faisal Shafait et.al.[14]	234,286,702,1158,819(Text -lines)	N/A	N/A	N/A	Binary image	1:3(aspect ratio)
SaeedaNaz et.al.[15]	N/A	N/A	N/A	N/A	N/A	N/A

TABLE III (ANALYSIS TABLE: ALGORITHMS)

Ref. No	Parameters			
	Algorithms			
	Segmentation	Image Transformation	Filters	Recognition Algorithms
S. A. Husain et.al.[1]	N/A	N/A	N/A	N/A
Tabassam Nawaz et.al.[2]	line segmentation & isolated character segmentation	Grayscale to binary	one dot, two dots, three dots	N/A
Muhammad Shafi et.al.[3]	N/A	N/A	N/A	N/A
Adnan Ul-Hasan et.al.[4]	N/A	Pre-processing Step(Sauvola's Method)	N/A	N/A
Gurpreet Singh Lehal [5]	Reduces classes to 2328(2190 primary ligatures, 22 secondary ligatures, 41 primary isolated characters & 95 touching components	N/A	N/A	N/A
Prakash Choudhary et.al.[6]	line & isolated character segmentation	N/A	N/A	Handwritten Text Recognition Algorithm
Imtiyaz Ahmed Ansari et.al.[7]	N/A	Colored to Binary	Median Filter	N/A
SaeedaNaz et.al.[8]	line(horizontal, vertical, diagonal) & isolated character segmentation	N/A	N/A	Multilingual cursive script character recognition algorithm
Faryal Jahangir et.al.[9]	N/A	N/A	N/A	Statistical Named Entity Recognition(N-gram, Unigram, Bigram Algorithm)
Muhamma	Up, Down, Right, Left, Diagonal Right	N/A	N/A	N/A

d Imran Razzak et.al.[10]	Downward, Diagonal Left Downward			
Sobia Tariq Javed et.al.[11]	N/A	N/A	N/A	N/A
Khalil Khan et.al.[12]	N/A	N/A	Median Filter	N/A
Muhammad Imran Razzak et.al.[13]	stroke segmentation	N/A	N/A	N/A
Faisal Shafait et.al.[14]	N/A	N/A	N/A	N/A
SaeedaNaz et.al.[15]	N/A	N/A	N/A	Name Entity Recognition Algorithm

TABLE IV (TECHNIQUES & RESULTS OF ANALYSIS)

Ref. No	Technique	Results	
S. A. Husain et.al.[1]	STNN, OLUCR, Tree based Dictionary Search, Intuous Wacom Board	Recognition Rate/ Precision	Recognition accuracy
Tabassam Nawaz et.al.[2]	Special Matching Technique, Morphology Technique(Pepper noise removal procees, thinning process)	93% for Base strokes & 98 % for secondary strokes	N/A
Muhammad Shafi et.al.[3]	Database retrieval	15 char/ sec	89%
Adnan Ul-Hasan et.al.[4]	Machine Learning, Rule Based Technique	N/A	N/A
Gurpreet Singh Lehal [5]	OCR	69%	88%
PrakashChoudhary et.al.[6]	HMM, Annotation, Word-level, complete level	N/A	99%
Intiyaz Ahmed Ansari et.al.[7]	BPNN	N/A	N/A
SaeedaNaz et.al.[8]	Neural Network	N/A	92.07%
Faryal Jahangir et.al.[9]	Smoothing Technique, bigram NER tagger	N/A	91.54% for Naksh& 94.5% for Nastaleeq
Muhammad Imran Razzak et.al.[10]	Fuzzy linguistic, HMM, Hybrid Approach	65.21 % precision for n-gram, 66.2 % for bigram	
Sobia Tariq Javed et.al.[11]	HMM, Jang Chin Algorithm	N/A	98.60 % digits, 98.49 % uppercase letters, 97.44% lowercase letters, 97.40% combined set
Khalil Khan et.al.[12]	Template Matching	N/A	92.73%
Muhammad Imran Razzak et.al.[13]	Novel technique, Bresenham's line algorithm	100% for 5 character ligatures, 87% for 3 character ligatures, 78% for 2 character ligatures	N/A
Faisal Shafait et.al.[14]	Layout Analysis	N/A	N/A
SaeedaNaz et.al.[15]	HMM, ME, CRF, SVM, ML appraoches, rule based approach	N/A	N/A

Hybrid Genetic Based Multi Dimensional Host Load Aware Algorithm for Scheduling and Optimization of Virtual Machines

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Abstract: Mapping the virtual machines to the physical machines cluster is called the VM placement. Placing the VM in the appropriate host is necessary for ensuring the effective resource utilization and minimizing the datacenter cost as well as power. Here we present an efficient hybrid genetic based host load aware algorithm for scheduling and optimization of virtual machines in a cluster of Physical hosts. We developed the algorithm based on two different methods, first initial VM packing is done by checking the load of the physical host and the user constraints of the VMs. Second optimization of placed VMs is done by using a hybrid genetic algorithm based on fitness function. Our simulation results show that the proposed algorithm outperforms existing methods and enhances the rate of resource utilization through accommodating more number of virtual machines in a physical host

Index Terms: Virtual Machine, Physical Machine Cluster, VM Scheduling, Load Rebalancing, Load Monitoring.

I. INTRODUCTION

Infrastructure-as-a-Service (IaaS) is the most fundamental use of cloud computing. The virtualization technology is the base to form an IaaS platform. This proposes the entire computing resources for deploying and executing applications, storing data, or accommodating a company's complete computing environment [3]. Virtualization technologies guarantee opportunities for cloud data centers to host applications on shared infrastructure. Data center expenses can be lessened by using virtual machines (VMs) Cloud data center providers can create a huge number of virtual machines (VMs) for different types of workload and specification requirements.[4] Each VM is configured with a

certain amount of computing resources which is adequate with workload requirements. The cloud service providers can consolidate all the VMs into a few numbers of physical hosts, keeping in mind the end goal to lessen the aggregate number of obliged physical servers and abusing server capacities all the more completely, permitting cloud providers to spare cash on equipment and vitality costs. VM consolidation method is the key sympathy toward attaining economy of scale in a cloud data center domain [5].

The advent of virtualization technology enables the physical server consolidation in datacenters which plays a vital role in minimizing the number of physical servers used and energy consumption also. Various approaches has been provided by the researchers for server consolidation in data centers but none of them have been considered all the aspects of the server consolidation which ensures the QOS as well as reduced cost for the datacenter administrators. Therefore a new algorithm is needed in order to provide better service to the cloud users and at the same time reducing the operational cost to the service provider. Placing the VM in the appropriate host is necessary for ensuring the effective resource utilization and minimizing the datacenter cost as well as power. To address this problem in this paper we propose a new efficient hybrid genetic based host load aware algorithm for scheduling and optimization of virtual machines in a cluster of Physical hosts. We divide this problem into two following categories.

A. Initial Scheduling of VMs

The Virtual Machine allocation problem in a cloud infrastructure is investigated by many researchers in the past. But the majority of the presented mechanisms paid no

attention to the ever changing load of the physical host and dynamic nature of the Virtual Machine deployment requests that frequently reaches the cloud provider infrastructure. Here we present an efficient hybrid host load aware algorithm for scheduling virtual machines to a cluster of Physical hosts. We developed the algorithm based on two different methods, first by checking the load of the physical host, the load factor of a physical host can be measured by the way of analyzing utilization level of the individual resources like CPU, Memory and Network bandwidth. Second by considering the past utilization activities of a VM to a physical host.

B. Ongoing Load Rebalancing or Optimization

Rebalancing of load in datacenter environment need live VM migrations but more number of frequently moved VMs between physical hosts causes increased network bandwidth utilization and datacenter cost hence the load rebalancing has to be achieved with minimum number of VM migrations in order to solve this issue we used a modified version of hybrid genetic algorithm for load optimization. The main contribution of this paper includes the introduction of virtualization technology, a new proposed algorithm for initial VM scheduling, ongoing load rebalancing or optimization and validation of the proposed algorithm on a simulated environment for its goals.

The rest of the paper is organized as follows: In Section II we describe the related work while in Section III placement problem under study has been explained, we present the design model to explain the proposed strategy in section IV The proposed algorithm for VM scheduling is discussed in section V. Load balancing and VM optimization based on genetic algorithm is presented in section VI. Section VII shows the experimental setup and results acquired by our technique compared with some of the existing strategy for optimal VM placement and optimization. Section VI concludes the paper and spotlights some possible future directions.

II. RELATED WORK

Most of the IaaS cloud data centers uses virtualization technology since it provides a good flexibility in the provisioning and placement of servers and their associated workloads and cost savings [6] [7] while this model provides a number of advantages, it is essential to administer the allocation of virtual machines to the physical hosts in the data center. Even though a lot of researchers have been studied this virtual machine mapping problem in the past we draw attention to some of the closest work in perspective of our point.

In [8] the number of physical machines needed to deploy the requested virtual machine instances are reduced by

combining time series forecasting techniques and bin packing heuristic but the model has not included the relationships between multiple resources, like CPU and I/O. In [9] the VM placement algorithms make use of the behavior of VMs to have some properties in general. In [10] for the placement of virtual machines to physical machines a two level control management system is used and it uses combinatory and multi-phase efficiency to solve potentially inconsistent scheduling constraints. In [11], VM scheduling constraints are considered as single dimension in a multidimensional Knapsack problem.

In [12], the VM scheduling policy is primarily dealt out from the viewpoint of network traffic and three common scheduling algorithms have been introduced for Cloud computing and simulation results provided. In [13] the performing load balancing in data centers are intensively studied the heuristics has been used as a common approach among systems to enables the load balancing among physical servers. In [14] the performance variations have been identified and monitored in a physical server hosting VMs. A few simple VM placement algorithms like time-shared and space-shared were presented and compared in [15] and introduced a method to model and simulate Cloud computing environments, in which the algorithms can be implemented. In [16] pioneered methods for virtual machine migration and proposed some migration techniques and algorithms. [17] Evaluated most important load-balance scheduling algorithms for conventional Web servers. VectorDot a novel load-balancing algorithm has been introduced in [18] to work with structured and multi-dimensional resources limitations by taking servers and storage of a Cloud into account. A countable measure of load imbalance on virtualized data center servers has been proposed in [19]. In [20] a comparative study of widely used VM placement strategies and algorithms for Cloud data centers has been presented. An overloaded resource based VM placement approach has been presented in [21]. In our previous study [22] the comparison of various VM scheduling algorithm has been presented and demonstrated the necessity of new efficient placement VM placement algorithm.

A genetic based simulated annealing algorithm for optimization of task scheduling in cloud computing has been proposed and implemented in [23]. This algorithm only considers the QOS necessities of various types of tasks. Some of the genetic operators that use the group-oriented structure lead the better results when compared to the non-grouping genetic based algorithms which are not use such grouping feature. In [24] [25] they used the grouping based genetic algorithm to reach better results than conventional methods and universal heuristic algorithms.

III. PROBLEM FORMULATION

The major principle of the IaaS cloud computing system is that its user can make use of the resources to have good performance and economic benefits. With the support of virtualization innovation the resources can be conveyed to the users in the form of virtual machines hence an efficient virtual machine allocation policy and management process is required to avoid underutilization or overutilization of the physical machines which may affect the quality of services of the IaaS cloud. The under utilization of servers is a well known expenditure concern in cloud management. Low utilization of server resources leads to the usage of more physical machines, increasing expenses for machine power and capital and operational expenses for cooling systems. Moreover, surplus machines require more carbon footprint.

The overutilization of physical servers results in violating the SLA and quality of service constraints. Efficient allocation of Virtual machine instance request will meet client requirements, improve the resource utilization, increases the overall performance of the cloud computing environment and also decreases the number physical machines used. Therefore an efficient VM scheduling and ongoing load monitoring and optimization in IaaS is an important cloud computing problem to resolve.

IV. DESCRIPTION OF DESIGN MODEL

To address the VM scheduling and ongoing load optimization problem we have proposed a multi dimensional physical host load aware scheduling and hybrid genetic based optimization algorithm and we implemented this heuristics in JAVA using Netbeans IDE.

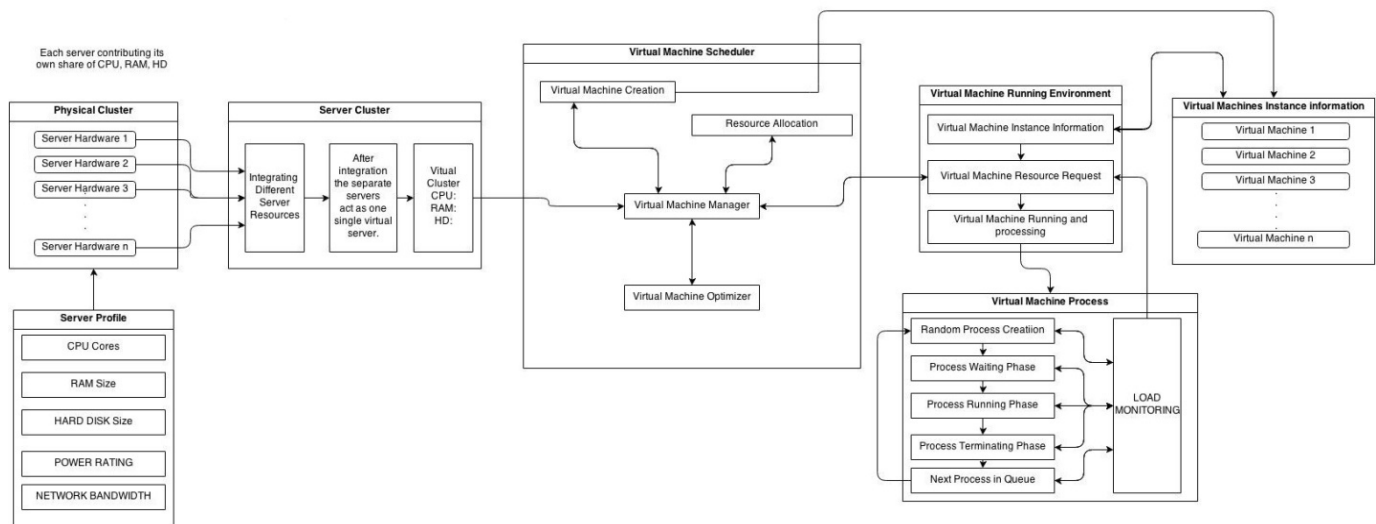


Figure 1: Framework model for VM placement in a cluster of physical machines

The above figure shows the framework model in which the proposed algorithm is implemented. Here the physical clusters can be formed by adding a set of physical servers each server contributing its own share of resources such as CPU cores, main memory, disk capacity and network bandwidth. The users can create virtual machine instances by giving their requirements for running the applications and the VM requests are submitted by the users to the computing system. As the submitted VMs enter to the cloud they are wait for their turn in the stack. The VM requests can be handled by the virtual machine scheduler and it finds the appropriate physical machine by estimating the VM size and checking for the availability and capacity of the physical machine when it finds the appropriate physical machine the VM scheduler immediately allocates the identified physical machine to the virtual machine instance request in queue and the required resource can be allocated to the virtual machine. Rebalancing of load in this environment is handled

by virtual machine optimizer we used a modified version of genetic algorithm for load optimization.

V. ALGORITHM DESIGN FOR THE PROCESS OF VIRTUAL MACHINE ALLOCATION

This is a simple and efficient method that uses the load factor of the physical machine and also VM constraints given by the user about the VM resource requirement. It also identifies the overloaded physical machine and selects the VM to migrate based on the past behavior of the VM and picks the appropriate PM based on its resource utilization rate. Then it discovers the underutilized PMs and migrates the VMs running on it to some other suitable PMs, and turn it off in view of energy saving. Since accurately forecasting the resource requirement and behavior of the VM is not possible our algorithm utilizes the user deployed resource details of workload of the VM and considers the load factor

of the physical machine as well as physical machine cluster to identify the appropriate PM for the given VM request. We use bin packing heuristic combined with three different algorithms to minimize the number of Physical machines required to place a set of VMs, quick and correct placement of VMs, maintain balanced load among the servers, increase the resource utilization rate and importantly doing all these things without violating any SLA agreements. N number of virtual machines with resource requirements VR (CPU, Memory, N/W Bandwidth) to be placed on a set of M physical machines with resource capacities of PR(CPU, Memory, N/W Bandwidth) grouped in K number of physical machine cluster.

Consider PM as a set of all the physical machines in the entire system, where $PM = \{PM_1, PM_2, PM_3 \dots PM_m\}$. m is total number of the physical machines and an individual physical machine can be denoted as PM_i , where i denote the physical machine number and range of i is $(1 \leq i \leq m)$. Similarly, the set of VMs on the physical machine i , can be $\{VM_{i1}, VM_{i2} \dots VM_{in}\}$ here n is the number of VMs on the physical server i . If we want to deploy VM j on the PM_i then the load of the CPU, RAM and bandwidth has to be calculated individually. The CPU load of the PM_i at the time interval ts is denoted as follows

$$PM_i(cpu, ts) = \sum_{j=1}^n VM_{ij}(cpu, ts) \quad (1)$$

The amount of RAM utilized by all the VMs of PM_i at the time interval ts can be denoted as follows,

$$PM_i(ram, ts) = \sum_{j=1}^n VM_{ij}(ram, ts) \quad (2)$$

The amount of Network Bandwidth utilized by all the VMs of PM_i at the time interval ts can be denoted as follows

$$PM_i(nbw, ts) = \sum_{j=1}^n VM_{ij}(nbw, ts) \quad (3)$$

Where PM_i represents the i^{th} physical machine of the Physical Machine Cluster k , VM_{ij} represents j^{th} virtual machine of the PM_i and cpu , ram and nbw denotes the amount of CPU, RAM and Network Bandwidth utilized by all the VMs of the PM_i respectively.

Hence derived from (1),(2) and (3) the weighted average load of the Physical Machine Cluster k at time interval ts can be denoted as follows

$$PMCK(WL, ts) = \sum_{i=1}^m PM_i(WL, ts) \quad (4)$$

Where $PMCK$ represents the k^{th} physical machine cluster of the datacenter, WL represents the weighted load of physical machine cluster at time interval ts and PM_i represents the i^{th} physical machine of the Physical Machine Cluster k

At any time interval the total VM load of a PM should not exceed the host capacity

$$\sum PM_i W_{resource\ usage}(ts) \leq TH\ value \leq \sum PM_i W_{resource\ capacity} \quad (5)$$

Where $resource \in \{CPU, RAM, Network\ Bandwidth\}$ and $W_{resource}$ is the weight associated with each resource TH value is the threshold value set by the administrator if the load goes beyond this value the host can be considered as overloaded host and the selected VMs has to be migrated to other appropriate physical machines.

VI. DYNAMIC VM PLACEMENT

In this process the objective is to place the VMs in PMs in a way that the total number of PMs required to place all the VMs is decreased. So we considered this a multi potential bin packing problem since this is a NP-hard problem, we provide a heuristic based on multiple policy. In the earlier stages of allocation most of the PMs are underutilized or not used so our heuristics works as like the first fit scheduler which is a simplest one to implement and which increases the response time of VM placement. As the number of VM grows in the datacenter the utilization level of PM is also being considered by our heuristic which really helps in maintaining the balanced load among servers. Towards the closing stages the heuristic works according to the nature of the VMs workload that is gathered from the user provided hints which helps in avoiding the bottleneck of a particular resource as well as avoiding the violence of any SLA agreements. The algorithm which is used to achieve these things is given below.

Algorithm 1: Dynamic VM placement

Step1:- The VM requests given by the user at the time t_i is considered for allocation and scans the values of number of CPU cores, amount of RAM and amount of N/W bandwidth required.

Step2: In this algorithm the scheduler maintains an index table for physical clusters and physical machines as well as their states whether available or busy.

Step 3: The scheduler scans the index table of the physical cluster for the load below 50 %, from top until the first available physical cluster is found or the index table is scanned fully.

Step 4: If the physical cluster is found then scan the index table of physical machines for the load below 50 % in all

three major resources, from the top until the first physical machine is found.

Step 5: When found return the ID of the physical machine to the main controller

Step 6: Assign the VM to the identified PM.

Step 7: Update the index table of the PM and Physical cluster.

Step 9: Go to the step 1

Step 8: If not found then scheduler scans the index table of the physical cluster for the load below 70 %, from top until the first available physical cluster is found or the index table is scanned fully.

Step 9: If the physical cluster is found scan the index table of the PMs based on the requirements of the requested VM.

Step 10: If the requested VM is a CPU intensive then scan the PM index table for the amount of CPU utilized is below 70 %, from the top until the first physical machine is found.

Step 11: When found return the ID of the physical machine to the main controller

Step 12: Assign the VM to the identified PM.

Step 13: Update the index table of the PM and Physical cluster and go to the step 1

Step 14: If the requested VM is a memory intensive then scan the PM index table for the amount of RAM utilized is below 70%, from the top until the first physical machine is found.

Step 15: When found return the ID of the physical machine to the main controller

Step 16: Assign the VM to the identified PM.

Step 17: Update the index table of the PM and Physical cluster and go to the step 1

Step 18: If the requested VM is a network intensive then scan the PM index table for the amount of network bandwidth utilized is below 70%, from the top until the first physical machine is found.

Step 19: When found return the ID of the physical machine to the main controller

Step 20: Assign the VM to the identified PM.

Step 21: Update the index table of the PM and Physical cluster and go to the step 1

Step 22: If Physical Cluster is not found. The scheduler scans the index table for the load below 80 %, from top until the first available physical cluster is found or the index table is scanned fully

Step 23: If found scan the index table of the PMs based on the requirement of the requested VM.

Step 24: If the requested VM is a CPU intensive then scan the PM index table for the least number of CPU cores utilized from the top until the first physical machine is found.

Step 25: If found check the host has enough CPU cores to fulfill the VMs CPU requirement and will not surpass 90%

of load after placing the new VM, then return the ID of the physical machine to the main controller.

Step 26: Assign the VM to the identified PM.

Step 27: Update the index table of the PM and Physical cluster and go to the step 1.

Step 28: Else go to step 22

Step 29: If the requested VM is a memory intensive then scan the PM index table for the least amount of RAM utilized from the top until the first physical machine is found.

Step 30: If host has enough RAM to fulfill the VMs memory requirement and will not surpass 90% of load after placing the new VM, then return the ID of the physical machine to the main controller.

Step 31: Assign the VM to the identified PM.

Step 32: Update the index table of the PM and Physical cluster and go to the step 1.

Step 33: Else go to step 22

Step 34: If the requested VM is a network intensive then scan the PM index table for the least amount of network bandwidth utilized from the top until the first physical machine is found.

Step 35: If host has enough bandwidth to fulfill the VMs bandwidth requirement and will not surpass 90% of load after placing the new VM, then return the ID of the physical machine to the main controller.

Step 36: Assign the VM to the identified PM.

Step 37: Update the index table of the PM and Physical cluster and go to the step 1.

Step 38: Else go to step 22

VII. LOAD BALANCING AMONG PHYSICAL SERVERS

Since virtual machine workloads frequently change eventually, the well primary placement choices is not sufficient to maintain the balanced load. So it is essential to dynamically rework placements to make QOS constraints are to be satisfied while change in the data center load. Maintaining balanced load among server requires more number of VM migrations which leads to increase the operational cost of the service provider so VMs should be rearranged in a way such that the number of VM migrations should be minimized while satisfying resource utilization and load balance. In this type of multifaceted problems, even the most prominent algorithms can't realize all the associations between VMs, physical servers, and physical clusters to lead the most finely optimized solution. In order to achieve this goal a new grouping based genetic algorithm is proposed and we believe that our new algorithm is useful for this kind of complex optimization problem.

A. Grouping Genetic Based Algorithm Design for Load Balancing among Physical Servers

Genetic algorithm is a better searching technique for VMs mapping problem because of its enhanced optimization ability and parallelism advantages to solve complex problems.

The common steps of the Genetic algorithm are summarized as follows:

- Creation of an initial population
- The below steps repeated until it reaches the stopping condition
- Select chromosome pairs for mating
- perform cross-over to generate new offsprings
- Calculate the fitness value of new offsprings
- Create a new population

B. Creation of an Initial Population

Genetic algorithm is executed in parallel on a set of selected physical servers. So creating Initial populations plays an important role [26] in genetic algorithm so we develop a novel algorithm to generate initial population. In solution space for these physical hosts Selection process chooses the solution vectors according to the probability which is proportional to the fitness value. Then the algorithm crosses the chosen product vectors and performs mutation operation on the crossed product vectors based on the fitness value. The algorithm continues the same stage until it reaches out the terminating situation, followed by the crossover and mutation process.

Steps for selecting initial Population

Step 1: Check the PM load against threshold value.

Step 2: If any PM resource utilization surpasses the threshold value that can be considered as an overloaded host

Step 3: Select the overloaded servers and sort those PMs based on their resource utilization value.

C. Fitness Function

The fitness value plays an important role in any individuals output. It is the evaluation methodology of the dominance of an individual in the population. The performance of an individual can be determined by its fitness value. The performance of an individual can be considered as better when the fitness value is high. The existence or termination of an individual is completely based on the fitness value. Therefore, the fitness function is an essential part of the Genetic Algorithm. The objective function can be defined as follows when there is m host in the physical cluster k and m is the number of VM in each host.

$$PMi(Rcpu, ts) = PMi(Tcpu, ts) - \sum_{j=1}^m VMij(Dcpu, ts) \quad (6)$$

Where $PMi(Rcpu, ts)$ represents the remaining CPU of i^{th} PM at the time slot ts , $Tcpu$ represents the total CPU capacity of i^{th} PM and $VMij(Dcpu, ts)$ represents the

demanded CPU of the j^{th} VM of the i^{th} Physical host at the time slot ts .

$$PMi(Rram, ts) = PMi(Tram, ts) - \sum_{j=1}^m VMij(Dram, ts) \quad (7)$$

Where $PMi(Rram, ts)$ represents the remaining RAM of i^{th} PM at the time slot ts , $Tram$ represents the total RAM capacity of i^{th} PM and $VMij(Dram, ts)$ represents the demanded RAM of the j^{th} VM of the i^{th} Physical host at the time slot ts .

$$PMi(Rnbw, ts) = PMi(Tnbw, ts) - \sum_{j=1}^m VMij(Dnbw, ts) \quad (8)$$

Where $PMi(Rnbw, ts)$ represents the remaining Network Bandwidth of i^{th} PM at the time slot ts , $Tnbw$ represents the total Network Bandwidth capacity of i^{th} PM and $VMij(Dnbw, ts)$ represents the demanded Network Bandwidth of the j^{th} VM of the i^{th} Physical host at the time slot ts .

$$PMck \mu Rcpu = \sum_{x=1}^m \frac{PMi Rcpu}{m} \quad (9)$$

$$PMck \mu Rram = \sum_{x=1}^m \frac{PMi Rram}{m} \quad (10)$$

$$PMck \mu Rnbw = \sum_{x=1}^m \frac{PMi Rnbw}{m} \quad (11)$$

Where $PMck \mu Rcpu$, $PMck \mu Rram$ and $PMck \mu Rnbw$ represents the k^{th} physical cluster's mean value of CPU, RAM and Network Bandwidth respectively.

In our proposed algorithm we consider four objectives in packing and optimizing the virtual machines in a data center: minimizing the total revenues, reducing the power consumption cost, reducing the cost of migration, increasing the total revenues and also reducing the SLA violation rate. These diverse objectives can be accomplished by evaluating the following fitness function described in equation 12 while allocating the VMs

$$\text{minimize} \left(\sqrt{\frac{1}{N} \sum_{i=1}^n (PMiR_{cpu} - PMCk_{\mu R_{cpu}})^2} \right) + \left(\sqrt{\frac{1}{N} \sum_{i=1}^n (PMiR_{ram} - PMCk_{\mu R_{ram}})^2} \right) + \left(\sqrt{\frac{1}{N} \sum_{i=1}^n (PMiR_{nbw} - PMCk_{\mu R_{nbw}})^2} \right) \quad (12)$$

The objective function of our algorithm wants to minimize the standard deviation of the remaining CPU, RAM and Network Bandwidth in each host. As we consider that the load of the entire physical cluster instead of taking into consideration of the total number of virtual machines in each physical host as a load balance metric we developed an objective function that tries to balance the consumption of CPU, RAM and Network Bandwidth on each host, in view of a heterogeneous environment, which consists of different hosts with different configurations.

D. Crossover Operator

Genetic algorithms crossover operator used to combine the qualities of different individuals in the population with the intention of creating a new generation. Hypothetically the new child will have good qualities from both parents and optimistically has better fitness. Any two parents have been chosen with probability relative to the fitness of the individual. Most of the times, the individuals with high fitness value will reproduce with higher probability than the individuals with lower fitness value. We followed a method which is similar to the one illustrated in [27] for the implementation process of the crossover operator. In our methodology all of the servers from both parents are integrated and the servers are sorted based on the fitness. The servers with less remaining capacity of all the individual resources are at the front of the list, whereas the servers with more remaining capacity are placed at the end of the list. Then our algorithm analytically chooses the servers which has less remaining capacity and remains them together in the same group. During this process whenever a selected server contains any VM that belongs to a server that has been chosen previously, then that server is a superfluous and can be removed in order to avoid duplication. But this process will create a list of servers that may not include all VMs. These VMs which are outstanding that have not been integrated in any server will be used to reinserted in to other servers based on the algorithm 1.

E. Mutation Process

Mutation operator in our algorithm comprises three alternatives. First, choice of mutation process removes the VMs of randomly selected servers and the removed VMs consequently reinserted into the other servers which are in

the new population based on our algorithm 1. Second, two randomly chosen VMs of existing packing order are interchanged between servers. In this process we assure that the algorithm never interchanges two VMs that came from the same server. As a third option, one VM is shifted to a different server to generate a new packing order.

Based on the information provided by the monitoring driver the second and third genetic operator works on the packing order list, to increase the performance of the ordering genetic process. Finally, for all the above genetic operators the mutation process is done on the VMs with probability inversely proportional to the fitness value of the server that the VMs originally come from. VMs placed in servers with lesser fitness value are mutated more frequently than VMs placed in servers with higher fitness value, in order to guarantee that the organization of enhanced server is retained. Presently new children will be an element of the next generation so we need to choose one solution from the next generation of solution. Whenever the exit criteria are satisfied then this algorithm is stopped and returns servers which has the highest fitness evaluation value.

Table I: Properties required for the index table of physical machine and physical machine cluster

S.No	Physical Machine	Physical Machine Cluster
1	Total number of VMs placed	Total number of PMs
2	Total number of VMs in each type (CPU intensive, RAM intensive, N/W intensive)	Total number of PMs exhausted
3	The percentage of load of the PM in each resource type individually	The cumulative percentage of the load of the entire PMs
4	Total number of CPU cores utilized and available	The list of PMs which can be used to place the CPU intensive VMs
5	Total amount of RAM utilized and available	The list of PMs which can be used to place the memory intensive VMs
6	Amount of n/w bandwidth utilized and available	The list of PMs which can be used to place the N/W Bandwidth intensive VMs

VIII. PERFORMANCE EVALUATION

A. Experimental Setup

The presented algorithm is implemented in JAVA Net beans IDE. Then we use CloudSim simulator for simulation to assess the execution and performance of our heuristics with some of the existing scheduling algorithm in terms of Response Time, Load Balancing among servers, Reasonable Resource Utilization, energy consumption, Minimum number of active PMs and Higher profit by reducing the number of migrations. The performances of the proposed algorithm were examined from both users and service provider's perception.

Since it is difficult to access the real datacenters or cloud infrastructures we used simulation based evaluation which can be easily reproducible to compare the performance of the proposed algorithm with the following existing works which is currently used by the majority of the cloud service providers: 1) First Fit Algorithm 2) Round Robin Scheduling Algorithm 3) Best Fit Algorithm. The simulated cloud environment contains a cluster of heterogeneous PMs the total resource capacity of PMs is expressed in percentage and randomly generated VM resource demand includes the number of CPU cores, amount of RAM and required network bandwidth.

B. Analysis

The investigations are done to analyze the effect our proposed algorithm in number of physical servers required to place a certain number of VMs, overall resource utilization rate of all the active servers, allocation time, load balancing, percentage of migration and percentage of SLA violations. The simulation results show that our proposed algorithm can use the less number of physical servers for placing a certain number of VMs which helps to improve the resource utilization rate. The response time of our algorithm is little bit more than the first fit algorithm because of its nature of allocating VMs is based on the user constraints and past usage history of the VMs. Higher SLA satisfaction rate and lower load imbalance rate can be observed in results which also show that our multi dimensional host load aware and user constraints based algorithm is applicable, valuable and reliable for implementation in real virtualized environments.

Rebalancing of load in datacenter environment need live VM migrations but more number of frequently moved VMs between physical hosts causes increased datacenter cost hence the load rebalancing has to be achieved with minimum number of VM migrations in order to solve this issue we used a modified version of genetic algorithm for load optimization. Our results show that the percentage of VM migrations had been decreased through which we can

achieve the better results for load balancing along with cost reduction.

In the following figures, Fig 2 shows the number of physical servers utilized by the scheduler to place the set of VM request without violating any SLA. Here our proposed host load aware user hint based algorithm and first fit algorithm uses comparatively same number of physical hosts for placing the set of VMs. The number of servers used by the proposed algorithm is minimized when compared to the round robin and best fit algorithm.

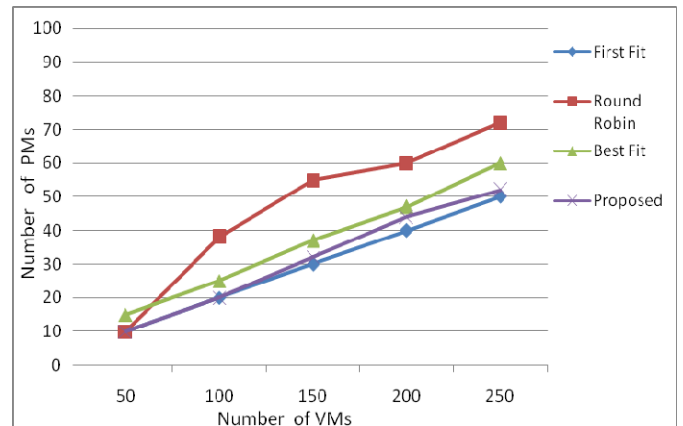


Fig 2: Comparison of the number of Physical Servers

Though the numbers of servers used by the first fit and proposed algorithms are comparatively stable from figure 3 we can see that the resource utilization rate of our algorithm is appreciably outperforms the other three algorithms.

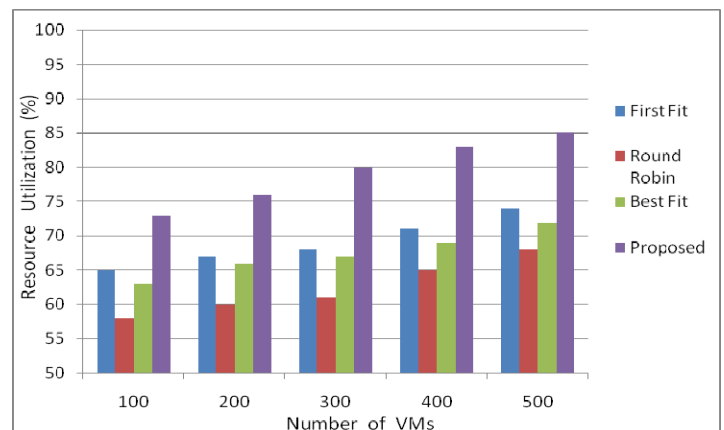


Fig 3: Comparison of the overall resource utilization rate

Fig 4 shows that the response time of all the algorithms are comparatively stable our algorithm takes little bit more time to allocate VMs than the first fit algorithm because of its nature of allocating VMs based on the user provided information and past usage history of the VMs

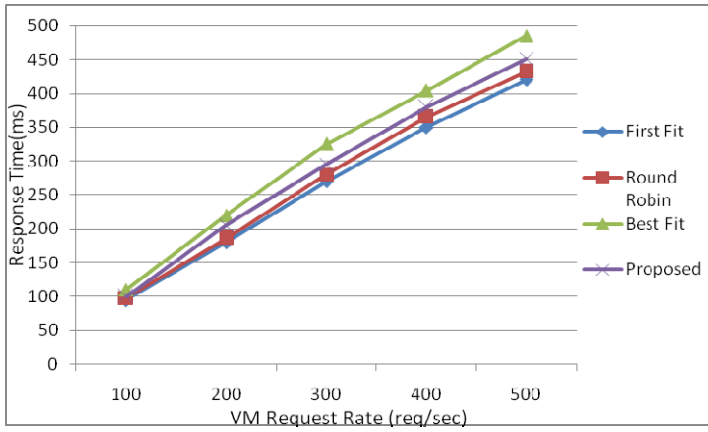


Fig 4: Comparison of the ResponseTime of different algorithms

The analysis extremely examines the effect of load balancing by using the algorithm and the number of migration needed to achieve the load balanced environment subsequent to scheduling.

Fig 5 shows the percentage of load imbalance value in which our algorithm demonstrates that it gets better the way to obtain the load balancing of the data center than the three other approaches when the number of VMs to deploy is increased.

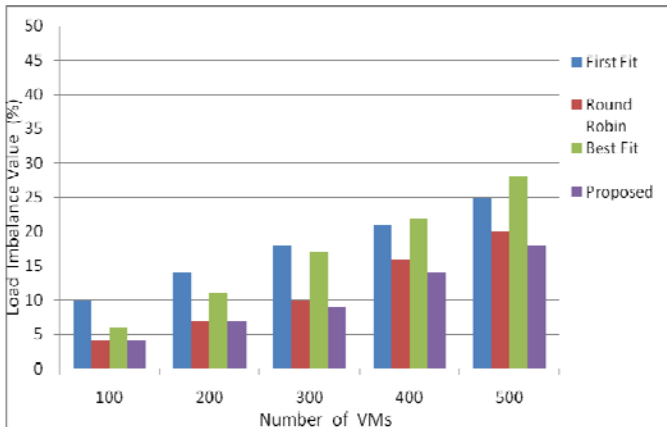


Fig 5: Comparison of the percentage of Load Imbalance Value

Our proposed algorithm is effective in improving the resource utilization rate and load balancing with the help of live migrations. But one of our major aims is increasing the total revenue which requires cutting down the VM migration cost which can be achieved by reducing the percentage of VM migration rate. We use migration rate as the estimation metric which is defined as the percentage of the migrated VMs to the total number of VM instances. We showed the results in the following Fig. 6. The proposed algorithm decreases the migrating rate from about 18%-20% to less than 13 % which leads to reduce the VM migration cost. Though the curve of our proposed algorithm indicates that only less number of VMs migrated from their original host

to a new host we achieved the better resource utilization benefit and balanced load among the physical hosts.

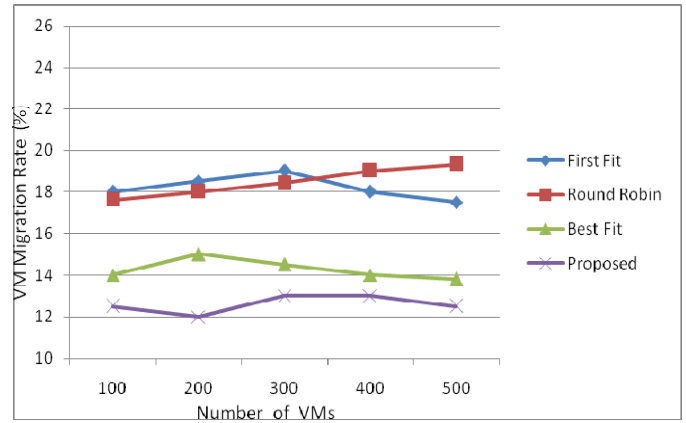


Fig 6: Comparison of the Percentage of VM Migration Rate for Load Balancing

From the below Fig 7 the low SLA violation rate is observed in the proposed algorithm because it uses the past behavior of the VM along with the user provided information and it maps the PM by considering the availability of the each key resource like CPU, RAM and network bandwidth individually.

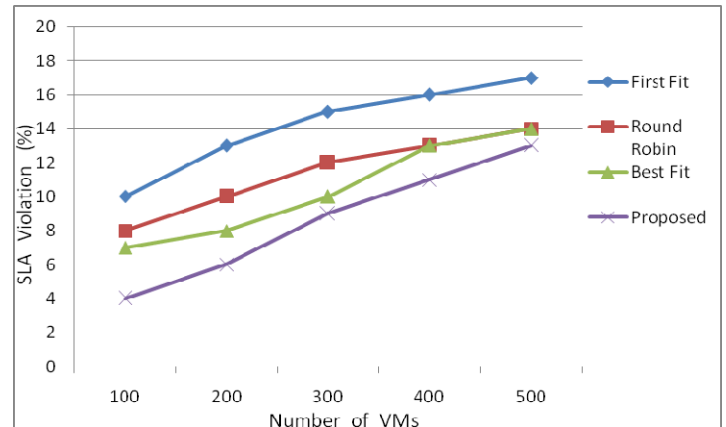


Fig 7: Comparison of the Percentage of VMs that violate their SLA

IX. CONCLUSION AND FUTURE WORK

We presented our novel algorithm that considers user constraints of VM along with physical host load factor to address the problem of mapping the VMs into PMs such that the number physical host used is minimized, the overutilization and underutilization of the resources of a host can be identified and resolved at the same time without violating any SLA agreements. Since we consider this as a multi potential bin packing problem we combined three different heuristics which considers load factor of hosts along with user provided information at the various stages of placing the VMs in physical hosts. Based on our analysis we

showed that our proposed algorithm utilizes minimum number of physical servers for hosting the set of VMs, which also reduces the energy consumption of the datacenter and it achieved high resource utilization rate by the way of using minimal number of physical servers. Another considerable enhancement in our algorithm is less percentage of load imbalance value and the percentage of VMs that violate their SLA.

As our future work we planned to incorporate the proposed algorithm with an open source cloud platform and test its efficiency against real time environment and also we would like to Modeling the interconnection prerequisites that can correctly express the relationships between VMs consolidated in the same host which will be valuable for additional optimizations of VM scheduling in cloud infrastructure.

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BIOMETRIC BANK ACCOUNT VERIFICATION SYSTEM IN NIGERIAN: CHALLENGES AND OPPORTUNITIES

BY

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ABSTRACT

Due to the need for strong security for customer financial information in the banking sector, the sector has started the introduction of biometric fingerprint measures in providing securities for banking systems and software. In this paper, we have carefully explained the methodology of using this technology in banking sectors for customer verification and authentication. The challenges and opportunities associated with this technology were also discussed in this paper.

KEYWORDS: Security, Biometric, Fingerprint, Bank

INTRODUCTION

Information technology has received a lot of advancement over the years, thus encouraging more improvement in information security. In order to improved security measures in many data-driven applications, authentication like biometric plays important roles [1].

Security is the state of being secure. In other words is building protection against advances. Since computers form the major tools used in processing data and manipulating information in many sector (e.g. banking sector), there is need to have adequate security for these computers. Meanwhile [2], define computer security as the need to secure physical location, hardware and computer software from outside threats. There exist multiple layers of computer security namely- physical security, personal security, operational security, communication security, network security and information security [2].

All these layers of computer security have received series of researchers' attentions since the information age and a lot of improvement has been recorded on them. Meanwhile, the layer of information or software security

still needs a lot of attention as well as other layers. It is true that computer softwares are used to process data and verily customers account details in the banking sectors. These computers need vigorous software security because any little compromise by the system like the banking Automatic Teller Machine (ATM) application, can lead to loss of large amount of money which can create problem for the banks and their customers.

Meanwhile for a very long time the banking sectors have been using account number, account name and customers signature for account verification and authentication. These methods of verification and authentication of bank customers has make banking operation to be very easy for the elite and highly difficult for the non-elite and have so many challenges in securing the customers data and money. This is true because, people can easily copy someone account number, forge his/her signature to commit fraud on that persons account. Also many people who are not familiar with the concept of PIN and account number are unlikely to memorize and recognize it [4], this

is mainly applicable to the non-educated customers, these has made many aged people mainly the non educated ones not to be making use of banks in making their transaction still we are talking about cashless society. The truth is that if we must attain the level of cashless society, every body (both educated and non-educated) must make use of the banking transaction thus its operations and method must be made simple to access and use. In light of the above, the banking sector have be making more efforts in introducing biometrics as a means of customers account verification and authentication. Recently the central banks of Nigeria make it mandatory for all bank customers to register their biometric information with their respective banks. However these biometric are not used yet as a meant of account verification and authentication. Meanwhile biometric is the utilization of physiological characteristics to differentiate an individual. It utilizes biological characteristics or behavioral features to recognize an individual. It is a new way to verity authenticity [3]. The reason why biometric is gaining more

attention in the banking sectors is because if used as a means of identification it will enhance information security and encourages many (both educated and non educated) customers to perform their transactions using the banking services. However, there are challenges and opportunity associated with the use of biometric fingerprint as a means of account verification and authentication. This paper therefore presents most of the common challenges and opportunities associated with using biometric fingerprint as a means of account verification and authentication in the banking sectors. Similarly the paper presents some of the solutions that can be given to these challenges, if biometric fingerprint account verification and authentication must see the light of the day.

BIOMETRIC FINGERPRINT

Biometric fingerprint are unique to every human. They are generations of numerous ridges and valleys on the surface of human figure. A finger print is the flows of ridges patterns in tip of the finger. Among all biometric traits, fingerprint has one of the highest levels of reliability [5]. In

the rapid growth of information security, fingerprints are highly used to secure information system and are highly reliable. These make many researchers agitating for the full use of this technology in securing information in different sectors. Finger print has so many application like banking security, ATM security, card transaction, physical access control, voting, identification of criminals as recorded by [6].

Similarly [7], shows in his work how a finger print can be used to control examination screening. The possibilities of using fingerprint to perform verification and authentication is determine by the pattern of ridges and furrows as well as the minutes points. It is also possible and highly secure to use fingerprint in electronic voting system as noted by [8].

METHODOLOGY

The banking sector manage large amount of customers data hence there is need to uniquely identify a particular customer for optimal operation and for security purpose. This brought the idea of using account number, signature,

and name and possibly PINS to identify the individual. However because of the changes in our society, banks application needs more security methodology than the ones mentioned above, hence, the need for biometric verification system cannot be under estimated. The question is how can we use biometric fingerprint to secure customers information in the banking sector?

The fingerprint scanner will be used to collect customers fingerprint sample with the aid of a well designed banking application and be stored in the application database. The application will have extended graphical user interface that adopt biometric fingerprint access control techniques. Whenever a customer needs his/her account details, he/she will place fingerprint on the scanner provided and the finger print image at that point will be capture and compare with the available fingerprint images in the system database, to ascertain if matches exist, if there is matches, the system will display the information corresponding to that fingerprint images as seen in the

database else an error message will be display to the system user.

CHALLENGES

There are many challenges in using biometric fingerprint as a means of account verification and authentication in the banking sector.

Allowing Artificial Fingerprint: Many fingerprint system, find it very difficult in detecting artificial finger print as noted by [3]. This is a serious challenge in using biometric system in banking as artificial finger print can be used to trick the biometric application software and still give access to the user, it is therefore a serious challenge for researcher to look for another best alternative in supporting fingerprint system in detecting artificial fingerprint.

Fingerprint Image Processing Resources: Fingerprint images require large amount of computer resources before it can be successfully processed. When this technology is employed in banking application, without finding solution to the large number of computer resources need to store

and process fingerprint images, the entire system will be slow and the performance of the system will not be encouraging at all.

Processing Fingerprint Images: Processing images across the network is always time consuming thus the need for methods of comparing and processing fingerprint images without actually using the complete image but some of the image vital properties will help to improve the processing speed of biometric images mainly when used in the banking sectors where customers satisfaction and quick responds is its watch words.

Scanner Software Development Kits: Fingerprint scanner has a kit that must be used during the application development, when this kit does not agree with the used technology during software development, there is always a serious problem.

Registration Process: Sometimes it may take many swipe of fingerprint to register [3]. Thus, there is need of improved methods of performing quick registration using this kind of system.

Society Effect to Human Fingerprints: The performance of fingerprint system for identification and authentication of customers' record in the banking sector is highly affected by the surface of the individual fingerprint. Some people do not have fingerprint, some people chemical has affected their fingerprint, and some has cuts on their own, all these poses a lot of challenges in using fingerprint for account verification and validation.

OPPORTUNITIES

Security: Biometric provide strong security to system that need strong security and authentication. Awasthi and Ingolikar (2013) noted that biometric provide a more reliability than other traditional authentication component. Using biometric for account verification and authentication will provide strong security to the system, operation.

Cashless Society: When biometric is used for managing customers account, it will encourage both educated and non-educated to make use of bank services since customers do not need to memorize account number or

signature before accessing their account details and it will help to achieve cashless society in Nigeria. With this a large number of people will be involved in using banking services even the old man in the remote village.

PIN-less Society: Using biometric for account verification and authentication will eliminate the use of PIN in accessing account details, since when this PIN is stolen the financial information of that customer is in serious risk.

Uniqueness of fingerprint: Fingerprint is unique to all human. Even, no twins in the world have the same fingerprint making the fingerprint technology credibly secure for account verification and authentication.

Reduction of Cash Theft: Biometric system will help to reduce if not totally eliminating cash theft since the real account owner must be present before the account information can be access and transaction made on the account.

Convenience: Biometric systems are convenient in environment where access privileges are necessary.

Biometric account verification will make account owners to be moving around with their account details without holding additional electronic device with them. This convenience alone is a great opportunity in biometric system.

Estimating Passwords Administrator Cost: The cost of administrating and controlling password will be totally eliminated with biometric system in account verification and authentication.

CONCLUSION

Biometric is gaining interest and attention in many fields of human endeavour to providing strong security to systems used in different fields. This is also applicable in today's banking sectors where people are agitating for the full implementation of biometric as means of account verification and authentication. This paper present a short introduction of biometric techniques in securing systems with more emphasis on how it can be used to secure customer account information in the banking sectors. The challenges and opportunities of using biometrics in banking application were also discussed in this paper. It is important to be address yet has some opportunities that must not be under estimated. The information provided in this paper will help to give a guide to the full implementation of biometric account verification system in Nigeria banking sectors.

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Access control, Anonymity, Audit and audit reduction & Authentication and authorization, Applied cryptography, Cryptanalysis, Digital Signatures, Biometric security, Boundary control devices, Certification and accreditation, Cross-layer design for security, Security & Network Management, Data and system integrity, Database security, Defensive information warfare, Denial of service protection, Intrusion Detection, Anti-malware, Distributed systems security, Electronic commerce, E-mail security, Spam, Phishing, E-mail fraud, Virus, worms, Trojan Protection, Grid security, Information hiding and watermarking & Information survivability, Insider threat protection, Integrity
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Location Anonymity schemes, Intrusion detection and prevention techniques, Cryptography, encryption algorithms and Key management schemes, Secure routing schemes, Secure neighbor discovery and localization, Trust establishment and maintenance, Confidentiality and data integrity, Security architectures, deployments and solutions, Emerging threats to cloud-based services, Security model for new services, Cloud-aware web service security, Information hiding in Cloud Computing, Securing distributed data storage in cloud, Security, privacy and trust in mobile computing systems and applications, **Middleware security & Security features:** middleware software is an asset on its own and has to be protected, interaction between security-specific and other middleware features, e.g., context-awareness, **Middleware-level security monitoring and measurement:** metrics and mechanisms for quantification and evaluation of security enforced by the middleware, **Security co-design:** trade-off and co-design between application-based and middleware-based security, **Policy-based management:** innovative support for policy-based definition and enforcement of security concerns, **Identification and authentication mechanisms:** Means to capture application specific constraints in defining and enforcing access control rules, **Middleware-oriented security patterns:** identification of patterns for sound, reusable security, **Security in aspect-based middleware:** mechanisms for isolating and enforcing security aspects, **Security in agent-based platforms:** protection for mobile code and platforms, Smart Devices: Biometrics, National ID cards, Embedded Systems Security and TPMs, RFID Systems Security, Smart Card Security, Pervasive Systems: Digital Rights Management (DRM) in pervasive environments, Intrusion Detection and Information Filtering, Localization Systems Security (Tracking of People and Goods), Mobile Commerce Security, Privacy Enhancing Technologies, Security Protocols (for Identification and Authentication, Confidentiality and Privacy, and Integrity), Ubiquitous Networks: Ad Hoc Networks Security, Delay-Tolerant Network Security, Domestic Network Security, Peer-to-Peer Networks Security, Security Issues in Mobile and Ubiquitous Networks, Security of GSM/GPRS/UMTS Systems, Sensor Networks Security, Vehicular Network Security, Wireless Communication Security: Bluetooth, NFC, WiFi, WiMAX, WiMedia, others

This Track will emphasize the design, implementation, management and applications of computer communications, networks and services. Topics of mostly theoretical nature are also welcome, provided there is clear practical potential in applying the results of such work.

Track B: Computer Science

Broadband wireless technologies: LTE, WiMAX, WiRAN, HSDPA, HSUPA, Resource allocation and interference management, Quality of service and scheduling methods, Capacity planning and dimensioning, Cross-layer design and Physical layer based issue, Interworking architecture and interoperability, Relay assisted and cooperative communications, Location and provisioning and mobility management, Call admission and flow/congestion control, Performance optimization, Channel capacity modeling and analysis, Middleware Issues: Event-based, publish/subscribe, and message-oriented middleware, Reconfigurable, adaptable, and reflective middleware approaches, Middleware solutions for reliability, fault tolerance, and quality-of-service, Scalability of middleware, Context-aware middleware, Autonomic and self-managing middleware, Evaluation techniques for middleware solutions, Formal methods and tools for designing, verifying, and evaluating, middleware, Software engineering techniques for middleware, Service oriented middleware, Agent-based middleware, Security middleware, Network Applications: Network-based automation, Cloud applications, Ubiquitous and pervasive applications, Collaborative applications, RFID and sensor network applications, Mobile applications, Smart home applications, Infrastructure monitoring and control applications, Remote health monitoring, GPS and location-based applications, Networked vehicles applications, Alert applications, Embedded Computer System, Advanced Control Systems, and Intelligent Control : Advanced control and measurement, computer and microprocessor-based control, signal processing, estimation and identification techniques, application specific IC's, nonlinear and adaptive control, optimal and robot control, intelligent control, evolutionary computing, and intelligent systems, instrumentation subject to critical conditions, automotive, marine and aero-space control and all other control applications, Intelligent Control System, Wiring/Wireless Sensor, Signal Control System. Sensors, Actuators and Systems Integration : Intelligent sensors and actuators, multisensor fusion, sensor array and multi-channel processing, micro/nano technology, microsensors and microactuators, instrumentation electronics, MEMS and system integration, wireless sensor, Network Sensor, Hybrid

Sensor, Distributed Sensor Networks. Signal and Image Processing : Digital signal processing theory, methods, DSP implementation, speech processing, image and multidimensional signal processing, Image analysis and processing, Image and Multimedia applications, Real-time multimedia signal processing, Computer vision, Emerging signal processing areas, Remote Sensing, Signal processing in education. Industrial Informatics: Industrial applications of neural networks, fuzzy algorithms, Neuro-Fuzzy application, bioInformatics, real-time computer control, real-time information systems, human-machine interfaces, CAD/CAM/CAT/CIM, virtual reality, industrial communications, flexible manufacturing systems, industrial automated process, Data Storage Management, Harddisk control, Supply Chain Management, Logistics applications, Power plant automation, Drives automation. Information Technology, Management of Information System : Management information systems, Information Management, Nursing information management, Information System, Information Technology and their application, Data retrieval, Data Base Management, Decision analysis methods, Information processing, Operations research, E-Business, E-Commerce, E-Government, Computer Business, Security and risk management, Medical imaging, Biotechnology, Bio-Medicine, Computer-based information systems in health care, Changing Access to Patient Information, Healthcare Management Information Technology. Communication/Computer Network, Transportation Application : On-board diagnostics, Active safety systems, Communication systems, Wireless technology, Communication application, Navigation and Guidance, Vision-based applications, Speech interface, Sensor fusion, Networking theory and technologies, Transportation information, Autonomous vehicle, Vehicle application of affective computing, Advance Computing technology and their application : Broadband and intelligent networks, Data Mining, Data fusion, Computational intelligence, Information and data security, Information indexing and retrieval, Information processing, Information systems and applications, Internet applications and performances, Knowledge based systems, Knowledge management, Software Engineering, Decision making, Mobile networks and services, Network management and services, Neural Network, Fuzzy logics, Neuro-Fuzzy, Expert approaches, Innovation Technology and Management : Innovation and product development, Emerging advances in business and its applications, Creativity in Internet management and retailing, B2B and B2C management, Electronic transceiver device for Retail Marketing Industries, Facilities planning and management, Innovative pervasive computing applications, Programming paradigms for pervasive systems, Software evolution and maintenance in pervasive systems, Middleware services and agent technologies, Adaptive, autonomic and context-aware computing, Mobile/Wireless computing systems and services in pervasive computing, Energy-efficient and green pervasive computing, Communication architectures for pervasive computing, Ad hoc networks for pervasive communications, Pervasive opportunistic communications and applications, Enabling technologies for pervasive systems (e.g., wireless BAN, PAN), Positioning and tracking technologies, Sensors and RFID in pervasive systems, Multimodal sensing and context for pervasive applications, Pervasive sensing, perception and semantic interpretation, Smart devices and intelligent environments, Trust, security and privacy issues in pervasive systems, User interfaces and interaction models, Virtual immersive communications, Wearable computers, Standards and interfaces for pervasive computing environments, Social and economic models for pervasive systems, Active and Programmable Networks, Ad Hoc & Sensor Network, Congestion and/or Flow Control, Content Distribution, Grid Networking, High-speed Network Architectures, Internet Services and Applications, Optical Networks, Mobile and Wireless Networks, Network Modeling and Simulation, Multicast, Multimedia Communications, Network Control and Management, Network Protocols, Network Performance, Network Measurement, Peer to Peer and Overlay Networks, Quality of Service and Quality of Experience, Ubiquitous Networks, Crosscutting Themes – Internet Technologies, Infrastructure, Services and Applications; Open Source Tools, Open Models and Architectures; Security, Privacy and Trust; Navigation Systems, Location Based Services; Social Networks and Online Communities; ICT Convergence, Digital Economy and Digital Divide, Neural Networks, Pattern Recognition, Computer Vision, Advanced Computing Architectures and New Programming Models, Visualization and Virtual Reality as Applied to Computational Science, Computer Architecture and Embedded Systems, Technology in Education, Theoretical Computer Science, Computing Ethics, Computing Practices & Applications

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