Organization Attendance Record System: Frauds and A Proposed Facial Recognition Technique

Morufu Olalere[*]
Cyber Security Science Dept.
FUTMinna, Nigeria

Femi Osho
Cyber Security Science Dept.
FUTMinna, Nigeria

Ojeniyi J. Adebayo
Cyber Security Science Dept.
FUTMinna, Nigeria

Joel N. Ugwu
Cyber Security Science Dept
FUTMinna, Nigeria

Abstract— The role of attendance in any organization cannot be over emphasis. Attendance Record System (ARS) is one of the tools used by organizations to track their staff`s daily attendance and performance analysis. ARS helps organizations to determine the number of their active staff, staff punctuality, preparation of monthly payroll and also in making some decisions on staff (such as staff promotion and award presentation at the end of the year). There are many ARSs with different frauds associated with each of them. This paper proposes an implementable biometric based Organization Attendance Record System(OARS) which uses the concept of facial recognition to eliminate frauds against the existing ARSs. We evaluate existing ARSs, identifying their strengths and weaknesses, identifying frauds against them and proposed a technique to eliminate these frauds. Although this study does not cover implementation of the proposed technique, details on how the system can be implemented is discussed. With the simplicity of the algorithm of our proposed system, it is our hope that decision makers in various organizations will be able to develop and implement the system through their information technology department thereby eliminating frauds associated with existing attendance record systems.

Keywords— Attendance Record System (ARS), facial recognition, fraud, real time authentication, database.

I. INTRODUCTION

The role of attendance in any organization cannot be over emphasis. Attendance Record System (ARS) is one of the tools used by organizations to track their staff`s daily attendance and performance analysis. It helps organizations to determine the number of their active staff, staff punctuality and also in preparation of monthly payroll. Attendance also helps organization in making certain decision as well as staff performance analysis especially on the aspect of time schedules [1].

Many organizations rely on attendance register to achieve the benefits of staff attendance while some organizations rely on smart card system. Meanwhile, both methods have their weaknesses and frauds associated with them. If attendance is to be used by any organization for the purposes alighted above, there is a need to marry staff attendance taking with their unique identity. However, unique identity of staff can only be achieved through biometrics technology.

Biometric measures both physiological and behavioural characteristics of human being [2]-[3]. Biometrics technology is the technology that measure any of the characteristics of human being for the purpose of authentication. Ref. [4] gives details on biometrics. Facial recognition is physiological biometrics that authenticate individual base on facial pattern. Many researchers have studied facial recognitions system in the recent years. The studies range from method of processing face image, method of feature extraction to the method of classification during verification/recognition process. Meanwhile, the application of researchers studies on face recognition has not been fully exhausted. Facial recognition has received substantial attentions from both the research communities and the market in recent times, but still remained very challenging in real applications [5]. Nevertheless, some organizations use facial recognition for security purpose in term of access control.

However, proposition of facial recognition for organization attendance record is not fund in literature. To the best of authors knowledge, apart from traditional attendance register, "what we have" and "what we are" are the mostly used attendance record system by many organizations. Whereas these methods give room for fraud perpetration.

This study reviewed some of the existing ARSs, identifies their weaknesses and proposed an easy to implement facial recognition technique. The rest of the paper is organised as follow: Section II gives related work and section III presents methodology adopted for this study. Section IV discusses existing ARS with their weakness and Section V discusses frauds against them. Section VI describes our proposed framework for Facial recognition and section VII presents conclusion of the study.

II. RELATED WORK

In the recent years, Physiological biometric has gained attention of many researchers. The need for individual to be uniquely identified and authenticated in one platform or the other has motivated the interest of researchers in this field.

Fingerprint and facial recognition techniques are common biometric techniques use to identify and authenticate individual [6]. Perhaps, this may explain why many researchers studies focus on these two physiological biometrics techniques for identification and authentication. Ref. [3] gives general review of biometrics while Recent review of [7] was on fingerprint, Iris and face. Ref [MS] carries out review on Facial recognition techniques. How our brief review only concentrate on physiological biometric techniques that relate to attendance management.

Ref. [8] implemented a biometric based attendance management system using fingerprint technology. In their study, they compared the success rate over time wasted during the manual attendance and the newly developed system. It was found that their new system is having 94% success rate over the manual type.

Ref. [9] proposed a system using Principle Component Analysis (PCA). In the study, PCA was used to reduce large dimensionality of the data spaces that are observed variable to smaller intrinsic dimensionality of feature spaces that are distinct variables, which are needed to describe the data economically. The PCA is one of the most successful techniques that have been used in image recognition and compression, as it establishes a strong correlation between observed variables.

Ref. [10] study observed that it is difficult to get precise estimate student attendance in a classroom with the use each result obtained from a facial recognition system independently. This is because the face detection rate is not sufficiently high. In their research, they proposed a method for estimating precise attendance by using all the results of face recognition obtained by continuous observation. Continuous observation improved the performance for the estimation of the attendance. Their study developed lecture attendance system based on face recognition, and applied the system to classroom lecture.

Ref. [11] implemented an attendance management system using Radio Frequency Identification (RFID). The system used radio waves to transfer data from an electronic tag, called RFID tag or label; it consisted of two parts, the hardware part and the software part which play vital role in the overall function of keeping the student attendance and time management

Ref. [12] developed an algorithm that automatically marks the attendance without human intervention. This attendance is recorded by using a camera attached in front of classroom that is continuously capturing images of students, detect the faces in images, process the images, extract some features and compare the detected faces with the database and mark the attendance. For the purpose of organization attendance, our study proposed facial recognition technique that will help organization decision makers to monitor their staff log-in/log-out.

.

III. METHODOLOGY

We studied the existing ARSs(traditional) in order to identifying possible crimes that are associated with them. We then proposed an implementable facial recognition algorithm as solution to address the problems of existing methods of staff attendance.

IV. EXISTING ATTENDANCE RECORD SYSTEMS

Gone are the days, when organizations did not find reasons to be taken the attendance of their staff. Today, due to increase in knowledge and learning, attendance record becomes a means by which organization leaders use to monitor their staff for the purpose of knowing staff that come to work regularly. The outcome of this monitoring by many organization leaders might be for decision making in term of selecting staff for award, promotion and so on. However, many mostly used attendance record systems do not give true picture of needed information for decision making due to their weakness thereby making difficult for decision makers to make correct judgement of their staff. Some of the mostly used attendance management systems are identified and discussed below:

A. Attendance Register

Attendance Register is a booklet that organization uses for the sake of keeping records of individuals that attend work on daily basis. Many organizations have the following attribute as the content of the attendance register.

- ➢ Name
- ➢ Date
- ➢ Time of Arrival
- ➢ Signature
- ➢ Staff Number
- ➢ Unit
- ➢ Optionally some organization do include these
- ➢ Time of Dismissal
- ➢ Sign out

Weakness of the System: Due to the fact that Registers is just a booklet that only contains individual`s data and has no means of authenticating that the person actually writing a name is the one that supposed to do so. A staff can mark attendance for another staff who is not available for daily job. Some staff even go to an extent of leaning the signature of their colleague for proper marking of attendance register for their colleagues. This act is referred to as impersonation.

Apart from low productivity, if there is a case of stealing on a particular day, there exist problem of figuring out those that are present at work that day making it difficult to carry out further investigation.

B.   Smart Card Attendance Record System

In an attempt to address the problem of attendance register, the use of "what you have" such as smart card was introduced for sign-in/out of staff. This improvement involves the use of card reader that can extract all the information about staff from the smart card for authentication. After authentication of staff through smart card by card reader, the staff is allow to either sing-in or sign-out.

Weakness of the System: At early stage of smart card introduction, it look pretty nice and promising. As time passed by, people started capitalise on the weakness "I don't need to be there before you sign for me, all you need is my card". This is true because information needed for sign-in/out by staff is embedded in the smart card, thereby making it easy for any staff in possession of another staff card to mark attendance for the right owner of the card. Again, this weakness exposes the smart card system to so many frauds that can be perpetrated by both the members of the organization and outsider in the case of lost smart card by any staff. Next section discusses some of the frauds against the existing attendance records.

V. FRAUDS AGAINST EXISTING ATTENDANCE REGISTRATION SYSTEM

Over the years, there have been recorded frauds against organization`s attendance systems such as Manual Registers and/or Smart Card Attendance Record System. These frauds have caused many organizations a lot of unjustified spending. Some of these frauds are discussed below:

A. Ghost Worker

This is one of the most popular frauds that are perpetrated against organization attendance registration system. A staff that does not exist is listed as a member of organization with the intention of getting benefit(s) meant for such ghost worker. The perpetrators of this crime are always those at the leadership position. Benefits such as salary and allowances are the main reasons for committing this crime. In an attendance register system, perpetrator needs not to sign for the Ghost worker every day, signing can be done at the end of every month making it very difficult for other member of organization to detect the this fraud.

B. Duty Impersonation

In this kind of fraud, A legitimate staff of organization that is not always available at his/her duty post because of one reason or the other is illegally(not with the knowledge of the organization leader) represented by another legitimate staff or outsider. Anytime the present/attention of the staff is need, someone stand on his behalf behaving as if he/she is the original staff. This type of fraud is said to be perpetrated when a person is masquerading a legitimate staff of the organization.

C. Substituted Signing

Some individuals within an organization usually ask their co-workers to sign attendance register for them. This fraud effect the output of any organization as the work meant for many people is being executed by few ones. Some people also use this means to make arrangement within their unit to ensure that they attend work on shifting basis. This type of fraud is recorded highly in government ministries.

D. Early Dismissal

In many organizations, some people do come to work for the sake of registering their names in the attendance register, after which they will head away with their private businesses. Such fraud is common among the high ranking staff of many organizations. This high ranking staff believe there are no superior to challenge them.

E. Late Attendance

This type of fraud is common among many organizations and is perpetrated against the employees` policies of an organization. It occurs when an individual fails to resume duty on or before organization duty resumption time. Every organization has specified period for staff clock-in and clock-out. Many staff don't go to their duty post on time and when they signed attendance, they put wrong resumption time to suit their lateness to duty. Unless someone is assigned to man attendance register, it very difficult to detect this fraud. This fraud has motivated some private companies to implement hour on duty payment system instead of monthly payment system.

F. Off-date signing

Off-date signing fraud occurs when a staff that did not come to work for a day or more and later signed the attendance register of the day(s) he/she was not on duty. In most case, this crime is committed in conjunction with the staff charged with the responsibility of keeping attendance register.

VI. DESCRIPTION OF PROPOSED FACIAL RECOGNITION TECHNIQUE

The architectural design of our proposed facial recognition technique for organization attendance record system is shown in fig. 1. The framework is divided into three parts. The three parts are system interface, enrolment phase, and Sign in/out phase (verification phase). The system interface is the place where both the enrolment phase and verification phase take place. Details about the enrolment phase and verification face is presented in the following sections.
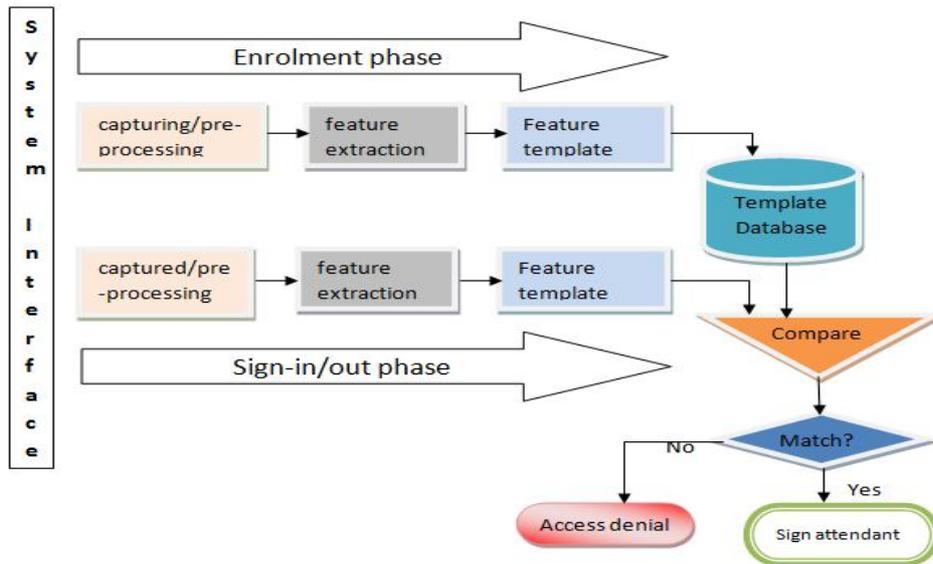
International Journal of Innovative Research in Information Security (IJIRIS)   ISSN: 2349-7017(O)
Issue 2, Volume 5 (May 2015)   ISSN: 2349-7009(P)
                                                                                    www.ijiris.com

Fig. 1 architectural design of face recognition for organization attendance record system

A. *Enrolment Phase*

Like other biometric techniques as in [13], enrolment phase is the first step in Facial recognition system. During enrolment phase, staff will be required to supply his/her staff identity number through system interface. This is to verify whether or not the staff has not gone through enrolment process. If the staff is identified by the system, it means the staff has gone through enrolment process, otherwise the staff need to undergo enrolment process. However, a page will be display for the staff to supply his/her profile thereby enabling the staff to proceed to enrolment phase. During enrolment phase, three important stages are involved. These stages are discussed below. Fig 2 shows the flow chart of the enrolment phase.

1) Face Capturing/Pre-processing: During this stage, staff face is captured and pre-process. It is important to note that staff face need to be captured under different conditions in order to have real representation of the staff face. Staff face image is captured with camera that is properly linked with the system. When staff face is captured under different condition, the system has to perform some levels of processing. For simple implementation of this our technique, we recommend the following pre-processing operations:

- Histogram Normalization
- Noise Removal

Histogram Normalization: Every captured image has some noise due to the illumination effect of the surrounding and this noise is to be removed before feature extraction can take place. Histogram normalization is used for contrast enhancement in spatial domain. However, there is need for conversion of face image to gray scale equivalent. Histogram normalization is a good technique for contrast enhancement.

Noise Removal: According to literature, there are several techniques that can be used for noise removal. To remove noise completely from training face image, we recommend the use of median filtering which according to literature has proved to be an effective noise removal technique. However, it is important to note that the use of low pass filtering in the frequency domain might remove some important information in the face image [14].

2) Face feature extraction: After pre-processing of staff face image, the image is subjected to feature extraction. There are a lot of feature extraction techniques for face image in literature, as in [15]-[16]. Eigenface, which involves PCA Principle Components Analysis(PCA) is one of the techniques used for face feature extraction in literature. Ref. [15] & [16] described the used of eigenface. The table 1 shows the steps involve in the used of eigenface for feature extraction.

TABLE I
FONT SIZES FOR PAPERS

Steps Involved	Action Taken
1	Obtain the images of the training faces
2	Represent every Image as a vector
3	Compute the average face vector
4	Subtract the mean face
5	Compute the covariance matrix
6	Compute the eigenvectors
7	Represent each face as a linear combination of best eigenvectors

3) *Feature Template Creation:* At this stage, a template of feature extracted from face image will be created for future verification. After data has been extracted from the features extraction stage, a Template of staff training face is being generated and stored in the database so that during the testing phase it could be used to identify and recognize the staff.
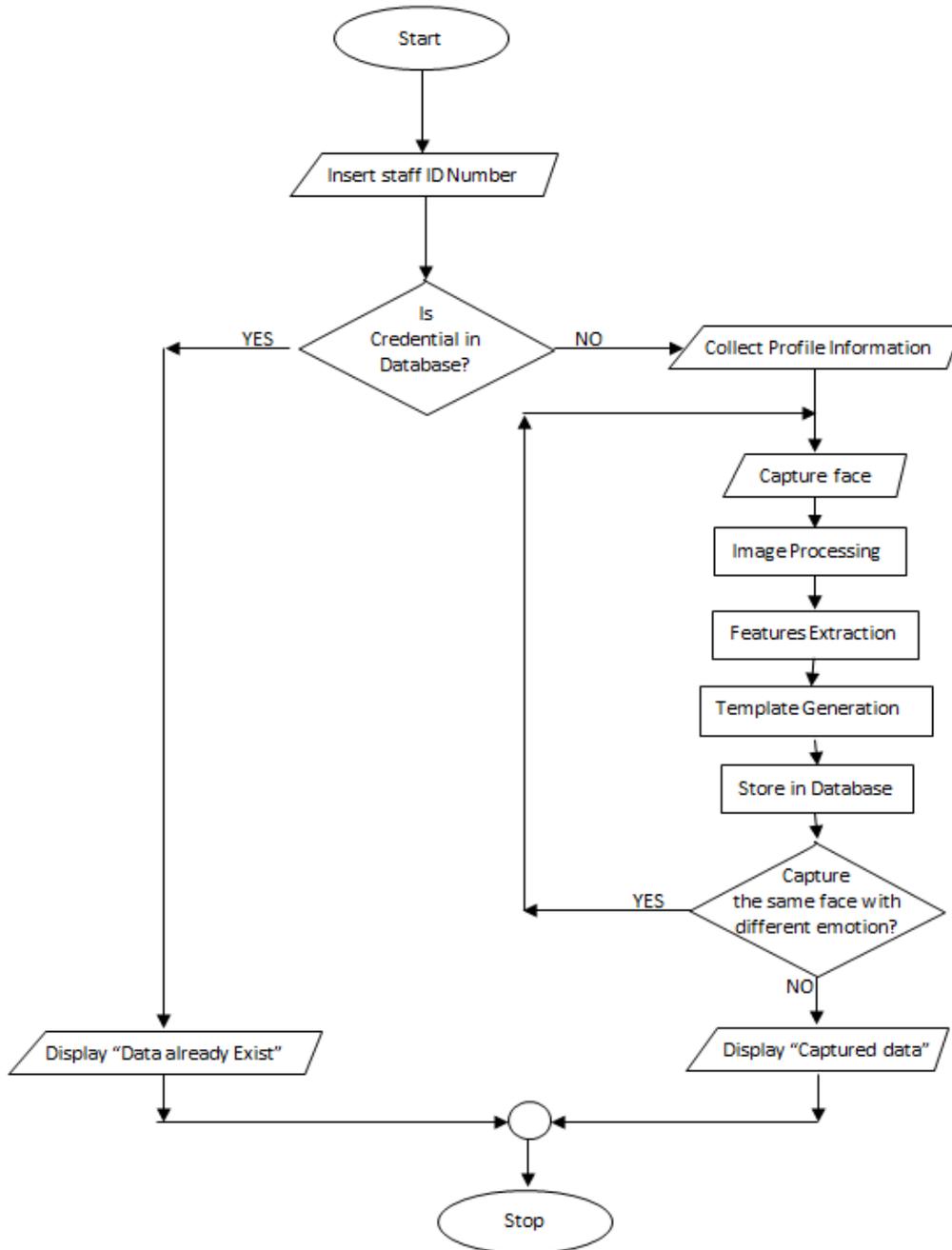

Fig. 2 Flow chart for enrolment phase

B. *Sign in/out Phase or verification phase*

Just like enrolment phase, verification is characterised with three important operations. These operations are the same operations perform during enrolment. However, the manner in which these operations will be performed is quite different from the way we have described for enrolment. The details of how the system work during sign-in/out is discussed below: Figure 3 represent the flow chart for Sign-in/out phase.

1) Staff Sign-in

During sign-in/out, staff is require to input his/her staff Identity number. If the staff identity is valid, the staff is sign in for verification. This verification is to know whether the staff has signed-in for that particular day. If the staff has signed-in before, the system then display you have "signed-in today".

If the staff has not signed-in before, the system move to the next stage of capturing the face of the staff. After capturing, all other processes that took place during enrolment will take place for the system to get the feature of the staff captured face. This feature will be used to compare with the prototype feature of the staff already stored in the template. If there is a match, the system will confirm the staff signed-in. Otherwise, the system will deny the staff sign-in permission by displaying "your face is not in the database".

2) Staff Sign-out

If the choice of staff is to sign- out, the system will perform a logical operation "Did the staff signed-in AND has not signed out today?". If the response is TRUE, it will display "You have signed out or have not signed in today" and ends. Else, the system will proceed to capturing face, after which the face is being authenticated by the template generated, the same as in signing- in stage, but displays "Sign out Successfully" and ends when the operation is completed.

Fig. 3 Flow chart for sign-in/out phase

International Journal of Innovative Research in Information Security (IJIRIS) ISSN: 2349-7017(O)
Issue 2, Volume 5 (May 2015) ISSN: 2349-7009(P)
www.ijiris.com

VII.   CONCLUSION

The importance of attendance to an organization cannot be underestimated; it is used in preparing staff's monthly payroll, determination of deserving staff for promotion, recommendation of staff for award. We have identified weakness and different frauds associated with existing Attendance record systems. The weakness and frauds against existing attendance record system motivated our proposition of face recognition based Organization Attendance Record System. It is our hope that the proposed system will go a long way in assisting organization decision makers to get their attendance system automated. It is important to note that our proposed system has the following features:

i. The algorithm represented with flow charts can easily be implemented using any high level programming language.
ii. The system will easily recognize an individual because the enrollment specification gives the flexibility to allow capturing of staff faces many times due to many emotions of human faces.
iii. There will be no room for identified frauds as the possibilities of their occurrence will all be eliminated in the proper implementation of our system.
iv. The system can be implemented as a standalone or in a network environment. Title must be in 20 pt Regular font. Author name must be in 10 pt Regular font. Author affiliation must be in 10 pt Italic. Email address must be in 9 pt Courier Regular font.

REFERENCES

[1] Jianfeng, Z. H. U., Zhuang, L. I. and Yuchun, M. A. "The Attendance Management System Based on Micro-cellular and GIS technology" I.J. Education and Management Engineering 2012, 5, 54-59 Published Online May 2012 in MECS (http://www.mecs-press.net) DOI: 10.5815/ijeme.2012.05.09

[2] Jain, A., Hong, L., and Pankanti, S. "Biometric Identification". Communication of the ACM, 43(2) p. 91-98, 2000. DOI 10.1145/328236.328110

[3] Jain, Anil K., Ross, Arun "Introduction to Biometrics" a handbook of Biometrics Springer. Pp. 1-22. ISBN 978038771040 – 2, 2008

[4] Debnath Bhattacharyya , Rahul Ranjan , Farkhod Alisherov A. , and Minkyu Cho(2009) "Biometric Authentication: A Review" International Journal of u- and e- Service, Science and Technology Vol. 2, No. 3, pp. 13-27

[5] Xiaoguang Lu ''Image Analysis for Face Recognition''. Available at www.citeseerx.ist.psu.edu/viewdoc/sumary

[6] Nirmalya, K.., M. K.. Debbarma, Ashim S., and D. R. Pal. "Study of Implementing Automated Attendance System Using Face Recognition Technique" International Journal of Computer and Communication Engineering, Vol. 1, No. 2, July 2012

[7] Samarth Bharadwaj, Mayank Vatsa, Richa Singh (2014) "Biometric quality: a review of fingerprint, iris, and face". EURASIP Journal on Image and Video Processing. 2014(34), pp. 1-28.

[8] O. Shoewu and O.A. Idowu, "Development of Attendance Management System using Biometric" The Pacific Journal of Science and Technology. Volume 13, Number 1.   http://www.akamaiuniversity.us/PJST.htm

[9] K. Kim "Face Recognition using Principle Component Analysis." Available at www.umiacs.umd.edu. Posted: 2000, cited: Dec, 2013.

[10] Y. Kawaguchi, T. Shoji, W. Lin, K. Kakusho, M Minoh "Face Recognition-Base Lecture Attendance System" 2005. Pp. 1-5, 2005. Available at http://www.mm.media.kyoto-u.ac.jp/old/research/doc/682/FRLASinAEARU.pdf

[11] Shashank Shukla, Shailee Shah, Pooja Save, "RFID Based Attendance Management System". International Journal of Electrical and Computer Engineering (IJECE). Vol. 3, No. 6, December 2013, pp. 784~790. ISSN: 2088-8708

[12] Asama Kuder Nseaf, Aziza Jaafar, Haroon Rashid, Riza Sulaiman, and Rahmita Wirza O.K. Rahmat. "Design Method of Video Based Iris Recognition System (V-IRS)"

[13] M. Olalere "Automatic Offline Signature Verification   System". Journal of Science, Technology and Mathematics Education (JOSTMED), Vol. (7)2, Page 100-108. ISSN:0748-4710, 2011

[14] Naveed Khan Balcoh, M. HaroonYousaf, Waqar Ahmad and M. IramBaig "Algorithm for Efficient Attendance Management: Face Recognition based approach" International Journal of Computer Science Issues, IJCSI Vol. 9, Issue 4, No 1, July 2012 ISSN (Online): 1694-0814 www.IJCSI.org

[15] Peter N. Belhumeur, Joao P. Hespanha, David J. Kriegman "Eigen Faces vs. Fisherfaces, Recognition Using Class Specific Linear Projection": IEEE Trans. On PAMI, 1997

[16] M. Turk and A. Pentland "Eigenfaces for Recognition", Journal of Cognitive Neuroscience, vol. 3, no. 1, pp. 71-86, 1991