

Development of Fingerprint Biometric Attendance Management System using Wireless Connectivity

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Abstract -In this paper, we propose an integrated biometric access system for attendance management based on fingerprint identification and authentication for restricted area using wireless connectivity. Maintaining the attendance record in institutions, companies and organisations is an imperative factor, maintaining so manually is herculean task. Along with it, institutions with single machine and more crowd makes this work more complicated to make this easier, an efficient Biometric Fingerprint Attendance Management system is proposed. This system registers the user and accepts biometric input through use of mobile network, and all records will be saved for subsequent operations. Since input image is accepted through mobile, it provides greater portability and reduces need for any specific biometric hardware, which in turn reduces the hardware cost. It further provides facilities to calculate and generate monthly report of attendance in order to reduce any human errors during calculations. Thus, the proposed system will help to improve the productivity of any organization if properly implemented.

Keywords- Institution, Attendance, Biometric, Fingerprint, Image Matching.

I. INTRODUCTION

Today, Secure and reliable user-authentication is an unavoidable need, and hence for user- authentication Biometric systems are widely used [2.] Biometric technologies are becoming the foundation for highly secure identification and personal verification solutions./ Biometric applications have the potential to offer much more robust *authentication/identification* security than traditional systems (eg: passwords or pass codes ,PINs , tokens). The main goal of applying biometrics to user authentication is to provide security to users and detect imposters in terms of users physiological (e.g. fingerprint, face, iris, hand) or behavioural characteristics (e.g. speech, keystroke dynamics).[7][8] Owing to the unique biometric characteristic that every person possesses, utilization of the same can be done in a form of identity access management. Ever since their inception, Fingerprint based biometric authentication and verification systems have gained immense popularity and acceptance. This is primarily because of the ease of operation, installation and easy acquisition of the biometric feature, which in this case is a fingerprint. Implementing fingerprint recognition system is secure to use since the uniqueness of one's fingerprint does not change in user's lifetime.[1][9]

The popularity of mobile devices is undeniable. According to the International Data Corporation (IDC), more smartphones were sold in 2012 than desktop and laptop

computers combined. This rise may be due to increasing functionality and technological advances which in turn supports greater functionality. [6]. Thus, the frequency with which smartphone owners use their devices, these devices can be used along with biometrics to provide certain advantages. [2][3][4].

The main characteristics of the proposal system are:

- 1) Dependency on biometric hardware is reduced.
- 2) Due to reduced dependency, cost of the system as whole is reduced.
- 3) Provides increased portability to system.

II. LITERATURE REVIEW

Today, biometric is being spotlighted as the authentication method because of the need for reliable security. 80% of public has biometric recorded. Thus, it is very well accepted in the government and also in the private sectors for better security. It has a long history in judicial science, complete with many studies which back up the use of fingerprints for identification. This honorable history gives it weight and faith which are not available to newer identification systems. Fingerprint identification is widely understand as highly accurate and very trustworthy, since the statistical chance of two people on Earth having identical fingerprints is very low.

Most of the attendance systems use paper based methods for tracking and calculating attendance. Previously little work has been done regarding academic attendance monitoring

problem. Some software's have been previously designed to keep track of attendance.

During the 14th century, in China, a European explorer, Joao de Barros recorded the first known example of fingerprinting, which is a form of biometrics. Chinese merchants used ink to take children's fingerprints for identification purposes. Oloyede et al. (2013) carried out an extensive research on applicability of biometric technology to solve the problem of staff attendance. However, the researchers did not provide any software to address the problems of attendance. Derawi et al. (2012) proposed an approach of applying cell phone cameras to capturing fingerprint images and evaluated up to 1320 fingerprint images from some embedded capturing devices like Nokia N95. The results indicated that an equal error rate (EER) of 4.5% could be achieved. In addition, Sin et al. (2012) proposed a template updating system for fingerprint verification where templates were replaced with matched inputs for a target structure. The system presented an ERR of 2% after updating in the evaluation and they further argued that their system was adopted on practical mobile phones in the commercial market from 2009. [2]

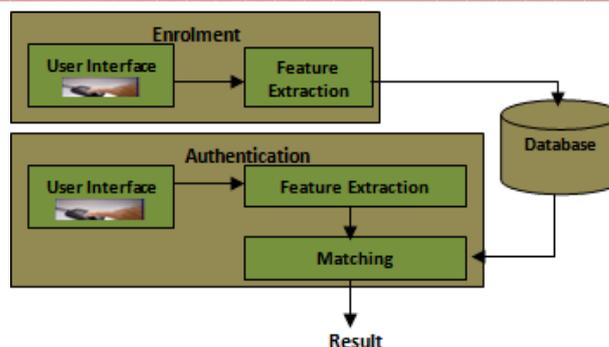
THE RESULTS OF PHYSIOLOGICAL BIOMETRIC AUTHENTICATION ON MOBILE PHONES WHICH CLAIMED BY RELATED WORKS.

Method	Works	Platform	Performance (%)		
			FAR	FR	EER
Fingerprint recognition	[14] in 2005	BIRD smart phone E868	-	-	4.16
	[16] in 2012	Nokia N95 and HTC Desire	-	-	4.66 (Nokia N95) 14.65 (HTC Desire)
	[199] in 2012	Simulated dataset	0.03	3.25	2.0

As fingerprint recognition can provide high authentication accuracy, more and more mobile firms recently started to integrate this technique with their developed new phones. Apple applied the fingerprint recognition to the iPhone 5s, while HTC also released the newest Android phone of HTC one max with a fingerprint scanner.

Also, biometrics system has been very useful in the education sector (Library management to keep records of borrowing and returning of books). Tabassam, Saim, Arash, and Azhar-ud-din (2009), developed a system that takes students lectures attendance while entering the lecture rooms. It is a fingerprint based model. This was designed for student only. According to [3], a biometric-based model called "School Attendance Management System (SAMS)" was developed. SAMS is a biometrics and RFID (Radio Frequency identification) based comprehensive attendance management system for schools and colleges. SAMS was design by in order to provide robust, secure and automatic attendance management system for both, students and staff. SAMS has an inbuilt facility of sending automatic SMS and Email alerts to the Parents/Guardians of the students. Furthermore, biometrics can be integrated with other systems for it to carry out its purpose of identification. E.Gokulakrishnan, S.Asha (2014), have provided research work on "MULTIMODAL BIOMETRICS USING MOBILE PHONE".

➤ **PROPOSED SYSTEM ARCHITECTURE:**



According to proposal, the modules are as follows

- i). Data Capturing and Pre-processing: The fingerprint is captured from the mobile scanner. The non-overlapping and unwanted regions are removed by pre-processing.
- ii). Feature Extraction Pattern: The algorithm used in Feature Extraction Pattern is Filter Bank Based Fingerprint Matching.
- iii). Decision Making: The template stored in the database is compared with the processed input image...
- iv). Output: If the pattern is matched, then the attendance of the user is marked in the database.

III. SYSTEM IMPLEMENTATION

A. Data Capturing and Pre-processing:

In practice, the placement of finger on the scanner for authentication is not done with extreme care as when placed during the registration or daily utilization and this results in rejection. Thus, the genuine acceptance rate (GAR) for authentication of fingerprints decrease. The pre-processing algorithm is used to achieve good vertical orientation and high ridge curvature area around the core point for fingerprint to overcome this limitation.

The algorithm is implemented in two stage, First being, the process of obtaining the vertical oriented fingerprint image. The core point detection of a fingerprint is followed. Thus core point detection is efficiently identified. The developed algorithm is tested using a line based feature extraction algorithm with a large internal database and samples of fingerprint verification competition. With the proposed algorithm, the tested images were oriented vertically and its genuine is verified by comparing the details of the oriented and un-oriented image of the same subject. Thus the fingerprint is captured from the mobile reader or scanner.

Feature Extraction Pattern [12]:

The algorithm used in Feature Extraction Pattern is Filter Bank Based Fingerprint Matching. The steps involved in Feature Extraction is as follows

1. Have to determine a reference point and region of interest for the fingerprint image.
 - a. Manually choose the reference point.
 - b. The appropriate orientation field is computed and identification masks are used.
 - c. Poincare Index method.

2. The region of interest around the reference point is determined.

a. The region of eight different directions using a bank of Gabor filters is filtered.

3. The average absolute deviation from the mean (AAD) of gray values in individual sectors is computed in filtered images to define the feature vector or the finger code[12].

4. Try to find directional field[12]

$$O_y = \sum_{u=i-w/2}^{j+w/2} (G_x(u,v) - G_y(u,v))$$
$$u = i - w/2$$
$$v = j - w/2$$
$$\theta(i,j) = 1/2 \tan^{-1} (O_x(i,j)/O_y(i,j))$$

Where $G_x(u,v)$ $G_y(u,v)$ are the gradients at each pixel. $\theta(i,j)$ is the direction of the block (i,j) .

5. Detect the singular point

a. Smooth the directional field of input fingerprint image and estimate it.

b. To compute the Poincare index in each block (8*8). The Poincare index is computed as follows:

$$\text{Poincare}(i,j) = 1/2 \Pi \sum$$

$$(k) = \{$$

$$\delta(k) = \theta(X(k'), Y(k')) - \theta(X(k), Y(k)), k' = (k+1) \bmod N$$

Where $\theta(i,j)$ is the directional field of fingerprint. $X(k), Y(k)$ are the coordinates of the blocks which are in the closed curve with N blocks. The Poincare Index is said to be core block if it results in $1/2$. The core point is the centre of this block. If more than two core points are detected, go to step 1.

3. Decision Making[12]

The template stored in the database is compared with the processed image. If both the features (fingerprint) are same then attendance of the user will be marked. If the features are not same then it will not be considered.

The proposed staff biometric attendance system takes attendance electronically. This system was implemented using Java programming language at front end and MySQL for database. It involves the interaction with the central database which contains all records of staff. The records provide details of attendance taken as well as the monthly summary attendance report can be generated and viewed along with IN and OUT timings[12].

ENROLMENT PHASE:

This phase involves registration of user. Registration is necessary in order to uniquely identify each user of the proposed system. Each staff member is required to register certain personal information like staff fingerprint, names, phone number, email address, sex, occupation, state of origin, house address, as well as academic information like

staff id, department, and designation. The registered information is then stored in database.

IDENTIFICATION PHASE:

The identification is accomplished by comparing the input image with stored template in the database. If both the fingerprints are matched, then it is considered as a positive match.

ATTENDANCE REPORT:

This report interface can be accessed under the report menu, where daily attendance of all staff can be generated. The attendance of each staff member per day is stored on the database. Thus the system allows the database administrator to view the attendance report as well as a summary report on monthly basis.

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V. CONCLUSION

Traditionally, manual attendance method, which involves pen, and paper results in very tedious work. The implementation of an electronic biometric-based method of attendance management system using wireless connectivity will greatly assist institutions or any organization and thereby prevents time-consuming processes. Staff biometric attendance system provides the administrator with easy access to staff attendance information as well as easy monitoring of monthly attendance summary. This will improve the net productivity of institutions or any organization. The proposed system is reliable, secure, efficient, and capable of replacing the traditional manual and unreliable method of attendance management. It helps to provide portability, ease of access to user. It also reduces the cost of actual biometric hardware required by using mobile based scanner. The proposed system can be improved through the integration of multimodal biometric technologies to provide more security for the staff attendance management system.

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