

# Development of Academic Attendance Monitoring System Using Fingerprint Identification

TABASSAM NAWAZ, SAIM PERVAIZ, ARASH KORRANI, AZHAR-UD-DIN

Software Engineering Department  
Faculty of Telecommunication & Information Engineering  
University of Engineering & Technology  
Taxila, Punjab  
PAKISTAN

## Abstract

In this paper we propose a system that automates the whole process of taking attendance and maintaining its records in an academic institute. Managing people is a difficult task for most of the organizations, and maintaining the attendance record is an important factor in people management. When considering academic institutes, taking the attendance of students on daily basis and maintaining the records is a major task. Manually taking the attendance and maintaining it for a long time adds to the difficulty of this task as well as wastes a lot of time. For this reason an efficient system is designed. This system takes attendance electronically with the help of a fingerprint sensor and all the records are saved on a computer server. Fingerprint sensors and LCD screens are placed at the entrance of each room. In order to mark the attendance, student has to place his/her finger on the fingerprint sensor. On identification student's attendance record is updated in the database and he/she is notified through LCD screen. No need of all the stationary material and special personal for keeping the records. Furthermore an automated system replaces the manual system.

## Keywords:

*Fingerprints, Enrollment, Fingerprint sensor, Failure to enroll (FTE), Failure to capture (FTC), Verification, Fingerprint templates*

## 1. Introduction

Every academic institute has certain criteria for students regarding their attendance in class. That is why keeping the accurate record of attendance is very important. At present attendance is usually noted using paper sheets and the old file system, this approach is being used from a long time. It becomes difficult for the management to regularly update the record and manually calculate the percentage of classes attended. Keeping these issues in mind a system is designed to overcome the problems associated with attendance system. Biometric systems

have been widely used for the purpose of recognition. These recognition methods refer to automatic recognition of people based on some specific physiological or behavioral features [1]. There are many biometrics that can be utilized for some specific systems but the key structure of a biometric system is always same [2].

Biometric systems are basically used for one of the two objectives identification [3] or verification [4]. Identification means to find a match between the query biometric sample and the one that is already been stored in database [5]. For example to pass through a restricted area you may have to scan your fingerprint through a biometric device. A new template will be generated that will be then compared with the previously stored templates in database. If match found, then the person will be allowed to pass through that area. On the other hand verification means the process of checking whether a query biometric sample belongs to the claimed identity or not [6].

Some of the most commonly used biometric systems are (i) Iris recognition (ii) Facial recognition (iii) Fingerprint identification (iv) Voice identification (v) DNA identification (vi) Hand geometry recognition (vii) Gait recognition (viii) Signature verification [5]. Previously the biometrics techniques were used in many areas such as building security, ATM, credit cards, criminal investigations passport control [4]. The proposed system uses fingerprint recognition technique [1] for obtaining student's attendance. Human beings have been using fingerprints for recognition purposes for a very long time [7], because of the simplicity and accuracy of fingerprints. Fingerprint identification is based on two factors: (i) Persistence: the basic characteristics and features do not change with the time, (ii) Individuality: fingerprint of every person in this world is unique [8]. Modern fingerprint matching techniques were initiated in the late 16<sup>th</sup> century [9] and have added most in 20<sup>th</sup> century. Fingerprints are considered one of the most mature biometric technologies and have been widely used in forensic laboratories and identification units [10].

Our proposed system uses fingerprint verification technique to automate the attendance system. It has been proved over the years that fingerprints of each and every person are unique [8]. So it helps to uniquely identify the students.

## 2. Previous Work

Most of the attendance systems use paper based methods for taking and calculating attendance and this manual method requires paper sheets and a lot of stationery material. Previously a very few work has been done relating to the academic attendance monitoring problem. Some software's have been designed previously to keep track of attendance [11]. But they require manual entry of data by the staff workers. So the problem remains unsolved. Furthermore idea of attendance tracking systems using facial recognition techniques have also been proposed but it requires expensive apparatus still not getting the required accuracy [12].

## 3. System Description

### 3.1. Hardware:

A fingerprint sensor device along with an LCD screen is placed at the entrance of each classroom as shown in the Figure 1. The fingerprint sensor is used to capture the fingerprints of students while LCD screen notifies the student that his/her attendance has been marked.



Figure 1: Hardware Equipment of automatic attendance system.

### 3.2. Software Tools:

For the development of the system, the following software tools were used

- Digital Persona's Software Development Kit [13]
- Microsoft Visual Studio 2008 (Microsoft® technologies)
- Sql Server 2005 (Microsoft® technologies)

### 3.3. Rules for marking attendance:

- I. Student should scan his/her finger correctly on the fingerprint sensor as shown in Figure 2. If fingerprint is not enrolled correctly on reader as shown in Figure 3, it could lead to biometric error i.e. biometric device does not make perfect match decision.

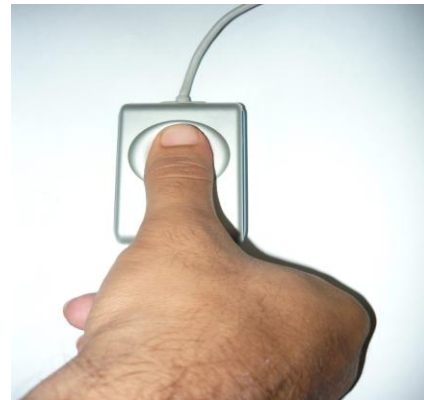


Figure 2: The correct method to place a finger on the device.

There are two reasons for error Failure to enroll rate (FTE) and Failure to capture (FTC) rate of biometric device [4]. FTC rate depends on functionality of the system and FTE occur due to poor quality inputs [4].

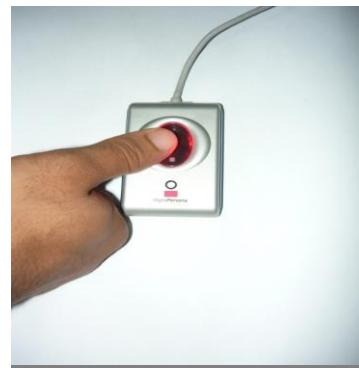


Figure 3: The wrong method to place a finger on the device.

- II. Students should mark their attendance within 30 minutes of start time of lecture. For example if a lecture starts on 9:00 am attendance shall not be marked after 9:30 am.
- III. If attendance has already been marked, student is not able to mark another attendance in the same lecture.

3.4. Scenario of automatic attendance system:

Figure 4 shows the scenario of automatic attendance system attached to a classroom. Database storage contains the fingerprint templates of students along with their information (names, registration numbers and Subjects/lectures). When student enrolls his/her finger on the scanner his/her fingerprint is matched with database to mark the attendance.

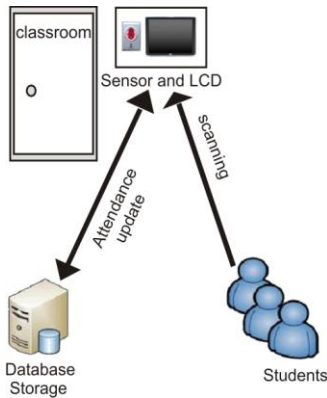


Figure 4: Scenario of Automatic Attendance system.

3.5. Implementation:

Hardware equipment is placed at the door of classroom (see Figure 1). Before entering the classroom students are identified through fingerprint scanner as shown in the Figure 5. On identification of a student his/her attendance is marked.



Figure 5: Students mark their attendance before entering the classroom

Following sequence of steps summarize the process of marking the attendance.

Step 1: Capture the student’s fingerprint sample and create a feature set.

A set of unique features created to match fingerprint is called feature set.

Step 2: Retrieve the stored templates from the repository (database).

Step 3: Perform a one-to-n comparison between the fingerprint feature set and the fingerprint templates stored in database, make a decision of match or non-match.

Figure 6 describes the process of identification.

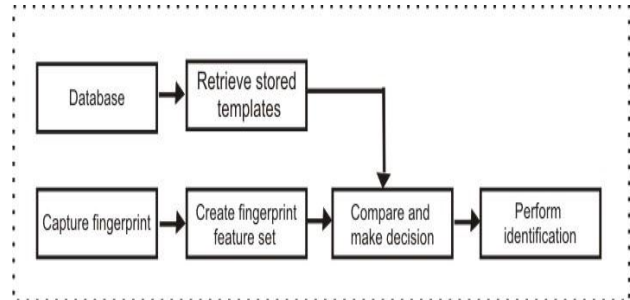


Figure 6: Identification Process

Step 4: If match is found retrieve student’s information (Registration number, Department, Subjects) from the database.

Step 5: Obtain the scheduled lecture from the database and mark attendance if student is within the specified time i.e. within 30 minutes of the lecture’s starting time (see rules for detail).

If verification is not done or there is some error in enrollment of fingerprint, system goes back to its initial state without marking the attendance as shown in Figure 7.

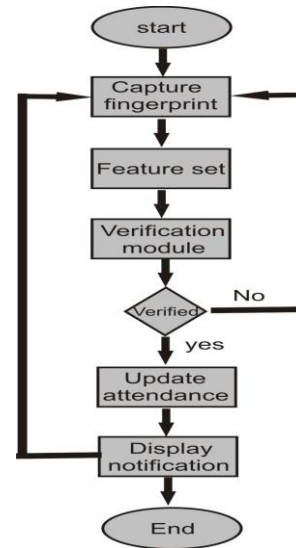


Figure 7: Flow chart of the system.

#### 4. Pseudo Code

```

Main
{
  Enroll fingerprint
  if (enrollment successful)
    {
    Read stored templates
    Identification (fingerprint, stored template)
    if (Identified)
      {
      Get students Id and check the student's schedule
      lecture & update attendance record
      Display "attendance updated" message;
      return to initial state
      }
    else
      {
      display "Not Identified" message
      return to initial state
      }
    else
      {
      Display "Error in fingerprint enrollment" message;
      }
    return to initial state
  }
}

```

#### 5. Results

The proposed system has been tested for a class of 50 students. Three students were 30 minutes late than the lecture time. The attendance of these three students was not updated (see rules for detail). Out of other 47 students

46 students were properly identified and thus their attendance record was updated. 1 unsuccessful identification occurred because student did not properly place his finger on the sensor (see rules for detail). The accuracy of the system is shown Table 1.

No. of students	Successful Identification	Unsuccessful Identification	Accuracy
50	49	1	98%

**Table 1:** Result of fingerprint Identification

The results shown in Table 1 prove that the system is near to an ideal system.

Furthermore after 25 lectures the record of different students was obtained. One such record is shown in Figure 9.

Subject	Attended Lectures	Total Lectures	Percentage
ADBMS	22	25	88%
ISOPN	17	25	68%
Software Testing	21	25	84%
System Programming	19	25	76%

**Figure 9:** Attendance record of student

#### 6. Conclusion

It can be concluded from the above discussion that a reliable, secure, fast and an efficient system has been developed replacing a manual and unreliable system. Results have shown that this system can be implemented in academic institutes for better results regarding the management of attendance. This system will save time, reduce the amount of work the administration has to do and will replace the stationery material with electronic apparatus. Hence a system with expected results has been developed but there is still some room for improvement.

## References

- [1] D. Maltoni, D. Maio, A. K. Jain, S. Prabhaker, "Handbook of Fingerprint Recognition", Springer, New York, 2003.
- [2] A.C. Weaver, "Biometric authentication", *Computer*, 39(2), pp 96-97 (2006).
- [3] J. Ortega-Garcia, J. Bigun, D. Reynolds and J. Gonzalez-Rodriguez, "Authentication gets personal with biometrics", *Signal Processing Magazine, IEEE*, 21(2), pp 50-62 (2004).
- [4] Anil K. Jain, Arun Ross and Salil Prabhakar, "An introduction to biometric recognition", *Circuits and Systems for Video Technology, IEEE Transactions on Volume 14, Issue 1, Jan. 2004* Page(s):4 – 20.
- [5] Fakhreddine Karray, Jamil Abou Saleh, Mo Nours Arab and Milad Alemzadeh, "Multi Modal Biometric Systems: A State of the Art Survey", *Pattern Analysis and Machine Intelligence Laboratory, University of Waterloo, Waterloo, Canada*.
- [6] Abdulmotaleb El Saddik, Mauricio Orozco, Yednek Asfaw, Shervin Shirmohammadi and Andy Adler "A Novel Biometric System for Identification and Verification of Haptic Users", *Multimedia Communications Research Laboratory (MCRLab) School of Information Technology and Engineering University of Ottawa, Ottawa, Canada*.
- [7] H. C. Lee and R. E. Gaensslen, "Advances in Fingerprint Technology", Elsevier, New York.
- [8] Sharath Pankanti, Salil Prabhakar, Anil K. Jain, "On the Individuality of Fingerprints", *IEEE transaction on pattern analysis and machine intelligence*, vol.24, no.8, august 2002.
- [9] Federal Bureau of Investigation, "The Science of Fingerprints: Classification and Uses", U. S. Government Printing Office, Washington, D. C., 1984.
- [10] H. C. Lee and R. E. Gaensslen (eds.), "Advances in Fingerprint Technology", Second Edition, CRC Press, New York, 2001.
- [11] K.G.M.S.K. Jayawardana, T.N. Kadurugamuwa, R.G. Rage and S. Radhakrishnan, "Timesheet: An Attendance Tracking System", *Proceedings of the Peradeniya University Research Sessions, Sri Lanka, Vol.13, Part II, 18th December 2008*.
- [12] Yohei KAWAGUCHI, Tetsuo SHOJI, Weijane LIN, Koh KAKUSHO, Michihiko MINOH, "Face Recognition-based Lecture Attendance System", Department of Intelligence Science and Technology, Graduate School of Informatics, Kyoto University. Academic Center for Computing and Media Studies, Kyoto University
- [13] DigitalPersona, Inc. 720 Bay Road Redwood City, CA 94063 USA, <http://www.digitalpersona.com>