A Theoretical Approach to Design "A Fingerprint based Attendance System"

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Abstract: **To provide high security to fingerprint based attendance system through random number. Authentication plays a very critical role in security-related applications like attendance system. There are a number of methods and techniques for accomplishing this key process. In this regard, biometrics is gaining increasing attention these days. Security systems, having realized the value of biometrics, use biometrics for two basic purposes: to verify or identify users. Every organization whether it be an educational institution or business organization, it has to maintain a proper record of attendance of students or employees for effective functioning of organization. Designing a better attendance management system, for students, so that records are maintained with ease and accuracy. This would improve accuracy of attendance records because it will remove all the hassles of roll calling and will save valuable time of the students as well as teachers. Image processing and fingerprint recognition are very advanced today in terms of technology. It was our responsibility to improve fingerprint identification system. We decreased matching time by partitioning the database to one-tenth and improved matching using key based one to many matching.**

INTRODUCTION

Biometrics is used as a form of identity access management and access control. So use of biometrics in student attendance management system is a secure approach. There are many types of biometric systems like fingerprint recognition, face recognition, voice recognition, iris recognition, palm recognition etc. In this project, we used fingerprint recognition system .There is a number of biometrics and different applications need different biometrics. Biometric is the most secure and convenient authentication tool. It cannot be borrowed, stolen, or forgotten and forging one is practically impossible. Biometrics measure individual's unique physical or behavioral characteristics to recognize or authenticate their identity. Common physical biometrics includes fingerprints, hand or palm geometry, retina, iris, and facial characteristics. Behavioral characters characteristics include signature, voice, keystroke pattern, and gait. Project deals with Identification, Authentication and Setup of Secure Attendance System using SM630 Biometrics Module and 8051 Microcontroller.

Whole projects is explained under some headings which are the small parts of the project like working, summary, finger print, its recognition ,approach to recognition, random number concept and its generation followed by hardware description along with components used with individual description.

Figure 1 A fingerprint image acquired by an optical sensor

Figure Shown Above, is a fingerprint pattern obtained from an optical sensor. The figure shows faint and dark lines emerging from a particular point and spiraling around it all over the finger. Every fingerprint consists of ridges and furrows. These ridges and furrows are known to show good similarities but when it comes to identifying a person or distinguishing between two different prints, these do not prove efficient enough. Research shows that fingerprints are not distinguished by ridges and furrows but by Minutia. Minutia refers to some abnormalities in a ridge, which shall be discussed in detail in the following pages. a fingerprint is the pattern of ridges and valleys on the surface of a fingertip. The endpoints and crossing points of ridges are called minutiae. It is a widely accepted assumption that the minutiae pattern of each finger is

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unique and does not change during one's life. Ridge endings are the points where the ridge curve terminates, and bifurcations are where a ridge splits from a single path to two paths at a Y-junction. Figure 1 illustrates an example of a ridge ending and a bifurcation. In this example, the black pixels correspond to the ridges, and the white pixels correspond to the valleys.

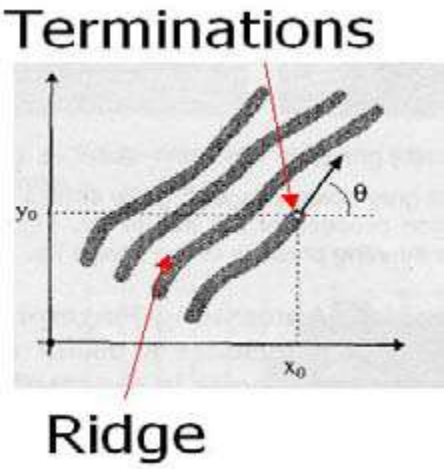

Figure 2 Termination minutia

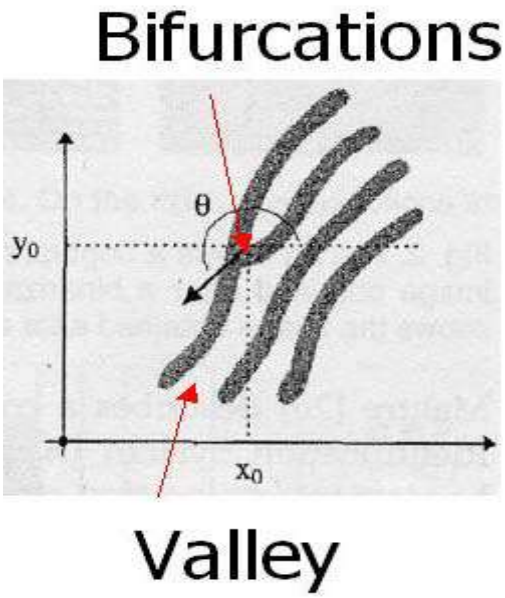

Figure 3 Bifurcation minutia's (Furrow, also known as valley)

ATTENDANCE MANAGEMENT FRAMEWORK

Manual attendance taking and report generation has its limitations. It is well enough for 30-60 students but when it comes to taking attendance of students large in number, it is difficult. For taking attendance for a lecture a conference, etc. roll calling and manual attendance system is a failure. Time waste over responses of student's waste of paper etc is the disadvantages of manual attendance system. Moreover, the attendance report is also not generated on time. To overcome these non-optimal situations, it is necessary that we should use an automatic on-line attendance management system. So we present an implementable attendance management framework. Student attendance system framework is divided into three parts Hardware/Software Design, Attendance Management Approach and On-line Report generation. Each of these is explained below.

HARDWARE-SOFTWARE LEVEL DESIGN

Required hardware used should be easy to maintain, implement and easily available. Hardware consists following parts:

(1)Fingerprint Scanner SM630

(2)LCD/Display Module

(3)Computer

(4)LAN connection

ATTENDANCE MANAGEMENT APPROACH

This part explains how students and teachers will use this attendance management system. Following points will make sure that attendance is marked correctly, without any problem:

(1)All the hardware will be inside classroom. So outside interference will be absent.

(2)To remove unauthorized access and unwanted attempt to corrupt the hardware by students, all the hardware except fingerprint scanner could be put inside a small cabin. As an alternate solution, we have pre installed CCTV cameras to prevent unprivileged activities.

(3)When teacher enters the classroom, the attendance marking will start. Computer software will start the process after inputting fingerprint of teacher. It will find the Subject ID and Current Semester using the ID of the teacher or could be set manually on the software. If teacher doesn't enter classroom, attendance marking will not start.

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(4)After some time, say 20 minutes of this process, no attendance will be given because of late entrance. This time period can be increased or decreased as per requirements.

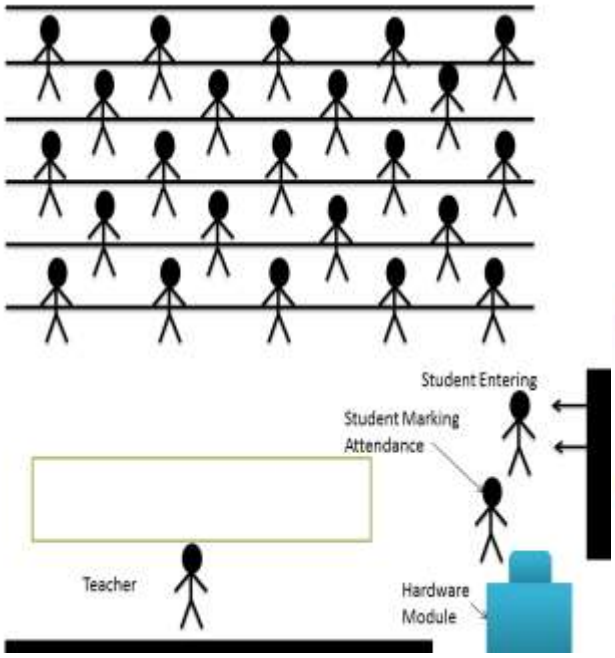

Figure 4 Classroom Scenario

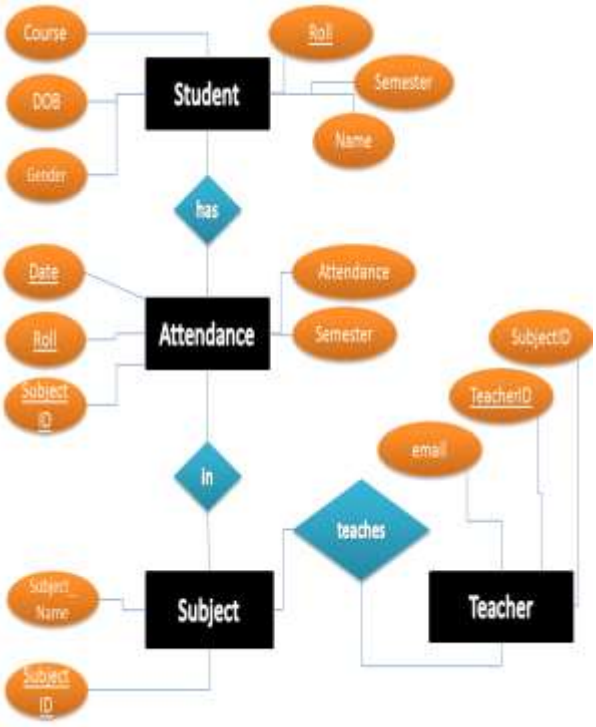

Figure 5 ER Diagram

Figure 6 Database System

FINGERPRINT IDENTIFICATION SYSTEM FLOWCHART

A brief methodology of our Fingerprint Identification System is shown here in following flowchart:

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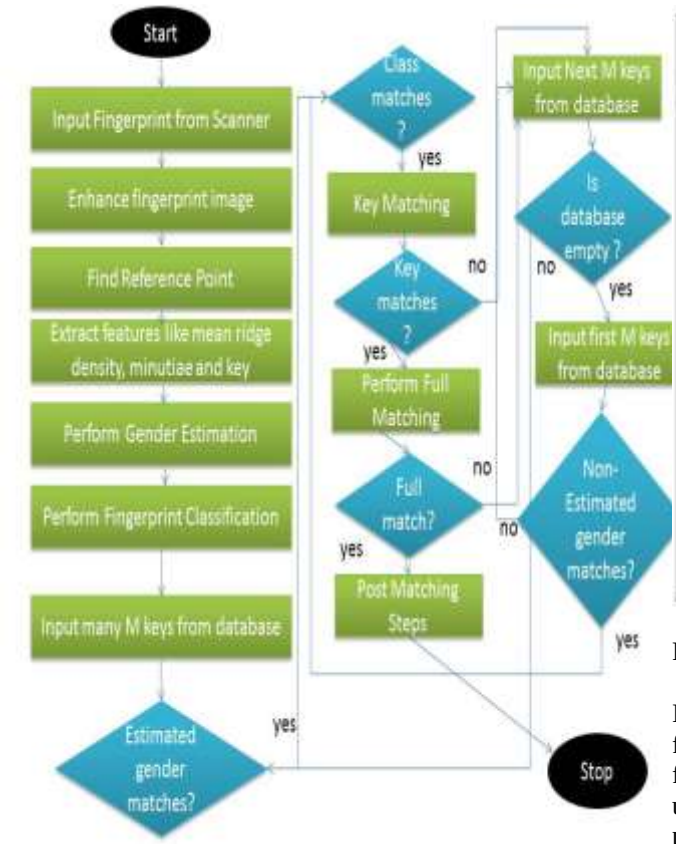

Figure 7 System Flowchart

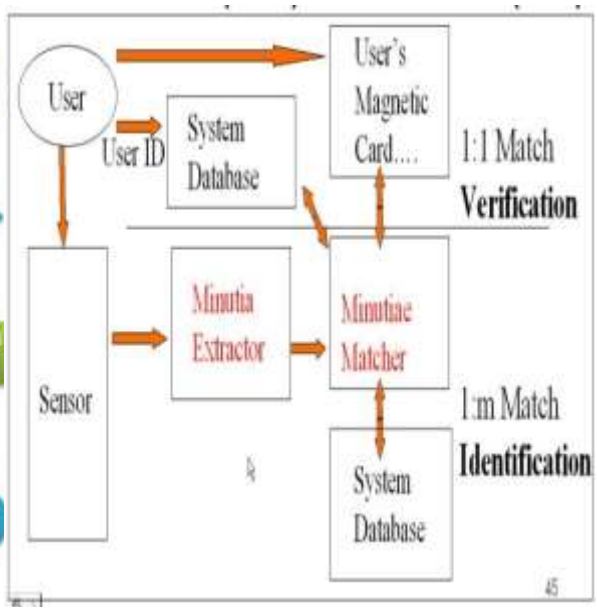

Figure 8 Verification Vs Identification

FINGERPRINT RECOGNITION

Once the fingerprint is captured, the next step is the recognition procedure. The recognition procedure can be broadly sub grouped into

a. Fingerprint identification

b. Fingerprint verification

Fingerprint identification refers to specifying one's identity based on his fingerprints. The fingerprints are captured without any information about the identity of the person. It is then matched across a database containing numerous fingerprints. The identity is only retrieved when a match is found with one existing in the database. So, this is a case of one-to-n matching where one capture is compared to several others. This is widely used for criminal cases.

Fingerprint verification is different from identification in a way that the person's identity is stored along with the fingerprint in a database. On enrolling the fingerprint, the real time capture will retrieve back the identity of the person. This is however a one-to-one matching. This is used in offices like passport offices etc. where the identity of a person has to be checked with the one provided at a previous stage.

Irrespective of the procedure carried out, the fingerprint recognition has to be such that the fingerprint is well- represented and retains its uniqueness during the process. In the following pages, an approach to fingerprint recognition has been discussed that will deal with the representation of the same.

APPROACH TO FINGERPRINT RECOGNITION

The approach that we have concentrated on in recognition of the fingerprints is the minutia based approach. In this approach the ridge bifurcations and terminations are taken into consideration for analyzing each fingerprint. The representation is based on these local features.

The scanner system uses highly complex algorithms to recognize and analyze the minutia. The basic idea is to measure the relative portion of minutia. Simply, it can be thought of as considering the various shapes formed by the minutia when straight lines are drawn between them or when the entire image is divided into matrix of square sized cells. If two fingerprints have the same set of ridge endings and bifurcations forming the same shape with the same dimension, there' s a huge likelihood that they are of the same fingerprint.

So, to find a match the scanner system has to find a sufficient number of minutia patterns that the two prints have in common, the exact number being decided by the scanner programming.

HARDWARE DESCRIPTION

This project gives you a fingerprint based attendance system with 8051 microcontroller. The SM630

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fingerprint module is used for fingerprint matching. It can store a max of 768 fingerprints. The admin can add/delete records from the PC through the VB application. There is an infrared LED and photo diode to sense the finger placed over the fingerprint module. All the attendance details are stored over the PC. The admin can generate reports and also this can print the reports.

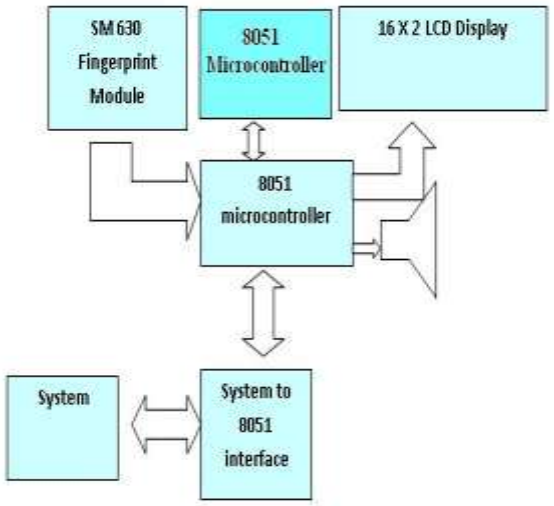

Figure 9 Block Diagram of Fingerprint Based Attendance System

RESULTS AND DISCUSSION

The project "Finger print based attendance system" made successfully along with a new concept of Random no. generation and the project is highly effective as well as efficient in terms of performance as well as the cost of the system is very less as compared to systems available in the market .

Figure 10 Master Slave Microcontroller

SUMMARY AND CONCLUSIONS

The project deals with the identification, authentication and setup of Attendance system using Biometrics module. Main aim of project is to take attendance of the user and to maintain data base.
The major enhancement is the use of Random number concept to avoid the use of system by an mentally unbalanced person.

- Interfacing with LCD
- Interfacing of switches
- Testing of module with design software
- Communication between master and slave

Formation of a complete system by combining all of the above individual sub system

SCOPE OF FUTURE WORK

Regarding our fingerprint indexing system, we are planning introduce more indexing techniques like ridge density tolerance etc. For making the search more faster. Also the key used will be more efficient when complex key will be used. We are trying to reduce matching error rates. Student attendance system is designed using LAN in this project. We have thought of using wireless LAN. The problem of using wire- less LAN is that wireless devices are costly and implementation is hard because the wireless devices work in small area. Our institute LNCT Indore is spread over large area so we may not use wireless network now. As an alternate, we may use mobile network (sec 2.5) which would be sufficiently suitable because now-a-days 3G network provides much speed. It would meet necessary throughput and data fetching speed requirements.

- Use of Random Vibration in place of Random Number.
- Use of Camera to restrict unauthorized users.

Data base can be maintained through Smart Mobile applications or web server.

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