Wireless based Fingerprint Attendance System

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Abstract— this paper presents the design methodology of a simple and high real time ZigBee - biometric system for easy and time saving attendance management using the finger prints of the Students at any College along with the Student's incoming and outgoing log maintenance. Firstly Student's fingerprints are scanned by a fingerprint scanner and an identity number is allotted as their enrollment. During the attendance process, the teacher gives his/her thumb impression to begin the attendance process. Later when Students impress their fingerprints, against the scanner, the system compares the new fingerprint patterns and the connection between various points in the fingerprint with the enrollment database. The teacher once again uses his/her thumb to stop the attendance process for a lecture. Through this automatic system, time and manpower is reduced to the great extent.

Key words: ZigBee, Fingerprints, Attendance, Image Processing

I. INTRODUCTION

Different wireless communication technologies (Wi-Fi, Bluetooth, infrared and ZigBee) are available to transmit the data over the wireless channel. Among all the techniques, ZigBee is most advantageous one because of its low power requirement and low cost.

Various biometric technologies are fingerprint, face, iris, hand geometry, voice and signature recognition. Among all those, fingerprint technology is the oldest biometric technology, but still it is most widely used because it provides good levels of accuracy and simplicity. This technology is highly reliable for the recognition purpose because of their individuality and constancy over the time. Also, the fingerprint is fast biometric technique for more reliable and secure system.

II. DESIGN

The total system is organized by means transmission element, receiving element and attendance supervision terminal. The transmitter module consists of fingerprint sensor, processing element (Microcontroller) & ZigBee transmitter section. Fingerprint collecting process is realized by means of sensor element. In order to perform attendance supervision operation, fingerprint extraction and matching algorithms are implemented and processed on the Microcontroller processor. The input fingerprint related information is communicated to the computer via ZigBee transmitting element. At the receiving side, to receive the fingerprint information i.e. another ZigBee element is used. To maintain the database related to employees, here a server called attendance supervision workstation is used. This system can automatically realize functions such as fingerprint sensing, fingerprint processing, fingerprint ID (FPID) transmission through wireless channel, fingerprint matching, and attendance supervision. This attendance system can be designed using two sub modules namely transmitter module and receiver module. The two modules are designed using embedded system technology.

The Microcontrollers are especially designed for signal processing applications. They provide good flexibility in real time environment. But FPGAs are not as much flexible as Microcontrollers in real time aspect. So finally, Microcontroller is selected for the implementation of the transmitter and receiver modules of this attendance management system.

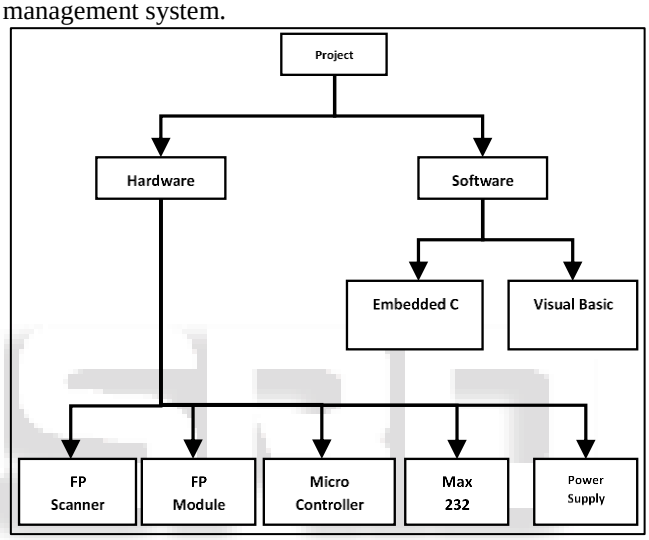

Fig. 1: System Overview

A. Transmitter Module

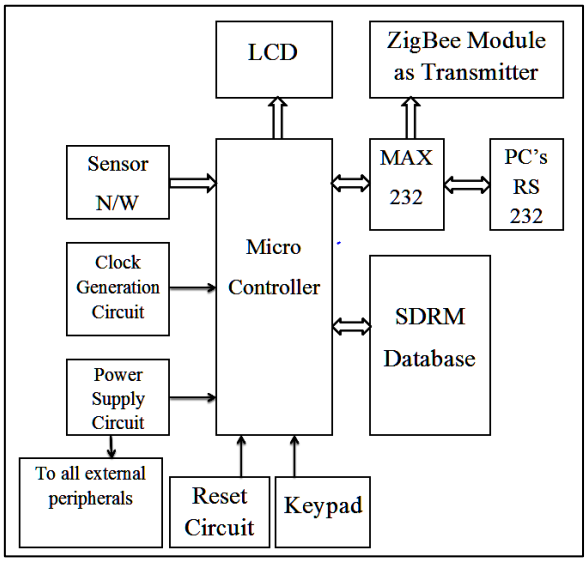

Fig. 2: Transmitter Module Block Diagram

This block diagram of transmitter section is. This sensor captures the patter of the person's fingerprint. The image that is captured by the fingerprint module is given to Microcontroller for the further processing of the image. During the fingerprint registration phase, the Microcontroller

processes the image, extracts the features from the image and then from the template related to current input user's fingerprint. Finally the Microcontroller store the template along one unique ill in the SDRAM database and also send the ID information to the receiver module with the help of ZigBee transmitter and ZigBee transmission channel. During the fingerprint matching phase, the Microcontroller processes the image, extracts the features from the image and then from the template related to current input user's fingerprint.

In this case, Microcontroller compares the current template with the templates that already exist in the SDRAM database. If any match is found, then the unique id corresponding to the arrest data is throwing to receiver module through the ZigBee transmitter and ZigBee wireless channel for further processing like attendance management.

B. Receiver Module

The receiver module receives the unique code i.e. ID from the transmitter and then give it to work station (PC) to register or update information related to the employee of the institution. The block diagram of the Receiver module is shown in Fig. 3.

The unique id is received by the receiver element and is forwarded to microcontroller. The PC thus updates the information in the database based on the signal received through the receiver.

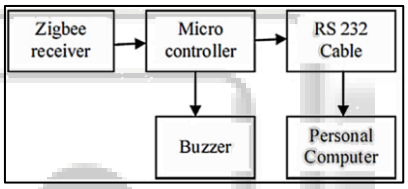

Fig. 3 Receiver Module Block Diagram

C. Software Development of Fingerprint

After extracting the minutia points, font the template corresponding to new input user and then stored in a specific memory location. The desired memory location can be selected with the help of increment and decrement keys on the keyboard. Enrolment algorithm steps are briefly furnished below. Enrolment algorithm flow is shown in Fig.

1) Noise removal and image segmentation: The image acquired from the fingerprint sensor is temporarily stored in the SDRAM. The noises introduced into the image during fingerprint acquisition process, so the image is first subjected to noise removal process. After removing the noise, image is segmented. In a Without segmentation process, if the image is directly subjected to the minutiae extraction algorithms then extraction algorithm extracts noisy and false minutiae along with genuine minutiae points.
2) Local normalization: Normalization is performed on the segmented fingerprint image to homogenize the grey-level intensity values in an image.
3) Block Orientation Estimation: The block direction estimation defines the local direction of the ridges enclosed in the fingerprint. The block direction is obtained through the least mean square estimation algorithm.
4) Image Enhancement using Gabor filter: The Gabor filter based enhancement requires direction O (i, j) and ridge frequency F (i, j). If the normalized image is passed through a Gabor filter with appropriate values of O (i, j) and F (i, j), enhanced version of the image is produced at the output of Gabor filter.
5) Image Binarization: The original image is an 8-bit greyscale image. The binarization process converts a greyscale image into binary image by assigning pixel values' l' for furrows and ' 0' for ridges.
6) Minutia Extraction and False Minutia Removal: The concept of Crossing Number (CN) is most extensively used method for extracting the minutiae from fingerprint image. Along with genuine minutia points some false minutia points are also present in the fingerprint image. So identify where these points are located and remove those points. Removal of false minutia points in the image makes the reliable minutia extraction.

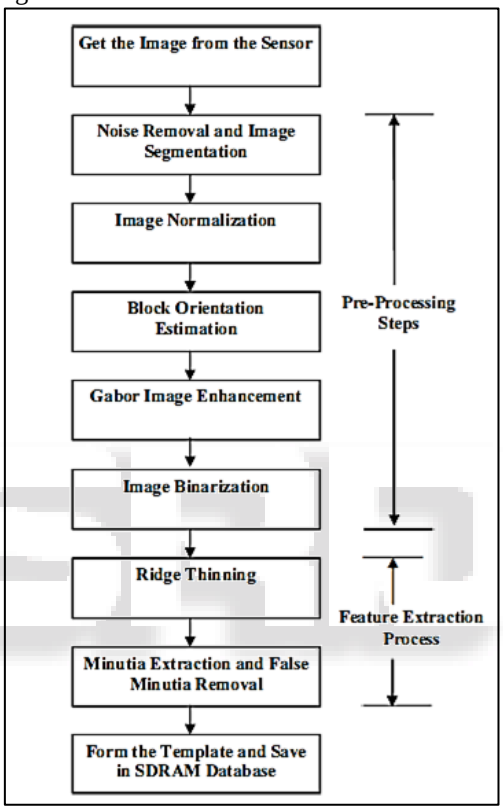

Fig. 4 Flowchart of Enrollment Algorithm

D. Matching Mode

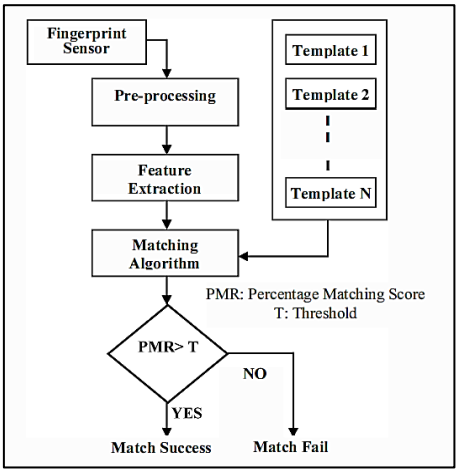

Fig. 5: Matching Process

The matching mode is responsible for identifying individuals at the point of access. Matching Process is shown in Fig. 5. The matching algorithm calculates the Percentage

Matching Score (PMR). If the matching score satisfies the specific condition then match is declared as successful match otherwise it is considered as the Failure match. Here the matching algorithm used is elastic match algorithm. Based on the minutia match count, percentage matching score is calculated. Now the calculated value of percentage match score is compared against the threshold value. If the percentage match score is greater than threshold value then the match is declared as the successful match.

III. VISUAL BASIC

Visual Basic (VB) is an event driven programming language and associated development environment from Microsoft for its COM programming model. VB has been replaced by Visual Basic .NET. The older version of VB was derived heavily from BASIC and enables the rapid application development (RAD) of graphical user interface (GUI) applications, access to databases using DAO, RDO, or ADO, and creation of ActiveX controls and objects

A programmer can put together an application using the components provided with Visual Basic itself. Programs written in Visual Basic can also use the Windows API, but doing so requires external function declarations.

In business programming, Visual Basic has one of the largest user bases. With 62% of developers using some form of Visual Basic, it currently competes with C++ and JavaScript as the third most popular programming language behind C# and Java.

IV. RESULT

The main UI features Enrollment and attendance controls and also keeps the data base for every class and subject.

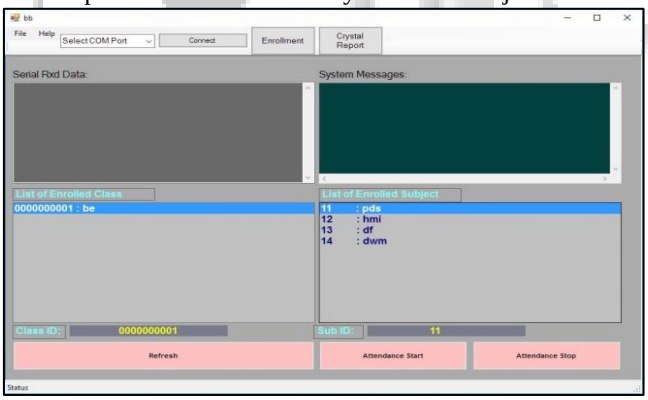

Fig. 6: Results

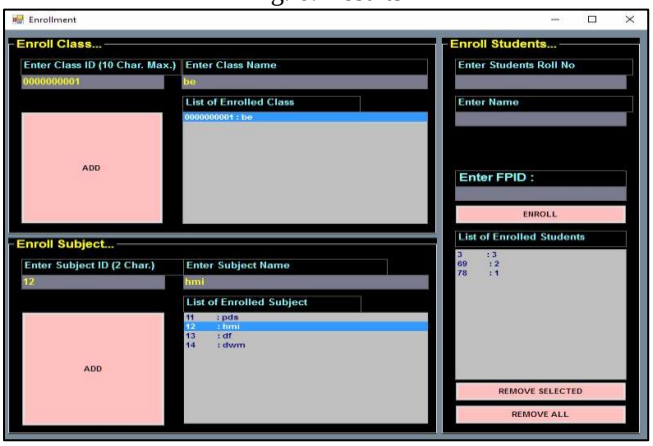

Fig. 7: Results

The Enrollment is used for enrolling students for the very first time. Students Name and Roll No. are used as some of the detail about a student. Each student is given a unique Fingerprint ID (FPID). Attendance is taken based on this FPID.

After the attendance is taken, the database maintains a full record of every subject and every lecture taken on any day and any time. A Crystal Report can be created based on an individual Subject or individual Student or individual Lecture.

Fig. 8: Results

V. CONCLUSION

During the verification phase, this system can collect real time fingerprint image signals, process the fingerprint image, extract fingerprint features, form the template based on the extracted features, and then match the template against the templates stored in database to identify/verify the person. Finally, the LCD displays the results of recognition process.

A program is coded in 'C' language to implement the algorithms for enhancement, minutiae extraction and matching processing. Apart from that, MA TLAB was used to demonstrate the various functions and processing methods used in image processing of the fingerprint. The outputs for all the trial runs were recorded. On observation, the designed system gives satisfactory results.

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