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Biometric Attendance System with Compromised Circuitry using IoT

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Abstract: ***Day by Day, the concept of smart and value of time are widely increasing in every work we do and at every place. Considering some commercial organizations and Educational Institutions, we modified some existing biometric attendance systems and enabled IoT using open-source internet platform boards to collect the presence of an individual in an organization or in any kind of educational institution. The improved technology of open source internet boards and various Display modules enabled us to feature our project as a Biometric Attendance System with Compromised Circuitry using IoT. The following paper explains the overview of the project using some flowcharts and a wide future scope of the project.***
Keywords: Phrases-- Biometric Attendance System, Use of SDA, Use of SCL, Open Source Internet Board, esp8266, Internet of Things (IoT), OLED Module, SPI, I2C Protocol.

I. INTRODUCTION

Earlier technologies like RFID, are used for making attendance of an individual presence in an organization or educational institution. And still at places like toll gates still these RFID cards are widely used with upgraded strong RFID signal receivers and invisible nano RFID. But it is hard to maintain such systems in any organization where their use allows them to commit different anti-purpose usage by the same or a different individual of that respective RFID tag. To bypass those acts Fingerprints came to rise to be the best option in the present days. The reason behind this is, fingerprints are unique from person to person and the deeply involved technology behind their recognition made biometric identification systems more secure compared to RFID technology. And the combination of improved technology in open-sourced internet boards and display modules, with these biometric systems, made our project circuitry compromised.

A. Biometric Sensors and Recognition

Biometric Identification Systems are widely used for the unique identification of humans. Fingerprints are also used as a form of access control. So the use of fingerprints in the student attendance management system is a secure approach. A fingerprint contains pattern of ridges on its surface tip. The tips of those ridges are called minutiae. It is a widely accepted assumption that the minutiae pattern of each finger is unique and does not change during one's life. And the minutiae pattern of every finger for each human is different and with the help of Digital Image Processing and concepts of Total Internal Reflection the pattern recognition will be stored and one to many algorithm is used to identify a user fingerprint to mark his attendance. There are two types of scanners. An optical scanner works Total internal Reflection phenomenon and collects its Bitmap. The scanner manufacturers a light sensor attached with a digital image sensor that processes bitmapping of finger. The computer analyzes the finger tip on the scanner and

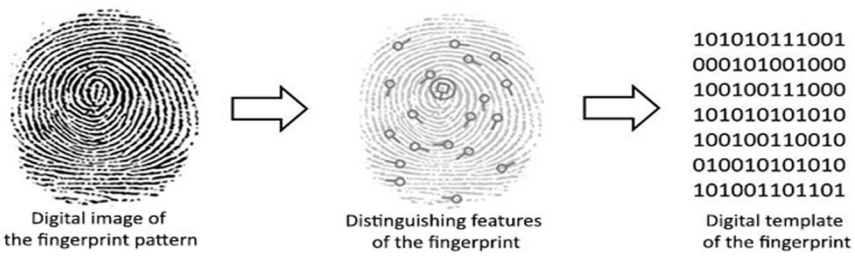


Fig. 1 Bitmap pattern recognition of a fingerprint

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The image processor starts to make bit pattern and a bitmap code serially. And it is known as Bitmap coding, which is encrypted in the form of 1's and 0's of any image that is in monochromatic form. The second one is known as a capacitive scanner, measures your finger electrically, that is it stores the picture of our fingerprint and gains access through, measuring distances between them. Mobiles phones we are using are examples of capacitive touch biometric sensors. In our project we are using an optical sensor which enables us to get user data to be stored in 1:1 ratio and enables the processor to search in 1: N ratio.

The fingerprint recognition can be explained simply using total internal reflection concept. The light behind the glass of fingerprint sensor undergoes total internal reflection and will help to recognize the bit pattern of the finger and the internal rom of any fingerprint sensor will store the scanned bit image in 1:1 ratio and helps when system started to check the placed fingerprint of a user in 1:N ratio.

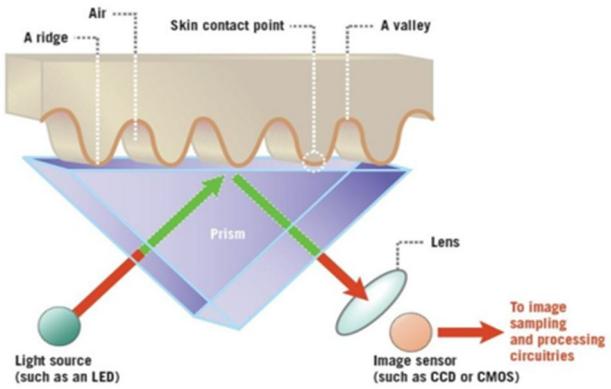


Fig. 2 Concept of fingerprint recognition (total internal reflection) inside a optical scanner

Some optical sensors like R307, R306 are examples of optical fingerprint sensors and used for practical prototype makings.

B. Display Modules

Display modules are used to indicate status of user entry when he/she places his/her fingerprint on the scanner. In existing systems of biometric attendance systems, earlier display modules like 16*2 LCD modules are used to indicate the status of record when someone places a finger on a scanner. But later on display modules are technically improved with different protocols in reducing the number of connection lines and data lines and making them compromised. For example a 16*2 LCD display module contains 16 lines for connections and data. Whereas an OLED module contains 6 or 4 total connection lines including power and data, depending on the protocol we selected. The OLED module has a wide range of uses that includes bitmap display and less equipped connections. The two protocols of the OLED module are serial peripheral interface (SPI) and Inter-integrated Circuit (I2C). To be more convenient we used I2C protocol as it communicates between different slaves from the master and it just requires two signal connections to exchange of information between master and slave. Apart from the two protocols of the display module, there exists two common signal lines to exchange data and communication between slave and master. Those are Serial Data (SDA) and Serial Clock (SCL).

1) *Serial Data (SDA):* Serial data transmits the data between master and slave but the I2C protocol is limited to 8 bit of data transfer which is less than SPI protocol.
2) Serial Clock (SCL): SCLcarries the clock signal. I2C is a serial communication protocol that the data is transferred synchronously along a single wire of serial data. Both the protocols of OLED are parallel in their operation that is both the serial data and serial clock acts parallel between the host and user .The clock signal is always controlled by the master/host.

C. Open Source Internet Platform Board

Earlier existing systems are done using GPS, GPRS, and manual monitoring systems. But by the improvement in open source internet platform boards like Arduino IoT, Nodemcu-- the developed board of esp8266 which enables all kinds of operations with this board itself. We used Nodemcu board as our open source internet platform board to develop and maintain the records in an internal server created using XAMPP.

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II. OVERVIEW OF PROPOSED SYSTEM

A. Overview

Our proposed system deals with compromised circuitry that is with less circuitry but with greater efficiency. The components are selected in a way that fulfill the motto of the proposed system and are tested in all kinds in our lab view. The below image illustrates the proposed system in a simple way that everyone understands.

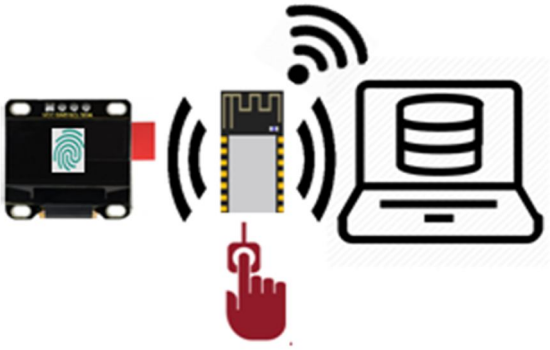


Fig. 3 Glimpse of proposed system

B. Block Diagram and working

In general, fingerprints scanners are made to collect user fingerprints initially and store them in the inbuilt space of fingerprint scanners using a separate software described by various manufactures. But later on using some libraries like Adafruit libraries in Arduino software, the process got simplified for creating a fingerprint database of users directly from a PC connecting the hardware to it and processing the work through Arduino software. In our proposed system a local server using XAMPP is created with basic html source codes and are programmed with esp8266 to create a user database from the internal server itself. This made our proposed system to be more secure, because an internal server cannot be accessed from other personal computers but through this compromised proposed system one can carry the equipment anywhere and can gain one's presence in ease of time and smartness.

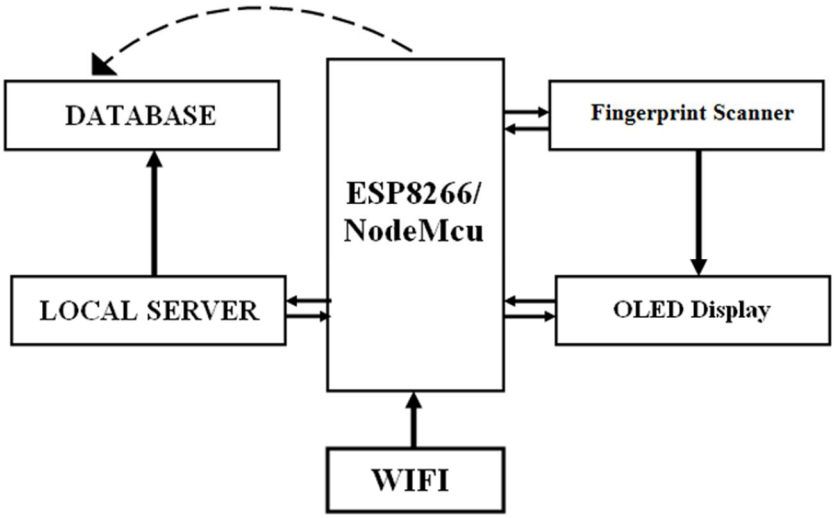


Fig. 4 Schematic of proposed system

The open source internet board can be accessed with a small change in its code every time we connect to a new wireless network.

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C. Software Design

In order to full-fill the motto of the proposed system, the hardware must be programmed to their responsibilities of work. In our proposed system nodemcu is allotted to control and maintain the operations of all hardware parts. And XAMPP is programmed for maintaining records of the data by users using phpmyadmin. Arduino software with some libraries like adafruit, ssd and some internet protocol libraries like html are used for programming esp8266.

III. CONCLUSION

The existing process of taking student attendance manually using paper is highly inefficient and time consuming. The attendance monitoring system based on the biometric authentication has a potential to streamline the whole process. An iot based biometric attendance system with compressed circuitry can prove to be a great value to educational institutions and organizations. The cost involved in making this system is quite less when compared to conventional biometric attendance systems. Coming to our proposed system we established, secure database and Easy circuitry and operational methodology.

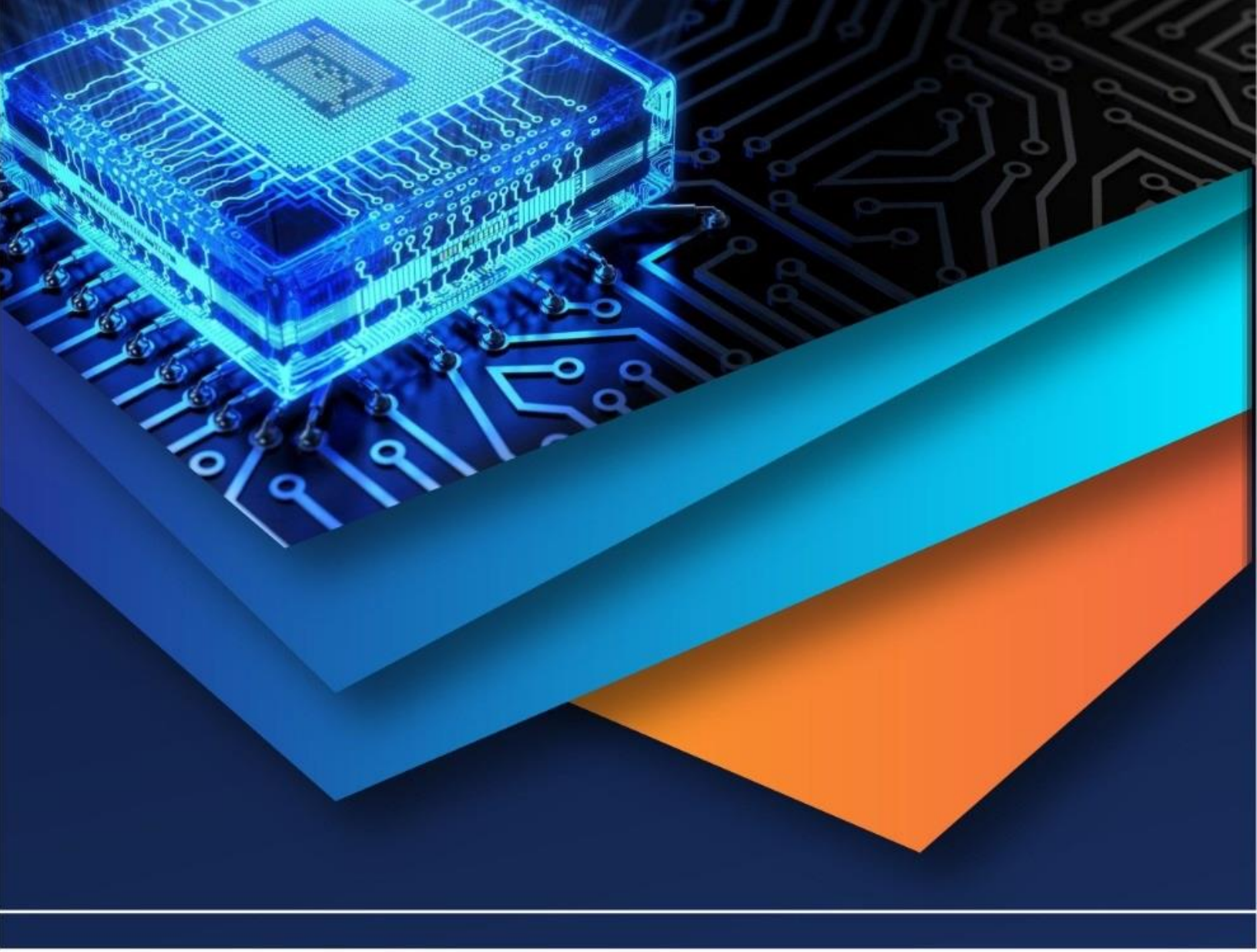
IV. FUTURE SCOPE

This would make the process of identifying an individual will be easier in any kind of environment. The proposed system further be implemented to automatically calculate attendance percentages of students and intimate the parents through any kind of communication. The hardware size can be reduced. A good display can be used instead of basic 128*64 oled display. One can try to interface all the required modules with the nodemcu to reduce the size. A better interactive website can be designed. We tested our website with a local server. The database has to be connected with the college server. Websites can be designed attractively. Even more pages can be created to add extra features for it.Although many speak about the disadvantages of using an IoT based attendance system, the advantages it offers by saving our time and energy cannot be ignored. The concept of IoT revolves around connecting devices using sensors and to the internet so they can communicate with other similar objects without human intervention.

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