



FINGERPRINT BASED BIOMETRIC ATTENDANCE SYSTEM

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Abstract

Biometric attendance systems that are based on fingerprints make use of the distinctive qualities of a person's fingerprint in order to precisely track and record their attendance. These systems often entail the use of a fingerprint scanner that takes a picture of the individual's fingerprint. This fingerprint image is then compared to a template that has been pre-registered in order to determine whether or not the person is who they claim to be. Because the biometric information is kept in a safe database and may be used to automate attendance tracking, there is less of a chance that the tracking will be inaccurate or incorrect information will be recorded. Traditional methods of attendance tracking, such as manual sign-in sheets or passwords, can be replaced by biometric attendance systems that are based on fingerprint recognition, which offers a more secure and efficient alternative. Through the implementation of a GSM system, the creation of a digital attendance system is our primary objective. The procedure of taking attendance is going to be streamlined in order to make it easier for teachers to keep track of attendance at all times. The device is able to send automatic text messages to the guardian's phone to confirm their child's attendance because the guardian's phone number has been linked to the GSM system. In this way, consistent attendance can be encouraged, and any potential consequences at home can be avoided. In addition to this capability, the institution will be able to compile attendance records in order to address any issues or concerns raised by guardians.

Keywords: Microcontroller, Fingerprint, Biometric, Attendance, Preprocessing, Restoration, Contextual filters, Segmentation, and GSM.

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1. Introduction

Keeping track of students' whereabouts in a classroom can be a tedious process for educators, especially when dealing with big class numbers. Making a point of going around the room during class and calling everyone's name to take attendance slows things down considerably. Furthermore, it can be challenging to manage attendance records for large groups. As an alternative, you could have students sign for their absent peers on an attendance sheet that you sent around the classroom. The ability to keep track of students' attendance is essential for students' progress in the classroom. However, many institutions of higher learning and government agencies in the world's poorest countries still use antiquated paper-based attendance systems. Businesses consider regular attendance at work as a matter of good moral character. Biometric technology has shown great promise as a means to improve the efficiency of attendance tracking. Fingerprint verification is one type of biometrics that uses computers to record and check a person's unique physical characteristics, such as their fingerprints, iris patterns, or facial features. Fingerprint-based attendance systems are widely utilized because they provide a dependable and convenient method of tracking attendance records in a variety of contexts, including schools and businesses. Teachers record students' presence or absence by calling out roll numbers and checking out the appropriate boxes on institute-provided attendance sheets. The form can also be circulated so that students can sign up to attend a certain lecture or class. Paper-based attendance systems are still widely used in K-12 and higher education, despite their inefficiencies and potential for underrepresentation of true enrollment. Ridge and valley patterns in fingerprints have been shown to be uniquely associated with each individual. Managing employee attendance to deter bogus absences and criminally identifying terrorists, murderers, and other lawbreakers are just two examples of the many applications now seeing widespread use for fingerprint identification. As a concern of national security, fingerprints are also employed in the issuance of passports. Our goal with this project is to automate the process of taking attendance in the classroom by connecting a fingerprint recognition module to an 8051 microcontroller. Systems that analyze a person's fingerprints can be used for either authentication or identification. In verification mode, the system checks if a fingerprint input matches a fingerprint stored for a particular user. In identification mode, the system checks if the input fingerprint is a duplication or a fraudulent identity by comparing it to all fingerprints of all users enrolled in the database. Using multiple

embedded system principles, this study details the design of a physical fingerprint system and the architecture of a matching algorithm. An easily transportable and commercially viable hardware product is the target.

Project Prototype

The main component on the circuit is fingerprint module. This module sends signals or commands to the internal controller after matching fingerprints. Further, signals received by the microcontroller were stored in the internal EEPROM to mark the attendance. There is also a keypad on the circuit board to enroll the new person or to exit from the screen prompted the texts related to the received commands. If any student doesn't attend the class or late the class then the parents can notify by the SMS system. Our key approaches are:

Automated Class Attendance

Automated class attendance refers to the process of automatically recording and tracking student attendance using technology such as a fingerprint-based biometric attendance system. This system uses biometric information, like a student's fingerprint, to confirm their identity and track their attendance in real time.

With an automated class attendance system, teachers and administrators can easily track student attendance, monitor punctuality, and identify students who are absent or tardy. The system is a quick and accurate way to keep track of attendance, which can save time and cut down on the mistakes that can happen with manual methods.

The use of a fingerprint-based biometric attendance system in particular provides an added layer of security, as it ensures that the student physically attends class and cannot be falsely marked present by another student. This technology can also be combined with other educational technologies, like learning management systems, to give a full picture of how engaged and making progress.

Easy Access of Class Directory

"Fingerprint Based Biometric Attendance System" suggests a technology-based solution for tracking attendance in a classroom setting. In this kind of system, each student's fingerprint is used as a unique identifier. This makes keeping track of attendance easy and accurate.

In the context of this system, easy access to the class directory could involve integrating the attendance data with a digital directory that includes information about

the students enrolled in the class. This directory could have not only their names and contact information, but also their academic records, course schedules, and grades, among other useful information.

With the integration of the fingerprint-based biometric attendance system and the class directory, instructors could quickly and easily access information about each student's attendance record and academic progress. This information could be used to identify patterns of attendance, monitor student progress, and communicate with students who are falling behind. Also, having easy access to this information could speed up and improve administrative tasks like grading and reporting.

Automated Class Monitoring Facility

"Automated class monitoring facility" refers to a system that uses technology, such as a fingerprint-based biometric attendance system, to automatically monitor and track student activities in the classroom. This system provides teachers and administrators with real-time information on student behavior, attendance, and engagement.

In addition to recording attendance, an automated class monitoring facility may use other types of sensors or cameras to track student movements and activities within the classroom. For example, the system may use motion sensors to detect when a student leaves their seat, or a camera system to monitor student interactions during group activities.

By providing this type of automated monitoring, teachers and administrators can quickly identify students who may be struggling or disengaged, and intervene before these issues become more serious. The system can also help teachers make data-driven decisions about classroom management, and adjust their teaching approach based on student performance.

Parental Facility

Parental facility refers to a feature or capability of a system that allows parents or guardians to access information related to their child's attendance and academic performance. With a biometric attendance system based on fingerprints, parents may be able to see their child's attendance record in real time or get notifications when their child is absent or late.

This type of parental facility can help improve communication between schools and parents, and ensure that parents are aware of their child's

attendance and academic progress. With access to this information, parents can take a more active role in their child's education and work with teachers and administrators to address any issues or concerns that arise.

In addition to attendance information, a parental facility may also provide access to other types of data, such as grades, class schedules, and assignment deadlines. This information can help parents stay informed about their child's academic performance and progress and facilitate communication with teachers and administrators.

Design & fabrication:

To minimize loss from employee downtime, attendance management involves controlling staff presence or attendance in a work environment. Time clocks and timesheets have been used to track employee attendance in the past, but attendance management goes beyond this to create an environment that encourages and maximizes staff attendance.

Today's human resource systems place a lot of emphasis on attendance management since it moves a company toward improved HR practices, excellence, and systems. As a result, all employees and job hopefuls are expected to show up on time and be there for work on a regular basis. Unplanned absences and tardiness are the main causes of poor attendance since they interfere with productivity and lower employee morale when work is transferred to other staff members. Also, attendance is a crucial factor that is taken into account for a variety of reasons in many academic institutions and organizations. Record-keeping, student evaluation, and the encouragement of optimal and regular attendance in class are some of these goals. Most universities in developing nations require students to attend class at least 80% of the time, however due to the numerous difficulties with the current system of recording attendance, this rule has not been followed. To record student attendance using this old technique, utilize sheets of paper or books. The attendance sheet could be taken or misplaced using this manner, and impersonation is a real possibility. Taking attendance takes time, and it might be challenging to determine how many students have achieved the required percentage and are thus qualified for an exam. A system that would get rid of all of these problem areas is therefore necessary.

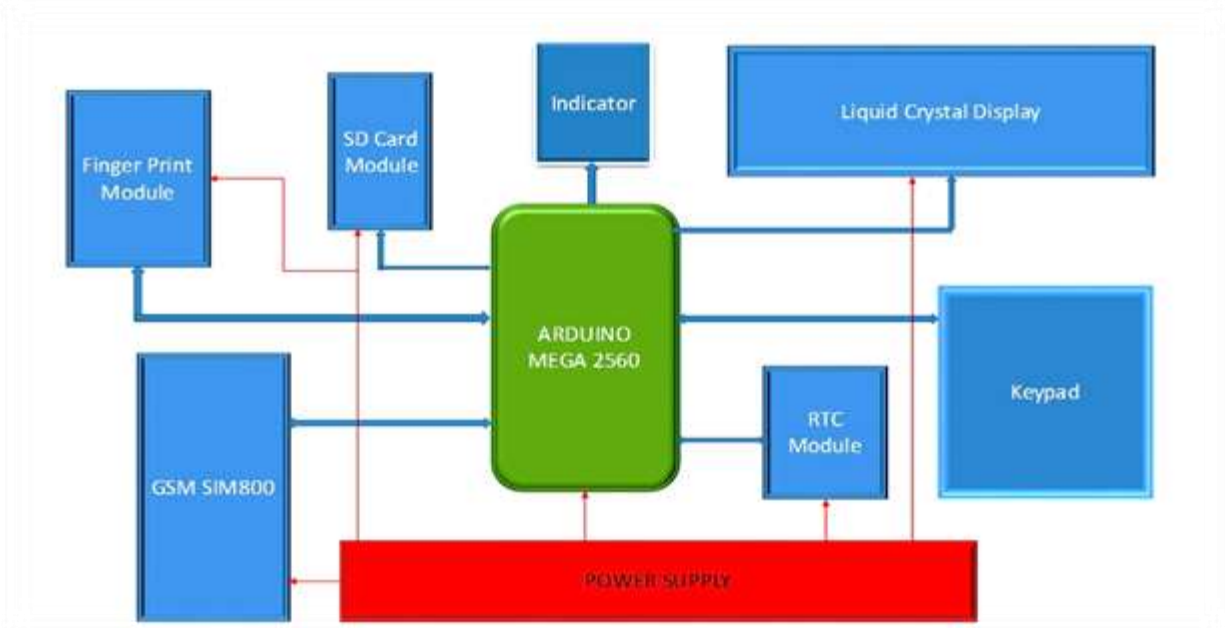
Block Diagram

Fig. Block Diagram of Fingerprint Based Biometric Attendance System

- The block diagram shows a system with the Arduino Mega 2560 as the main control unit. The other components in the system include the Finger print module, SD card module, indicator, LCD, GSM SIM 800, Power Supply, RTC module, and keypad.
- The Power Supply provides power to the system, and is connected to the Arduino Mega 2560. The Arduino Mega 2560 is the central component of the system, and is connected to all the other components.
- The LCD module is used to display information to the user, and is connected to the Arduino Mega 2560. The Keypad module is used to input data, and is also connected to the Arduino Mega 2560.
- The GSM SIM 800 module is used to communicate with the GSM network, and is connected to the Arduino Mega 2560. The Finger print module is used for biometric authentication, and is also connected to the Arduino Mega 2560.
- The SD card module is used to store data, and is connected to the Arduino Mega 2560.
- The RTC module is used to keep track of time, and is connected to the Arduino Mega 2560. The indicator is used to display the status of the system, and is connected to the Arduino Mega 2560.
- The block diagram shows how all the components in the system are connected to the Arduino Mega 2560, which serves as the main control unit. The Arduino Mega 2560 communicates with the other components to perform various functions, such as displaying information on the LCD, reading input from the Keypad, authenticating users with the Finger print module, communicating with the GSM network with the GSM SIM 800 module, storing data on the SD card module, and displaying the status of the system with the indicator. The RTC module is used to keep track of time for the system.

Circuit Diagram & Description

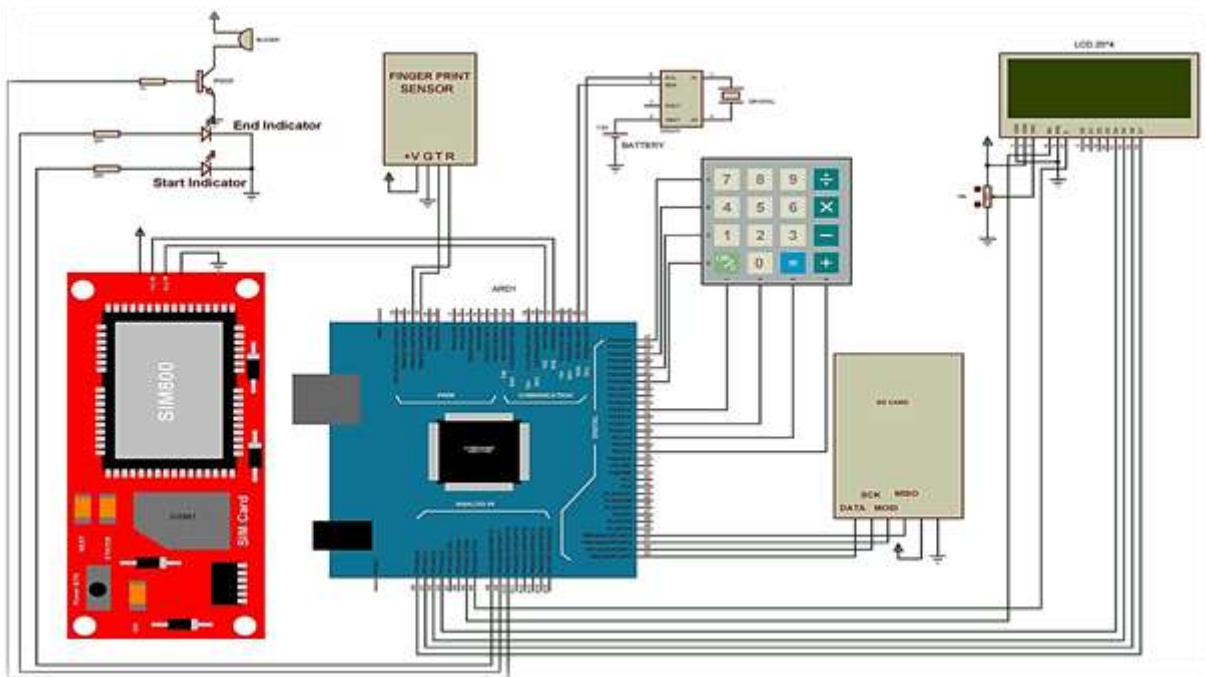


Fig. Circuit Diagram of Fingerprint Based Biometric Attendance System

As shown in the circuit diagram, a push button is directly connected to pin A0(ENROL), A1(DEL), A2(UP), A3(DOWN) of Arduino with respect to the ground. A yellow LED is connected at Digital pin D7 of Arduino with respect to ground through a 1k resistor. Fingerprint module's Rx and Tx are directly connected at Serial pin D2 and D3 (Software Serial) of Arduino. 5v supply is used for powering the fingerprint module taken from the Arduino board. A buzzer is also connected at pin A5. A 16x2 LCD is configured in 4-bit mode and its RS, EN, D4, D5, D6, and D7 are directly connected at Digital pin D13, D12, D11, D10, D9, and D8 of Arduino.

2. Result Analysis

The goal of this project is to take daily attendance of employees through fingerprints. The project is designed and implements software architecture for fingerprint analysis. The system should be able to extract key features from a scanned fingerprint image and to

compare these with a database of known fingerprint images and/or extracted feature sets. For this project, we provided a set of previously acquired fingerprints and a working fingerprint sensor with driver software for Windows. Our expectations were fulfilled by most of the algorithm development which was executed in dot net and this work was done on a Windows PC.

Our project "Fingerprint Based Biometric Attendance System" is an extensible work for any organization or company in this fast world. Keeping the view of research in mind, there is a lot of improvement work and flexibility for the coming technologies in the various demanding directions. The language which we have is very vast and even the under Microsoft products is trying to rule over the Information Technology. So, we hope that this project will be the point of interest for our successors to be enhanced further to market it compatible with the demands of the organization requirements.



Fig. Real Image of the Project

ADVANTAGES

Security

We used to have passwords with numbers, alphabets, symbols, etc., which are becoming easier to hack every day. There are zillions of hacking incidents happening every year, and we are losing money constantly. Biometric technology brings different types of solutions that are nearly impossible to hack, unlike passwords. This is a great help for us, specifically for business owners who have been fighting with security problems for a long time.

Accountability

In other verification methods, anybody can use your password or security number to hack your personal information, which is highly risky and we are suffering from this problem continuously. But, in case of biometric security, it needs your direct interactions to login or pass the security system which allows 100% accountability for all your activities.

Convenient

Imagine all the times you forgot your passwords, quite nerve-wrecking, right? You are not alone. We all have gone through this process where it is hard to memorize or write down each and every password, and we are more than likely to forget it in some sticky situations. There are some handy tools to do the job for you, but none of these can beat the convenience of biometric solutions, which stand to be the most convenient solution ever. Your credentials are with you forever, so it doesn't require you to memorize or write anything down.

Scalability

Unlike other solutions, biometrics are a highly scalable solution for all types of projects. Biometric technologies are used in many government projects, such as banking security systems, workforce management, etc. It is possible because of the scalability of its solutions.

3. Discussion

Feedback from Users Information on users' experiences is gathered through the usage of a questionnaire. Thirteen questions regarding user satisfaction with the Indigo Home Automation System have been answered in a questionnaire. Mostly the IT department received and filled out these surveys, and we got 20 responses. No one takes more than five minutes to absorb the information. Ninety-five percent of people say it's not difficult at all to operate the appliance, and only five percent say it's very difficult. All respondents also found the diagnosis feature to be either useful or very useful. No one who has used the system has had any trouble getting about, and everyone who has is pleased with the user interface. While the vast majority of respondents (90%) are pleased with the system's responsiveness, some are not. Ninety percent of responders are firm in their conviction that the Indigo Home Automation System is an effective means of reducing vampire energy. The Indigo Home Automation System is still highly recommended by all respondents, and 5% of people think it has to be made available to the public.

4. Conclusion

In this paper, we have presented a fingerprint-based attendance management system. The developed system is an embedded system that is part of a fingerprint recognition and authentication system based on minutiae points. The system extracts a fingerprint's local characteristic, which is made up of minutiae points in a template. Templates are matched during both the registration and verification processes. For improved quality control during the registration or verification process, a matching score was used to determine the success of the operation. The matching score was specified so that only sets of minutiae data that exceed the score will be accepted, and data below the score will be rejected. Therefore, fingerprint recognition using the minutia score matching method was used for matching the minutia points before attendance was recorded. The developed system is very helpful in saving the time of students and lecturers, saving paper, and generating reports at the required time. The system can record the clock in and clock-out times of students and workers in a very convenient manner using their fingerprint to prevent impersonation and reduce levels of absence. Also, it reduces most of the administrative jobs and minimizes human errors, avoids proxy punching, eliminates time related disputes and helps to update and maintain attendance records.

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