

SMART BIOMETRIC ATTENDANCE REGISTER USING ARDUINO-UNO MICROCONTROLLER SYSTEM

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ABSTRACT

Arduino-based fingerprint attendance register offers a consistent, protected, and proficient system for tracking attendance using biometric identification. The system leverage Arduino microcontroller combined with fingerprint sensor to authenticate user by scanning their fingerprint, thereby eliminating the need for manual entry or traditional ID cards, which can be lost or misused. The system adopts a fingerprint sensor module that captures and processes individuals fingerprint data, the data is stored in the Arduino's internal memory. Individual finger contour grids are captured on placing on the sensor, the system matches the fingerprint against the stored data and record attendance upon successful verification. The enabling capacity of system is able to manage large set of fingerprints, permitting scalability for small to medium sized institutions attendance system. This project presents an affordable and scalable solution for schools, offices and organizations looking to automatic attendance tracking, enhance security, and minimize errors. More so, the system's low-cost hard ware components, it efficiency, ease of use and it open-source nature, also making the microcontroller highly customizable and adoptable for specific needs.

Keywords: *Arduino UNO, Fingerprint Sensor, Attendance Tracking.*

INTRODUCTION

In today's swift advancements in technology, the old or traditional attendance system is obsolete and faces several challenges such as manual errors, time-consuming, fraudulent record keeping. An effective method to handle these issues is the adoption of biometric systems being a reliable and secure solution for automating attendance tracking (Jarudin et al 2024). There are many effective methods of biometric capturing, however, fingerprint recognition stands out remarkable due to its unique combination of precision, affordability and ease of integration (Lakshmi, P. and Jayashree, S 2020). This project uses a microcontroller board known as Arduino Uno based fingerprint attendance register that utilizes biometric technology to streamline the process of recording attendance. The microcontroller in conjunction with a fingerprint sensor to authenticate users by scanning their fingerprints. By scanning the unique fingerprint data of a user, the system ensures that attendance is marked for the rightful user or individual ensuring and enhancing both security and accuracy useful for administrative purposes.

This system is smartly designed for schools, offices, and organizations, it offers an effective and efficient alternative to the usual traditional methods, by reducing the risk of proxy attendance and human errors. In support of the statement Jinani W, (2020) emphasized that the system is ideal for various settings, including educational institutions and workplaces, where attendance accuracy and security are crucial. As IoT technologies evolve, future iterations of such systems could integrate cloud-based storage and real-time monitoring features for further scalability (Jarudin et al 2024).

Design of the Proposed System

The design consists of a Fingerprint Module, the Arduino microcontroller board and the RTC module. The design structure is for the enrolment purpose. The result is displayed on a serial monitor.

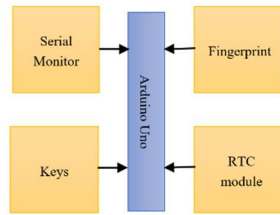


Fig. 1: The Fingerprint Proposed Diagram

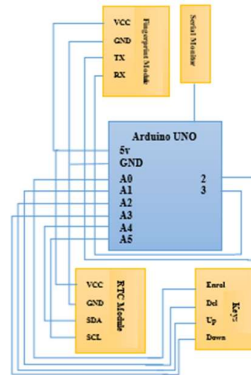


Fig 2: Proposed Circuit System diagram

Component Needed

- Arduino Uno
- Real-Time Clock (RTC)
- Parallax Data Acquisition tool (PLX-DAQ)
- Microsoft Excel
- Fingerprint Module

Arduino UNO is a special microcontroller which is a circuit board system that consists of hardware and software components (Dan Riley 2017). The microcontroller manages data and connections it stores, register and display the data. The microcontroller stores a unique ID Number of a registered user. After registration the fingerprint will be checked with the stored fingerprint, and if both the fingerprint match then the ID Number of that fingerprint is displayed on the serial monitor and the data as further displayed On MS Excel (PLX-DAQ) <https://store.arduino.ce/usa/arduino-UNO-rev3>.



Fig 3: Arduino UNO Microcontroller

Real-Time Clock (RTC)

Is an electronic component which keeps track of time even when the microcontroller or computer is powered off, it is used for time-stamping events like fingerprint time tracking as user fingerprint is scanned time and date stored in the buffer of the RTC. More so it create alarm and accurate time programs.



Fig. 4: RTC Module

Parallax Data Acquisition Tool (PLX-DAQ)

PLX-DAQ is a Microsoft Excel add-on tool for displaying of data in the Serial monitor in Excel Spread sheet. A connection is link via Arduino UNO microcontroller is linked with PLX-DAQ to a computer using USB cable. In activating the PLX-DAQ tool, the excel sheet open on its own. Thereafter, a connection with the PLX-DAQ is made by simply providing the port to which the controller is connected at 9600bps. An effective connection will send data signals directly to the Excel spreadsheet.

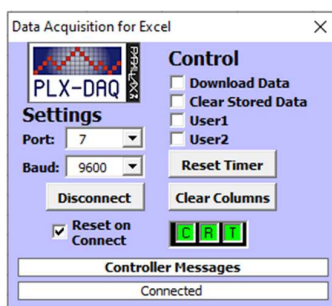


Fig. 5: PLX-DAQ Tool

Fingerprint module:

Fingerprint Sensor are of various types ranging from the Optical, Capacity, Ultrasonic, Thermal etc. The paper opt for Optical Fingerprint Sensor Module. This Module is used for scanning the fingerprint of the user and save the image of the fingerprint in memory.



Fig. 6: Finger Sensor Modules

Experimental setup:

- I. Arduino UNO is a microcontroller enabled with the task of interfacing with other components, hence, the fingerprint module id interfaced with the microcontroller. The fingerprint module scans and capture the fingerprint of the user and store the data or image of the fingerprint

in the memory codes to determine the time and date at which we have stored the fingerprint is recorded by the RTC Module.

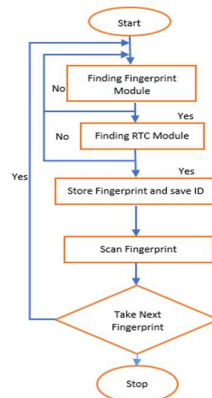


Fig. 7: Flowchart for Registration of Fingerprint

II. Displaying the Stored Result:

in figure 9 displays the storage of the fingerprint to match with the stored fingerprint the user will again scan his/her finger for the fingerprint to be displayed on the serial monitor as a fingerprint ID. If it matches the fingerprint saved in memory (EFROM) thereafter the ID is displayed with due time and date.

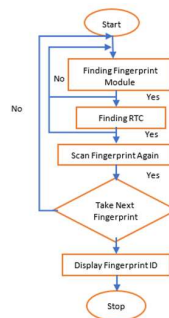


Fig. 8: Flowchart for Displaying the Fingerprint ID

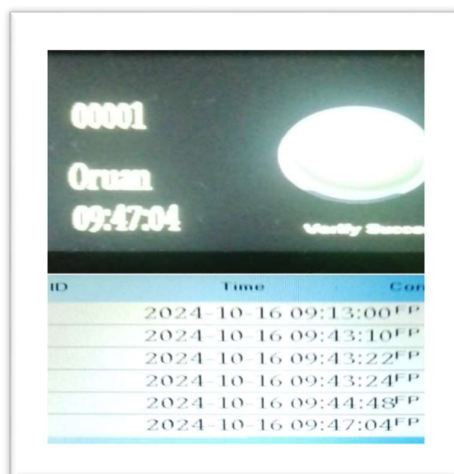
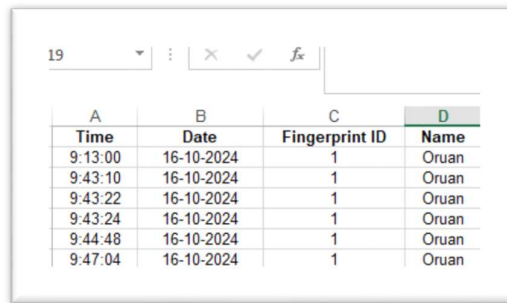


Fig. 11: Finding fingerprint module and attendance displayed



A	B	C	D
Time	Date	Fingerprint ID	Name
9:13:00	16-10-2024	1	Oruan
9:43:10	16-10-2024	1	Oruan
9:43:22	16-10-2024	1	Oruan
9:43:24	16-10-2024	1	Oruan
9:44:48	16-10-2024	1	Oruan
9:47:04	16-10-2024	1	Oruan

Fig. 12: Data Display for Fingerprint Attendance System

CONCLUSION

The Smart Fingerprint attendance system has smartly taken over the manual and unreliable method by adopting reliable, fast, efficient and secured system. The digitalized system will enable administrators to detect the presence of students and other staffs in the school community. The system is user friendly and keeps accurate records of movement register of attendance. The system displays time, date, ID number and names of individual attendee as shown in figure 12 in the Ms Excel spreadsheet. With the Ms Excel, individual analysis is easily calculated and chart plotted for a better view.

REFERENCE

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