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Fingerprint Based Attendance System

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ABSTRACT—

In today's world, security and data integrity are of utmost importance. Maintaining accurate attendance records in various industries and organizations presents a significant challenge, especially when done manually. Educational institutions, such as schools and colleges, also face difficulties in keeping precise logs of student attendance through traditional methods. Manual entry of attendance data is prone to errors, inconsistencies, and inefficiencies. To address these challenges, we have designed and developed a fingerprint-based attendance system that is portable, efficient, and easy to install. This paper presents the implementation of the system using the ESP8266 microcontroller and an OLED display for real-time feedback. The ESP8266 facilitates wireless connectivity, allowing seamless data transmission, while the OLED screen displays attendance confirmation through graphical images, ensuring transparency and accuracy. This system enhances reliability, reduces human intervention, and improves overall attendance management.

Keywords—Attendance, Cloud, ESP8266, Fingerprint, OLED

Introduction

Attendance of students in most institutes is taken by the teacher on paper based attendance registers. There are various disadvantages to this approach such as data is not available for analysis because paper based registers are not uploaded to a centralized system, time taken for data collection reduces the effective lecture time and fake attendance by students. Biometric techniques can be used to solve these problems[1].

Biometrics technologies verify identity through characteristics such as fingerprints, faces, irises, retinal patterns, palm prints, voice, hand-written signatures, and so on[2]. There are some more conventional techniques are used such as passwords and ID card. In these technologies, fingerprint becomes the most mature and popular biometrics technology used in automatic personal identification. The reason for the popularity of fingerprint verification is that fingerprints satisfy uniqueness, stability, permanency and easily taking[3][4].

The Fingerprint-Based Attendance System is a modern biometric solution designed to replace traditional attendance management methods with a secure, efficient, and automated approach. This system uses the unique and immutable nature of human fingerprints to accurately identify individuals and record their attendance. By eliminating manual processes such as registers or swipe cards, the system enhances security, reduces administrative workload, and prevents fraudulent practices like proxy attendance.

Literature Review

A secure and effective identity management system plays an important role in the successful deployment of e- government schemes. This also enables secure and reliable access to online services, hence reducing the cost and improving the quality of the delivered services. To make the identity management system even more secure and reliable for authentication, biometric data such as fingerprints are integrated in the national ID card. Biometric based identity management systems are essential to the effective operation of any organizational information systems that utilize personal data[5].
Biometric is used to analyse biological data which is related to human characteristics and traits. Several biological characteristics are now used in biometric systems, for instance, iris, voice, face and fingerprints. It is more reliable to use biological characteristics to identify people that the traditional method such as pin numbers or passwords[4].

This project involves creating a secure and efficient fingerprint-based attendance system that utilizes an ESP8266 microcontroller for processing and communication,a fingerprint sensor for biometric authentication, and an OLED display for user interaction. Automated Attendance Tracking,Replace

manual systems with an efficient biometric solution.Data Accuracy**,**Prevent fraudulent attendance by ensuring only authorized users can register their presence.Real-Time Updates**,**Utilize Wi-Fi capabilities of the ESP8266 to send attendance data to a server or cloud in real time.

In conclusion, the proposed idea offers a cost-effective, low maintenance, easy-to-install and comparatively simple circuit design, making it a practical, efficient and scalable solution.

Methodology

Figure 1 shows the block diagram, it explains the components used and how the components are interfaced with the ESP8266 in Figure 2. Figure 3 describes the workflow of the project and it begins with enrolling fingerprints into the system, where each fingerprint is linked to a unique identifier, such as an employee or student ID. During attendance, the user places their finger on the sensor, and the system matches it against stored templates. On successful authentication, the system logs the attendance along with the timestamp and sends the data to a cloud server or database via the ESP8266s
Wi-Fi module. If the authentication fails, the OLED display provides feedback, allowing the user to retry.

Hardware
System Develpoment

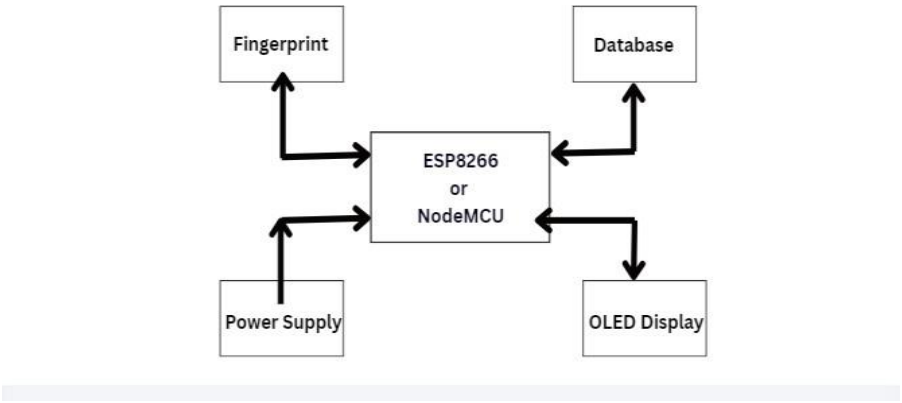

Figure 1: Block diagram

As shown in Figure 1, we need both hardware and software to implement the project. A Finger print sensor is used to scan the fingerprints, the SSD1306 OLED display is to provide feedback to the user, database is to store the name and timestamp of the entries. Each component is interfaced with the ESP8266.To keep the device active we need to supply
the power externally.

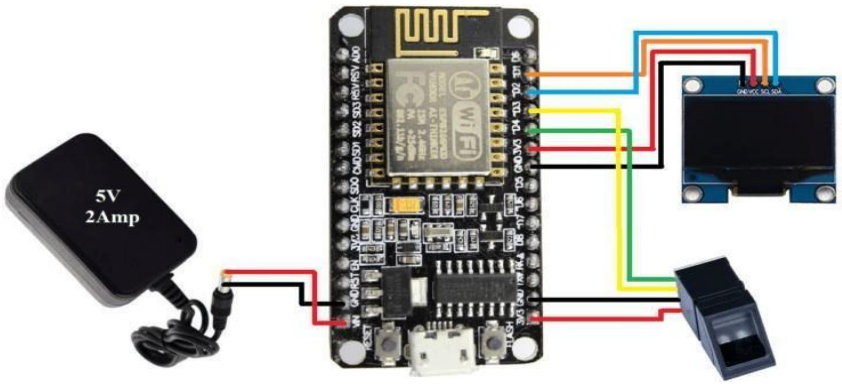

Figure 2 : circuit connection

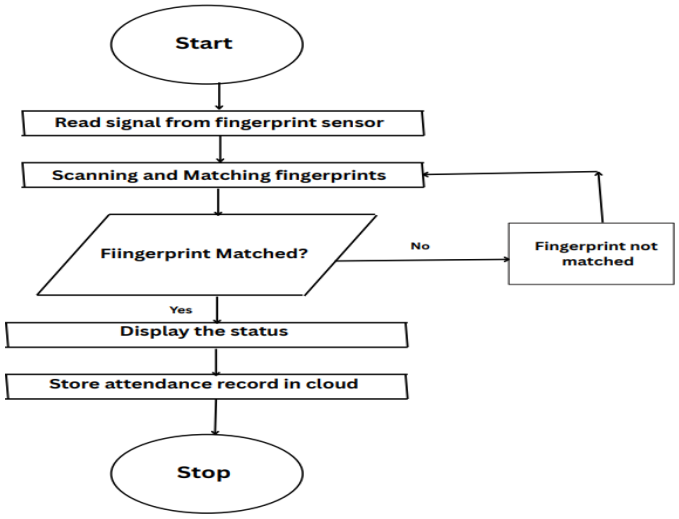

Figure 3 : circuit connection

ESP8266 Wi-Fi module is mainly utilized for IoT-based embedded applications development. It is capable of handling various functions of the Wi-Fi network from another application processor. It is a SOC (System On-chip) integrated with a TCP/IP protocol stack, which can provide microcontroller access to any type of Wi-Fi network. The ESP8266 Wi-Fi module comes with a boot ROM of 64 KB, user data RAM of 80 KB, and instruction RAM of 32 KB. It can support 802.11 b/g/n Wi-Fi network at 2.4 GHz along with the features of I2C, SPI, I2C interfacing with DMA, and 10- bit ADC. Interfacing this module with the microcontroller can be done easily through a serial port. An external voltage converter is required only if the operating voltage exceeds 3.6 Volts. It is most widely used in robotics and IoT applications due to its low cost and compact size.[6]

Fingerprint scanner will generate images of the ridges and valleys on every human fingerprint. The R307 Fingerprint Module consists of optical fingerprint sensor, high-speed DSP processor, high-performance fingerprint alignment algorithm, high-capacity FLASH chips and other hardware and software composition, stable performance, simple structure, with fingerprint entry, image processing, fingerprint matching, search and template storage and other functions.[7]

OLED is Organic Light Emitting Diode that emits light in response to an electric current. OLED display works with no backlight so it can display deep black levels. It is small in size and light in weight than Liquid Crystal Displays.128x64 OLED display is simple dot matrix graphic display. It has 128 columns and 64 rows which make it display of total 128x64 = 8192 pixels. By just turning on/off these pixel's led we can display a graphical image of any shape on it.[8]

Software

The required softwares are, Arduino IDE to program the ESP8266. Some required libraries need to be installed i.e., required for fingerprint sensor, OLED display (Adafruit SSD1306) and for Wi-Fi communication.

XAMPP server is an open-source and cross-platform software which integrates several critical components, including the Apache web server, MYSQL/MariaDB database, and programming languages like such as PHP and Perl. XAMPP is used to store and manage attendance logs.

Results and Discussion

By implementing the proposed system we eliminate the use of manual ledger based attendance , a complete digitized model is implemented. The following images show the

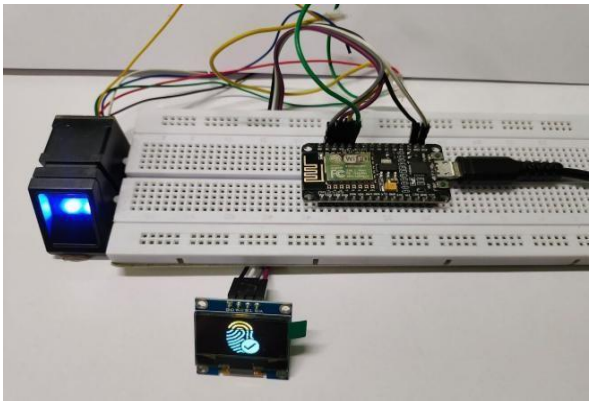

Figure 4 : Waiting for the fingerprint

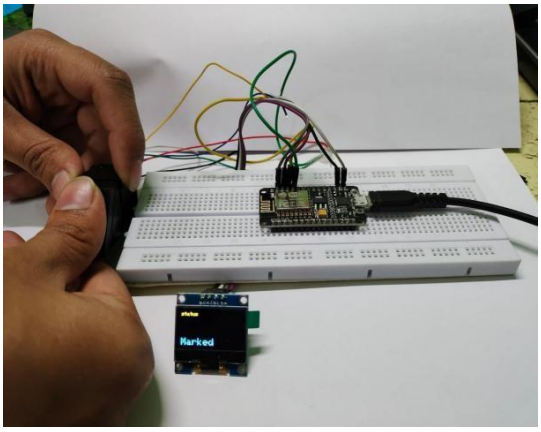

Figure 5 : When the finger is placed

working of the Fingerprint Based Attendance System and attendance data is stored by it. Figure 4 showing the sensor is ready to read the fingerprint when the finger is placed on sensor and feedback is has been shown on the OLED display as "Marked" as shown in Figure 5.

Enrollment process of fingerprints has shown in

Figure 6 on the serial monitor. Whenever the registered person Marked their attendance, login details of the person will be stored in the database as shown in Figure 7.

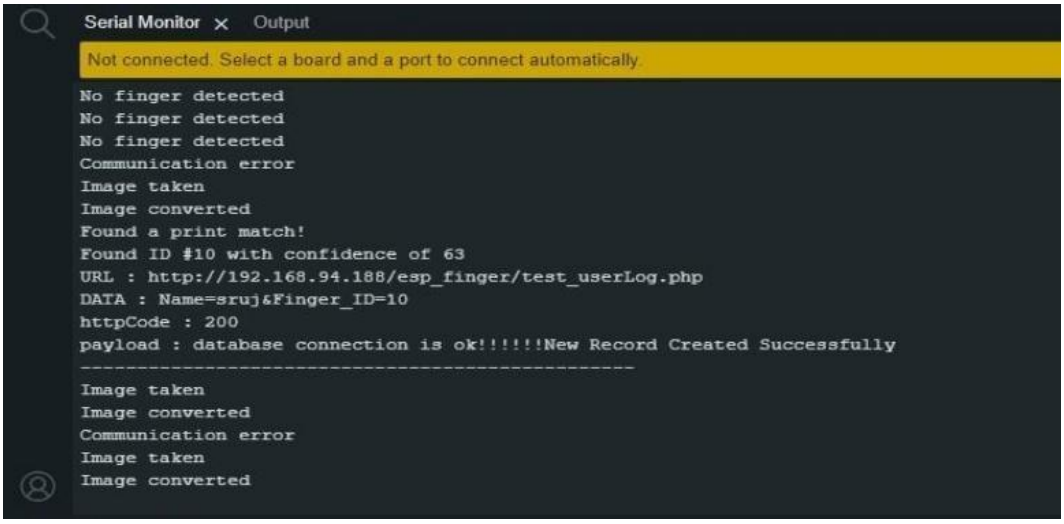

Figure 6 : Output on serial monitor

	SNo.	Name	Finger_ID	Date	Time
Edit Copy Delete	152	.sruj2.	11	2024-11-27	00:47:15
Edit Copy Delete	153	.sruj3.	12	2024-11-27	00:47:21
Edit Copy Delete	154	.sruj3.	12	2024-11-27	00:47:29
Edit Copy Delete	155	.sruj2.	11	2024-11-27	00:47:32
Edit Copy Delete	156	.sruj.	10	2024-11-27	00:47:37
Edit Copy Delete	157	..	14	2024-11-28	21:53:20
Edit Copy Delete	158	..	14	2024-11-28	21:53:23
Edit Copy Delete	159	..	14	2024-11-28	21:53:25
Edit Copy Delete	160	..	14	2024-11-28	21:53:27
Edit Copy Delete	161	..	14	2024-11-28	21:53:28
Edit Copy Delete	162	..	14	2024-11-28	21:53:30
Edit Copy Delete	163	..	14	2024-11-28	21:53:32

Console

Figure 7 : Data is stored in Database

Conclusions

This work presents the design and implementation of Fingerprint based Attendance system. Various works on the Fingerprint based Attendance system were reviewed and presented. We discovered that some of the existing research doesn't take into consideration the cost effectiveness and time effectiveness of the Fingerprint attendance system for administration usage and further modified it. This research work had advanced in knowledge as it included an embedded system to monitor the attendance of individuals, it eliminates the use of manual and time consuming attendance ledger.

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