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Cloud-Integrated Fingerprint-Based Attendance System for Smart Campus Applications

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Abstract. Traditional authentication methods, such as Radio - frequency identification and identification cards, have several flaws; the biometric technique of authentication provides an immediate substitute for them. Biometrics, such as fingerprints, personalities, and ECG signals, are one-of-a-kind human characteristics that cannot be altered or copied. This simplifies the implementation of real-time systems. Automatic attendance systems are widely used in companies and schools to track people's whereabouts. This initiative has a wide range of the applications in schools, colleges, corporate organizations, and workplaces where attendance must be marked properly and on time. As a result of the fingerprint reader, the system will be more secure for consumers. The ESP8266 Wi-Fi Module will gather biometric data from many individuals and transmit it to a server through the internet technology. Fingerprints are enrolled on the site using a Fingerprint Reader, and validation is performed on the client via the network transfer of fingerprint patterns.

Keywords: Biometric attendance system, Internet of things, Cloud server, Fingerprint sensor

INTRODUCTION

Attendance systems use biometrics to verify that a person is attending, or logged into, a computer or other de- vice. Biometric technologies include fingerprint scanners, facial recognition, and iris scanners. Many schools are now using biometric attendance systems to improve attendance, reduce absenteeism, and improve school security. In the future, biometric attendance systems may also be used to verify students' identity and eligibility for school services. Attendance records are a vital part of any school, and modern biometric systems can help ensure that attendance is accurate and reliable. By collecting and analyzing biometric data, such as fingerprints, face scans, and iris scans, biometric systems can help schools improve attendance management and reduce the need for human attendance clerks. This reduces the risk of absenteeism, increases student attendance, reduces the cost of attendance records, and improves school operations. Biometric attendance systems also provide an effective way to identify students who may be experiencing homelessness, which can help schools ensure that they are providing a fair education to all students.

Attendance systems use fingerprint or other biometric data to verify who is in the room. Fingerprint scanners are fast, but they are also expensive and can be spoofed. Iris cameras and facial recognition are a better choice for large-scale use cases where privacy, reliability and low cost are priorities. Iris cameras and facial recognition can identify people with high accuracy even when they try to hide their identity. Internet of things (IoT) is a network of physical devices, vehicles, buildings, and other items—and the software, algorithms, and sensors that power them—that is connected through the internet and able to exchange data and information. IoT is a system of devices that can communicate with each other and exchange data without requiring human intervention. It is a system of devices that sense and/or collect data where the data is processed in a cloud or on a server. IoT is a system of devices that can be remotely accessed and controlled through the internet.

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IoT is a network of devices and sensors that communicate with each other and exchange data without requiring human intervention. IoT is making our lives better by providing us with the ability to monitor our homes, cars, and various other devices remotely in order to keep them running smoothly. One of the most useful applications of IoT is the Internet of things-based attendance system in colleges. College campuses are a perfect place to utilize the benefits of IoT because students often move from one building to another during the day. During the lecture, the gadget may be shared around, and students can indicate their attendance. Students would be required to touch their finger on the sensor to indicate their presence in class. Using its USB interface, it can connect with a host computer. This gadget is powered by a rechargeable battery. The GUI program on the host computer assists the teacher in managing the device and attendance [1].

To address the shortcomings of traditional wire attendance systems, a wireless fingerprint attendance system design technique based on ZigBee technology is provided. In the computer, the system incorporates a terminal fingerprint acquisition module and an attendance management module. It can perform operations such as fingerprint information gathering, processing, wireless transmission, fingerprint matching, and attendance monitoring automatically [2]. At this research, we propose a system that captures student attendance and automatically maintains attendance records in an academic institute. Taking attendance manually and keeping track of it until the end of the year (or even beyond) is a laborious task that wastes time and paper. This involves the development of an efficient, completely automated system [3].

This paper describes how to create a portable fingerprint-based student attendance system that uses GSM. The system contains a fingerprint acquisition module for the terminal as well as an attendance module. It can perform operations such as fingerprint information gathering, processing, wireless transmission, fingerprint matching, and attendance reporting automatically [4]. This article describes the process for designing a wireless fingerprint attendance system based on ZigBee technology [5]. The system incorporates a terminal fingerprint acquisition module and a computer-based attendance management module [6]. It can perform operations such as fingerprint information gathering, processing, wireless transmission, fingerprint matching, and attendance monitoring automatically [7].

PROPOSED METHODOLOGY

This effort has a wide range of applications in schools, universities, business organizations, and work- places where attendance must be accurately and timely recorded [8]. The fingerprint reader will make the system more secure for customers. The ESP8266 Wi-Fi Module will collect biometric data from a large number of people and transfer it to a server using internet technologies [9]. Fingerprints are enrolled on the site using a Fingerprint Reader, and client validation is conducted via network transmission of fingerprint patterns as shown in Figure 1 [10].

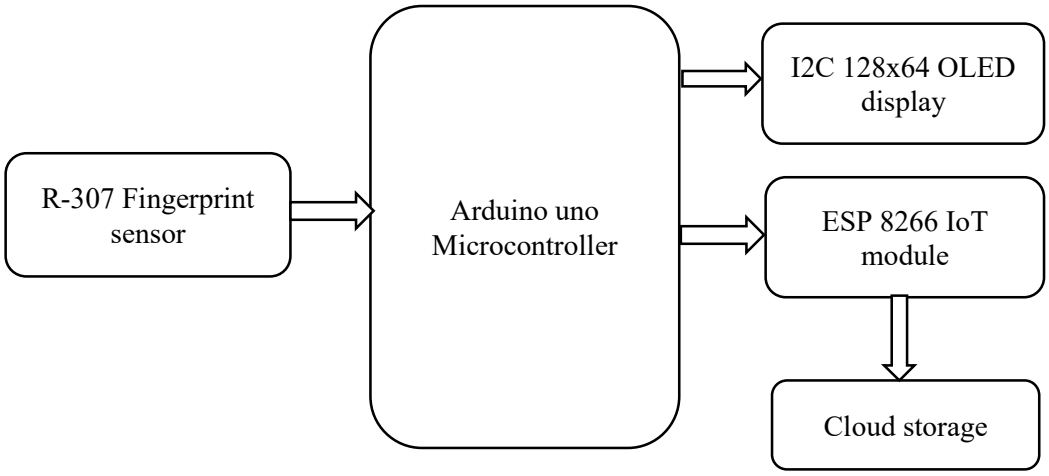

Figure 1. Proposed Model

The Fingerprint component may be immediately connected to any microcontroller or Uno Board. This optically biometrics fingerprint sensor has excellent characteristics and may be integrated into a wide range of end devices such as security devices, attendance structures, safety deposit boxes, and automobile door locking systems [11]. Biometric technology is becoming an increasingly popular way of managing access and authentication. Fingerprint sensors are commonly used for building access control and can also be used as a secure method of logging attendance [12]. Fingerprints are unique to each person and can't be shared or duplicated, making them a more secure alternative to traditional passwords and PINs. They also don't require users to remember complex passwords or change them regularly, making them a great option for those who find it difficult to remember passwords [13].

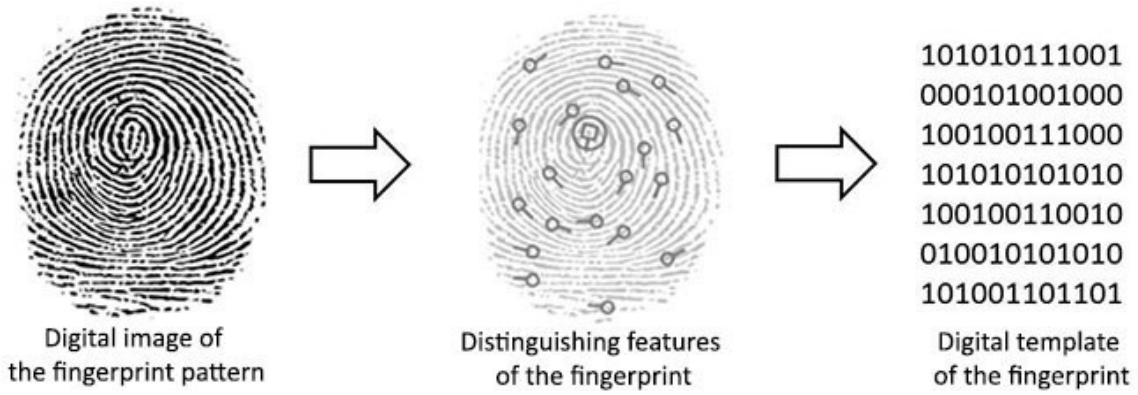

FIGURE 2. Finger Print Working Principle

There are many different types of electronic displays that you can use with your Controller. The most common type of display is a simple text and background graphics LCD screen [14]. These LCD screens are easy to use and provide you with a lot of control over what is displayed. The next most common type of display is an OLED i2c display. Figure 3 shows the circuit diagram [15].

RESULTS AND DISCUSSIONS

Following the connections with the block diagram, it will try to associate to the Wi-Fi. It will show Connected after it is attached. This log may be seen on both the Serial Monitor and the OLED Display as shown in Figure 4. The user's fingerprint is captured twice and saved in the Fingerprint Sensor's EEPROM. It should be noted that this R305/R307 module can only hold 127 fingerprints [16]. So, after the fingerprints of several users have been saved, you may begin scanning and reporting attendance. If the fingerprint is not matched, an error notice will be displayed, as seen in Figure 5. Whenever an authorized user scans their fingerprint for the first time, the greeting message appears as shown in Figure 6.

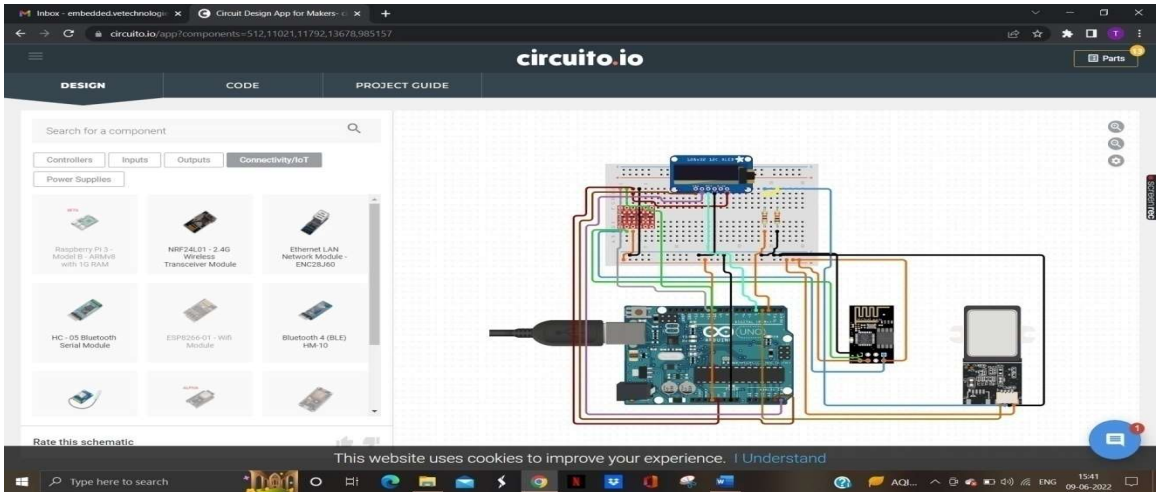

FIGURE 3. Circuit Diagram

FIGURE 4. Hardware Model of the Proposed System with Wi-Fi Connected

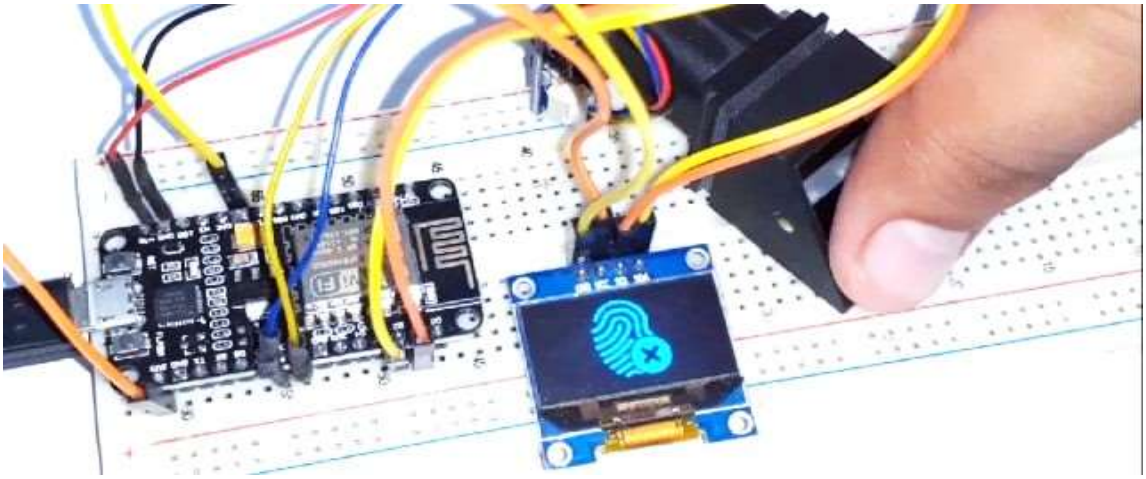

FIGURE 5. Error display when Fingerprints are not Matched

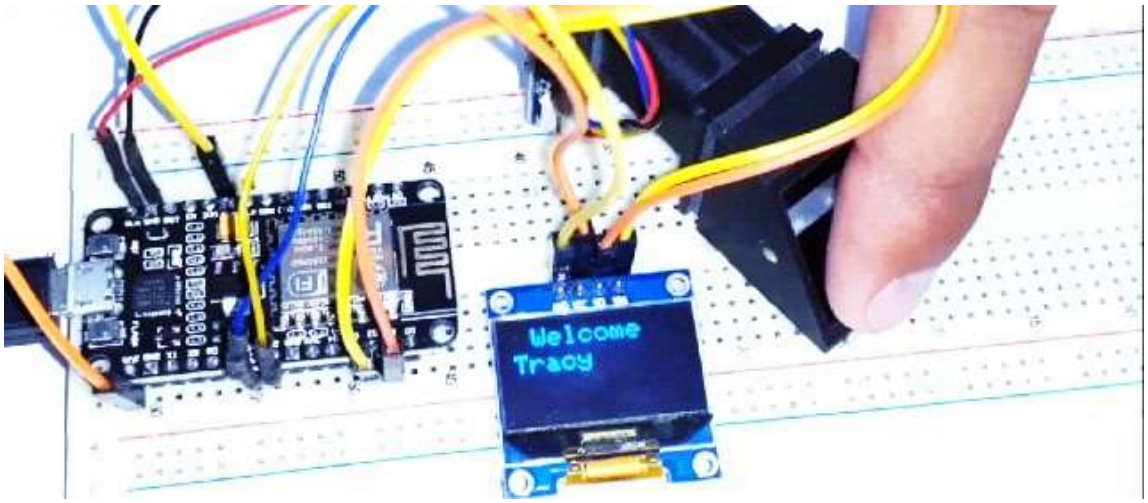

FIGURE 6. Display when Fingerprints are Matched

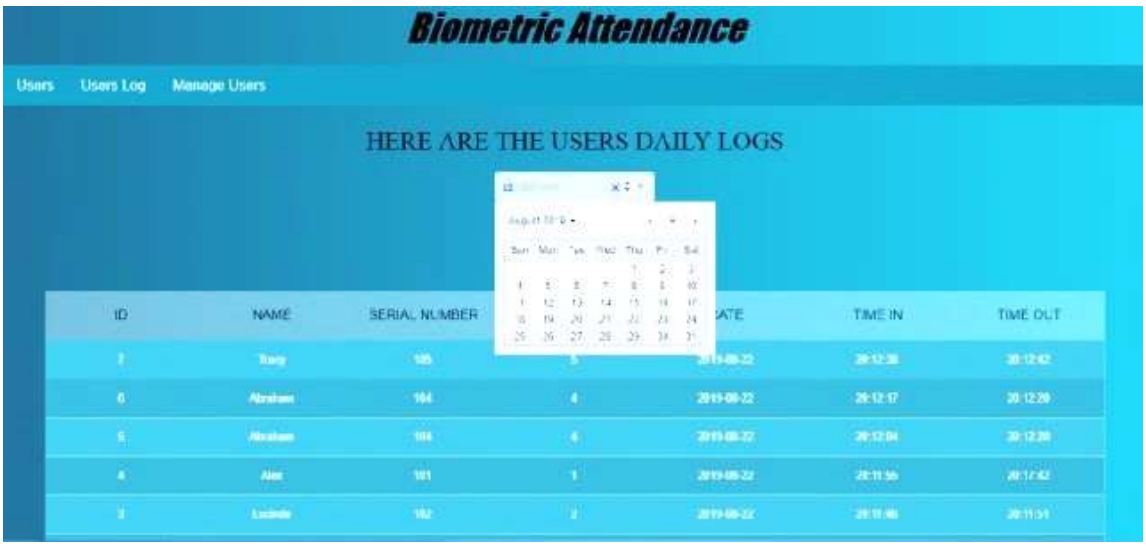

FIGURE 7. Cloud Database Over Attendance System

The implementation of a fingerprint scanner assures that the attendance and punctuality is accurate. Because of its simplicity, the system is simple to operate and user pleasant. In this context, an Internet of Things (IoT)-based portable biometric attendance system might be of considerable use to educational institutions since it is very efficient and safe. When compared to traditional biometric attendance systems, the cost of developing this system is significantly lower. The use of cloud computing as shown in Figure 7, to keep attendance records makes all data easily accessible and retrievable by instructors as and when needed.

CONCLUSIONS

The experimental model was constructed in accordance with the circuit schematic, and the intended results were attained. When a person touches his or her finger on the sensor, the sensor reads the data and stores it in the cloud. When someone wishes to check his or her fingerprint, he or she places the finger on the sensor. The sensor reads the data and looks for and compares it to previously saved fingerprints. If it matches any of them in the stored database,

the username, date, and time are displayed. If not, it indicates that the fingerprints do not match. That is how the entire system operates. The ESP8266 Wi-Fi Module will gather biometric data from many individuals and transmit it to a server through the internet technology. Fingerprints are enrolled on the site using a Fingerprint Reader, and validation is performed on the client via the network transfer of fingerprint patterns.

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