# IOT-BASED BIOMETRIC ATTENDANCE SYSTEMS: ENHANCING EFFICIENCY AND SECURITY IN WORKPLACE MANAGEMENT

**[#1] Dr.GIRIRAJ PRAJAPATHI, Professor**
**[#2] MADASU AKHILA**
**[#3]MEKALA SUMITH**
**Department of Electronics & Communication Engineering,**
**SREE CHAITANYA INSTITUTE OF TECHNOLOGICAL SCIENCES, KARIMNAGAR, TS.**

**ABSTRACT:** The use of biometric technologies increases the effectiveness of the student attendance system.This paper describes an Internet of Things (IoT) system that uses a fingerprint-based biometric scanner to track student attendance. The data is saved securely on the cloud. It is a portable and simple way to record attendance. The goal of this technical breakthrough is to automate the labor-intensive process of manually collecting and storing student attendance data. In addition, proxy attendance will be removed, resulting in more reliable attendance data. The instructor can easily access the recordings from a secure place as needed.

***KEYWORDS***:Biometric,Fingerprint,IoT,FingerprintScanner,Attendance.

## 1.INTRODUCTION

Attendance is extremely important in educational settings. While calling out students' roll numbers and having them sign an attendance form distributed during the lecture are the two most common methods for acquiring student signatures. Manually collecting and monitoring attendance information becomes increasingly difficult.

The current status of biometric systems has improved to the point where their incorporation into systems does not jeopardize their portability. The introduction of various cloud-based computing and storage technologies has permitted the secure storing and retrieval of data when needed. Fingerprint and iris readings are considered the most reliable biometric data for system use.

Difficulties can be managed using a system that registers attendance using biometric scanners and stores the data in a secure Google Spreadsheet in the cloud. Each pupil's identity is verified using the system's fingerprint scanner. When the fingerprint scan matches the information in the database, the Google Spreadsheet is updated to show the student's attendance.

## 2.RELATEDWORK

Using RFID technology, the attendance system shortens lecture times, streamlines documentation, and tracks attendance. To authenticate their attendance, students must present their RFID cards to the RFID reader. The instructor may then keep a daily attendance log by telling students to send the collected data to their mobile devices over Bluetooth.

The attendance system includes a small, extremely high-resolution camera for ocular capture. The computer then processes the image and compares it to data saved in the database. A user's existence can be determined by comparing entered data to existing data in the system. The increased expense of this technique is due to the high-resolution camera, but it is the most dependable way available because each person's iris pattern and pigment are unique.

By leveraging biometrics, the wireless fingerprint attendance management system removes both the trouble of configuring the requisite network and the possibility of incorrect attendance records. It can help people attend in a more efficient and convenient way.

Digital Fingerprint of a Persona The server uses USBSensor to enroll fingerprints, and fingerprint templates are delivered to the client via the network for verification. This system automatically generates an attendance record, which is then emailed to professors. In addition, when a student is absent, an SMS notification is delivered to the parent's cell phone.

## 3.SYSTEM OVERVIEW

The suggested biometric attendance system consists of an ESP8266 NodeMCU expansion board and a fingerprint reader. The fingerprint scanner detects the user's fingerprint to confirm the student's attendance. NodeMCU sends attendance data to Google Spreadsheet via the PushingBox API method.

**ESP8266NodeMCU**

The open-source development board ESP8266NodeMCU has GPIO, PWM, I2C, and ADC. The ESP8266-12E hardware and NodeMCU firmware serve as the base.Each of the 10 GPIs on board can be configured for PWM.Its hardware I/O, similar to Arduino, can substantially speed up the time-consuming process of configuring and fine-tuning hardware. Because of their small size, lightweight design, and wireless capabilities, IoT devices may be prototyped quickly. It is possible to program NodeMCU using Lua scripts.

Writing NodeMCU firmware with Lua script has several disadvantages, including the requirement to learn a new programming language, a limited number of available pins, and a lack of detailed documentation. The board can be easily programmed using the Arduino IDE after wiping the NodeMCU firmware because its hardware IO is identical to that of an Arduino. The Arduino IDE provides a wider support network and documentation, as well as being easier to use.

**Finger print scanner**

Every person on the earth has an imprint. These dings generate a configuration known as a fingerprint

They have evolved into the best biometric identifying approach since they are unique and immutable.

The biometric scanner captures the user's fingerprints. This image is known as a "live scan." A biometric template made up of retrieved attributes is digitally created and saved from the live scan for later matching [8]. Individual fingerprints are detected using a combination of hardware and software techniques.

**Finger print Processing**

Fingerprint processing has three main functions: enrollment, searching, and verification. Enrollment is one of the most important considerations.A snapshot of the user's fingerprint is required. The act of searching entails the methodical study and comparison of an input fingerprint to a maintained collection of fingerprints. The verification method comprises determining a match between the fingerprint provided as input and a pre-existing fingerprint in the database.

**Internet of Things**

IoT is a situation in which items, including humans, animals, and other things, are assigned unique identities (IDs) that allow them to communicate data wirelessly across a network, eliminating the need for direct human-to-human or human-to-computer interaction [9]. The Internet of Things (IoT) is a technical framework designed to improve machine-to-machine communication. It is made up of actuators and wireless embedded sensors, which allow users to monitor and control equipment remotely and efficiently [5]. This breakthrough will be made possible by electronics' capacity to effortlessly merge into everyday physical objects and communicate with current infrastructure.

**Pushing BoxAPI**

An API (Application Programming Interface) is a set of protocols and procedures that allows users to interact with web-based software applications and utilities.PushingBox is a cloud utility that sends cloud alerts using API calls.The PushingBox API requires only one argument to initiate the notification scenario, which is DeviceID. These instances may include sending and receiving emails, posting files to Google Docs, and tweeting. The service's integrative functionality is given using the PushingBox API.

**Google Spreadsheet**

Google Sheets allows you to create, modify, and update spreadsheets online while also sharing data in real time. Google Sheets are dynamic since they were developed using Ajax. Similar to Microsoft Excel, it allows for the organization and storing of a wide range of data formats. While Google Sheets does not have all of the functionality present in Excel, it is nonetheless a simple program for creating and editing spreadsheets of any complexity. Google Sheets is compatible with Microsoft Excel and CSV (Comma Separated Values), and it also supports HTML saving.

## 4.IMPLEMENTATION

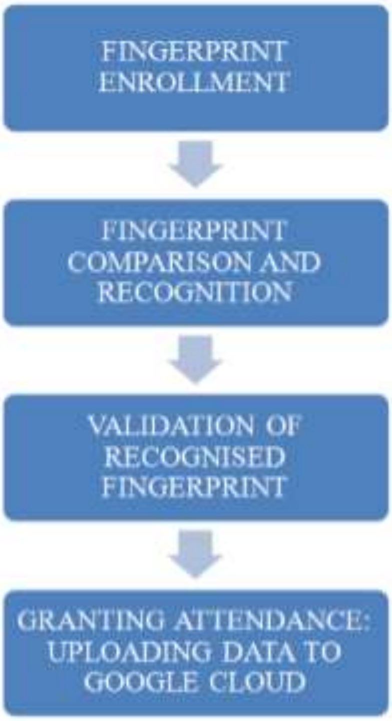
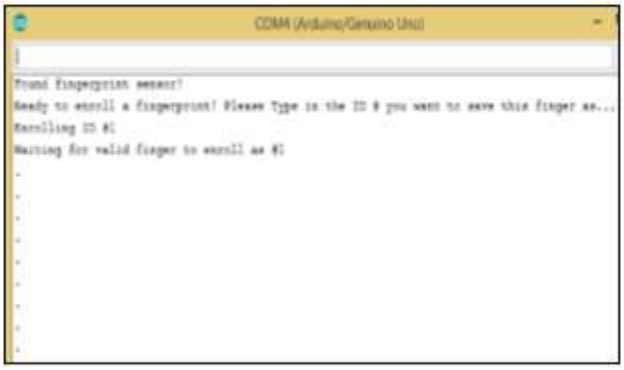

FINGERPRINT ENROLLMENT
FINGERPRINT COMPARISON AND RECOGNITION
VALIDATION OF RECOGNISED FINGERPRINT
GRANTING ATTENDANCE: UPLOADING DATA TO GOOGLE CLOUD

Fig.1Block Diagram

### Fingerprint Enrolment

Fingerprints are acquired from each infant as part of the enrolling process. The fingerprint is collected by the biometric scanner built inside the machine. Every fingerprint is allocated an ID number. The ID number is displayed on the NodeMCU board. Each student is given a unique number. Enrollment via fingerprint is only done once. Student IDs can be amended and updated as necessary. Describe the steps in Figures 2 and

3.



```
Found fingerprint sensor!
Ready to enroll a fingerprint! Please type in the ID # you want to save this finger as...
Enrolling ID #1
Waiting for valid finger to enroll as #1
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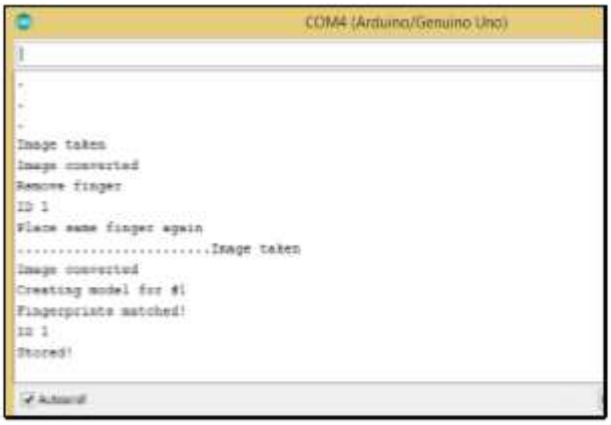
Fig.2Enrolment Process



```
.
.
.
Image taken
Image converted
Remove finger
ID 1
Place same finger again
.......................Image taken
Image converted
Creating model for #1
Fingerprints matched!
ID 1
Stored!
```

Fig.3Enrolment Process

### Fingerprint Comparison and Recognition

Because of its portability, students can use the technology to track attendance during lectures. During the fingerprint comparison and recognition phase, the pupil's fingerprint will be compared to prior fingerprints saved on the NodeMCU board.Figure 4 depicts a yellow LED that will illuminate during this technique. The pupil will be notified when the system's fingerprint entry capability becomes operational. The learner then needs to place a fingertip on the fingerprint scanner. Next, the biometric input is confirmed using the previously recorded fingerprints.

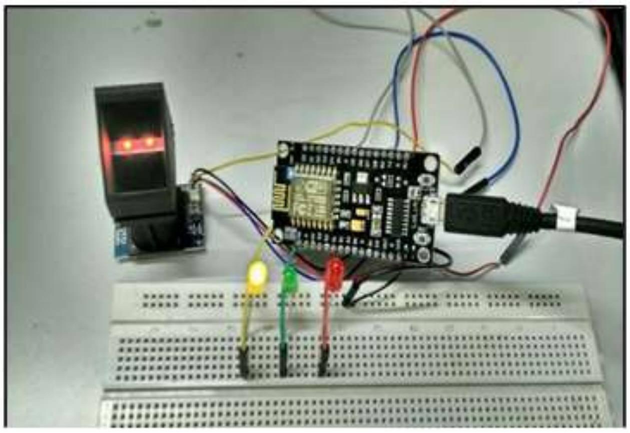


Fig.4Ready for Input

**Validation of Recognised Fingerprint**

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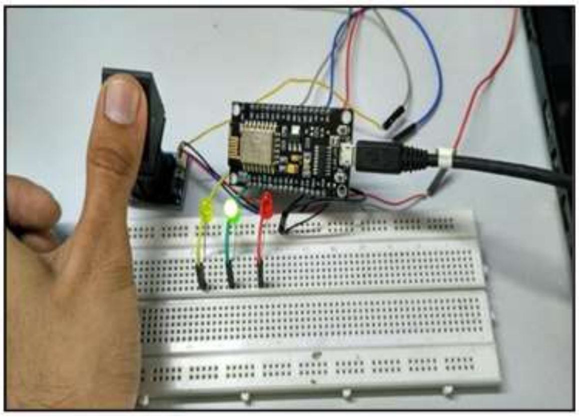


Fig.5Fingerprint Matched

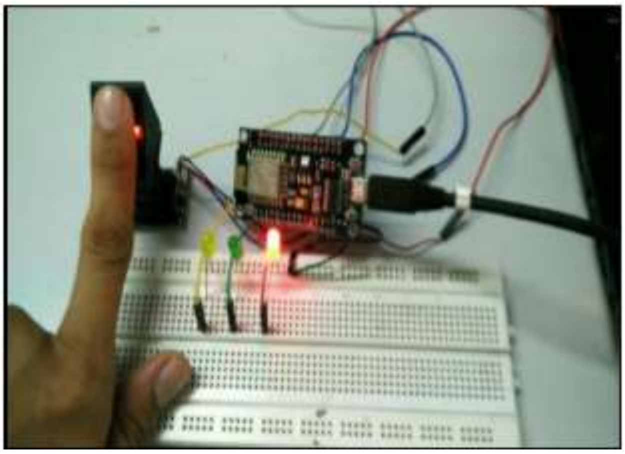
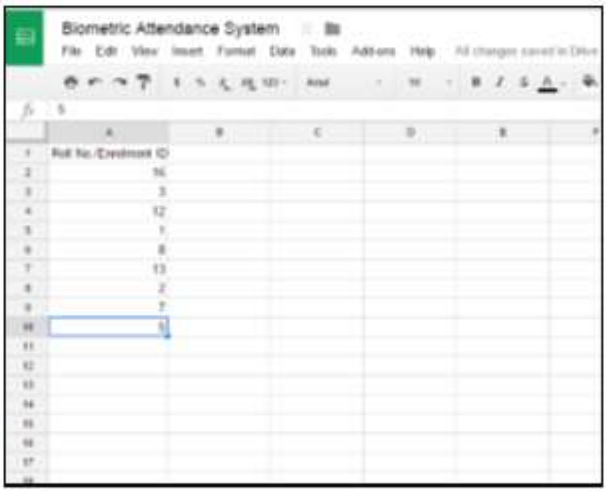


Fig.6Fingerprint Not Matched

Authorizing Attendance via Google Spreadsheet by Entering Data

The procedure of granting attendance begins immediately when the fingerprint is identified. Each pupil's unique identifying number is acknowledged. Figure 7 illustrates how attendance data is entered into a Google Spreadsheet using the student's ID number. The PushingBox API is used to upload the ID number to a Google Spreadsheet. After attendance verification, which includes entering the ID into a Google Spreadsheet, the fingerprint comparison and identification procedure begins. Following that, an extra student has access to the system.



Biometric Attendance System
File Edit View Insert Format Data Tools Add-ons Help All changes saved in Drive
Arial
10

fx 5

| | A |
|---|---|
| 1 | Roll No./Enrollment ID |
| 2 | 16 |
| 3 | 3 |
| 4 | 12 |
| 5 | 1 |
| 6 | 8 |
| 7 | 13 |
| 8 | 2 |
| 9 | 7 |
| 10 | 5 |

Fig.7Attendance Data on Google Sheets

## 5.CONCLUSION

The traditional method of manually recording and tracking student attendance requires a significant expenditure of time and effort. The deployment of the biometric authentication-based attendance monitoring system has the potential to improve the overall efficiency of the process. Because of its excellent efficiency and security, educational institutions can benefit significantly from using a portable biometric attendance system based on the Internet of Things (IoT). This system's building costs are much cheaper than those of a typical biometric attendance system. Attendance records are managed on the cloud, making it easier for teachers to access and retrieve data. The use of a biometric scanner ensures the accuracy of the attendance record. Because of its simple design, the system is intuitive and easy to understand.

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