

## **RASPBERRY PI-BASED ATTENDANCE SYSTEM WITH BIOMETRIC INTEGRATION**

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### **Abstract**

The Internet of Things-based biometric attendance system is often referred to as the smart attendance system. The students' attendance can be monitored efficiently using this kind of system. Using a fingerprint biometric scanner, student attendance is recorded and securely stored in an encrypted cloud service. In this system, proxy attendance cannot occur, so attendance will be recorded accurately. Students' information is kept securely in the cloud, which makes it easy and fast when retrieved. This research provides a simple, portable, and scalable method of monitoring student attendance through IoT technology.

**Key Words:** Fingerprint, Biometric Attendance, Internet of Things.

### **I. Introduction**

The idea of the Web of Things is integrated into a conventional classroom attendance system in this innovative solution. The proliferation of cloud-based computing has led to the rise of several storage systems from which data may be accurately archived and retrieved at any moment. Fingerprints, in general, are seen to be the most trustworthy kind of data to employ in biometric systems. An FPS is included into the project to verify a student's identification via fingerprint scanning. Scannable biometric identifiers, such as a student's fingerprint, may be used to verify their presence in class by cross-referencing them with a cloud-based database. Time is saved, and more security is provided, by this approach compared to the traditional manual attendance system. The suggested system calls for online access, which may be achieved through a Wi-Fi connection.

### **II. Literature Survey**

#### **How to Use the Rasp Pi 3 & Python for Cutting-Edge IoT Development**

Researchers and IT fans alike have taken notice of the Internet of Everything (IOT) due to the impressive synergy it provides when conventional networks are combined with instruments and gadgets. Here at Internet of Things Programming, we use Raspberry Pi and Python to their full potential so that you may build interesting things<sup>[1]</sup>. The first section of the book serves as an introduction to the Raspberry Pi and its setup; from there, you'll move on to Python programming. Eventually you'll move on to the digital age, when information is shown



digitally. In this course, you will learn how to use a Raspberry Pi to create a security system for your house. The following project adds a touch of modernity by using the Arduino. Here, the Microcontroller informs when someone is at the door. Using everything you've learned in the first two projects; you design an Internet of Things (IoT) robot vehicle to track your pets' whereabouts while you're gone. This book will provide you with the knowledge you need to make your Internet of Things initiatives stand out from the crowd.

## **Experience the IoT firsthand with Blynk. Use Blynk as a foundation for configuring smart devices and creating innovative IoT solutions.**

This study explores the concept of using a mobile device for command and monitoring of household appliances. The concept to enable the monitoring and control of electrical equipment using the Arduino microcontroller and Node MCU built on the Blynk architecture [2]. In this investigation, we use a prototype-building strategy that involves the usage of sensors, actuators, Pir sensor, Node MCU, and mobile devices. Device motion is achieved by actuators, whereas sensing is accomplished by sensors. The Raspberry Pi functions in two distinct roles: internet-connected server and bridge. In order to connect household appliances and sensors to a Raspberry pi, a Node MCU microcontroller is often used. Node MCU collects information from sensors and uploads it to a server. Requests from cellphones with the Blynk framework installed are processed by the server. The system is built to run automatically while the homeowner isn't there, and it stores all of the relevant system log information.

## **Understanding how Arduino works and putting it to academic use**

This article discusses the philosophy behind the Arduino board's operation and its uses in IoT and real-time applications. Most Internet of Things (IoT) sensors may be integrated into a real-time application using the Arduino board, a kind of development board. The Arduino board's main advantages are its fast-processing speed, pleasant interface, and straightforward debugging method. It's a cheap, trustworthy, and cheap technology that's often employed by students for developing projects [4]. This article introduces the reader to Arduino, its ecosystem of code and applications, and the many Arduino boards now on the market.

## **System for Monitoring the Environment Using the Internet of Things, IEEE Transactions on Electronics, Communication, and Technology**

In this article, we take a look at the environmental monitoring systems that are based on the Internet of Things. The primary objective of the suggested system is to send environmental characteristics through the internet to a distant site [3]. The suggested method is a practical and easy way to monitor the surrounding environment and atmosphere. The system is a representation of ambient and environmental parameter monitoring using Internet-connected, low-power wireless sensors that report their readings to a centralized server. At long last, any Internet-connected computer or mobile device may access and explore data collected from anywhere in the globe and kept at a central location. The creation of a cyber-physical system to track weather and other environmental factors in faraway places. The resulting system enables users to record measurements from any Internet-connected location, then view, explore, and analyze the collected data from any Internet-enabled device. This project



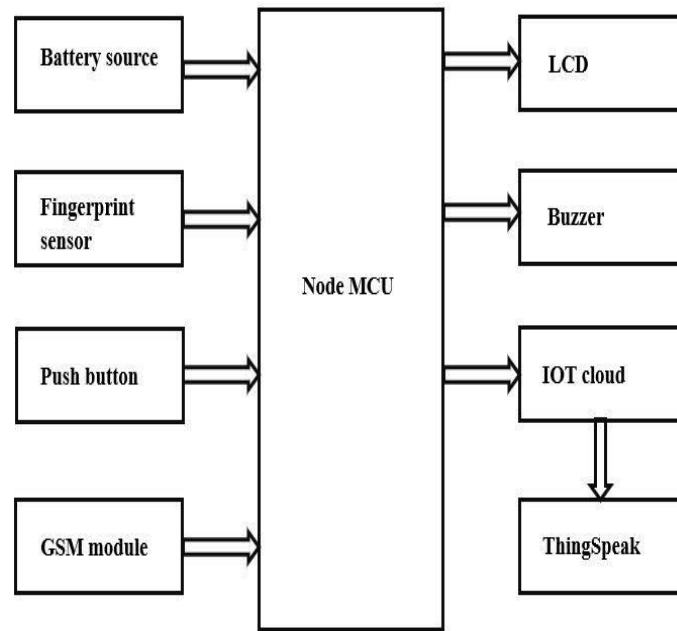
comprises the whole solution, a malware system, from the physical level (composed of sensors as well as the communication protocol) all the way up to the cyber level (managing and storing data). By offering a clearly defined architecture that streamlines the transfer of data from sensors with varying measurement capabilities, it solves the issue of system interoperability and integration and improves the effectiveness of supervision. Devices including a soil moisture detector and a temperature probe have been added into the proposed greenhouse management system to prove the system's viability and usefulness. In this course, you will learn how to use a Raspberry Pi to create a security system for your house.

## **Internet of Things Based Greenhouse Observation System**

With IoT devices, greenhouse conditions like temperature and moisture can be constantly monitored (IOT). Thanks to IoT technology, we can keep an eye on and adjust the greenhouse settings from anywhere in the globe. All of the critical sensor information will be made accessible online to authorized users. Although widespread adoption of this technology has not yet occurred, the research examines the potential for greenhouse and IOT integration. Both embedded systems and networking are explored in depth throughout the project<sup>[5]</sup>. Using an integrated MCU that has wi-fi connectivity to the internet, this study proposes a cheap and adaptable greenhouse monitoring system. The suggested system provides a lightweight protocol to track and oversee the environment, unlike comparable solutions which need a dedicated server Computer. Devices including a soil moisture detector and a temperature probe have been added into the proposed greenhouse management system to prove the system's viability and usefulness.

## **III. PROPOSED METHOD**

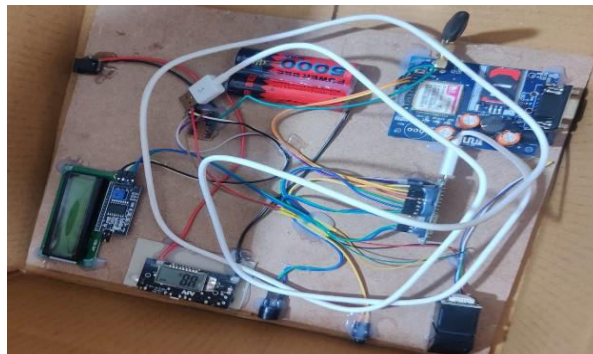
An attendance monitoring system is developed as part of this suggested system. The proliferation of cloud-based computing has led to the rise of several storage systems from which data may be accurately archived and retrieved at any moment. Fingerprints, in general, are seen to be the most trustworthy kind of data to employ in biometric systems. An FPS is included into the project to verify a student's identification via fingerprint scanning. Scannable biometric identifiers, such as a student's fingerprint, may be used to verify their presence in class by cross-referencing them with a cloud-based database. Time is saved, and more security is provided, by this approach compared to the traditional manual attendance system.



**Fig. 1. Block diagram**

In this proposed method, the fingerprint database is stored at the time of coding itself. The program is written in embedded C++ and then is dumped into the esp8266 microcontroller which also acts as wi-fi module.

#### **IV.COMPONENTS DESCRIPTION**



**Fig.3. Entire setup model**

#### **A. HARDWARE COMPONENTS**

##### **Node MCU**

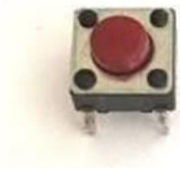
Open-source prototype board layouts are also available for the Node MCU firmware. Node MCU is an acronym for "node microcontroller unit" (micro-controller unit). The "Node MCU" in "Node MCU firmware" refers to a firmware itself, not the development kits.



**Fig.4.ESP8266 Microcontroller**

### **Push Button**

You can tell when the buttons in your Photonic kit are being pressed since they are momentary switches. The keys on a keyboard are an example of momentary switches since they only become "on" when the user presses it. This is in contrast to switches that are kept in a constant state of either on or off. A toggle bulb is a sustained switch because when you turn it on by pushing (or flicking) the switch, it stays on until you turn it off (or flipped back).



**Fig.5.Push button**

### **GSM Module**

A GSM modem, often called a GSM module, is a piece of hardware that employs GSM mobile phone technology to establish a wireless data connection to a network. Mobile phones and other devices that need to talk to cellular networks utilize GSM modems.



**Fig.6.sim module**

### **Finger Print Sensor**

The fingerprint is examined by pressing the finger on a flat surface. The hand's ridges and troughs are scanned, and the resulting set of discrete points at the beginnings and endings of the valleys and ridges are known as minutiae. The system that recognizes fingerprints utilizes these specifics to make comparisons.

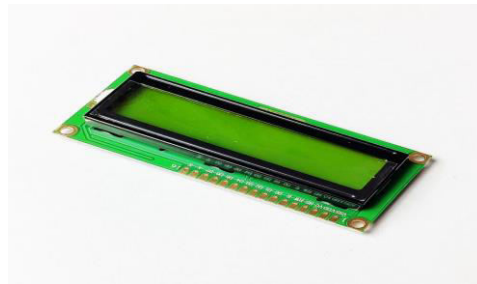




**Fig.7.Fingerprint Scanner**

## LCD

The basic mechanism of functioning of LCDs (Liquid Crystal Displays) is the usage of liquid crystals, making them a sort of flat panel display. Smartphones, TVs, computer displays, and vehicle instrument panels are just a few of the many consumer and commercial applications for LEDs.



**Fig.8.LCD 16x2**

## Buzzer

It is an audio signalling device, and it is of two types may be mechanical or piezoelectric. Major uses of buzzers are alarms, timers and to confirm when user gives input for example a mouse click and a keystroke.



**Fig.9.Buzzer**

## Battery Source

A battery source can be a rechargeable battery or a secondary cell which is a electrical battery and it can be charged, discharged as a load, and can be reused multiple times, so it is money and time-saving where as if we consider a primary battery, firstly it is fully charged and disposed after use. It is made of many electrochemical cells.



**Fig.10. Rechargeable Battery**

### **Dual USB mobile power bank with LCD**

A battery charger<sup>[1][2]</sup> is a machine which stores energy in a battery when an electric current passes through it. The amount of voltage and current and the time for the charging depends on the size and type of the battery being charged. The input/output voltage is 5V and input current is 1A, output current is 2.1A/1A as it has dual USB interface. The type of material used is



liquid lithium-ions in the batteries.

**Fig.11. Battery Charger**

## **B. SOFTWARE COMPONENTS**

### **IOT Cloud**

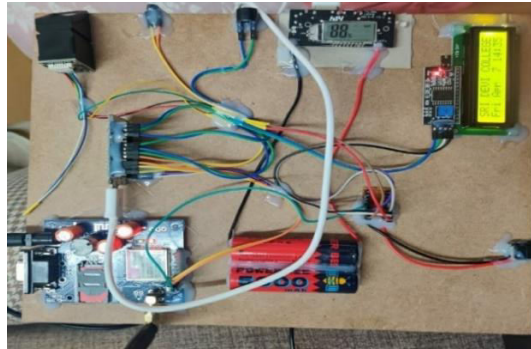
It offers an efficient model which is flexible and scalable for providing services needed for the IoT devices and applications for businesses with rare resources. IoT clouds offer the resources which are in demand and also which are cost-effective, so that the industries and companies can get the significant potential of IoT without struggling to build the services from scratch.

### **Things speak**

It is a website which provides many services mainly for creating IoT applications. It provides the abilities of real-time data gathering, envisioning the gathered data in different formats like charts, it also has ability to build plugins and apps for social network and other APIs.

### V.RESULTS AND DISCUSSION

#### A. Device on



**Fig.13. Date and time**

The figure 13 shows the date, time and name of the college in the attendance system and the LCD indicates the system is in on state.

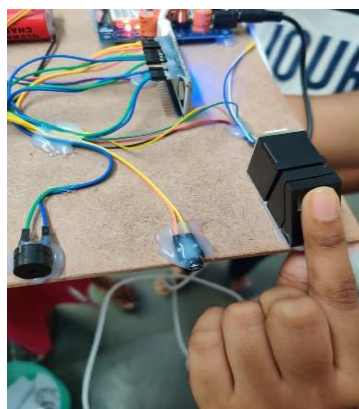
#### B. Process for registering attendance

After the device is powered on, it should be connected with the mobile hotspot by the default name project07 as the system has in-built wi-fi module.



**Fig.14. Place Finger**

When user presses the push button, the system gives indication through the LCD to the user to place the finger on the fingerprint scanner as shown in figure 14.



**Fig.15.Fingerprint scanning**

Now the user places the finger on the scanner as shown in figure 15.





**Fig.16.Fingerprint matched**

If the fingerprint of the user matches with the fingerprints database, then the system displays finger matched via LCD as shown in figure 16.

### C. Attendance registered



**Fig.17. Attendance registered**

The figure 17 shows that the user successfully given their attendance and the system collects the information which can be accessed through laptop or PC by logging in to the things speak account as the data is stored in iot cloud.

### D. Fingerprint Not Matched



**Fig.18.Fingerprint Not Matched**

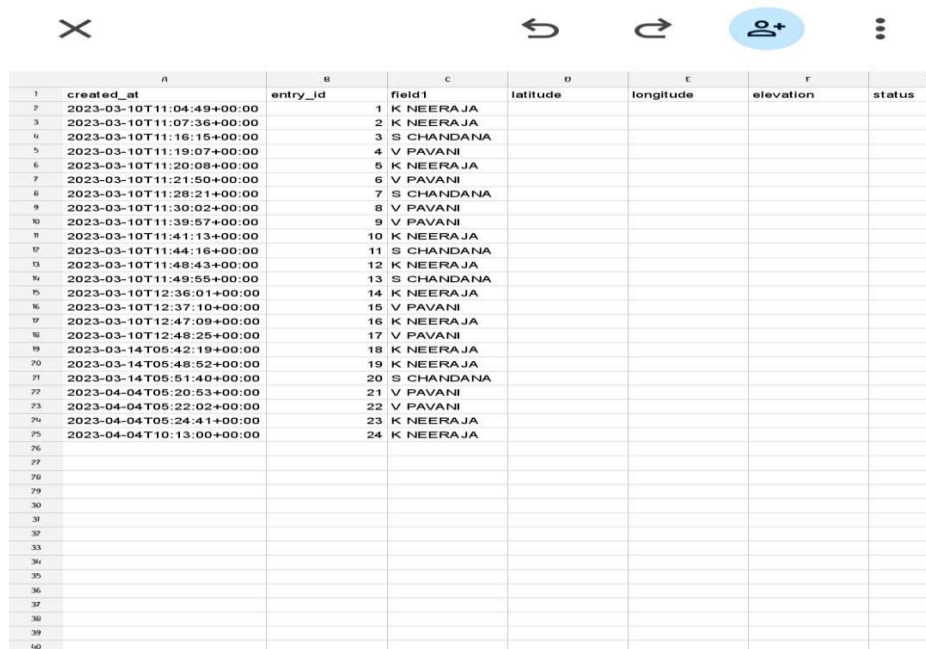
Incase if the student fingerprint is not present in the database which is stored in the system, then the system will display to the student as shown in the figure 18.

### E. Text message and Call

After the attendance is registered successfully, the particular user receives a text message and a call immediately to ensure that attendance is given in case if system fails to indicate whether the attendance is given successfully or not.

### F. Attendance Database

The stored attendance data can be downloaded as excel sheet through things speak website and can also be transferred to any other devices easily through social media apps as shown in figure 20.



1	created_at	entry_id	field1	latitude	longitude	elevation	status
2	2023-03-10T11:04:49+00:00	1	K NEERAJA				
3	2023-03-10T11:07:36+00:00	2	K NEERAJA				
4	2023-03-10T11:16:15+00:00	3	S CHANDANA				
5	2023-03-10T11:19:07+00:00	4	V PAVANI				
6	2023-03-10T11:20:08+00:00	5	K NEERAJA				
7	2023-03-10T11:21:50+00:00	6	V PAVANI				
8	2023-03-10T11:28:21+00:00	7	S CHANDANA				
9	2023-03-10T11:30:02+00:00	8	V PAVANI				
10	2023-03-10T11:39:57+00:00	9	V PAVANI				
11	2023-03-10T11:41:13+00:00	10	K NEERAJA				
12	2023-03-10T11:44:16+00:00	11	S CHANDANA				
13	2023-03-10T11:48:43+00:00	12	K NEERAJA				
14	2023-03-10T11:49:55+00:00	13	S CHANDANA				
15	2023-03-10T12:36:01+00:00	14	K NEERAJA				
16	2023-03-10T12:37:10+00:00	15	V PAVANI				
17	2023-03-10T12:47:09+00:00	16	K NEERAJA				
18	2023-03-10T12:48:25+00:00	17	V PAVANI				
19	2023-03-14T05:42:19+00:00	18	K NEERAJA				
20	2023-03-14T05:48:52+00:00	19	K NEERAJA				
21	2023-03-14T05:51:40+00:00	20	S CHANDANA				
22	2023-04-04T05:20:53+00:00	21	V PAVANI				
23	2023-04-04T05:22:02+00:00	22	V PAVANI				
24	2023-04-04T05:24:41+00:00	23	K NEERAJA				
25	2023-04-04T10:13:00+00:00	24	K NEERAJA				
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**Fig.20.Attendance data excel sheet**

## VI. CONCLUSION

Keeping track of students attendance in the old fashioned way is a tedious, error-prone, and time-consuming process. In order to fully automate its operations, the IoT-based biometric attendance system makes use of biometric identifying characteristics. Institutions of all types may benefit greatly from an attendance system that combines the power of the Internet of Information (IoT), cloud computing, and fast, precise data entry (FPS). This demonstrates its great dependability and security because of these factors. Because of its simplicity, this method is easy to learn and utilize.



## VII. FUTURE SCOPE

The proposed method can be encased in the plastic in the future for making it more compact and easier to implement in the classroom. Moreover, if the proposed system can calculate the percentage of students, it will be easier for the students to know their attendance percentage. And it will be useful if the system can send a message to an appropriate person about the attendance data.

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