

# An IoT Based Attendance System using PI Cam and RFID Controller

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**Abstract:** *The primary focus of our country's education system is on attendance, particularly during graduation and post-graduation, as it is considered indicative of a student's commitment to their education. This project specifically centers around improving the attendance system. In the past, attendance used to be recorded in a traditional manner. However, over time, various attendance systems have been introduced, many of which rely on a single authentication method using a single sensor. Currently, there are attendance systems that utilize two sensors, like the "attendance system using biometric and RFID controller," for capturing attendance. Nevertheless, a drawback of the current system is the potential problem faced by management if one of the sensors fails to record data, making it difficult to obtain accurate attendance records. Moreover, injuries to the hand can hinder the use of the biometric attendance system results in a reliance on conventional techniques. An ESP32 camera is used in our project to take pictures of students or staff. for attendance purposes. This camera is capable of capturing facial images as well, ensuring attendance can still be recorded even in cases of facial injuries. Alternatively, an RFID card can be used as a backup method for attendance. The materials required for this project include Node MCU or ESP32, ESP32 camera, and an RFID controller.*

**Keywords:** Attendance system using biometric and RFID

## I. INTRODUCTION

Attendance is defined by Oxford University as a count of those who are present. at an event, class, or similar gathering. According to them, if individuals are at the event or location, it indicates their presence. They consider this record as evidence of their attendance.

[1] It is common practice for schools and colleges to maintain attendance records. There is no need for an individual to manually track every time a enters or departs from college. Upon graduation, the college sends the university a list of every student's attendance. Currently, all students are required to attend college. Traditional methods, including using paper to collect attendance in the past, were labour- and time-intensive. The biggest disadvantage of manually transmitting attendance records to the institution is that it takes up more memory to retain all the data. Additional time for computerization. Some colleges or students may engage in the practice of falsifying attendance records.

[2] The primary internet of things (IoT)-based attendance system that digitally records data offers a solution to these problems. With this system, attendance is recorded in a database at the college and an Excel file. It becomes simpler to grant access to the database or email attendance reports to the institution. It becomes easier to send attendance to the university via email or provide access to the database. Hence, an IoT-based attendance system is considered the best solution.

## II. EXISTING SYSTEM

There are several existing IoT-based attendance systems that leverage IoT technology to streamline the process of tracking attendance. Here are a few examples:

- **RFID-based Attendance Systems:** These systems use RFID (Radio Frequency Identification) technology to track attendance. Each student or employee is assigned an RFID card or tag, which they can use to scan when

entering or leaving a premises. The system captures the unique ID associated with the card and records the attendance data in a centralized database.

- **Biometric Attendance Systems:** Biometric attendance systems utilize biometric traits such as fingerprints, facial recognition, or iris scanning to identify individuals and record their attendance. These systems often integrate IoT devices, such as biometric scanners or cameras, to capture the data and transmit it to a central server for processing.
- **Beacon-based Attendance Systems:** Beacon technology involves small Bluetooth Low Energy (BLE) devices called beacons that transmit signals to nearby smartphones or IoT devices. In an attendance system, each student or employee carries a smartphone or wearable device that receives the beacon's signal when they enter a predefined area. The system captures this information to record attendance.
- **GPS-based Attendance Systems:** GPS-based attendance systems leverage the GPS technology in smartphones or wearable devices to track the location of individuals. These systems are commonly used for field-based work or remote employees.[4] The system records the GPS coordinates and timestamps when an individual enters or leaves a designated location.
- **Wireless Sensor Network (WSN) based Attendance Systems:** WSNs consist of a network of interconnected sensors that can collect data wirelessly. In an attendance system, sensors are placed strategically in a room or area, and when individuals with IoT-enabled devices enter the area, the sensors detect their presence and record their attendance.

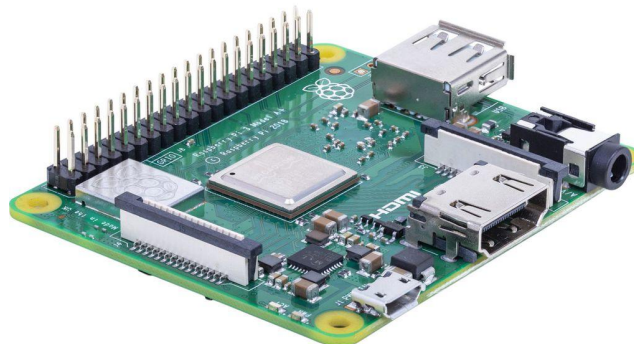
These are just a few examples of existing IoT-based attendance systems. Each system may have its own variations and additional features depending on the specific requirements of the organization implementing it. But all are single sensor attendance system which doesn't have any alternative. But there are some attendance system uses two sensors. But this attendance system contains two behavioural pattern recognizing sensors or physical pattern recognizing sensors. which is a disadvantage two it. It will be for students to proxy the attendance system.

### III. PROPOSED SYSTEM

To solve above problems, the solution is attendance system which has both sensors of behavioural pattern recognition and physical pattern recognition. So mal practice like attendance proxy will not happen. [6] We are using RFID and pi-cam as sensors in our attendance system where RFID is physical pattern recognition sensor and pi-cam is a behavioural pattern recognition sensor. If any sensor fails other act as alternative. We have created mobile app for attendance in which attendance can be shown and can be downloaded.

#### 3.1 Hardware Requirements

**Raspberry pi:** It is a mini computer which is used in making IoT projects. Raspberry Pi, a computer of compact size, employs the ARM processor architecture, which is commonly found in the majority of contemporary smartphones.

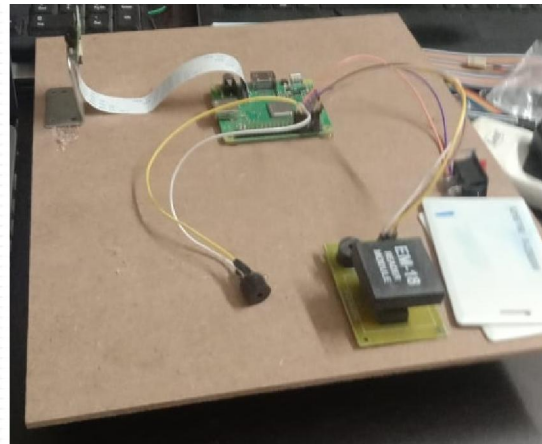
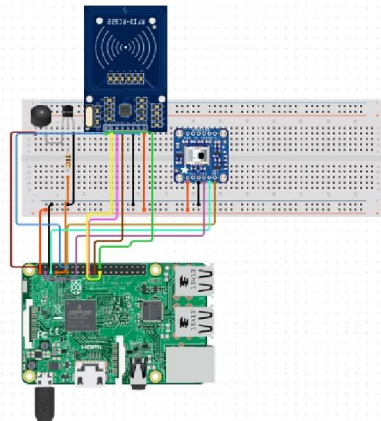


- **RFID controller:** The term RFID stands for Radio Frequency Identification. The RFID Phi get enables the reading and writing of data from RFID tags. These tags are capable of storing small amounts of data. When an RFID tag enters the range of an RFID reader, data is transmitted wirelessly to the reader.
- An interesting aspect of RFID is that it operates independently without the need for a VINT Hub.

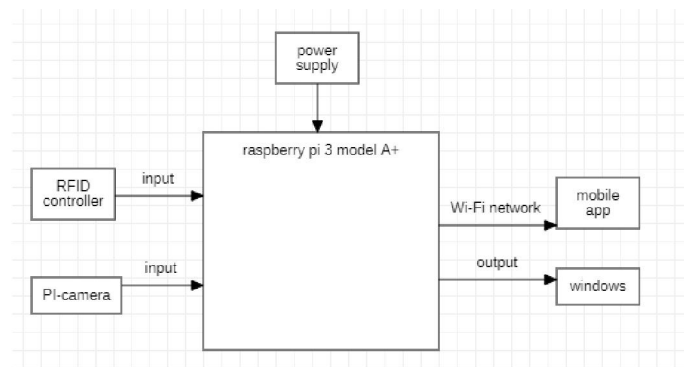
- **Pi-cam:** Pi Camera module is capable of capturing high-definition photos and videos. The Raspberry Pi Board is equipped with a Camera Serial Interface (CSI) interface, allowing for the direct attachment of the Pi-Camera module. By utilizing a 15-pin ribbon cable, the Pi Camera module can be connected to the CSI port of the Raspberry Pi.

#### IV. SYSTEM ARCHITECTURE

Pi-cam is connected to camera slot in raspberry pi. RFID controller is connected to raspberry pi through GPIO pins. Buzzer is kept for notifying the user if attendance is marked or not. After attendance is recorded user can see in mobile and can be downloaded in csv format. This system can increase the efficiency of the system compared to existing system because of alternative sensors design.



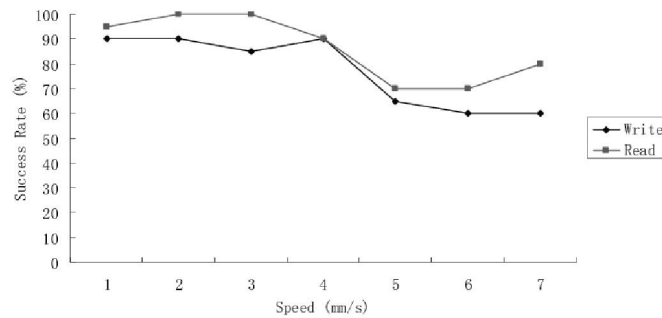
[3] The architecture of the proposed is given below which can be easy to understand. The RFID value obtained through recognition is cross-referenced with the RFID value provided by the user, and attendance is recorded in the local database along with the corresponding date and time. Each student is issued a distinct RFID card, which they present to the camera and swipe when entering the classroom. This action automatically records their attendance, including the date and time.



#### V. PERFORMANCE EVALUATION

##### 5.1 RFID Controller

In the proposed system, there has been a noticeable improvement in the performance of the RFID reader compared to the existing system. The existing system heavily relied on an RFID controller for the attendance system, which consumed a significant amount of energy for each sensor. However, in the proposed system, the RFID reader is utilized as an alternative. This alternative approach results in reduced energy consumption and improved overall efficiency.



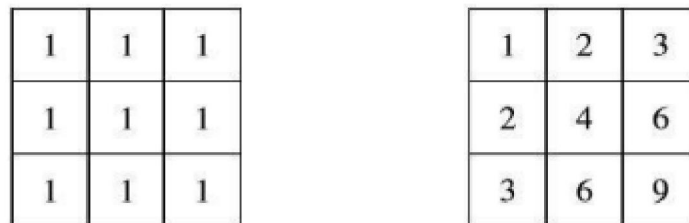
### 5.2 Pi-cam

The performance of the pi-cam has significantly improved in comparison to the existing system. This improvement can be attributed to our utilization of a different sensor. Due to excessive usage, the efficiency of the previous sensor had decreased, resulting in occasional failures to capture inputs or recognize users. However, in our system, this issue has been resolved by using an alternative sensor.

### 5.3 Software Performance

The composition of stages in the cascade classifier involves the utilization of a strong classifier in each stage. The features are combined into different stages, with each stage consisting of a specific number of features. These stages are employed to determine whether an object is a face or not.

[5] In the context of face recognition, the implementation involves utilizing Local Binary Patterns (LBP). This approach involves extracting image features using LBPs and then comparing these extracted features with trained datasets. Local Binary Pattern is an efficient texture analysis tool utilized for labelling pixels in an image obtained from detection. The LBP algorithm applies thresholds to the neighbourhood of each pixel and generates a binary number. The initial step in this process is to construct a grayscale image.

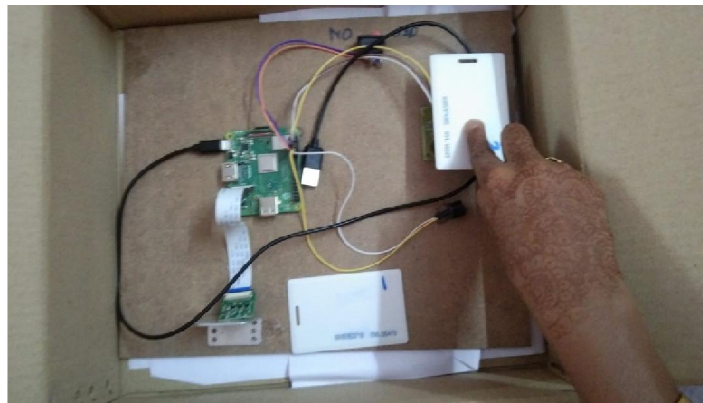
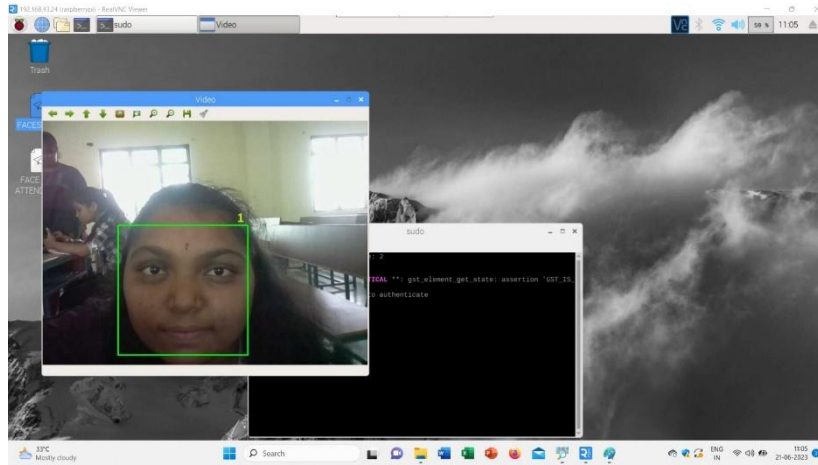


For each pixel in the grayscale image, we consider a neighbourhood of size  $r$  surrounding the centre pixel. The Local Binary Pattern (LBP) value is calculated for this centre pixel and stored in the output array, which has the same width and height as the input image. Since the centre pixel has 8 surrounding neighbours in a 3x3 configuration, it can be represented as a binary number. If a neighbour's value is greater than or equal to the central pixel, a logic '1' bit is assigned to that pixel. Otherwise, a logic '0' bit is assigned. The resulting 8-bit binary number is then converted into a decimal value, which represents the threshold for the corresponding centre pixel.

## VI. EXPERIMENTAL RESULTS

There is switch in the attendance system. if the switch in off then user can record their data in database. If the switch is on the user can mark their attendance using either pi-cam or RFID tag. But system gives first preference to camera. If user face is recognized, then it will small buzz sound. If user is not recognized then ask for RFID tag. If tag id is present in database, then is give small buzz sound or else system takes user as unknown person and it gives continuous buzz until unknown user has left.





All the attendance data is stored in cloud. After attendance has marked then using cloud user can see his attendance in mobile and can download it and share it. Which can be easy for administrative department to share it.

**FACE RECOGNITION ATTENDANCE SYSTEM**

**ROLL NO 1 : PRESENT**    2023-06-05  
11:57:58

**ROLL NO 2 : ABSENT**    2023-06-05  
11:57:59

**ROLL NO 3 : ABSENT**    2023-06-05  
11:58:00

**ROLL NO 4 : ABSENT**    2023-06-05  
11:58:01

DOWNLOAD

Move Task To Back

Rollno	Status	Date & Time
1	ABSENT	2023-06-03 16:26
2	ABSENT	2023-06-03 16:26
3	ABSENT	2023-06-03 16:26
4	ABSENT	2023-06-03 16:26
5	PRESENT	2023-06-03 16:42
6	ABSENT	2023-06-03 16:42
7	ABSENT	2023-06-03 16:42
8	ABSENT	2023-06-03 16:42
9	ABSENT	2023-06-03 16:42
10	PRESENT	2023-06-03 19:32
11	ABSENT	2023-06-03 19:32
12	ABSENT	2023-06-03 19:32
13	ABSENT	2023-06-03 19:32
14	ABSENT	2023-06-03 19:32
15	ABSENT	2023-06-03 19:32
16	ABSENT	2023-06-03 19:32
17	ABSENT	2023-06-03 19:32
18	ABSENT	2023-06-03 19:32
19	ABSENT	2023-06-03 19:32
20	ABSENT	2023-06-03 19:32
21	ABSENT	2023-06-03 19:32
22	ABSENT	2023-06-03 19:32
23	ABSENT	2023-06-03 19:32
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25	ABSENT	2023-06-03 19:32
26	ABSENT	2023-06-03 19:32
27	ABSENT	2023-06-03 19:32
28	ABSENT	2023-06-03 19:32
29	ABSENT	2023-06-03 19:32
30	PRESENT	2023-06-03 19:32
31	ABSENT	2023-06-03 19:32
32	ABSENT	2023-06-03 19:32
33	ABSENT	2023-06-03 19:32
34	PRESENT	2023-06-03 19:32
35	ABSENT	2023-06-03 19:32
36	ABSENT	2023-06-03 19:32
37	ABSENT	2023-06-03 19:32
38	PRESENT	2023-06-05 11:57
39	ABSENT	2023-06-05 11:57
40	ABSENT	2023-06-05 11:57
41	ABSENT	2023-06-05 11:57
42	ABSENT	2023-06-05 11:57
43		
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### VII. CONCLUSION

This system was created since there are numerous distinct types of input attendance methods in the currently operating system. The majority of them have RFID cards and fingerprint integration. The system's primary drawback is that the sensor may or may not detect a fingerprint. The majority of attendees so mark attendance using cards. However, none of them use the camera for attendance, which is more efficient, saves more time, and requires less storage. Additionally, it is economical. Future research in other fields using it as a source will broaden the use of new progressive sensors.

### VIII. ACKNOWLEDGEMENT

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