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## IoT Based Non Contact Temperature Measurement With Attendance Integration

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### Abstract

This work introduces a new paradigm of monitoring student attendance using ESP 8266, Radio Frequency Identification (RFID) based on the Internet of Thing (IoT) and Monitoring the Temperature MLX (90614) for (COVID 19) pandemic. Educational institutes are concerned about student irregular attendance. The traditional method of taking attendance by calling names or signing on project is very time consuming and inefficient. The proposed work comprises of two most popular trend in technology research; IoT and ESP 8266, RFID. An efficient attendance monitoring system needs to be enforced at such places. Radio Frequency Identification (RFID) based attendance system provides us with a solution that caters to issues like proxy attendance, late comers. This project describes the design of an RFID based attendance monitoring system which uniquely identifies each student based on their RFID tag which is attached to their ID card. This makes the mechanism of recording the attendance effortless, quicker and protected as compared to conventional method. This system is designed to educational institutions, corporate offices, government offices etc. The proposed system consist of both hardware and software components based on IoT Technology. The students just need to place their RFID card or tag on the reader and their attendance will be recorded for the day. Also, the attendance recorded will be more accurate as the system is synced with a real-time clock.

**Keywords:** RFID, Temperature, IoT, Attendance Monitoring.

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## 1. Introduction

### 1.1 PREAMBLE

The traditional way for marking and maintaining attendance has several drawbacks such as it's difficult to maintain manual records, proxy attendance may be marked etc. Tracking and tracing attendance becomes harder. The IoT technology based attendance system such as sensors; biometric based attendance system reduced human involvement and errors. Every institution whether it is an educational institution or any organization has to maintain a proper attendance of students, employees for effective functioning of the organization. By designing a user-friendly IoT based attendance management system, the employees/students can record their attendance with ease. This would improve the accuracy of attendance records and also saves the valuable time of the students and employees.

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Smart Attendance Management is a solution to one of the most challenging and long standing problems in management of employee or student's attendance. For IoT based Smart Attendance Management, there are several attempts made by many researchers in this direction. , has proposed their work titled "RFID Technology Based Attendance Management System". In the project the author describes the distinctive components of RFID technology and highlights the core competencies such as scalability and security. A deep study towards the feasibility and practicality of RFID technology is carried out. The outcomes are identified as the key benefits of RFID technology where the main focus is to improve the efficiency at lower cost.

To build a Smart IoT based Attendance Management System there is a need to integrate different hardware components such as RFID Card Reader, temperature sensor with the ESP 32 which in turn needs to be connected with the Computer through which data communication and data handling takes place. The LED display are used to indicate Humidity of the users of the Success or Failure Scenarios when their card is made to sense against the card reader. RFID Tags or RFID Cards are used to read the user's data. These tags may contain an RFID number which is read and recorded by the system. The RFID tags or card can contain user's information such as student-id or employee-id, user name, department etc. Thus the Smart Attendance Management System is build by basic blocks which comprises of both the

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software and the hardware component.

The user must be registered in the system for the Smart Attendance Monitoring system to identify the user. The user's information may be stored in the RFID card or tag. Once the user swipes the card against the RFID card reader, The Card reader senses the RFID card/tag number stored on it. This card number is searched in the database, if the user login time is noted to indicate the Temperature is measured and recorded by the system. If the user with normal Humidity is authenticated, i.e. the user's Humidity is abnormal hence is not authorized and this is indicated to the buzzer. Only if the user has a valid login time recorded against the user's RFID number the user log out time can be recorded once the user leaves the organization and swipes the card again. Once again a green LED light glows to indicate the user's logout time is recorded by the system.

The student's can register themselves through the User Interface provided, also scan the RFID card to know the RFID card number, along with the card details student details such as Name can be recorded. Further when the student's log their attendance daily by flashing their RFID cards in front of the card reading module. The attendance gets recorded which can be fetched by the Head of the Department to view the details of time when the student has entered the institution. Also there is a facility provided for the Head of the Department to notify the student's parents who reach late or remain absent for the day.

## 1.2 Internet of Things

As the concept "Internet of Things" (IoT) has recently attracted growing attention from both academia and industry. IoT is a scenario where devices (even animals or people) are provided with unique identifiers and the ability to automatically transmit data over a network without requiring human-to computer interaction. ESP 8266 and RFID forms an essential block of IoT where RFID devices are wireless microchips used for tagging objects for automated identification .RFID systems consist of a reading device called a reader, and one or many tags. The frequency band in which each RFID system operates can be low, high or ultra-high frequency. The low-frequency band (LF) covers frequencies from 30 KHz to 300 KHz. The high band (HF) ranges from 3 to 30 MHz. Most HF RFID systems work at 13.56 MHz with reading ranges between 10 cm and 1 m. The ultra-high frequency band (UHF), recurrence band, covers the reach from 300 MHz to 3 GHz.

### 1.3 The Proposed Smart Attendance System Using Rfid Technology

Our framework utilizes RFID tags which allow school/college to monitor the student attendance in and out of the class, upload the data on Google Spreadsheet and also temperature of the student.

## 2. Devices For Measuring The Entire System

The reader is a powerful device with a lot of memory and computational resources which could be connected to Raspberry Pi. The tags are usually of two major types; active or passive. In the active RFID systems, each tag has its own transmitter and power source. In most cases, the source of power is a battery. Active RFID systems frequently operate in the ultra-high recurrence (UHF) band and offer a range of up to 100 m [5]. Passive RFID system doesn't have a power source where it gets in power from the reader when the tag chip is brought close to it. Passive RFID systems can work in the low recurrence (LF), high recurrence (HF) or ultra-high recurrence (UHF) radio groups. RFID technology can help to identify and to monitor items (products, people, student, etc.) wirelessly within a specified distance (a few centimeters to hundreds of meters). In this project, we describe the proposed Smart Attendance System using RFID technology. Our framework utilizes RFID tags which allow school/college to monitor the student attendance in and out of the class, upload the data on Google Spreadsheet, send alert to parents using SMS/email and generate a report quickly. When RFID tags pass through the read-range zone of the RFID reader, the system will record data from the RFID tags to the database system which could be a central server at the school. In Addition to schools, SAS is an automatic integrated system used to assist in taking attendance in any organization. provides organization, efficiency, and convenience utilizing the trending technologies of IoT.

The ultimate benefits of this system to schools and organizations is to automate the attendance system and save time. It will prevent students from bunking classes through SMS sending feature to parents if they subscribe to the service. The framework will generate reports of student's attendance in a click. It is a low cost, and portable IoT enabled RFID reader. The power supply system designed will automatically switch to batteries power if the AC power was removed. The size of the device is small. These two features make the system portable

and easily packed and carried to the classroom or other places. we present the design of the framework. In section we provide the conclusion and future work.

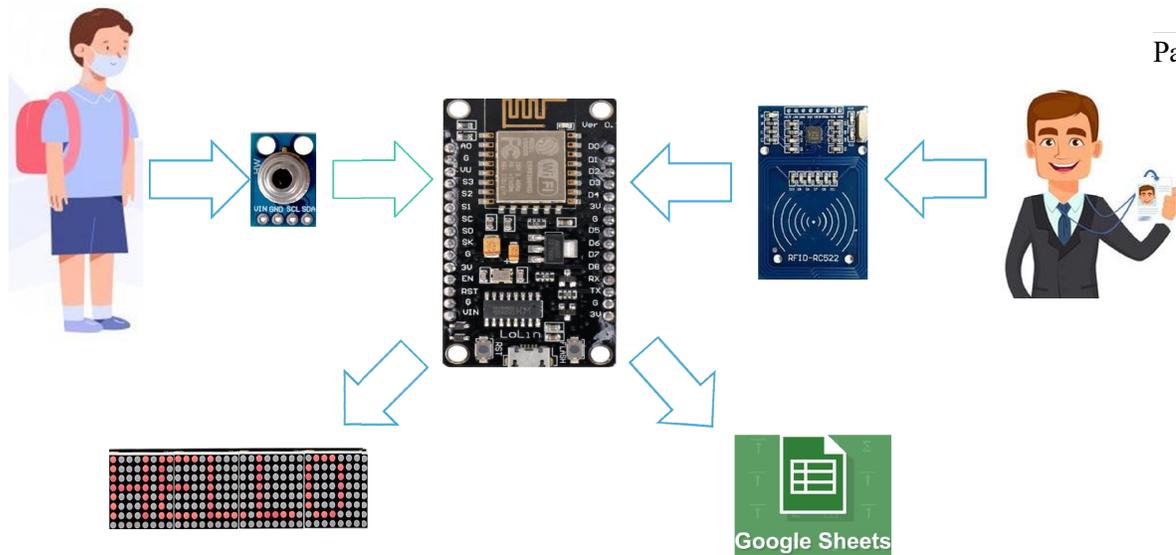
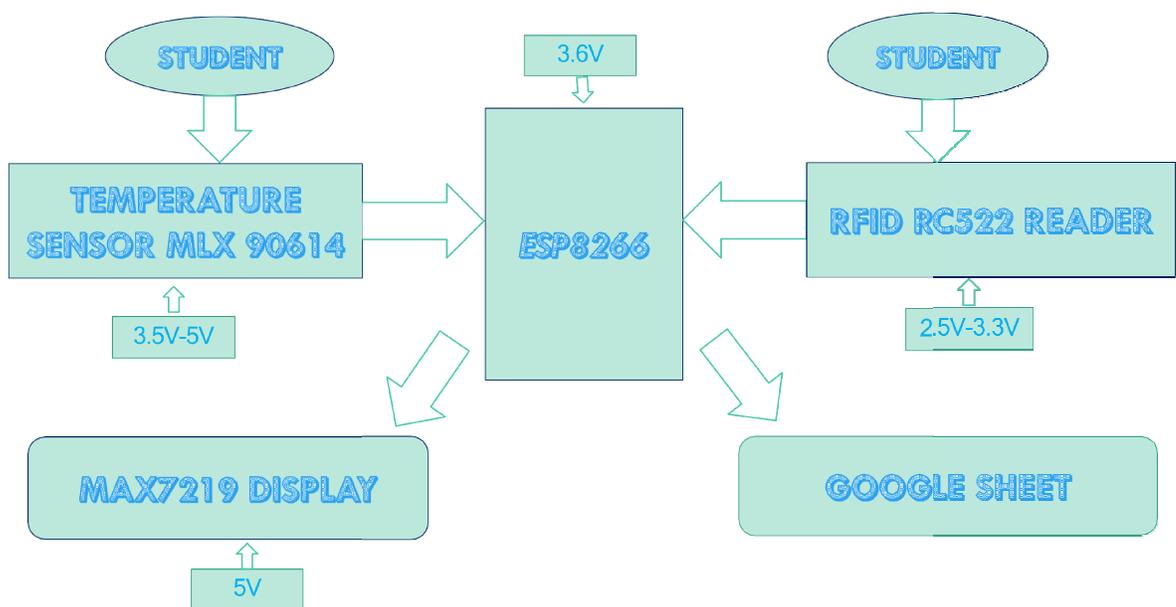


Figure. 1. Smart Attendance System With Temperature Monitoring

### 2.1 Functional Diagram



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## Figure. 2. Functional Block diagram

### 2.2 Overview

NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kits. Both the firmware and prototyping board designs are open source.

The chip first came to the attention of Western makers in August 2014 with the ESP-01 module, made by a third-party manufacturer Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at first there was almost no English-language documentation on the chip and the commands it accepted. The very low price and the fact very few external that there were components on the module.

## 3. Software Description

### 3.1. Introduction

The Arduino Integrated Development Environment (IDE) is a cross- platform application (for Windows, macOS, Linux) that is written in functions from C,C++ and google sheet . It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards.

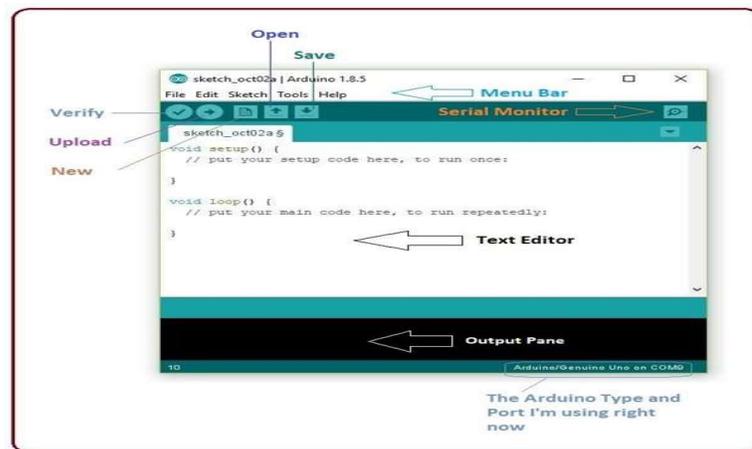
### 3.2. Arduino IDE

Arduino IDE is an open source software that is mainly used for writing and compiling the code into the Arduino Module. It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process. It is easily available for operating systems like MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment. A range of Arduino modules available including Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro and many more. Each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code.

The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board. The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module. This environment supports both C and C++ languages.

The IDE environment is mainly distributed into three sections

1. Menu Bar
2. Text Editor
3. Output Pane



**Figure. 3. Arduino IDE**

### 3.3. Google Sheet Based Desktop Application For Monitoring Attendance System

**Flexible:** You can create your own attendance system to suit your school. When things change in the future you can simply adapt your spreadsheets, without the need for new software or IT support.

**Accessible:** You can access data for all your classes from anywhere in the world on your laptop or Smartphone.

**Compatible with everything:** Every other piece of software in the world integrates with Google Sheets. If you have data stored in other programs (such as Google Classroom), you can easily download or directly import that data and centralize everything in Google Sheets.

**Easy to use:** Almost every professional works with spreadsheets at some point during their life. Google Sheets is a very intuitive and user-friendly system, even for spreadsheet novices. This makes maintenance and training easier, and you can be sure that your system is future-proof.

### 3.4. Dashboards

Dashboards allow you to visualize data and control **MYSRIPT** IOT connected projects from any modern web browser. Widgets such as charts, sliders, are available to help you quickly get our IoT project up and running without the need for any custom code.

	A	B	C	D	E	F	G	H	I	J	K	L
190	189	12/03/2021	13.19.01	28.75								
191	190	12/03/2021	13.19.09	28.91								
192	191	12/03/2021	13.19.18	28.85								
193	192	12/03/2021	13.19.27	28.95								
194	193	12/03/2021	13.19.35	28.99								
195	194	12/03/2021	13.19.44	28.99								
196	195	12/03/2021	13.19.53	28.89								
197	196	12/03/2021	13.20.01	28.95								
198	197	12/03/2021	13.20.10	29.11								
199	198	12/03/2021	13.20.18	29.05								
200	199	12/03/2021	13.20.28	28.91								
201	200	12/03/2021	13.20.36	29.05								
202	201	12/03/2021	13.20.45	29.09								
203	202	12/03/2021	13.20.54	29.09								
204	203	12/03/2021	13.21.03	28.91								
205	204	12/03/2021	13.21.12	28.85								
206	205	12/03/2021	13.21.20	28.85								
207	206	12/03/2021	13.21.28	28.79								
208	207	12/03/2021	13.21.37	28.95								
209	208	12/03/2021	13.21.46	28.79								
210	209	12/03/2021	13.21.56	28.95								
211	210	12/03/2021	13.22.03	28.83								

**Figure.4. Google sheet output**

## 4. Problem Formulation

In existing system Attendance plays a very important role in any organization. Attendance in many organizations, college and schools are project-based. When project-based attendance is considered, the chances of error are high. Using technology this issue can be solved and the projects can be avoided in this process. There are many technologies that support to solve this issue. But best among them is RFID (Radio Frequency Identification) as the names suggest it uses the radio waves to identify and track the object or individual. The communication with respect to RFID is wireless using an electromagnetic and electrostatic coupling, where a radio

frequency of spectrum is used to communicate. For demonstrating the results, the system is built using an RFID card reader module of the model RC522 RFID card reader and RFID cards/tags.

Consider the example that shows. This makes the mechanism of recording the attendance effortless, quicker and protected as compared to the conventional method. This system is designed to be used at different educational institutions, corporate offices, government offices etc. The proposed system consists of both hardware and software components based on IoT Technology.

The hardware component consists of RC522 RFID card reader and RFID tags/cards. The software component of the Web-based GUI for viewing the employee's or student's attendance, which is hosted on a web server and which stores the data in a database server. The employees or students just need to place their RFID card or tag on the reader and their attendance will be recorded for the day. Also, the attendance recorded will be more accurate as the system is synced with a real-time clock.

The hardware component consists of RC522 RFID card reader and RFID tags/cards. The software component consists of the Web-based GUI for viewing the employee's or student's attendance, which is hosted on a web server and which stores the data in a database server. The employees or students just need to place their RFID card or tag on the reader and their attendance will be recorded for the day. Also, the attendance recorded will be more accurate as the system is synced with a real-time clock.

#### **4.1. Proposed Methodology**

Smart Attendance Management is a solution to one of the most challenging and long-standing problems in the management of employee or student's attendance. For IoT-based Smart Attendance Management, the smart attendance management system removes the traditional way of registering the attendance [4]. It also provides a secure, error-free method of attendance management. The administrators can be at ease by employing such a smart attendance system. The system is best suited for managing the attendance of employees. It can also be used to record attendance for students at their hostels.

#### **4.2. Schematic of the System**

The schematic of the system is shown below.ESP 8266 and RFID reader of the attendance recording system.

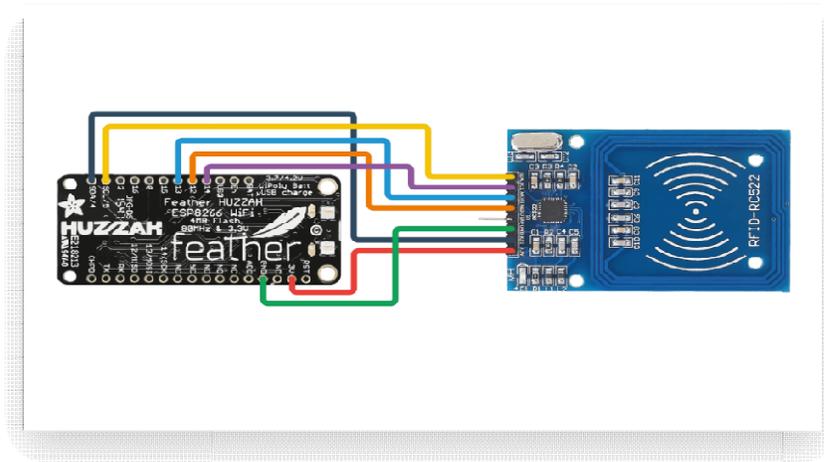
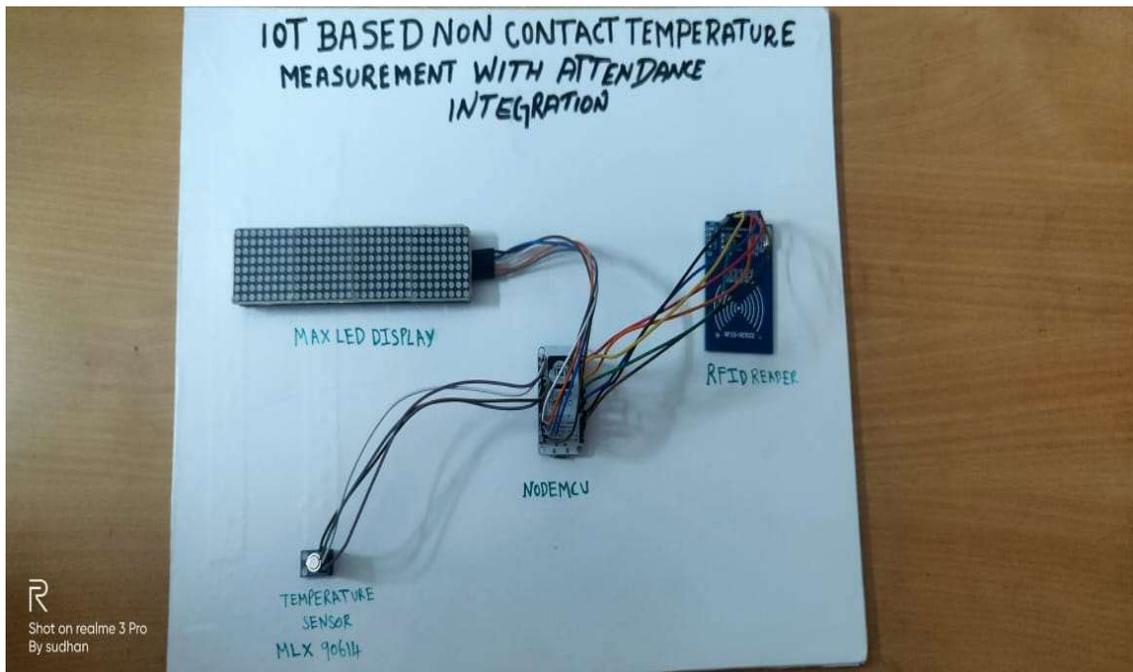


Figure.5. Schematic diagram

### 4.3. Circuit Connection

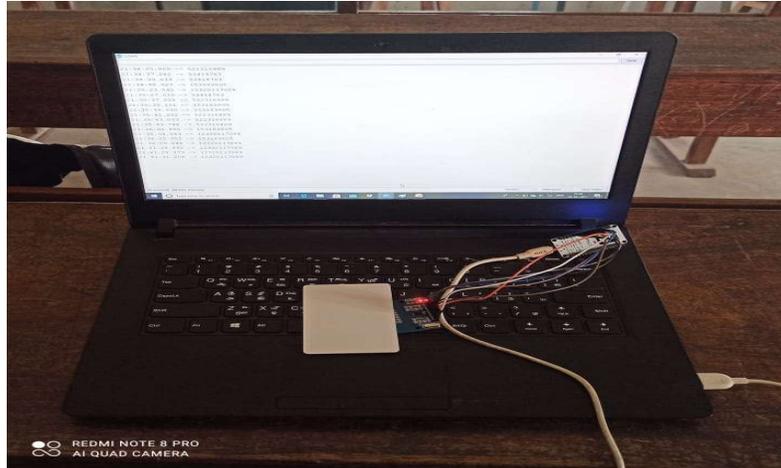
The below circuit shows the electrical connection among the microcontroller, sensor and RFID reader.



**Figure. 6. Circuit Connection****4.4. Experimental Setup/Hardware Prototype**

The below figure depicts the hardware prototype that has been developed to realize the proposed methodology. The tests were conducted using the below experimental setup.

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**Figure. 7. Experimental Setup with RFID reader****Figure. 8. Experimental Setup with temperature sensor****4.5. Working**

The first step would be entering valid id card. After the user is validated, it will direct the user to the database. The user can view humidity of the student. Once the student is added to the database, the instructor can go to the Attendance Module by clicking the attendance on the screen. After entering the correct communication port and baud rate, the system verifies the values and then the status changes to indicate that software is ready to take attendance. The students can swipe the cards and attendance is marked on the database. After marking the attendance, the instructor information can stored in Google Sheet File.

## 5. Results

### 5.1. Validation of the Sensor

The IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations. An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations.



**Figure. 9. Infrared Sensor**

The transmitter section includes an IR sensor, which transmits continuous IR rays to be received by an IR receiver module. An IR output terminal of the receiver varies depending upon its receiving of IR rays. Since this variation cannot be analyzed as such, therefore this output can be fed to a comparator circuit. Here an operational amplifier (op-amp) of LM 339 is used as comparator circuit. When the IR receiver does not receive a signal.

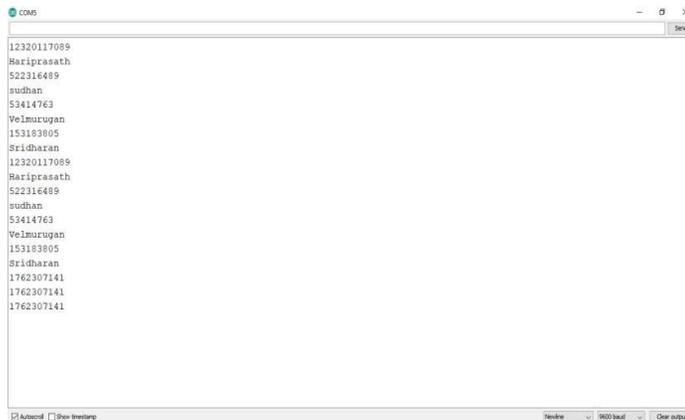


```
COM3
21:16:13.132 -> Ambient = 29.61°C    Object = 29.77°C
21:16:13.179 -> Ambient = 85.30°F    Object = 85.59°F
21:16:13.179 ->
21:16:18.118 -> Ambient = 29.57°C    Object = 29.69°C
21:16:18.165 -> Ambient = 85.23°F    Object = 85.44°F
21:16:18.212 ->
21:16:23.118 -> Ambient = 29.59°C    Object = 29.59°C
21:16:23.161 -> Ambient = 85.26°F    Object = 85.26°F
21:16:23.181 ->
21:16:28.123 -> Ambient = 29.57°C    Object = 29.69°C
21:16:28.170 -> Ambient = 85.23°F    Object = 85.44°F
21:16:28.215 ->
21:16:33.144 -> Ambient = 29.53°C    Object = 29.63°C
21:16:33.190 -> Ambient = 85.15°F    Object = 85.33°F
21:16:33.190 ->
21:16:38.120 -> Ambient = 29.51°C    Object = 29.85°C
21:16:38.167 -> Ambient = 85.12°F    Object = 85.59°F
21:16:38.214 ->
21:16:43.134 -> Ambient = 29.53°C    Object = 29.79°C
21:16:43.181 -> Ambient = 85.15°F    Object = 85.62°F
21:16:43.229 ->
21:16:48.159 -> Ambient = 29.51°C    Object = 30.11°C
21:16:48.159 -> Ambient = 85.12°F    Object = 86.20°F
21:16:48.207 ->
```

Figure. 11. Temperature Sensor Output

### 5.2. Live Monitoring Dashboard Output

The power consumption, cumulative number of units consumed and the corresponding cost incurred during the current billing cycle is made available in the adafruit dashboard through the MQTT protocol available in the adafruit i/o service provider by the NodeMCU. The result is shown below.



```
COM3
12320117089
Hariprasath
522316489
sudhan
53414763
Velmurugan
153183805
Sridharan
12320117089
Hariprasath
522316489
sudhan
53414763
Velmurugan
153183805
Sridharan
1762307141
1762307141
1762307141
```

Figure. 12. RFID Reader output

## 6. Conclusion and Future Scope

Thus a IoT based non contact temperature measurement with attendance integration was successfully developed and validated. The proposed methodology is found to be one of the ideal solution to the problems mentioned in the chapter 5. With the proposed system Our goal is to develop a secure, portable and ready to deploy RFID-based attendance. The system provides a practical and efficient solution for monitoring student attendance on a largescale.

The proposed attendance monitoring system uses the concept of IoT to log and fetch data on the server/cloud and make it available for the user anytime and anywhere. For future work, we would also like to give access to students about their attendance, so they can log in and check their attendance remotely. We would integrate the entire system with a mobile phone application so that all functionality is on the mobile itself. Also, we will integrate this system with Google sheet interface.

The proposed scheme can be extended to The students can swipe the cards and attendance is marked on the database . The user could specify the date or a span of dates for attendance. The report will be fetched from the database and presented in Google sheet file format

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