IoT Based Attendance Monitoring System

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***Abstract*— To ensure the productivity of students, attendance monitoring is a crucial task for any school, regardless of its size. In this research paper, an Arduino-based fingerprint attendance monitoring system is presented, which is capable of storing up to 100 entries and updating them in the server software. The system utilizes an ESP8266 module, Arduino Uno Rev 3, an R-307 fingerprint sensor, and attendance management software, and it can also send notifications through IoT whenever attendance is recorded. The proposed system aims to offer an efficient and dependable attendance monitoring solution for schools.**

***Index Term*- Arduino Uno, Attendance Monitoring System, IoT Attendance, Node MCU.**

1. INTRODUCTION

Attendance monitoring is a critical aspect management in any school. Manual attendance monitoring is a tedious and time-consuming task, which is prone to errors. Thus, automated attendance monitoring systems are gaining popularity in recent times. Fingerprint-based attendance monitoring systems are widely used as they are reliable and provide accurate data. Thus, we propose an Arduino-based fingerprint attendance monitoring system that can store up to 100 entries and update them in the software inside the server. The system also sends an SMS to the registered phone number whenever attendance is registered.

1.0 Sensors and components used in the system.

In our project, we have used three main components. Arduino uno board, sim 800L Module, RTC DS3231 Module.

1.0.0 Arduino UNO Rev 3

The ATmega328P microcontroller-based Arduino Uno Rev 3 is a widely used microcontroller board that is popular among hobbyists, educators, and professionals for prototyping and developing electronic projects. It is an integral part of the Arduino ecosystem, an open-source electronics platform that encompasses both hardware and software components.

The board features 14 digital input/output pins, 6 analog input pins, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button. Its digital pins can be employed as either inputs or outputs and can be managed using the digitalWrite() and digitalRead() functions provided by the Arduino IDE. Additionally, the analog pins can read analog voltage values from sensors and can be accessed using the analogRead() function. Power can be supplied to the board via a USB cable or an external power supply. To program the board, users can utilize the Arduino IDE, which is an easy-to-use software tool for writing, compiling, and uploading code to the board. This IDE is compatible with Windows, Mac, and Linux operating systems. The programming language used is a simplified version of C++ that is easy to learn and use.

The Arduino Uno Rev 3 can be used to control a wide range of electronic projects, including robots, sensors, actuators, displays, and more. The board is compatible with a variety of shields, which are daughterboards that can be plugged into the board to provide additional functionality, such as Ethernet connectivity, wireless communication, motor control, and more to ensure its productivity in every field.

In conclusion, the Arduino Uno Rev 3 is a versatile and easy-to-use microcontroller board that is ideal for prototyping and developing electronics projects. Its popularity and wide range of compatible shields make it a go-to choose for everyone.

Figure 1, Arduino Uno Rev 3 microcontroller

1.0.1 RTC Module

The RTC DS3231 is a high-precision, low-power real-time clock module that is widely used in various electronic applications. It is a compact, easy-to-use device that can be integrated with microcontrollers or other electronic circuits to keep track of time and date with high accuracy. The DS3231 is designed to work in a wide range of temperatures and is equipped with a battery backup system that ensures that time and date data is preserved even when power is lost. Additionally, the DS3231 offers features such as alarms, programmable square-wave output, and temperature measurement, making it a versatile and valuable component in many electronic projects. With its reliable performance and ease of use, the DS3231 is a popular choice for hobbyists and professionals alike.

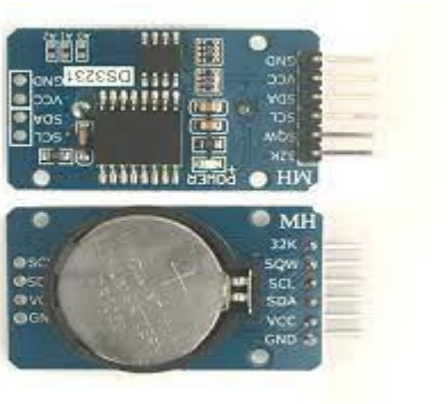


Figure 2, RTC Module

1.0.2 Node MCU ESP-8266

The Node-MCU ESP-8266 is an affordable and versatile development board that allows Wi-Fi connectivity through its onboard ESP-12E module. Its onboard USB-to-serial converter makes programming and debugging a breeze. Due to its cost-effectiveness, small size, and user-friendly features, it is a popular choice for IoT projects. The Node-MCU ESP-8266 can be programmed using the Arduino IDE or other development environments, and a variety of online libraries and examples are available to help developers get started. Apart from its Wi-Fi capabilities, the Node-MCU ESP-8266 boasts several other features, including GPIO pins that control external devices, an analog input pin, and compatibility with I2C and SPI communication protocols. As a result, it is a versatile development board that can be used for a wide range of IoT projects, including home automation and industrial monitoring and control. To sum up, the Node-MCU ESP-8266 is an affordable and versatile development board that is ideal for a broad range of projects.

Figure 3, Node MCU- ESP 8266 Module.

2. IMPLEMENTATION

2.0.0 Methodology

The basic methodology for an IoT-based attendance management system using Arduino can be summarized in the following steps:

Hardware setup: The first step is to assemble the hardware components required for the attendance management system. This includes the Arduino board, the ESP8266 Wi-Fi module, and the R307 fingerprint sensor

Software setup: The next step is to set up the software required for the system. This includes installing the Arduino Integrated Development Environment (IDE) and the libraries required for the ESP8266 module and the fingerprint sensor along with the data to be uploaded in the attendance management software by the admin.

Fingerprint registration: The system should be programmed to allow for fingerprint registration of students. This can be done by enrolling each person's fingerprint into the system, assigning a unique ID, and storing the data in the system.

Attendance registration: The fingerprint sensor should be programmed to read the fingerprints of students as they enter or exit the building. The attendance data should be stored in the system's memory.

Wi-Fi connectivity: The system should be programmed to connect to a Wi-Fi network, which will allow attendance data to be transmitted to a cloud-based server.

Data transmission: The attendance data stored in the system should be transmitted to a cloud-based server through the Wi-Fi connection. This can be

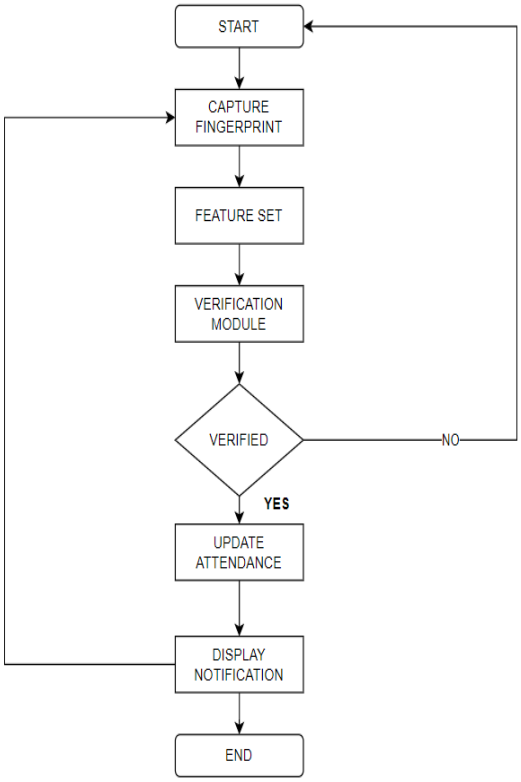
done by sending HTTP requests to a server using the ESP8266 module

Cloud-based storage: The attendance data transmitted to the cloud-based server should be stored in a database or spreadsheet for further processing and analysis.

Notification: The system can be programmed to send notifications to authorized personnel whenever attendance is registered. This can be done through email or SMS.

Data analysis: The attendance data stored in the cloud-based server can be analyzed to generate reports on student attendance. These reports can be used to track attendance trends and identify areas for improvement.

System maintenance: Regular maintenance of the hardware and software is essential to ensure the system's proper functioning. This includes checking the connections, updating the software, and troubleshooting any issues that may arise.



2.0.1 Block Diagram

This is a map of our project IoT based attendance monitoring system, RTC & LCD. Here the Arduino UNO acts as an electronic device that controls all other components as an input/output unit.

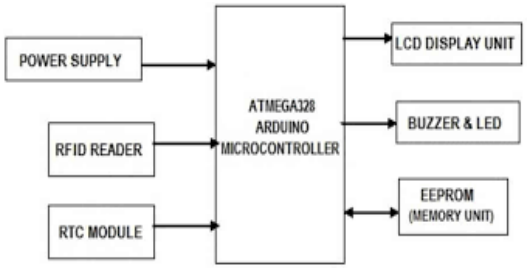


Figure .2.0, System Block.

We used a 5-volt power supply to power all the components used in this project. The RFID Reader module is integrated with the Arduino to read information from the RFID card/tag. The remote time clock (RTC) is used to display the current time and date on the LCD. Each release of the LCD, such as current date & time, current or non-existent scholar information, and menu options from 1 to 4.

The red and green LEDs are used as a signal to come andgo. Similarly, the buzzer makes a sound whenever an interruption is detected. The most important part of this map is the EEPROM part. EEPROM stands for Electrically Erasable Programmable ROM. It stores information in RFID Reader whenever users change their card.

2.0.1 Circuit Diagram

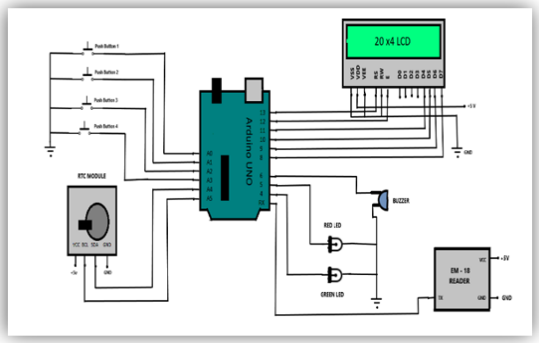


Figure 2.1, Schematic Diagram

To get started, the Arduino is equipped with the UNO EM- 18, RTC module, LCD, Buzzer, LED Lite, and push-buttons. When the connection is ready. Configure the RFID library inthe Arduino IDE.

3. SYSTEM ARCHITECTURE

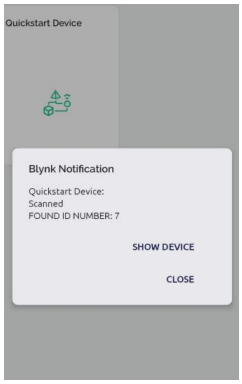
The system's operation involves two stages, namely enrollment and attendance registration. In the enrollment stage, the student's fingerprint is captured using the R307 fingerprint sensor. The fingerprint data

is then stored in Arduino's memory, along with the student's details, such as name and ID. The system can store up to 100 entries.

In the attendance registration stage, the student places their fingerprint on the sensor, and the system matches the fingerprint data with the stored data. If the match is successful, the system records the attendance and updates it in the software inside the server. The attendance management software provides an interface for the admin to view the attendance data. The system also sends an SMS to the registered phone number whenever attendance is registered.

4. RESULTS

The proposed system was implemented, and its performance was evaluated. The system was tested with 10 students, and the attendance data was recorded for two weeks. The system was found to be reliable, and the attendance data was accurate. The system's response time was less than a second, which is acceptable for an attendance monitoring system. The SMS feature was also found to be working correctly.



5. FUTURE SCOPE

In the coming future, we will replace manual methodology by automatic methodology. For automating we will replace Arduino Uno by Raspberry pi and avoid the hustle to update the attendance in our software manually by admin.

6. CONCLUSIONS

In this research paper, we presented an Arduino based fingerprint attendance monitoring system that can store up to 100 entries and update them into the software inside the server. The system is reliable, efficient, and provides accurate attendance data. The system's response time is less than a second, and it can also send an SMS to the registered phone number whenever attendance is registered. The proposed system can be used in any organization to automate the attendance monitoring process, thus saving time and reducing errors.

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