Tech of Attendance

Team leader – Date -24/11/2025

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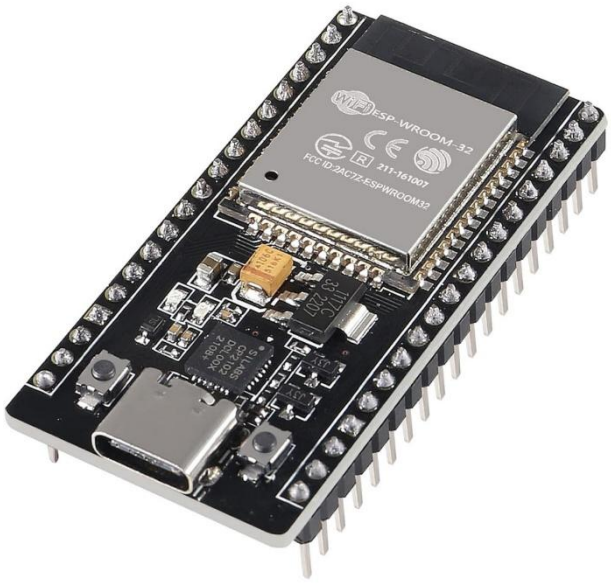
The project

A student attendance system in which by a single tap of a RFID card a student can login to the excel sheet and mark his attendance without any interference of the teacher, pen and book. This also helps the teacher to get faster intel.

What is ESP 32 ?

ESP32 is a small, low-cost, and powerful microcontroller board developed by Espressif Systems. It is widely used in electronics, IoT (Internet of Things), home automation, robotics, and hobby projects.
Key Features of ESP32



- **Dual-core processor** → Faster and more powerful than many microcontrollers.
- **Built-in Wi-Fi + Bluetooth** → Main reason it is very popular.
- **Low power consumption** → Good for battery-powered devices.
- **Multiple GPIO pins** → Can connect sensors, motors, displays, LEDs, etc.
- **ADC, DAC, PWM support** → Helps in analog and digital control.
- **Huge community support** → Easy tutorials and libraries available.

Why ESP32 is Popular?

- Very powerful compared to Arduino Uno/Nano.
- Has Wi-Fi + Bluetooth built-in (no extra module needed).
- Can run complex programs, sensors, AI-based applications, and even small servers.

What you can make with ESP32

- Smart home automation (Wi-Fi switches, sensors)
- IoT devices with cloud connectivity
- Security systems
- Smart door lock with RFID
- Weather station
- Robot control
- Bluetooth remote control

What is an RFID Reader?

An RFID Reader **(Radio Frequency Identification Reader)** is an electronic device used to read information stored in RFID tags or cards.

It works using radio waves and does not need direct contact—just bring the card near the reader, and it scans it instantly.

The most common module used in projects is the MFRC522 RFID Reader.

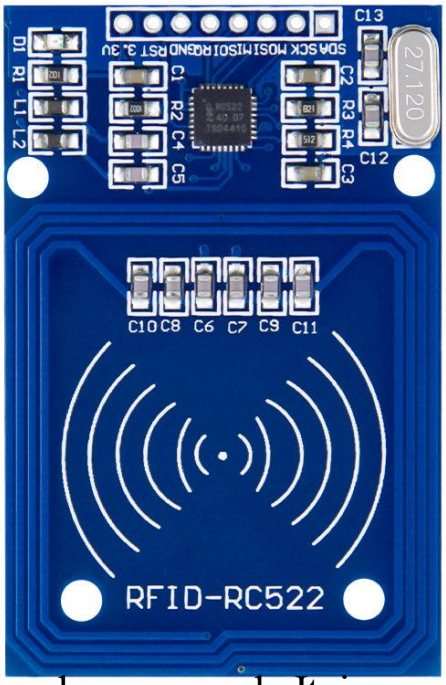
Key Features of an RFID Reader (MFRC522 / RC522)

- Contactless reading → No physical touch required.

- Reads unique ID (UID) of cards.
- Fast scanning → Reads cards in milliseconds.
- Operates at 13.56 MHz frequency.
- Low power → Suitable for Arduino, ESP32, Raspberry Pi.

How RFID Reader Works

1. The reader generates a small electromagnetic field.
2. When you bring an RFID card close, it gets powered by this field.
3. The card sends back its unique ID (UID).
4. The reader receives this ID and sends it to your microcontroller (Arduino, ESP32).
5. Your code decides what to do:
    - Open door
    - Mark attendance
    - Turn on a device
    - Display name



What You Can Make With an RFID Reader

- Student/employee attendance system
- Access control system (door lock)
- Electronic payment system prototype
- Smart library management
- Smart safe/locker
- Inventory management system

What is a Buzzer

A buzzer is a small electronic device that produces sound. It is commonly used in circuits to give alerts, alarms, beeps, or notifications.

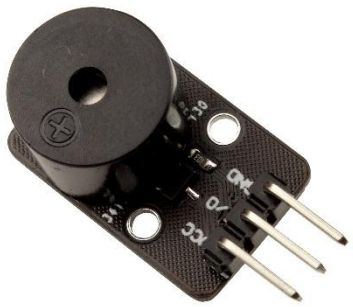
Simple Definition

A buzzer is an electronic component that makes beeping or buzzing sound when electricity is appliedTypes of Buzzers

Active Buzzer

- Produces sound automatically when powered.
- Works with just 5V/3.3V.
- Needs only ON/OFF control from Arduino/ESP32.

- Used for alarms.



Passive Buzzer

- Needs a signal or frequency to create sound.
- Can create tones, melodies.
- Requires PWM pin.
- Used for music, tones, beeps.

What is a Jumper

A jumper is a small electrical connector used to connect two points in a circuit.

It is used to make or break connections without soldering.

Working

The development of an RFID-based student attendance system using the ESP32 microcontroller demonstrates how modern embedded technologies can greatly simplify administrative tasks such as attendance tracking. By integrating the RC522 RFID reader with the ESP32 and programming it to identify each student's unique UID, the system provides a fast, contactless, and highly reliable method for recording attendance. The addition of WiFi connectivity enables the ESP32 to synchronize accurate time and date information through an NTP server, ensuring that every entry logged reflects real-time data. This eliminates the need for manual timekeeping and prevents errors that typically occur in traditional attendance registers.

Furthermore, using serial communication and PLX-DAQ allows the ESP32 to directly send attendance logs into an Excel sheet on a computer. This seamless transfer of data not only makes storage convenient but also makes digital tracking more structured and future-proof. Teachers can easily monitor the attendance record of each student, generate reports, analyse patterns, and maintain long-term records without any manual rewriting. The system also includes a simple but effective buzzer alert mechanism which provides immediate feedback when a card is scanned, enhancing user interaction and ensuring the device is functioning properly.

The project also required understanding key hardware concepts such as pin mapping, SPI communication, powering the RFID module correctly, and accurately connecting the buzzer. Troubleshooting issues like incorrect wiring, faulty 3.3V supply, or mismatched pin numbers highlighted the importance of careful hardware-software coordination. Fixing these issues deepened the understanding of embedded systems and microcontroller operation.

Overall, this RFID attendance system project showcases how inexpensive components like the ESP32 and RC522 can be combined with thoughtful programming to create a practical, real-world solution. It highlights the importance of automation in everyday tasks and encourages further exploration into IoT-based applications. The successful completion of this system not only improves efficiency and reduces human error but also demonstrates how students can use modern electronics to build meaningful technological solutions. This project can be scaled further by adding cloud database storage, mobile app monitoring, or Bluetooth attendance for portable use, making it a strong foundation for future innovation in smart campus systems.