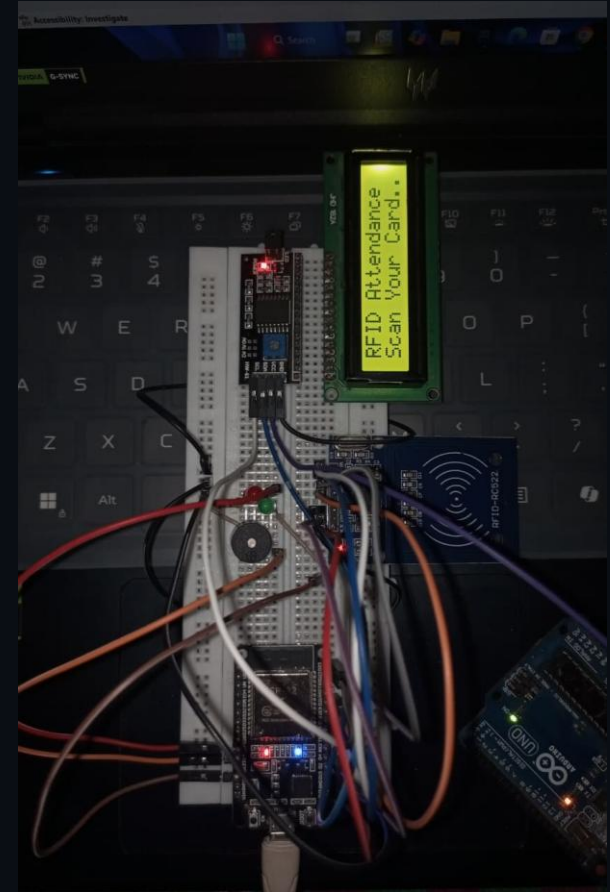# _RFID Based Attendance System Using ESP-32_

- Automated Attendance Monitoring Solution
- Uses RFID (MFRC522), ESP32, LCD, LEDs, Buzzer
- Real-Time Storage in Google Sheets
- Fast, Accurate, and User-Friendly

← </build_rohaesthetics>

Introduction / Project Overview

This project focuses on developing a **smart attendance system** that uses RFID technology and an ESP32 microcontroller to automate the process of student/staff attendance marking.
The system reads RFID cards, identifies the user, marks attendance automatically, and stores data in a **Google Sheet** with real-time internet connectivity.

Key Goals:

- **Replace manual attendance with automation**
- **Reduce errors and improve accuracy**
- **Provide real-time cloud storage**

Problem Statement

Traditional attendance methods such as manual entry, paper sheets, or calling out roll numbers are:

- Time-consuming
- Prone to human error
- Easily manipulated
- Difficult to store and analyze

Therefore, an automated system is required to ensure accuracy, speed, and reliability.

Proposed Solution

A fully automated **RFID-based attendance system** that:
- Detects students using RFID cards
- Validates the card with pre-stored data
- Displays attendance status on LCD
- Stores attendance in real-time to Google Sheets
- Uses LEDs and buzzer for feedback

This ensures secure, fast, and error-free attendance marking.

Hardware Components Used
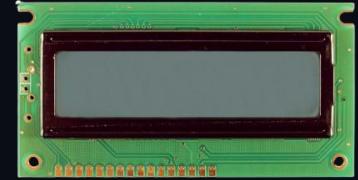
ESP32 WiFi Microcontroller

MFRC522 RFID Module

RFID Cards/Tags

16x2 LCD Display

I2C

Green & Red LEDs Resistors

Buzzer

Connecting wires, USB cable

ESP32 WiFi Microcontroller | 01

MFRC522 RFID Module | 02

RFID Cards/Tags | 03

I2C 16x2 LCD Display | 04

Breadboard | 05

Green & Red LEDs | 06

Buzzer | 07

Connecting wires | 08

Hardware Components Used

ESP32 Microcontroller

- Dual-core microcontroller with built-in **WiFi & BLE**
- Used for reading RFID data and sending it to Google Sheets
- Handles all processing, decision-making, and LCD control
- Communicates with RFID via **SPI protocol**
- Ideal for IoT applications due to high reliability
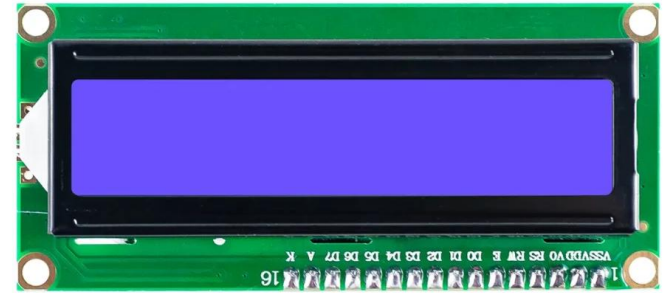

← </ESP32_Dev_Kit>

MFRC522 RFID Sensor

- Operates at **13.56 MHz**
- Reads UID (Unique ID) from RFID cards
- Communicates with ESP32 using the **SPI interface**
- Provides fast and accurate card detection
- Low power consumption and high reliability

I2C LCD Display (16x2)

- Displays instructions and attendance status
- Shows messages like:
    - *"Scan Your Card"*
    - *"Card Detected"*
    - *"Welcome, Rohit"*
    - *"Attendance Marked"*
    - *"Invalid Card"*
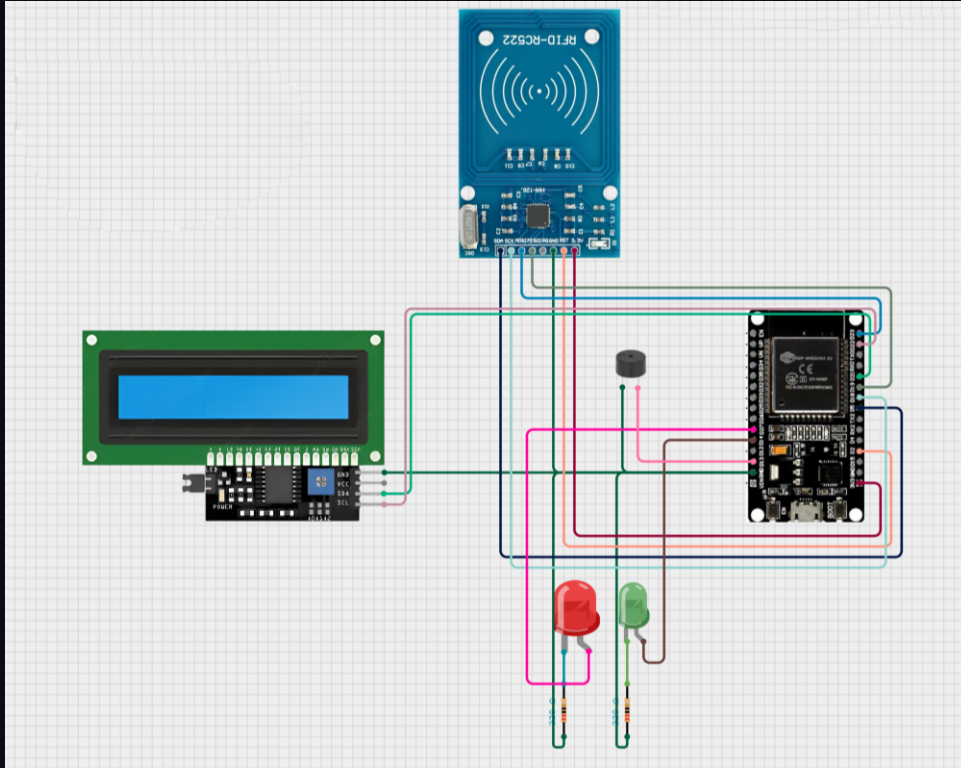- Uses I2C communication (SDA + SCL), reducing pin usage on ESP32

LED & Buzzer Feedback System

- **Green LED** → Valid card (attendance marked)
- **Red LED** → Invalid/Unknown card
- **Buzzer** provides audio confirmation:
    - Short beep → success
    - Long beep → error
- Improves user experience & clarity

Circuit Diagram_

MFRC522 Pin	Connect to ESP32
3.3V	3.3V
GND	GND
RST	GPIO 2
SDA (SS)	GPIO 5
MOSI	GPIO 23
MISO	GPIO 19
SCK	GPIO 18

I2C LCD

LCD Pin	ESP32
VCC	5V
GND	GND
SDA	GPIO 21
SCL	GPIO 22

LEDs & Buzzer

Device	ESP32 Pin
Green LED	GPIO 13
Red LED	GPIO 27
Buzzer	GPIO 14

(Use 220Ω resistor for LEDs)

System Architecture

The overall flow:

- **RFID Card → MFRC522**

- **UID is read by ESP32**

- **ESP32 checks if UID exists in student database**

- **LCD displays attendance status**

- **ESP32 sends JSON data to Google Apps Script**

- **Google Script writes the data to Google Sheets**

A complete IoT-based attendance ecosystem.

Working Principle

- When a card is placed near the RFID reader, the module reads its unique ID.

- ESP32 compares the UID with the internal data list.

- If valid, attendance is marked and uploaded to cloud.

- LCD and LEDs provide instant user feedback.

- Invalid cards trigger red LED and error messages.

Google Sheets Integration

- ESP32 sends attendance data using **HTTP POST Requests**
- Google Apps Script receives the data
- Sheet updates automatically with:
  - Roll Number
  - Name
  - Department
  - Course
  - RFID UID
  - Date
  - Time
- 100% cloud-based storage, accessible anywhere

Google Apps Script Workflow

- ESP32 sends JSON data
- Script receives and processes it
- Google Sheet appends the new attendance entry
- Timestamp is automatically generated
- Sheet acts as a real-time database
- This removes the need for MySQL or external servers.

Output / Results

System Output Includes:
- Smooth LCD UI
- Accurate RFID card detection
- Instant attendance confirmation
- Real-time cloud logging
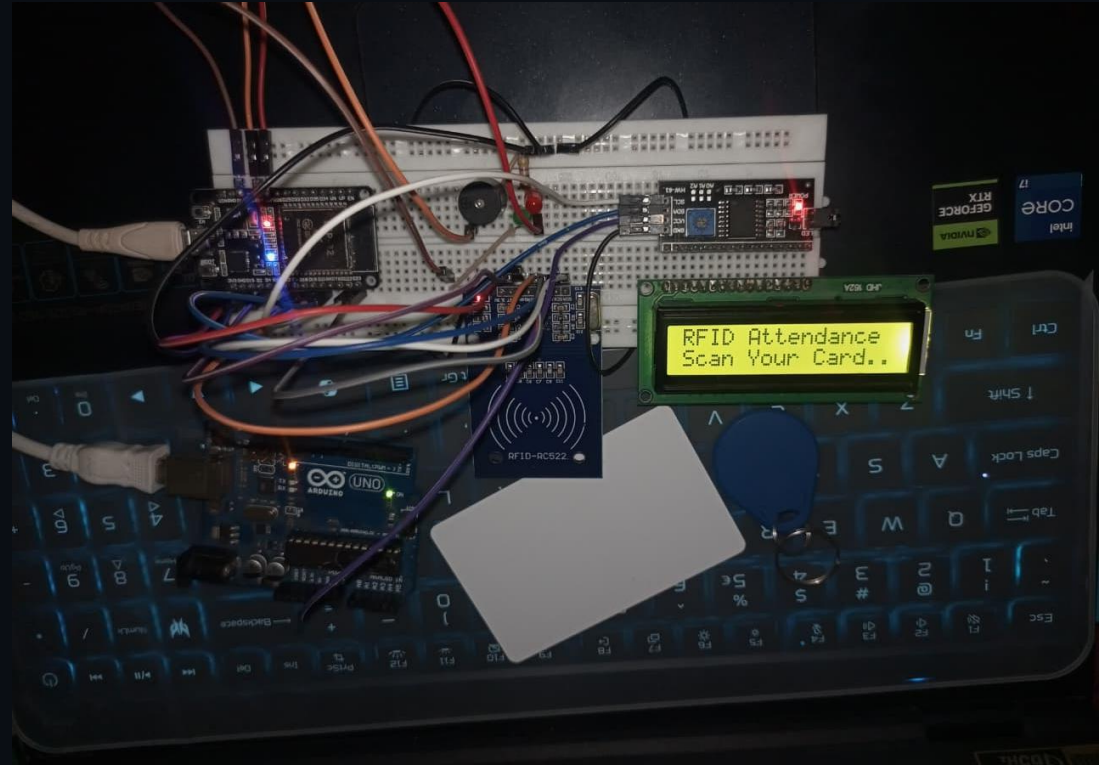- Secure and tamper-proof records

User Experience:
- Scan card → Attendance marked in under 1 second
- No manual entry required

Conclusion:

This RFID-based attendance system provides a reliable, fast, and automated method for marking attendance. It reduces human error and stores data securely in the cloud.

Future Enhancements:

- Mobile app integration
- Face recognition + RFID hybrid system
- NTP-based real-time clock
- Classroom door lock automation
- Multiple-class support
- Admin dashboard for analytics

Conclusion & Future Scope

Do you have any questions?

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Thank_
you_

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