

RFID-Based College Classroom Attendance System

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Abstract

Attendance management is a critical function in academic institutions, impacting student accountability and administrative efficiency. This project presents a modern solution—a classroom attendance management system using RFID technology, Arduino UNO, ESP32, and Google Sheets integration. The proposed solution offers error-free, tamper-proof, real-time digital attendance marking, scalable across classrooms and educational contexts.

Introduction

Background and Motivation

Manual roll call or paper attendance registers are still widely used in college classrooms, causing delays, proxy attendance, and errors. These traditional methods consume valuable class time, lack real-time data access, and are prone to faults such as loss of records or intentional malpractice. Recent advances in technology now enable educational institutions to automate and digitize attendance using RFID and IoT.

Objectives

- Develop a contactless, automated classroom attendance system.
 - Prevent proxy and false attendance.
 - Maintain secure, easily accessible digital attendance logs.
 - Provide a user- and administrator-friendly solution that is scalable to multiple classrooms.
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Problem Statement

Manual classroom attendance systems commonly face the following issues:

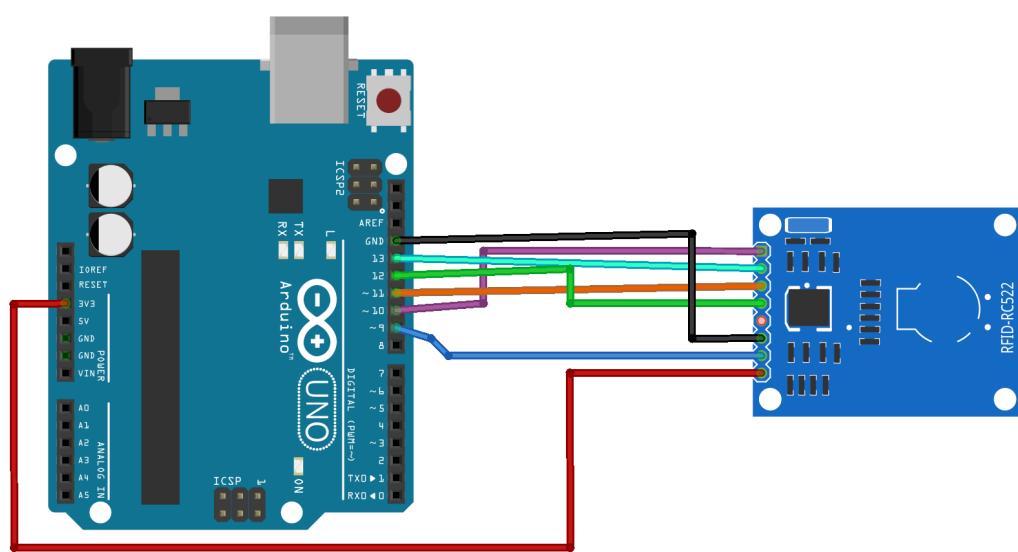
- **X** Time-consuming, especially in large classes.
- **X** Open to human error and proxy attendance.
- **X** Paper-based records can be lost or manipulated.
- **X** Difficulty in generating timely reports for parents, teachers, and administration.

Proposed Solution

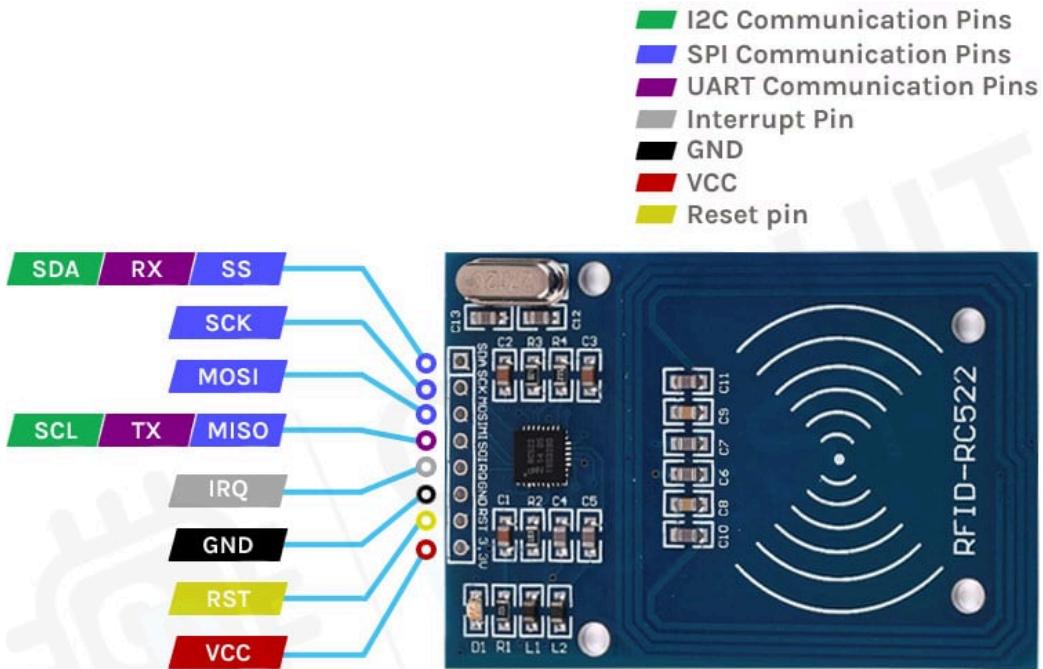
System Overview

The RFID-based classroom attendance system consists of an RFID tag/card for each student, an RFID reader at the classroom entrance, Arduino UNO for controlling and processing, ESP32 for Wi-Fi communication, and Google Sheets for real-time attendance logging.

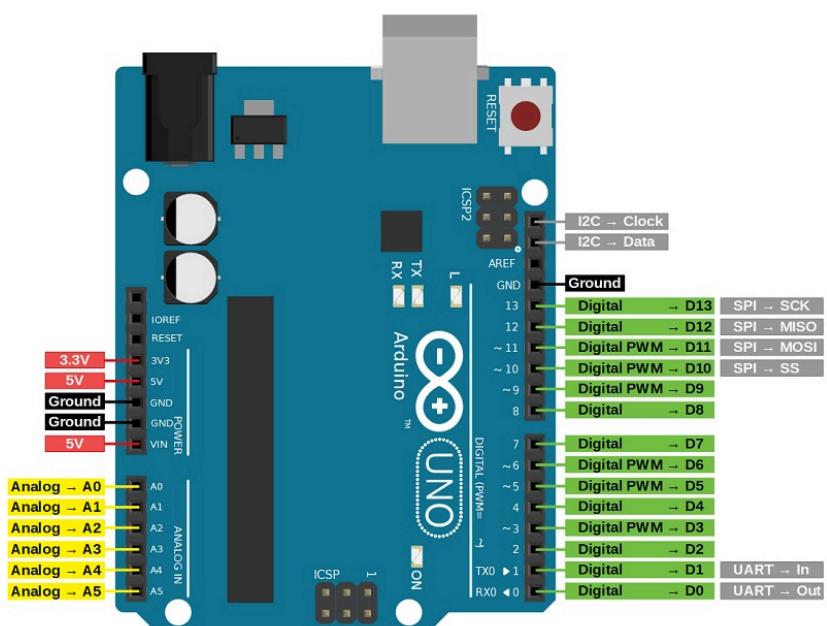
Block Diagram



fritzing



Arduino pin diagram :



Each student receives an RFID card linked to their ID.

- RFID Reader, connected to Arduino UNO and ESP32, is placed at the classroom entrance.
 - Students tap their cards to mark their presence automatically on Google Sheets through the Wi-Fi-enabled ESP32 module.
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Components Used

Component	Purpose
RFID Card	Unique student identifier
RFID Reader	Scans each student's card at the classroom entrance
Arduino UNO	Central processor controlling input/output and logic flow
ESP32	Communicates attendance to cloud over Wi-Fi
Google Sheets	Real-time, accessible attendance database
Breadboard/Wires	Circuit prototyping connections
Power Supply	Battery or USB

Methodology

Registration

- Student and RFID card mapping is recorded and enrolled in the database with student details.

Attendance Marking Process

1. The student enters the classroom and scans their RFID card at the reader.
2. The RFID ID is read and validated by Arduino UNO.
3. ESP32 sends student ID, classroom, date, and time to Google Sheets.
4. Each scan is logged in real-time; duplicate scans in a session are ignored.
5. Teachers/admins can view, analyze, or download attendance data instantly.

Software Stack

- Arduino IDE firmware for Arduino UNO and ESP32, programmed in C/C++.
- Google Apps Script or API receives data and logs attendance.
- Google Sheets with per-day and summary views.

Hardware Setup Reference

- RFID Reader near classroom entry (diagram in DOCX).
 - All connections housed in a tamper-resistant enclosure for reliability.
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Implementation Details

- RFID Reader is connected to Arduino UNO, which is programmed to poll for new cards.
 - ESP32 is set to Wi-Fi station mode and sends HTTP POST requests to a Google Apps Script Web App, interfacing with Google Sheets.
 - For each new attendance mark, the Google Sheet stores: Student Name, ID, Date, Time, and Classroom.
 - Attendance data is available for automated report generation and statistical analysis.
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Results and Testing

The prototype was tested across several classrooms. Multiple students could mark their attendance within seconds, and records appeared instantly in the cloud database. Teachers saved time, and proxy or forged attendance attempts were eliminated by unique card mapping.

Illustrative Example:

- 9:00 AM: Classroom attendance opens; students tap in.
 - 9:05 AM: Real-time log in Google Sheets shows each present student and latecomers.
 - End of session: Teacher exports attendance to Excel/PDF.
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Advantages

- ✓ No manual errors or proxies.
 - ✓ Real-time, cloud-based record secure from tampering.
 - ✓ Faster and more efficient for both students and teachers.
 - ✓ Scalable—can be used in multiple classes, labs, or large events.
 - ✓ Provides data for reporting, alarm for absentees, and trend monitoring.
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Limitations and Scope for Improvement

- RFID tag loss or damage requires quick re-issuance policy.
 - Wi-Fi dependent; offline storage or buffer needed if network fails.
 - Further security possible via dual authentication (e.g., RFID + fingerprint or face recognition).
 - Potential extension: Integrating automated email/SMS notifications for absentees.
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Future Scope

In the future, additional features could include biometric verification, auto-report cards, parental notifications, analysis dashboards, and integration with learning management systems. The RFID framework may also support access control, library management, and cashless transactions within the campus.

Conclusion

The RFID-based classroom attendance system offers a robust and scalable solution to age-old attendance management problems in colleges. The system saves time, improves accountability, and is easily extensible for other campus automation goals.

Acknowledgements

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