PROJECT ABSTRACT

RFID Attendance Logger using ESP32

A contactless RFID attendance logger built on the ESP32 with RC522 reader, DS3231 timestamping and microSD CSV logging — delivered as a built-to-order student project with firmware, card set, report, PPT and viva kit.

01. Title

RFID Attendance Logger using ESP32

02. Introduction / Background

Radio-frequency identification at 13.56 MHz (near-field communication band) lets a reader power and interrogate a passive card at a few centimetres, reading its factory-programmed unique identifier without contact or line of sight. MIFARE Classic cards — the familiar white access cards — are the cheapest embodiment of this technology. Paired with a microcontroller that can timestamp, display and log each read, UID-based RFID becomes a complete attendance pipeline: sense an identity, attach trusted time, give the user feedback, and store a durable record. The ESP32 contributes ample flash for an enrollment roster plus hardware SPI for both the reader and the storage card.

03. Problem Statement

Paper registers consume the first minutes of every lecture and make proxy attendance trivially easy. Biometric alternatives are expensive, slow in queues and raise hygiene concerns. What classrooms need is a tap-and-go system: sub-second identification, trustworthy timestamps that survive power cuts, immediate feedback to the person tapping, and a spreadsheet-ready record at day's end — all at a student's component budget and operable with no network. An ESP32-based RFID logger with battery-backed clock and SD storage meets each of these requirements directly.

04. Objectives

- Read MIFARE card UIDs through the RC522 over SPI with tap-to-feedback in under a second.
- Maintain an on-device enrollment roster (design target ~200 cards) manageable without a PC.
- Timestamp every event with a battery-backed DS3231 real-time clock.
- Show cardholder name and IN/OUT status on a 16x2 LCD per tap.

- Append timestamped rows to dated CSV files on microSD for Excel-based attendance computation.
- Suppress duplicate rows from rapid repeat taps via debounce logic.

05. Proposed Methodology

The RC522 is brought up over the ESP32's SPI bus and validated with UID dump sketches before application code. A master-card procedure implements enrollment: the master tap enters enroll mode, subsequent taps register UIDs into a flash roster with assigned names. The DS3231 is integrated over I2C with a one-time serial set procedure and verified across power cycles. The SD module is mounted over a second SPI path using a FAT library; each event appends a timestamp–UID–name–direction row to the day's CSV. A 16x2 LCD via I2C backpack gives per-tap feedback, and a configurable debounce window plus an IN/OUT mode button complete the door-side behaviour. Testing covers unknown-card rejection, power-cut timestamp retention and end-to-end CSV correctness.

06. System Architecture / Working

The RC522 continuously polls its RF field; a card tap wakes the read routine, which fetches the UID over SPI and looks it up in the flash roster. The DS3231 supplies date and time, formatted into a timestamp. The LCD displays the cardholder name with IN or OUT status (or an unknown-card warning), and the event is appended to the day's CSV on microSD. Duplicate taps inside the debounce window are discarded. Removing the SD card yields files that open directly in Excel, where a pivot table converts raw taps into the daily attendance sheet.

07. Hardware / Software Requirements

- ESP32 DevKit (dual-core, flash roster storage).
- RC522 RFID reader module (13.56 MHz, SPI; ~3–5 cm read distance).
- DS3231 real-time clock with CR2032 backup (±2 ppm).
- 16x2 character LCD with I2C backpack.
- MicroSD card module (SPI) with FAT-formatted card.
- MIFARE Classic 1K cards and keyfobs (UID-based).
- Software: Arduino IDE (C/C++ firmware); spreadsheet application for attendance computation.

08. Expected Outcomes

A working logger that registers a tap — UID read, roster lookup, RTC timestamp, LCD confirmation and CSV append — in under a second, rejects unknown cards visibly, survives power cuts with correct time, and produces dated CSV files that pivot directly into attendance sheets. The enrollment procedure runs entirely on-device via the

master card, and the roster design target of ~200 cards covers a typical class or lab batch.

09. Applications

- Classroom and laboratory attendance.
- Workshop and training-centre check-in.
- Small-office staff entry logging.
- Event and seminar participant tracking.
- Library and equipment-issue desks.

10. Future Scope

WiFi uplink would sync logs to a server dashboard automatically; a web interface could replace the master-card procedure for roster management. Anti-passback logic, shift-aware IN/OUT inference and BLE-based phone-as-card operation are natural extensions, as is migrating the roster to external flash for larger institutions.