

PROJECT ABSTRACT

RFID Warehouse Inventory Tracker with Live Stock Dashboard

An ESP32 RFID warehouse tracker with tagged bins, gate and handheld readers and a live stock dashboard. Delivered built-to-order with model aisle, firmware, dashboard, report, PPT and viva kit.

01. Title

RFID Warehouse Inventory Tracker with Live Stock Dashboard — turning bin movement into inventory data with HF RFID.

02. Introduction / Background

Small warehouses still count stock by hand — slow, error-prone and blind between counts. RFID changes the economics: a tag on every bin and a reader at the gate turns material movement into data automatically. This project demonstrates that on a model warehouse aisle: 48 tagged bins, an MFRC522 reader at the gate and a handheld reader point, all feeding an ESP32. Firmware resolves tag reads to bin identities, tracks check-in/check-out events and publishes stock levels over Wi-Fi via MQTT. The dashboard shows a live bin stock table with reorder flags, reads-per-hour graphs and unknown-tag alerts.

03. Problem Statement

The project addresses manual, infrequent stock visibility by demonstrating automatic RFID-based inventory tracking. It is honest about the technology: 13.56 MHz HF RFID reads at centimetres (approximately 3-5 cm, datasheet) — bins are presented to readers, not read at dock-door distance — with UHF portals discussed as future scope.

04. Objectives

- Tag 48 bins with RFID tags bound to SKU, quantity and reorder level.
- Read tags at a gate reader and a handheld cycle-count reader (MFRC522).
- Implement anti-collision handling for multiple tags in the field.
- Publish read events and stock updates over Wi-Fi via MQTT with immediate delivery.
- Render a live bin stock table with reorder flags and reads-per-hour graphs.
- Raise low-stock and unknown-tag alerts with event logging.

05. Proposed Methodology

Tags are registered to bins in the database with SKU, quantity and reorder level. The gate reader polls continuously; firmware runs the MFRC522 anti-collision sequence, resolves UIDs, updates last-seen timestamps and movement direction, and publishes events over MQTT. The dashboard updates the stock table, reads-per-hour and reorder evaluation on every event. The handheld reader verifies recorded stock for cycle counts. Unknown UIDs raise alerts. A tag registration procedure with expected read ranges validates the installation.

06. System Architecture / Working

The ESP32 drives both MFRC522 readers over SPI and publishes to an MQTT broker. The dashboard backend holds the bin database, persists read events and serves the stock table, graphs and alerts. A 16x2 LCD at the gate shows last-read status locally without network.

07. Hardware / Software Requirements

- Hardware: ESP32 development board, 2x MFRC522 RFID readers, 48x RFID tags (13.56 MHz), model warehouse aisle with 48 bins, 16x2 LCD gate display.
- Software: Arduino IDE (C/C++ firmware), MQTT broker, web dashboard (HTML/CSS/JS), tag registration utility.

08. Expected Outcomes

- A working model warehouse aisle with RFID-tracked bins.
- A live dashboard with stock table, reorder flags and read analytics.
- Working anti-collision multi-tag reads.
- A documented tag registration procedure.
- Complete documentation: report, PPT, viva Q&A and setup guide.

09. Applications

Small-warehouse inventory, tool-crib tracking, library stock verification, and any tagged-asset check-in/check-out process.

10. Future Scope

UHF dock-door portals for drive-through reads, ERP/WMS integration, handheld UHF sledges for full-aisle cycle counts, and tag authentication.