PROJECT ABSTRACT

RFID-Guided Warehouse Robot using Arduino

Arduino Mega robot that navigates a warehouse floor grid by reading RFID tags, executing queued pick tasks tag-to-tag with a live grid dashboard, delivered as a built-to-order student project with firmware, build guide, report, PPT and viva kit.

01. Title

RFID-Guided Warehouse Robot using Arduino

02. Introduction / Background

Warehouses locate goods with barcodes and human-operated scanners, and misplaced pallets cost real money - yet industrial AGVs are far beyond a student budget. A scaled demonstrator is the honest middle ground: a floor grid marked with cheap passive RFID tags, and a robot that reads those tags to know exactly where it is and where to go next. This project builds that demonstrator on an Arduino Mega: the under-chassis RC522 reader scans floor tags, each UID maps to a grid coordinate, and a route planner turns pick tasks into turn-by-turn driving. The report is explicit about the physics: a 13.56 MHz reader sees tags a few centimetres away, so guidance means a dense floor-tag grid, not long-range tracking.

03. Problem Statement

Student robotics projects usually navigate by line following, which teaches little about localization. The project addresses this by giving the robot absolute position fixes from the environment itself: floor RFID tags that correct the position estimate at every grid point, turning a pick list (aisle + rack) into executed routes on a demonstrator warehouse floor - with the range limits of near-field RFID stated plainly.

04. Objectives

- Build a two-motor Arduino Mega chassis with an under-mounted RC522 reader, L298N drive, IR obstacle sensor and battery telemetry.
- Implement the navigation loop: UID-to-coordinate map, tag-to-tag route planning, turn execution and speed capping near tags for reliable reads.
- Implement obstacle halt/resume behaviour and a manual-override drive mode.
- Build the dashboard (live grid, tag-scan log, task queue, manual pad) and deliver the full student kit: firmware, build guide, report, PPT and viva Q&A.

05. Proposed Methodology

The work proceeds in four stages. (1) Mechanical: the chassis kit is assembled, the reader is mounted at the tested read height, and power wiring (separate logic/motor feeds) is completed. (2) Firmware: tag reading, the UID map, the route planner and differential-drive control are implemented and unit-tested per tag. (3) Mapping: floor tags are laid in the grid and registered to coordinates with the provided procedure; reliable traverse speed is found experimentally. (4) System: the dashboard bridge is connected, task queues are executed end to end, and missed-tag rate, halt behaviour and battery endurance are logged for the report.

06. System Architecture / Working

Each floor tag's UID is registered to a grid coordinate (aisle, rack). For a pick task, the route planner computes the tag-to-tag path from the current position; the Arduino drives the motors and corrects its position at every tag read, deciding straight/left/right from the route plan. The front IR sensor halts the motors on obstruction until the path clears. Every tag read, turn decision, halt and completion is sent over the serial/Wi-Fi bridge to the dashboard's grid view, event log and task queue, which advances when the target tag is reached.

07. Hardware / Software Requirements

- Arduino Mega 2560, RC522 13.56 MHz reader, passive RFID floor tags
- L298N motor driver, 2x DC gear motors, robot chassis kit
- IR obstacle sensor, buzzer, status LEDs, battery pack
- Voltage divider for battery sensing on the Arduino ADC
- Web dashboard with serial/Wi-Fi telemetry bridge

08. Expected Outcomes

- A robot that executes queued pick tasks across a tagged floor grid, stopping at target racks.
- Measured navigation data: missed-tag rate, halt events and per-task completion logs.
- A live dashboard with grid position, tag-scan log, task queue and manual drive.
- A complete documentation set: report, PPT, viva Q&A, build and tag-registration guides.

09. Applications / Use Cases

- Demonstrating absolute localization for mobile-robotics coursework
- Teaching material for RFID physics, path execution and motor control
- Reference platform for multi-robot or UHF-tag extension studies

- Prototype logistics demonstrator for project expos (scaled, non-industrial)

10. Future Scope

- UHF RFID variant study for longer-range tag reads
- Multi-robot coordination with task allocation
- QR-code fallback localization for tag-free zones
- Payload bay with pick verification sensor