Semester Project Proposal

Title:
IoT-Based RFID Smart Car Attendance System
Group Members:

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Category:
Yes, the project has **mobility**. It's a **small car** controlled by an **ESP32** and **L298N motor driver** on **DC** motors. The car moves **autonomously** for a set **distance or time**, stops at RFID checkpoints, scans tags to **mark attendance**, and then continues moving to the next point.

Description:
In our project we aim to automate the attendance process in a creative and mobile way. Instead of requiring students or employees to move toward a scanner, our system brings the scanner to them in the form of a **small moving car**.
This smart car is built using an **ESP32 microcontroller**, an **L298N motor driver**, and **DC motors** that allow it to move autonomously. An **RFID module** is mounted on the car, which will scan **RFID tags** of different students. Each tag represents a person's ID. When the car passes near a tag, it an individual will scan its card, marks attendance, and transmits the data wirelessly through WiFi (using the ESP32) to a connected system such as Google Sheets.
The car's movement is **pre-programmed** it moves forward for a specific **distance or time**, stops to scan, and then continues to the next checkpoint. This makes the system **completely autonomous**, without needing human control or remote operation.

Traditional attendance systems require manual scanning or stationary setups. Our idea was to reverse the process instead of people moving toward the system, the system moves toward them.

Full Pipeline

1. **Initialization:**
   The ESP32 initializes the RFID reader and motor driver.
2. **Movement:**
   The car moves forward for a set distance or time using motor control signals.
3. **RFID Detection:**
   It stops and person scans its card or tag on the scanner
4. **Attendance Logging:**
   The ESP32 sends the scanned ID to a cloud database or serial monitor.
5. **Stop & Resume:**
   After scanning, the car stops for a short delay, then resumes to the next location.
6. **Completion:**
   After scanning all checkpoints, the car stops, indicating that attendance collection is complete.

The **hardware challenge** is the binding of all the components safely without damaging them. The **software challenge** is the programming that enables ESP 32 to control motordriver and RFID at the same time.

Usecase:
The system will be used in schools or offices where the car moves through rows of students or employees, **scanning their RFID tags** to mark attendance without manual input. Users only need to **carry their RFID card**, and the car handles all scanning and recording.

User Action	Product Reaction
User places RFID tag near car	Car scans and marks attendance
User is out of RFID range	No attendance recorded
Car reaches checkpoint	Car stops and scans tag
All tags scanned	Car stops and displays “Attendance Complete”

Modules:
1. Motion Control Module: Controls car movement using ESP32 and L298N, moves based on preset time/distance. *(Rule-based motor control)*
2. RFID Scanning Module: Reads RFID tags at checkpoints to identify users and mark attendance. *(RFID tag detection algorithm)*
3. Data Logging Module: Stores or uploads attendance data to a database or cloud via WiFi.

Hardware Components:
The main hardware components identified for the project include an **ESP32 microcontroller**, **L298N motor driver**, **RFID module (RC522)**, **RFID tags/cards**, **DC motors with wheels**, a **power supply or battery pack**, and a **chassis for the car**. Optional components may include **LED indicators** for status display.

Contribution:
Hardware: We will be making the **car chassis** ourselves by combining wheels, DC motors, and a frame, customized to hold the **ESP32, L298N, and RFID module** securely.
Software: We will develop a our own program that integrates **time/distance-based motion with RFID scanning and attendance logging**, specifically for this project.

Outsourcing:
Hardware: The RFID module (RC522), L298N motor driver, DC motors, wheels, and battery pack are pre-assembled/purchased components.
Software: No core functionality is outsourced, all movement control, RFID scanning, and attendance logging code will be developed by us.

Minimum viable product:

1. **Motion Control (individually):** The car moves autonomously for a set distance or time using the ESP32 and L298N motor driver.
2. **RFID Scanning (with data logging):** RFID scanner will be able to scan and update the attendance to the sheets.
3. **Data Logging:** Attendance data from scanned tags is stored or uploaded to a sheet.

This minimum version still addresses the **main hardware challenge** of assembling all the components together and the **main software challenge** (integrating movement with real-time RFID scanning and data logging).

Diagram: