

PRE-BOOKING SMART PARKING SYSTEM

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Abstract: The Pre-Booking Smart Parking System is designed to simplify parking by allowing users to book parking spots in advance, reducing the difficulty of finding available spaces. The system utilizes RFID for secure access, IR sensors to detect parking slot occupancy, automatic gates controlled by motors, and Arduino for system management. Accessible through a website, this solution reduces traffic congestion, minimizes fuel consumption, and contributes to a greener environment by improving parking efficiency and cutting down on carbon emissions.

Index Terms: parking slots, RFID card, booking, payment

I. INTRODUCTION

As urban areas expand and vehicle numbers rise, parking management has become increasingly challenging. The time spent searching for available spaces leads to traffic congestion, increased fuel usage, and environmental pollution. The Pre-Booking Smart Parking System solves these problems by enabling users to reserve parking spots in advance, offering a hassle-free parking experience.

The system combines advanced technologies like RFID for secure identification, IR sensors for monitoring parking space availability, and motors for gate automation, all controlled by an Arduino microcontroller. This integration ensures smooth operation of the entire system.

The system is accessible via a web interface, where users can check real-time parking availability, make, cancel, or modify bookings. This minimizes time spent looking for parking, optimizes space usage, and lowers fuel consumption, contributing to sustainability.

Flexible and scalable, this solution is ideal for both public and private parking facilities in modern urban environments.

II. LITERATURE SURVEY

- **[1] Sharigia Arif (2022):** Developed a smart parking system using Arduino UNO that eliminates the need for users to search for parking. The system only opens the parking gate when an available space is detected, and if the parking lot is full, a message is displayed.
- **[2] Mohan P. Thakre et al. (2021):** Proposed an IoT-based smart parking system that shows vacant parking slot numbers on an LCD display as vehicles approach. The system checks the availability of parking slots and displays the number of available slots on the screen.
- **[3] K. Narayana Krishna et al. (2024):** Introduced a parking system that uses computer vision and deep learning to analyze parking lot occupancy. The system divides the parking area into blocks and provides real-time updates on available spaces.
- **[4] Jaafar Ahmed Abdulsahab et al. (2024):** Developed a smart parking system using IoT, which includes a smartphone app, RFID, and Arduino to detect parking space availability and guide users efficiently.
- **[5] Iparkisa (2021):** Proposed an automated system that tracks the entry and exit of vehicles. It displays the total number of parked cars and available spaces in real-time.
- **[6] Mahmoud Y. Shams and Amira A. Elsonbaty (2020):** Designed a system that allows users to check available parking spaces and reserve spots. The system uses IR sensors to detect car presence, and Wi-Fi connectivity transmits the data to a server, which is accessible through a mobile app.

III. METHODOLOGY

This system combines various components to enable users to pre-book parking spaces.. Key components include:

- **RFID Reader Module (EM-18):** Used for user authentication through RFID cards.
- **Arduino Uno:** Serves as the main controller for managing the system.
- **IR Sensors:** Detect the presence of vehicles at parking slots and gates.
- **Servo Motors:** Control the operation of the entry and exit gates.
- **16x2 LCD Display:** Shows parking space availability and other information.
- **Wi-Fi Module:** Allows the system to communicate with the central server.
- **Power Supply:** Powers all system component

IV. BLOCK DIAGRAM

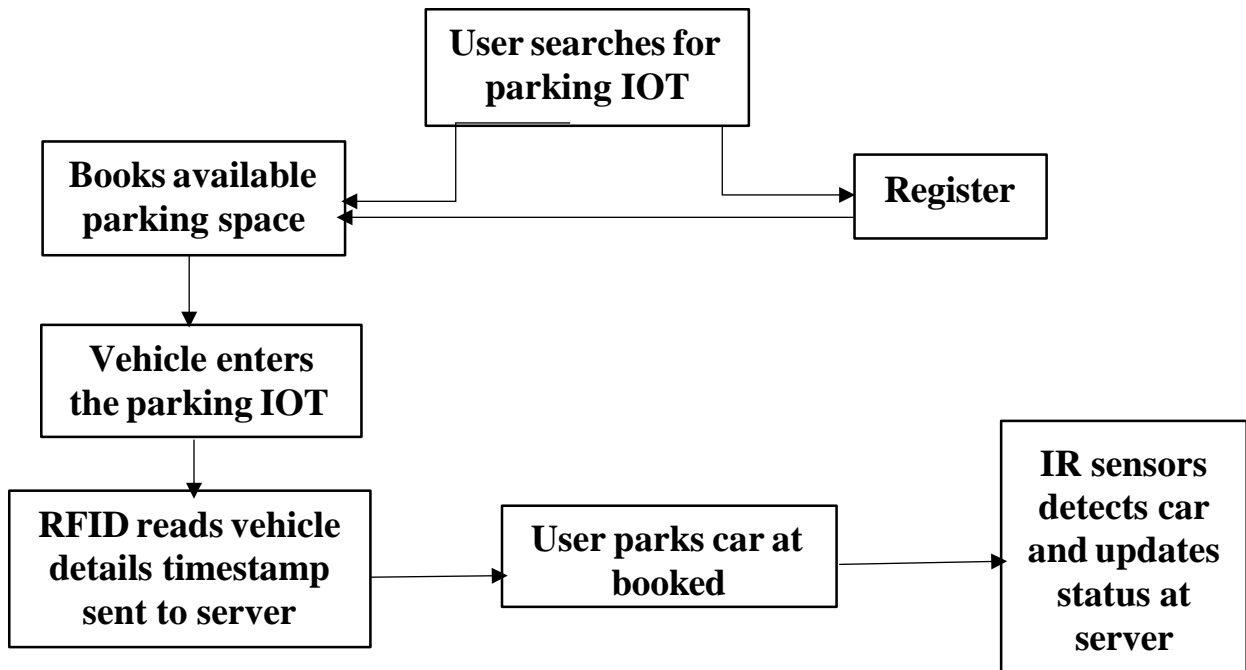


Fig1;- Entry of vehicle

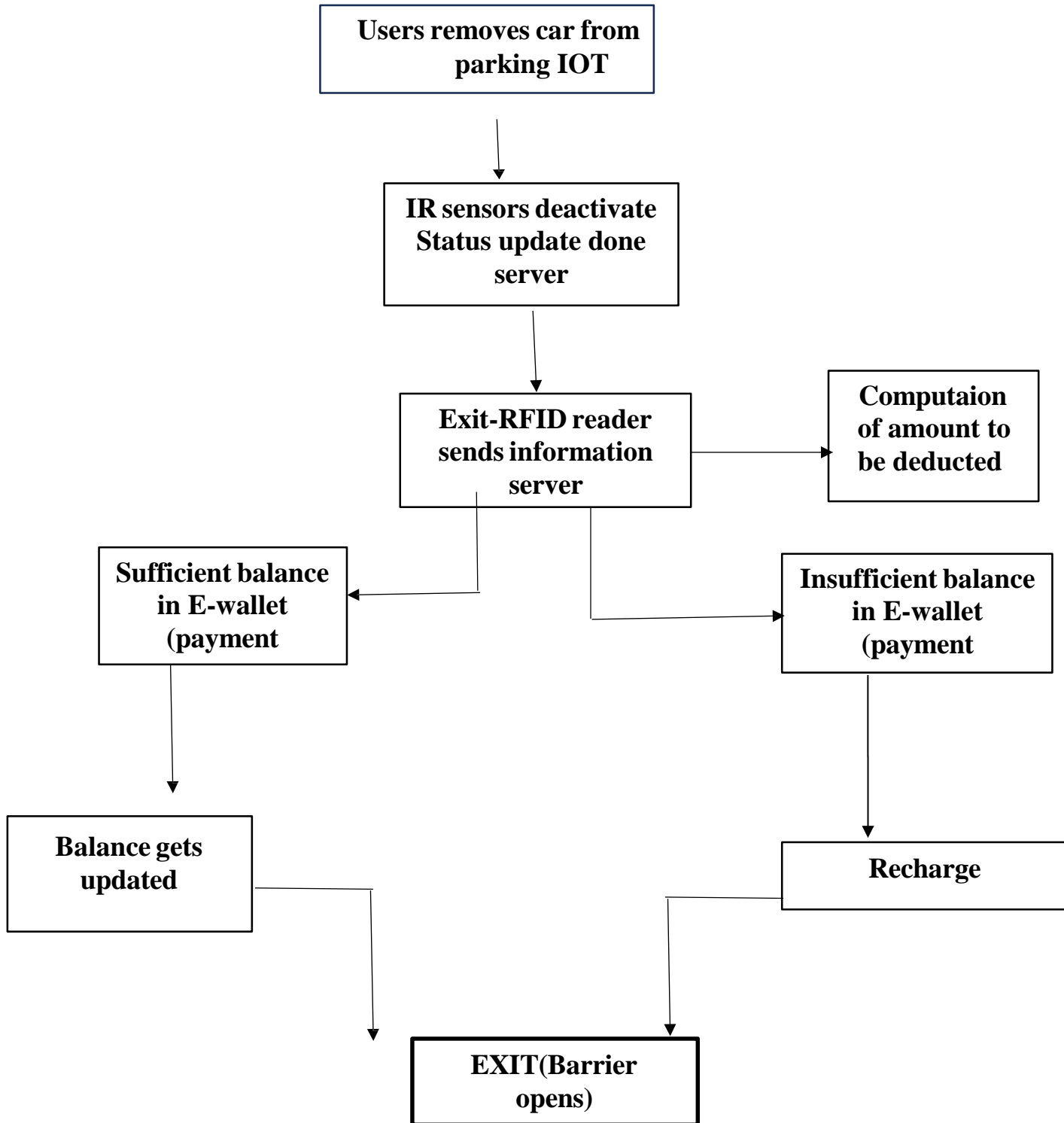


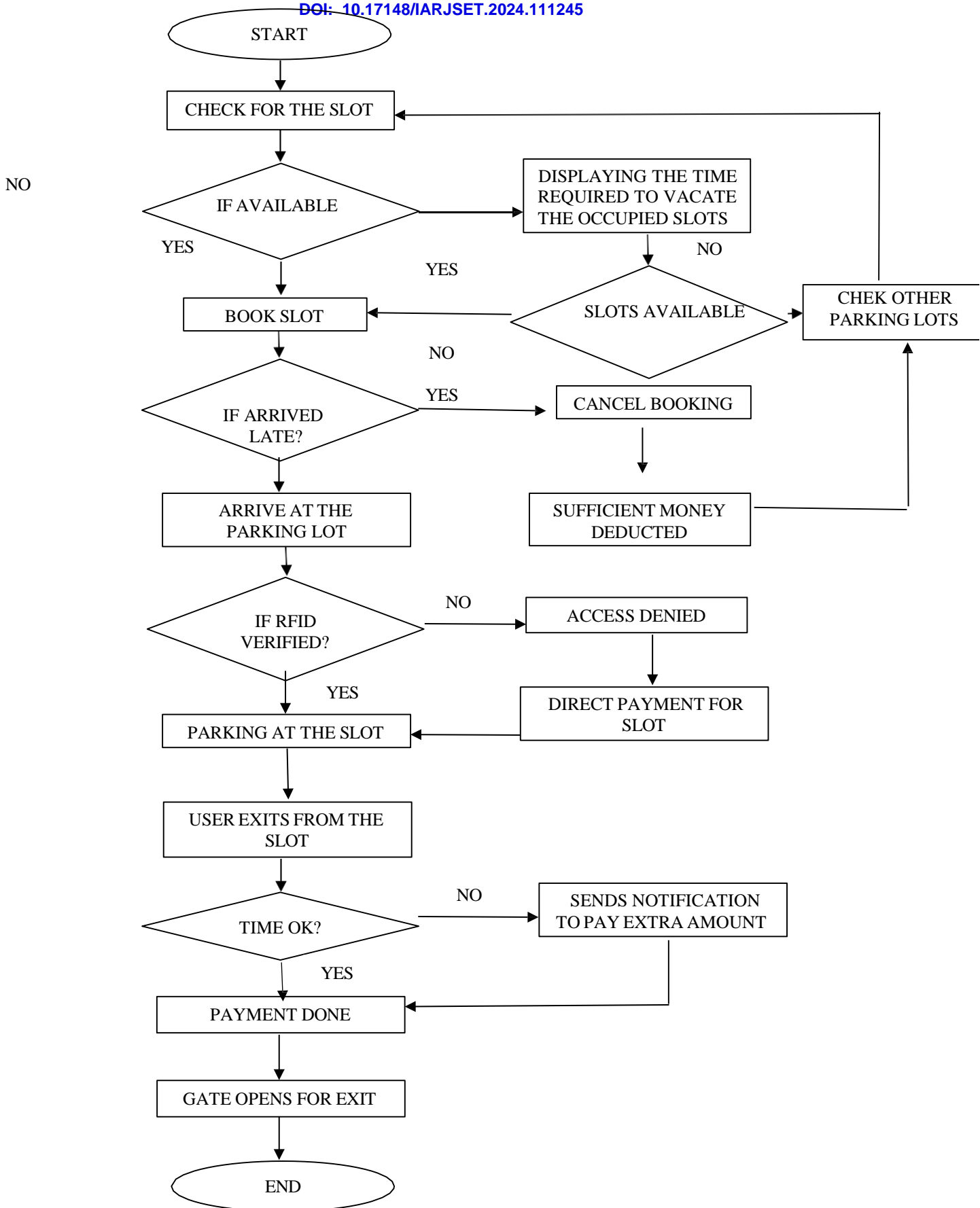
Fig2:- Exit of vehicle

**V. WORKING**

Users prebook parking slots using a website, and the system assigns a unique slot ID linked to their RFID tag. At the parking lot, the user scans their RFID tag at the entry gate's RFID reader module. The reader communicates the tag ID to the Arduino, which verifies it against the prebooking data stored locally or fetched from a central server via a Wi-Fi module (if used). If the tag ID is valid, the Arduino triggers the servo motor to open the entry gate. An IR sensor at the gate ensures that the gate remains open until the vehicle fully enters and closes it afterward. Inside the parking lot, IR sensors installed at each parking slot monitor real-time slot occupancy and update the system's database. A 16x2 LCD display positioned at the start gate shows slot availability, guiding users to their prebooked slot or other available slots.

For exit, the user scans their RFID tag at the exit gate's reader module. The system verifies the parking session and calculates any applicable parking fee. Upon successful verification or payment, the Arduino commands the servo motor to open the exit gate. An IR sensor ensures the gate remains open until the vehicle has exited completely. The parking slot status is then updated as vacant, and the LCD display reflects the change.

FLOWCHART



VI. RESULT

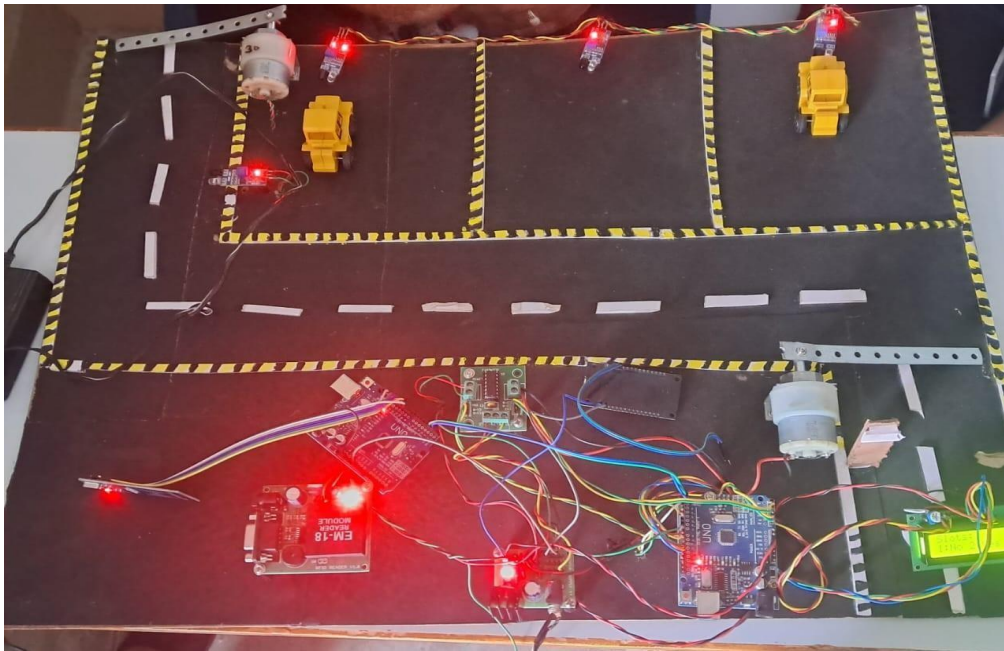


Fig3:- Demonstration project



Fig4:- Before the entry of the vehicle

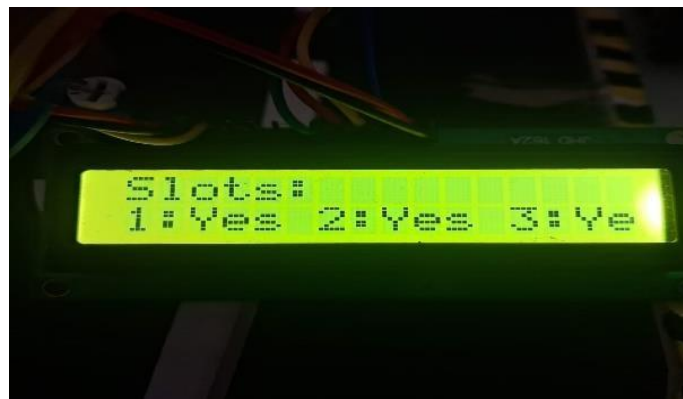


Fig5:- Slots available



Fig6:- Accepted RFID Card

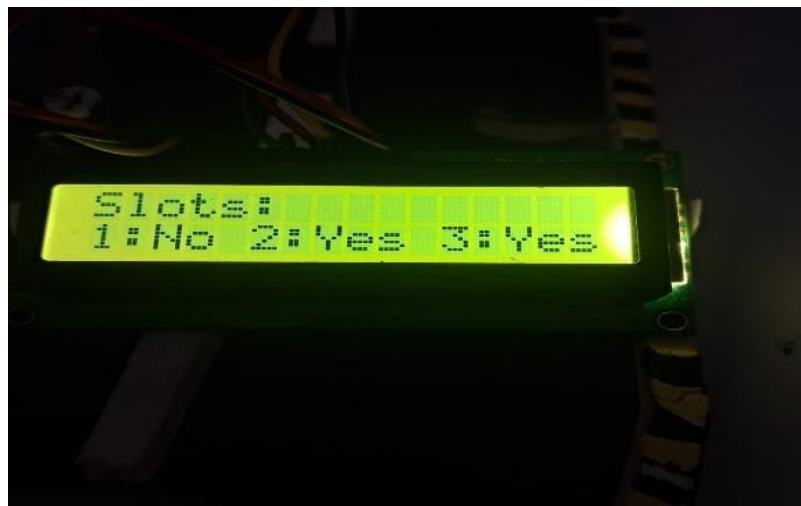


Fig7:- Slot one parked



Fig8:- Exit of the vehicle

VII. APPLICATIONS

- Shopping Malls and Commercial Complexes
- Airports and Railway Stations
- Corporate Offices
- Smart Cities
- Residential Complexes
- Event Venues and Stadiums
- Hospitals
- Educational Institutions
- Tourist Attractions

VIII. CONCLUSION

The **Pre-Booking Smart Parking System** represents a significant advancement in parking management by leveraging modern technology to improve user convenience and optimize resource utilization. By enabling users to reserve parking spaces in advance, the system reduces the time and stress associated with finding available spots, especially in crowded areas. It efficiently manages parking resources through real-time data integration and reservation mechanisms, ensuring optimal usage without overbooking or underutilization. The integration of technologies such as RFID modules, IR sensors, servo motors, and Arduino demonstrates the power of IoT in creating smart, responsive systems.

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