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Multi-level Car Parking System

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ABSTRACT:

The project titled "Multilevel Car Parking System" with RFID Authorization and Automated Spot Detection presents a sophisticated solution to the challenges faced in traditional car parking systems. The system is designed to efficiently manage parking spaces in a building, integrating RFID technology for user authorization and IR sensors for automated spot detection.

The system incorporates two distinct pathways, one for entrance and the other for exit, ensuring smooth traffic flow within the parking facility. Authorized users are granted access through RFID authentication, ensuring that only permitted individuals can enter the parking premises. Upon entry, users are guided to available parking spots through a display screen that showcases real-time information about vacant parking spaces on each floor.The implementation of IR sensors at every parking spot enables automated detection of vacant spaces, eliminating the need for users to manually search for parking spots. This feature not only enhances user experience but also optimizes space utilization within the parking facility.Overall, the Multilevel Car Parking System with RFID Authorization and Automated Spot Detection offers a comprehensive solution for efficient, secure, and user-friendly parking management in urban environments.

Index Terms - User Authorization, Automated Spot Detection, Space Utilization, RFID Technology.

Introduction :

A multilevel car parking system, also known as a multi-story or automated parking system, is a modern and efficient solution designed to optimize the use of limited urban space for parking vehicles. This innovative approach to parking management addresses the challenges of increasing urbanization, limited land availability, and the growing number of vehicles on the road.

As urban areas continue to expand and population densities rise, the demand for parking spaces in cities has become a pressing issue. Traditional surface parking lots and on-street parking can no longer suffice to accommodate the ever-increasing number of vehicles. This is where multilevel car parking systems come into play, offering an ingenious solution to the urban parking crisis.

A multilevel car parking system is a technologically advanced method of parking that maximizes the utilization of available space by stacking multiple levels of parking spaces vertically or horizontally. Unlike conventional parking lots, where vehicles are parked side by side, these systems efficiently organize vehicles in a more compact and automated manner.

Index Terms – Automated parking System, Urban Space, Population density rise.

EXISTING HARDWARE

There are several hardware components that are commonly used for crop protection, including

1. **Hydraulic Systems:** Many multilevel car parking systems in India utilize hydraulic lifts to vertically move vehicles between different levels. These systems are efficient and commonly used due to their reliability and relatively low maintenance.

2. **Puzzle Parking Systems:** Puzzle parking systems are another popular choice in India. These systems use a combination of horizontal and vertical movements to stack cars in a compact space, optimizing the available area for parking.

3. **Automated Parking Systems:** Automated parking systems are gaining popularity in urban areas of India due to their efficiency and space-saving benefits. These systems use robotics and automation to transport vehicles to designated parking spots without the need for human intervention.

4. **Stack Parking Systems:** Stack parking systems are widely used in India, especially in densely populated cities where space is limited. These systems stack cars vertically using mechanical platforms or lifts, allowing for efficient use of vertical space.

5. **Mechanical Parking Systems:** Mechanical parking systems rely on mechanical components such as lifts, conveyors, and turntables to move vehicles to different levels or slots within a parking structure. They are commonly used in India to maximize parking capacity in constrained urban environments.

6. **Semi-automated Parking Systems**: Semi-automated parking systems combine manual operation with automation to facilitate parking. Users typically drive their vehicles onto a platform or into a designated space, and the system handles the rest of the parking process automatically. These systems are often found in commercial and residential complexes in India.

While multilevel car parking systems offer numerous benefits, including efficient space utilization and increased parking capacity, they also come with certain limitations that hinder their widespread implementation in every location. Firstly, the initial setup cost for these systems can be significantly high, making them financially unfeasible for many areas, especially in smaller towns or less affluent regions. Additionally, the maintenance and operational costs of such systems can be substantial, requiring specialized technical expertise for upkeep. Furthermore, multilevel parking systems often require a considerable amount of land, which may not be available in densely populated urban areas where parking demand is highest. Moreover, these systems rely on electricity and mechanical components, making them susceptible to power outages and mechanical failures, which could disrupt parking operations. Lastly, there are logistical challenges associated with user accessibility and safety regulations, which must be carefully addressed to ensure smooth operation and compliance with local laws. Thus, while multilevel car parking systems offer innovative solutions to urban parking challenges their implementation is constrained by various factors, limiting their universal adoption. The proposed Multi-level Car Parking system addresses many of these limitations by providing a cost-effective and efficient solution that can be deployed in urban areas.

WORKING METHODOLOGY

- **RFID Authentication:**
  - The RFID authentication process begins when a vehicle approaches the entrance gate.
  - The RFID reader scans the RFID tag attached to the vehicle or held by the driver.
  - The RFID reader sends the unique identification code from the tag to the microcontroller for verification.
  - The microcontroller checks the received code against the authorized codes stored in its memory.
  - If the code is authenticated, the microcontroller sends a signal to the motorized gate mechanism to open the gate.
  - Once the gate opens, the vehicle is allowed to enter the parking facility.

- **IR Sensor Parking Detection:**
  - Inside the parking facility, each parking spot is equipped with IR sensors positioned to detect the presence of vehicles.
  - When a vehicle is parked in a spot, the IR sensor associated with that spot detects the presence of the vehicle.
  - The IR sensor sends a signal to the microcontroller indicating that the spot is occupied.
  - The microcontroller updates the LCD display to reflect the status of the parking spot, marking it as occupied.
  - If the vehicle leaves the spot, the IR sensor detects the absence of the vehicle and informs the microcontroller.
  - The microcontroller updates the LCD display to show that the spot is vacant again, ready for another vehicle to park.

- **Security Measures:**
  - A buzzer is integrated into the system to provide an audible alert in case of unauthorized access attempts.
  - If someone tries to enter forcefully without presenting an RFID tag or with an invalid tag, the buzzer activates to alert security personnel.
  - The security personnel can then take appropriate action to address the security breach and prevent unauthorized access to the parking facility.

- **Motorized Gate Operation:**
  - After successful RFID authentication, the microcontroller sends a signal to the motorized gate mechanism to open the gate.
  - The gate opens smoothly, allowing the authenticated vehicle to enter the parking facility.
  - Once the vehicle passes through the gate, the microcontroller sends another signal to the gate mechanism to close the gate automatically.
  - This automatic gate closure prevents unauthorized vehicles from entering the parking facility without proper authentication.

- **Lift Mechanism:**
  - To optimize space utilization and reduce congestion at the entrance, a lift mechanism is installed for vehicle retrieval.
  - When a vehicle wants to exit the parking facility, it drives onto the lift platform located at the exit level.
  - The lift mechanism raises the vehicle to the ground level, bypassing the entrance traffic.

- Once the vehicle reaches the ground level, it can exit the parking facility smoothly without encountering any traffic congestion at the entrance.

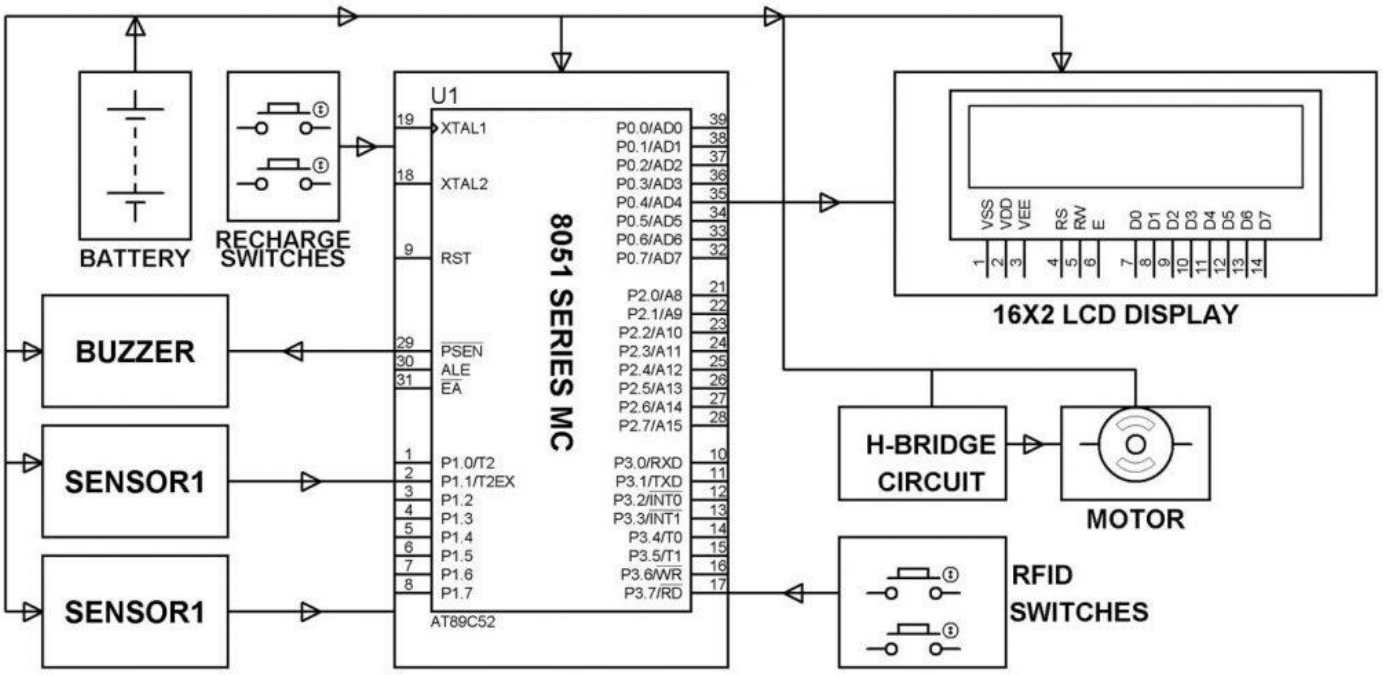

Figure 1: Circuit Diagram

BLOCK DIAGRAM

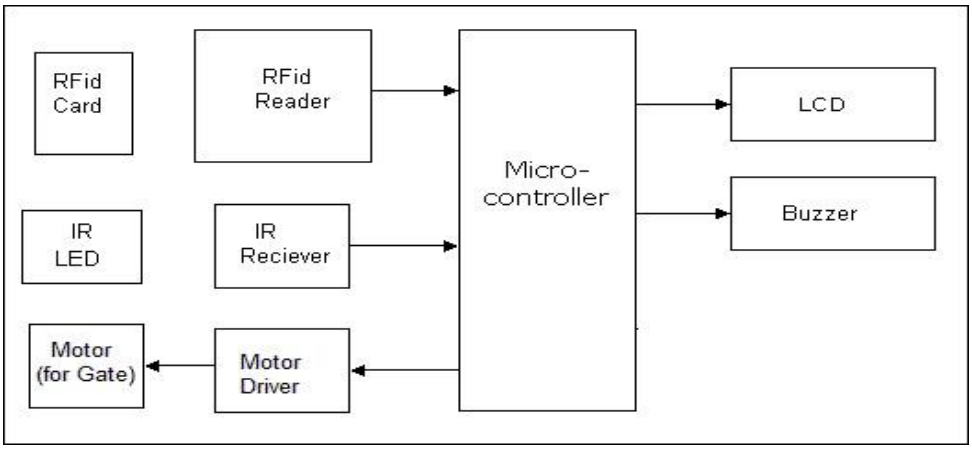

Figure 2: Block Diagram

HARDWARE DETAILS

8051 Series Microcontroller:

Figure 3: 8051 Microcontroller

At the heart of the Multilevel Car Parking System is the 8051 series microcontroller, which serves as the central processing unit. It coordinates the operation of various system components, including the LCD, buzzer, IR sensors, RFID reader, and servo motor. Programmed with the system's logic and functionalities, the microcontroller receives inputs from sensors, processes data, and sends commands to actuators, ensuring seamless operation and effective management of the parking facility. Its versatility, reliability, and ease of programming make it an ideal choice for controlling complex systems like the multilevel car parking system.

RFID

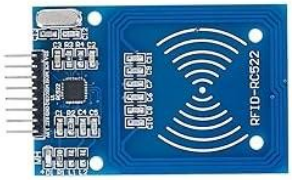

Figure 4: RFID

The RFID (Radio Frequency Identification) reader and receiver form the core of the authentication system, allowing only authorized individuals to access the parking facility. Each user is provided with an RFID tag containing a unique identification code. When a vehicle approaches the entrance gate, the RFID reader scans the tag, and if the code is authenticated, the gate opens automatically. This system enhances security by preventing unauthorized access and streamlining the entry process for registered users.

IR Sensor

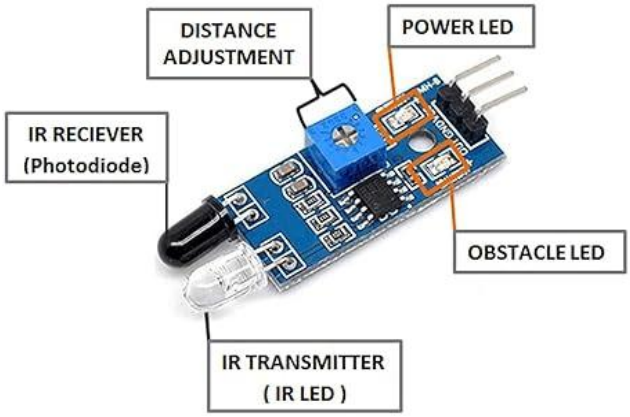

Figure 5: IR Sensor

Incorporated into each parking spot, IR sensors detect the presence of vehicles and relay this information to the microcontroller. These sensors work by emitting infrared light and measuring the intensity of the reflected signal. When a vehicle occupies a spot, the infrared beam is interrupted, signaling to the microcontroller that the spot is occupied. This data is then used to update the LCD display, providing users with real-time information on parking spot availability.

LCD (Liquid Crystal Display)

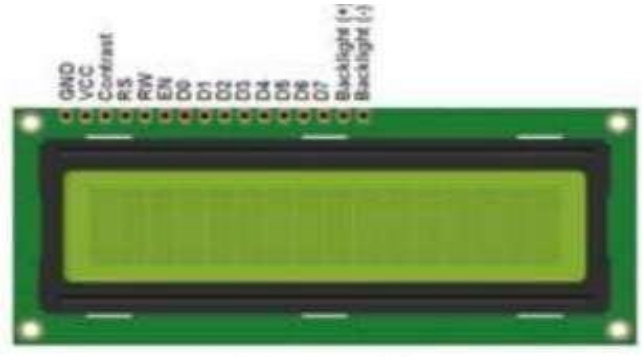

Figure 6: LCD (16 X 2)

A liquid crystal display (LCD) is a type of flat panel display that uses the light-modulating properties of liquid crystals to produce images or text. The 16x2 LCD display is a common type of LCD module that displays two lines of 16 characters each. In the proposed IoT-based crop protection system, a 16x2 LCD display can be used to provide real-time feedback on the status of the system. The display can be connected to the Raspberry Pi or ESP8266 to show the system's current state, such as the status of the camera, the detection of any stray animal movement, or the battery level. The LCD display can also be used to provide error messages, such as when there is a problem with the system's connectivity or when the battery level is critically low. This information can be used by farmers to quickly identify and resolve any issues with the system, ensuring its reliable operation. The 16x2 LCD display is compact and easy to use, making it an ideal choice for IoT-based systems that require a small form factor. It is also low power, which is crucial for IoT-based systems that rely on battery power. With its ability to provide real-time feedback and error messages, the LCD display can enhance the functionality and reliability of the proposed IoT-based crop protection system.

Servo Motor

Figure 7: Servo Motor

The servo motor is responsible for controlling the movement of the gate in the parking system. It is connected to the microcontroller and operates based on the instructions received from the RFID authentication process. Upon successful RFID verification, the microcontroller sends a signal to the servo motor, causing it to open the gate, allowing the vehicle to enter. The servo motor ensures precise and controlled movement, contributing to the overall efficiency and reliability of the parking system.

HARDWARE RESULT

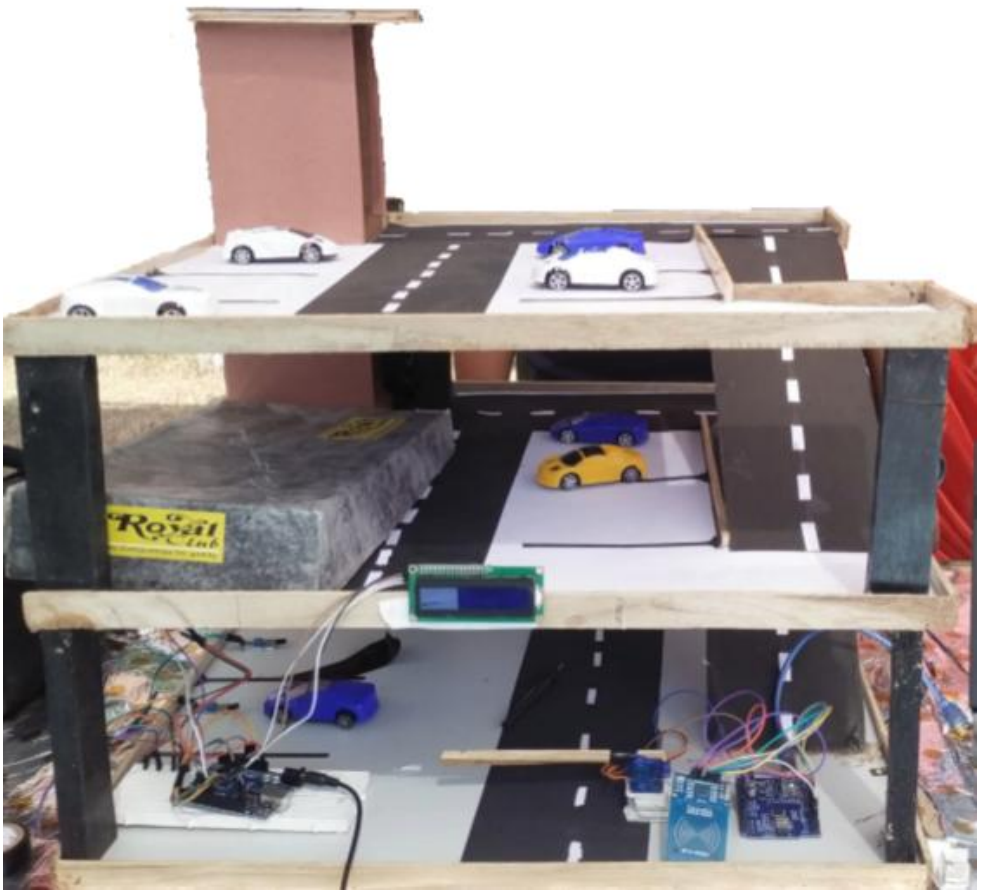

Figure 8: Final Hardware Design

CONCLUSION :

The Multilevel Car Parking System with RFID Authentication represents a significant advancement in urban parking infrastructure. By seamlessly integrating RFID technology, IR sensors, a motorized gate, an LCD display, and a lift mechanism, this system offers a holistic solution to the challenges of modern parking. Through RFID authentication, the system ensures that only authorized individuals can access the parking facility, enhancing security and preventing unauthorized use. The IR sensors enable real-time monitoring of parking spot availability, allowing drivers to quickly locate vacant spots without the hassle of manual searching. Moreover, the motorized gate facilitates smooth entry and exit of vehicles, while the lift mechanism eliminates congestion at the entrance by providing an alternative route for vehicles exiting the facility. This not only enhances user convenience but also contributes to improved traffic flow in urban areas. In conclusion, the Multilevel Car Parking System with RFID Authentication not only addresses the immediate needs of efficient and secure parking but also lays the foundation for future advancements in urban mobility. By leveraging cutting-edge technologies, this system represents a vital step towards creating smarter, more sustainable cities.

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