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Design and Development of Number Plate Recognition Based Smart Parking System

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Abstract: Parking management has become difficult due to the increasing number of vehicles in urban areas. Traditional parking systems require manual monitoring, which can lead to errors and delays. This paper proposes a smart automatic car parking system using Number Plate Recognition (NPR) technology. The system captures vehicle number plates using a camera and processes them with image processing techniques. It records the entry and exit time of vehicles and calculates the parking duration automatically. Based on the duration, the system generates the parking fee, improving efficiency, security, and reducing manual work.

Keywords: Smart Parking System, Number Plate Recognition, Image Processing, Vehicle Detection, Automated Parking.

INTRODUCTION

The rapid increase in vehicles has created major parking problems in urban areas. Traditional parking systems depend on manual monitoring, which is time-consuming and may lead to errors. To solve this issue, smart parking systems using advanced technologies have been developed. Automatic Number Plate Recognition (ANPR) is one such technology that identifies vehicles through their number plates using cameras and image processing. In this system, vehicle entry and exit are automatically recorded, parking duration is calculated, and billing is generated, improving parking efficiency and reducing manual work.

PROBLEM STATEMENT

Parking management in urban areas has become difficult due to the increasing number of vehicles. Traditional parking systems mainly rely on manual monitoring and record keeping, which can lead to errors, delays, and inefficiency. Drivers often face difficulties in finding parking spaces, and security issues may also arise due to lack of proper vehicle tracking. Manual billing and record maintenance require more time and effort. Therefore, an efficient automated parking management system is required to improve vehicle monitoring, reduce manual work, and provide accurate parking duration and billing

PROPOSED IDEA

The proposed system is designed to automate the parking management process using number plate recognition technology. A camera is installed at the parking entrance and exit to capture vehicle images. When a vehicle enters the parking area, the camera captures the number plate image. The image processing module detects the number plate region and extracts the characters. The system stores the vehicle number and entry time in a database. when the vehicle exits the parking area, the camera again captures the number plate. The system matches the number plate with the stored records. It calculates the parking duration and generates the parking bill automatically. This automated process reduces manual work and improves the accuracy of parking management.

METHODOLOGY:

The proposed smart parking system is designed using Arduino UNO and several electronic components such as an IR sensor, LCD display, servo motor, and power supply. The IR sensor is placed near the entry and exit gate to detect the presence of a vehicle. When a vehicle approaches the gate, the IR sensor detects it and sends a signal to the Arduino UNO.

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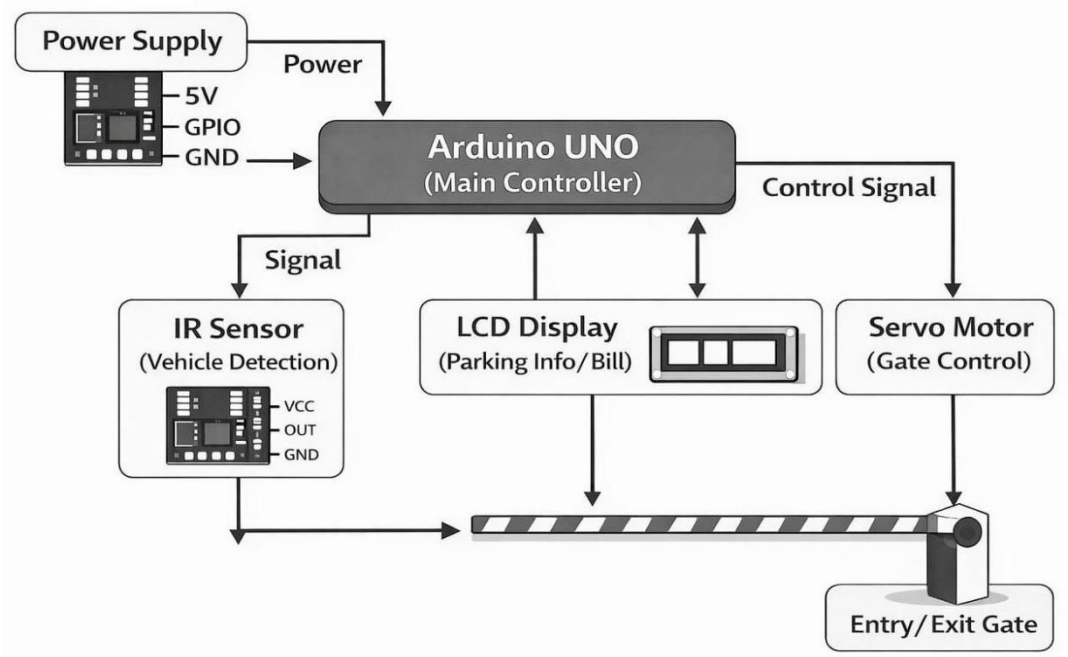
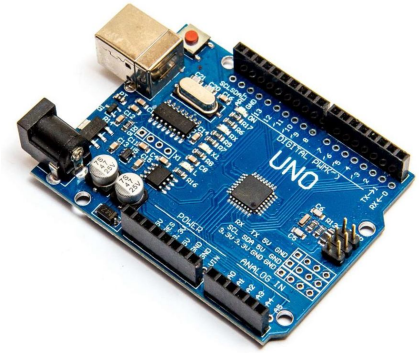
The Arduino acts as the main controller and processes the received signal. Based on this signal, the Arduino controls the servo motor to open the gate automatically. After the vehicle passes through the gate, the servo motor closes the gate. The LCD display shows messages such as vehicle entry or exit status. This process is repeated for each vehicle, allowing the system to manage parking automatically and reduce manual effort effectively.

BLOCK DIAGRAM:



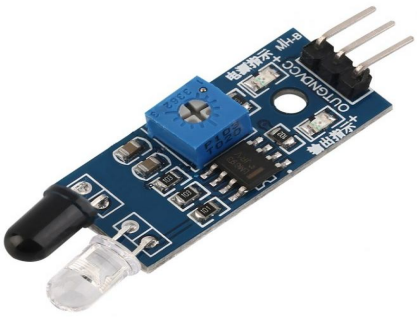
The system consists of components such as a power supply, Arduino UNO, IR sensor, LCD display, servo motor, and an entry/exit gate. The power supply provides electrical energy to operate the system. The IR sensor detects the presence of a vehicle at the gate and sends a signal to the Arduino UNO. The Arduino processes this signal and controls the servo motor to open or close the gate. At the same time, the LCD display shows parking information or billing details to the user.

COMPONENTS USED:



Arduino UNO

Arduino UNO is a microcontroller board based on the ATmega328P. It is used as the main controller in many embedded systems and electronics projects. In this parking system, Arduino UNO receives signals from the IR sensor and controls the LCD display and servo motor to manage the entry and exit gate automatically.



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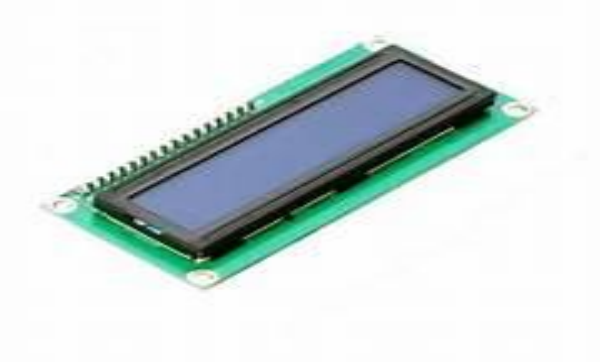
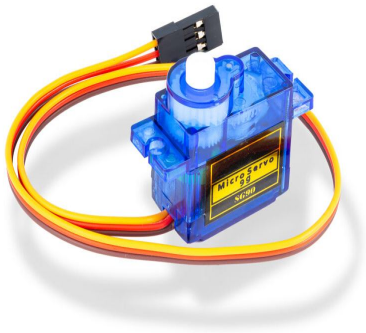
IR SENSOR

An IR sensor is used to detect the presence of a vehicle using infrared light. When a vehicle comes near the sensor, it sends a signal to the Arduino UNO. The Arduino processes this signal and controls other components like the servo motor and LCD display to performautomatic parking operations.



LCD Display

An LCD display is used to show information in the parking system. It displays messages such as vehicle entry, exit status, and parking details. The display helps users understand the system status easily. It receives signals from the Arduino UNO and presents the information clearly on the screen.



SERVO MOTOR

A servo motor is used to control the opening and closing of the parking gate. It operates based on signals received from the Arduino UNO. When a vehicle is detected by the IR sensor, the Arduino sends a command to the servo motor to rotate and open the gate automatically.

CONCLUSION

The smart automatic car parking system provides an efficient solution for managing parking areas using simple electronic components and automation. Arduino UNO acts as the main controller that manages the operation of the IR sensor, LCD display, and servo motor. The IR sensor detects vehicles at the entry and exit points and sends signals to the Arduino. Based on the signal, the servo motor opens or closes the gate automatically. The LCD display shows parking information to the user. This system reduces manual work, improves efficiency, and provides better parking management. In the future, the system can be improved using advanced technologies such as IoT and mobile applications.

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