

IOT Based Rotary Car Parking System

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ABSTRACT

The rapid growth in the number of vehicles has created a serious parking-space problem in urban and congested areas. Conventional parking facilities require considerable land and often involve additional manpower for vehicle guidance and management. This paper presents an IoT-based rotary car parking system developed to provide compact, automated, and efficient parking. The proposed system combines a rotary parking mechanism with Arduino Uno, IR sensors, DC motor/gear mechanism, relays, LCD display, ESP8266 Wi-Fi module, and a fire-alarm arrangement. IR sensors detect vehicle presence and parking-slot occupancy, while the Arduino processes the sensor information and controls the gate and rotary mechanism. The LCD displays the availability status of the parking slots, and the ESP8266 provides Wi-Fi-based monitoring/control functionality. The project model uses four parking slots for demonstration, while the report proposes that a space intended for approximately three conventional cars can accommodate more than twelve vehicles using an expanded rotary arrangement. The system is intended to reduce parking-space requirements, searching time, fuel consumption, congestion, and dependence on parking attendants.

Keywords— Internet of Things, Rotary Parking, Smart Parking, Arduino Uno, ESP8266, IR Sensor, Automated Parking, LCD.

INTRODUCTION

The increasing number of private vehicles has made parking a major challenge in urban areas. Conventional parking arrangements consume large amounts of land, while vehicles parked on roads contribute to traffic congestion and inefficient utilization of available space. The project report identifies insufficient parking space, additional searching time, fuel consumption, congestion, and the need for manpower as important concerns associated with conventional parking systems.

Automated parking systems provide an alternative by organizing vehicles systematically and reducing the space required for parking. Rotary parking is particularly useful because vehicles can be arranged vertically and moved through a rotating mechanism. The proposed concept is intended to utilize a compact area efficiently and provide flexible operation without requiring a dedicated attendant.

The developed prototype incorporates sensing, control, display, actuation, and IoT communication. Arduino Uno acts as the principal controller, while IR sensors identify vehicle presence and slot occupancy. A motor-driven mechanism operates the gate and rotary movement, and an LCD provides information regarding parking availability.

The project report describes a four-slot prototype for demonstrating the operating principle. The proposed expanded rotary arrangement is intended to accommodate more vehicles within a significantly smaller footprint. The system also incorporates an ESP8266 module for wireless communication and a fire-alarm arrangement to improve the functional capability of the parking system.

LITERATURE SURVEY

Madhav Bhagdev and Nitika Agarwal [1] presented an Arduino-based vertically automated rotary parking system designed to address parking-space limitations in urban areas. Their system uses an authorization mechanism to identify users and checks parking-space availability before allowing vehicle entry. The system improves parking security by

restricting unauthorized access and provides information about available parking locations. M. Swatha and K. Pooja [2] proposed a rotary parking system consisting of vertically arranged parking shelves that rotate to utilize a narrow parking area. An Arduino Uno was employed as the main controller for operating the system, and the experimental implementation demonstrated the feasibility of the rotary parking mechanism.

Erick Fernando [3] developed a smart parking system using Arduino components along with a website and mobile application. The system provides information about vacant, reserved, and booked parking spaces, helping drivers locate available spaces and reducing the time and fuel spent searching for parking. Mohammed Omar Ba Sabbea *et al.* [4] proposed a parking system capable of controlling the entry of authorized vehicles while preventing unauthorized vehicles from accessing the parking area. M. Kannan *et al.* [5] proposed an intelligent parking architecture based on parking-availability monitoring and sensor-based control. These studies demonstrate the importance of combining automation, sensing, access control, and information monitoring for developing efficient smart parking systems.

PROBLEM STATEMENT

The increasing number of vehicles has resulted in inadequate parking space, roadside parking, traffic congestion, increased fuel consumption, and unnecessary time spent searching for available parking. Conventional parking facilities may also require manpower to guide vehicles.

OBJECTIVES

1. To develop an IoT-based rotary car parking system that efficiently utilizes limited parking space by automatically detecting vehicle presence and monitoring parking-slot availability using IR sensors and Arduino.
2. To automate vehicle entry, exit, and parking management using a motorized rotary mechanism, LCD display, and ESP8266-based IoT connectivity, thereby reducing parking time, congestion, and dependence on manual operation.

PROPOSED SYSTEM

The proposed system is an IoT-based rotary car parking system designed to maximize parking capacity while minimizing the required parking area. The system uses an Arduino Uno as the main controller, IR sensors for detecting vehicle entry, exit, and parking-slot occupancy, a motor-driven mechanism for gate operation, and an LCD display to indicate slot availability. The prototype consists of four parking slots and can be expanded for larger parking requirements.

When a vehicle reaches the entrance, the IR sensor detects its presence and the Arduino checks the availability of the slots. If a slot is available, the motor-operated gate opens and the vehicle enters the parking area. The corresponding IR sensor detects vehicle occupancy and the LCD updates the slot status. When all slots are occupied, the entrance is closed and the display indicates that the parking is full. The ESP8266 Wi-Fi module provides IoT-based connectivity for monitoring and control, while relay and driver circuits interface the controller with the motors and other loads.

BLOCK DIAGRAM

The Fig 1 illustrates the integration of IR sensors and keypad with the Arduino controller for detecting vehicle presence and processing parking operations. The Arduino controls the LCD display, Wi-Fi module, and servo motor to provide parking-status information and automated gate operation.

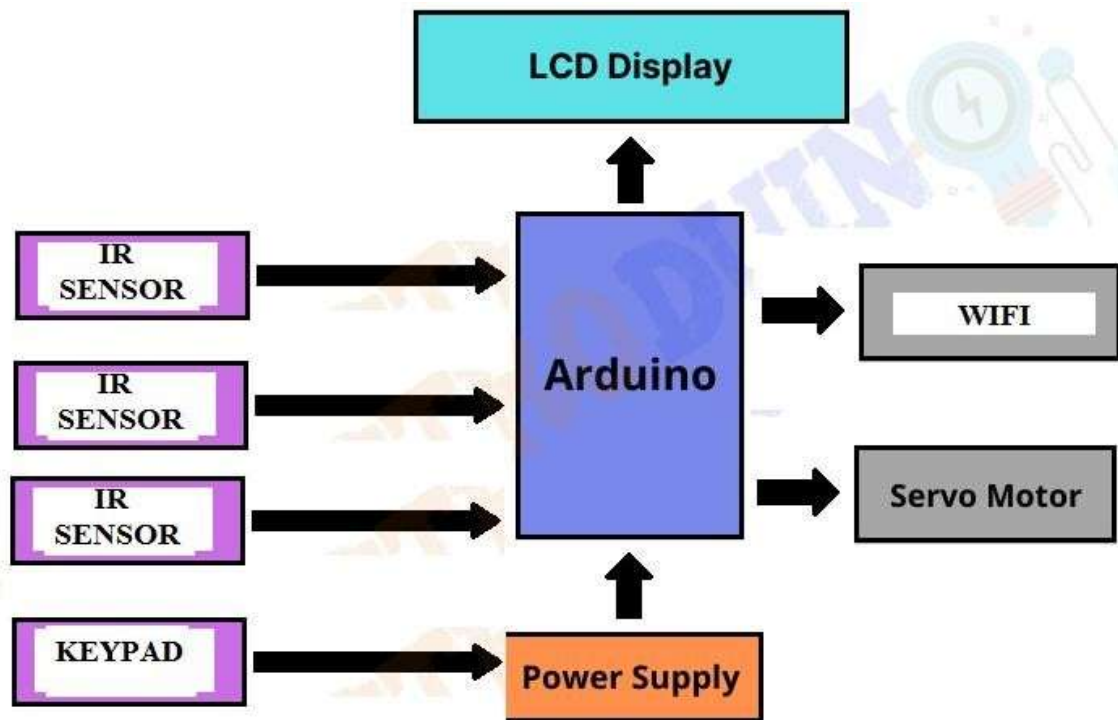


Fig 1:Block diagram of IOT Based Rotary Car Parking.

CIRCUIT DIAGRAM

The Fig 2 shows the interfacing of the Arduino Uno with the IR sensors, keypad, LCD display, and motor for automated parking control. A regulated power supply provides the required voltage, while the Arduino processes sensor inputs and controls the motor and display according to the parking status.

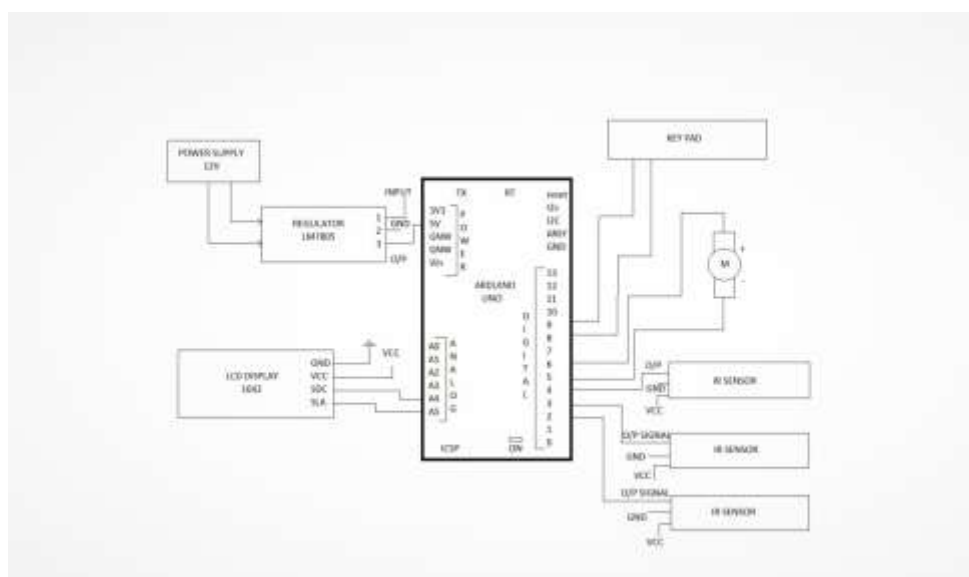


Fig 2:Block diagram of IOT Based Rotary Car Parking.

METHODOLOGY

The proposed IoT-based rotary car parking system uses Arduino Uno as the central controller to monitor parking-slot availability and control the parking mechanism. Three IR sensors are used to detect the presence of vehicles at different locations, while a keypad provides user input. The sensor signals are processed by the Arduino, and the parking status is displayed on the 16×2 LCD. A regulated power supply provides the required operating voltage to the controller and connected components.

When a vehicle is detected, the Arduino checks the availability of the parking slots and operates the servo motor to control the parking mechanism accordingly. The LCD provides the user with information about the parking status, while the Wi-Fi module enables IoT-based connectivity for monitoring and control. The overall methodology integrates sensing, processing, display, motor control, and wireless communication to achieve an automated and space-efficient rotary parking system.

RESULTS AND DISCUSSION

The project report identifies the objective of developing a rotary car parking system as achieved and describes the proposed arrangement as an optimum parking solution with lower building cost per parking slot.

The prototype demonstrates automatic detection of vehicle entry and exit, parking-slot status monitoring, gate operation, LCD-based status indication, and rotary movement. The four-slot prototype is used to demonstrate the control concept, while the report proposes the use of the rotary arrangement to accommodate a substantially larger number of vehicles within a compact area.

The major expected benefits identified in the report include reduced parking-space requirements, shorter waiting time, reduced fuel consumption, reduced congestion, and improved vehicle security. The report also identifies the system as suitable for residential and other areas where conventional parking space is limited.

CONCLUSION

An IoT-based rotary car parking system provides a compact and automated approach to the increasing parking-space problem in urban areas. The proposed system combines rotary mechanical movement with Arduino-based sensing and control, IR-based vehicle detection, LCD status indication, relay-driven actuation, and ESP8266-based wireless connectivity. The prototype demonstrates automatic vehicle detection, parking-slot monitoring, gate control, and rotary operation.

The rotary arrangement can significantly improve the utilization of available parking space compared with conventional arrangements. The project report identifies benefits including reduced parking footprint, improved operational efficiency, reduced searching time, and reduced congestion. Therefore, the proposed system represents a practical approach for compact parking facilities in areas where conventional parking space is limited.

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