VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"Jnana Sangama", Belagavi - 590018, Karnataka, India

MINI PROJECT REPORT

On

"AUTOMATED CAR PARKING SYSTEM"

Submitted in partial fulfillment of the requirements for the award of the Degree

BACHELOR OF ENGINEERING

In

ELECTRONICS AND COMMUNICATION ENGINEERING

By

DILEEP SINGH BISHT	**1DA21EC046**
DIVYA U	**1DA21EC049**
NAMRATHA SD	**1DA21EC091**
PRAJWAL K	**1DA21EC105**

Under the Guidance of

Dr. Girija S
Assistant professor, Department of ECE, Dr. AIT, Bengaluru – 560056

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY
MALLATHAHALLI, OUTER RING ROAD, BENGALURU – 560056

2023-24

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY
Mallathahalli, Bengaluru – 560056

Department of Electronics & Communication Engineering

Certificate

Certified that the project work entitled **"Automated car parking system"**, carried out by Dileep Singh Bisht, bearing USN: 1DA21EC046, Divya U, bearing USN:1DA21EC049, Namratha SD, bearing USN: 1DA21EC091, Prajwal K, bearing USN: 1DA21EC105, bonafide students of **Dr. Ambedkar Institute of Technology, Bangalore – 560056** in partial fulfillment for the award of Bachelor of Engineering in Electronics and Communication Engineering of the **Visvesvaraya Technological University, Belagavi** during the year 2022–2023. It is certified that all the corrections/suggestions indicated for Internal Assessment have been incorporated in the Report deposited in the departmental library. The Mini project report has been approved as it satisfies the academic requirements.

Signature of the Guide	**Signature of the HOD**	**Signature of the Principal**
Dr. Girija S	Dr. Ramesh S	Dr. C Nanjundaswamy

External Viva

Name of the Examiners **Signature with Date**

1. _____

2. _____

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY
Mallathahalli, Bengaluru – 560056

Department of Electronics and Communication Engineering

Declaration

We, **DILEEP SINGH BISHT**, bearing USN : **1DA21EC046, DIVYA U** bearing USN :**1DA21EC049 , NAMRATHA SD**, bearing USN:**1DA21EC091**, **PRAJWAL K**, bearing USN:**1DA21EC105**, hereby declare that, the project work entitled "**Automated car parking system**" is independently carried out by us at Department of Electronics and Communication Engineering, **Dr. Ambedkar Institute of Technology, Bengaluru-560056**, under the guidance of **Dr. Girija S**, Assistant Professor, Department of Electronics and Communication Engineering, Dr. Ambedkar Institute of Technology. The Project work is carried out in partial fulfillment of the requirement for the award of degree of Bachelor of Engineering in Electronics and Communication Engineering during the academic year 2023- 2024.

Place: Bengaluru

Date:

Name & Signature of students

DILEEP SINGH BISHT

DIVYA U

NAMRATHA SD

PRAJWAL K

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STUDENTS NAME

DILEEP SINGH BISHT
DIVYA U
NAMRATHA SD
PRAJWAL K

ABSTRACT

Automated car parking systems are a smart solution to parking problems. By utilizing advanced technology to park and get back cars without needing a lot of space. These systems have many benefits. They make better use of space, save money on running them, improved environmental outcomes through decreased vehicle emissions and energy consumption and improve traffic flow by reducing congestion. They also make parking quicker and safer for people, as they don't need someone to do it for them. These systems are great for busy cities, buildings, and places like hospitals or entertainment spots. As cities get busier and need better parking, automated systems are a smart choice to make parking easier and more efficient. This project explores the key features, advantages, and diverse applications of automated car parking systems, highlighting their potential to change urban parking infrastructure.

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CHAPTER 1

1.1 INTRODUCTION

Building an advanced parking system is essential in a developing country like India where population and automobiles are increasing rapidly. Usage of the automobiles is increasing very rapidly, but, the efficient parking slots are not available to park an automobile, which force the driver to park a vehicle on the roads, which is the reason for heavy congestion on the roads and slow movement of traffic. Although, lot of time is wasted in searching for parking slot and while searching unintentionally it effects environment by the emission of harmful and dreadful gases from automobiles. This emission adulterates the air by CO2 and other gases by combustion of fuel. Also, while searching parking slots, movement of traffic becomes slow. To overcome all the problems mentioned above, we need an efficient parking system which would help to reduce traffic congestion and improve air quality at important locations where traffic rush is more.

"Automated car parking system" is an exigency because the most serious problem of any developing country is traffic (Congestion) on a road and pollution. In addition to this, this project will help to ensure the security of a vehicle, reduce corruption, man power and makes the whole parking as an automated system which will be error free and can reduce time of users in parking their vehicle. Because of, not properly maintained parking spaces, peoples are forced to park their vehicle on the roads which result in heavy congestion as well as road blockage. Our automated parking provides the user-friendly environment to park a vehicle in a safe place.

Traditional parking systems requires a work force to handle the parking places. So**,** An automatic parking system has to be implemented which will reduce manual work as well as safe parking .

1.2 PROBLEM STATEMENT:

As the population has been increasing tremendously, vehicular traffic and its parking has become an issue of great concern. In public places where there are many visitors, a lot of time is wasted for searching parking slots. Also, a lot of manual labour is required to look after the existing parking arrangement. Moreover, there is no way of knowing whether a vacant parking space is available or not. The smart parking system is going to be implemented in several countries. In India, this type of parking system is most likely to be implemented.

CHAPTER 2

2.1 LITERATURE SURVEY

1. “Detecting Efficient Parking Space Using Smart Parking” by Ajay Zajam :

The system consists of the integration of various frequency such as Ultra-High Frequency, Radio Frequency Identification and IEEE 802.15.4 Wireless Sensor Network. This system has customized algorithm, which collect the related to the occupancy state of the parking space and show the direction to the driver to the nearest car parking.

2. “Smart Parking System for Monitoring Cars and Wrong Parking” by FarisAlshehri:

In this paper ultrasonic sensor is used to help drivers to locate the vacant parking in a short period. The ultrasonic sensor is used as a detector to detect the car park availability. Smart Parking System contains few features such as vacant car park detection, improper parking detection, display available parking lot and directional indicators.

3.“Advanced CAR Parking System using Arduino” by Hemanth Chaudhary:

This paper explains the architecture and design of Arduino based car parking system. Authorization of driver or user is the basic rule used to park a vehicle in a parking place. Authorization card will be given to each user, which carries the vehicle number or other details. If the user is authorized and space is available in the parking, then the parking gate will open and the user is allowed to park the vehicle in parking place else the user is not allowed even the user is authorized person.

4. “Automatic parking lot mapping for available parking space detection” by Kairoek Choeychuen:

This paper presents a method to estimate map of parking lot for automatic system of available parking space detection. The parking space detection is important module for the parking guidance system (PGS) that can help drivers to find the parking space efficiently.

2.2 OBJECTIVES:

- Enhance User Convenience: Provide a seamless and hassle-free parking experience for users.
- Increase Safety: Minimize accidents and vehicle damage through precise and automated parking.
- Reduce Operational Costs: Lower the need for manual labor and reduce overall management costs.
- Improve Traffic Flow: Reduce congestion and wait times within parking facilities and surroundings.
- Optimize Space Utilization and energy efficiency: Efficiently manage and maximize the use of available parking space. Automated systems can be designed to operate with minimal energy.

CHAPTER 3

PROPOSED WORK

3.1 METHODOLOGY:

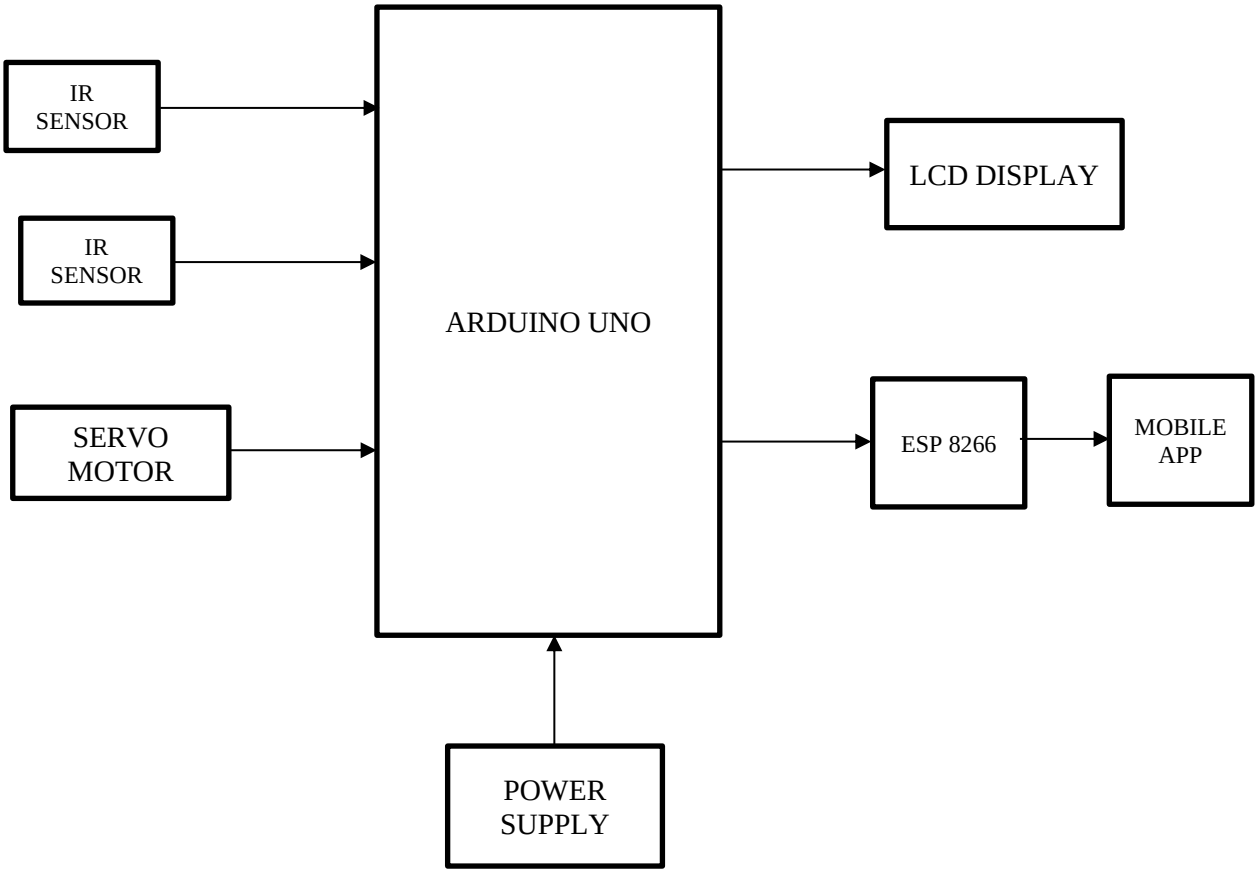

Fig 3.1 Block diagram of car parking system

The IR sensor at the entrance toll gate detects a coming car and will automatically open whenever there is a free slot in the parking lot but if the lot is full, then LCD displays message that the parking is full and the gate does not open. A simple mobile app is designed to show the driver the occupied and empty slots in the parking lot where Esp8266 NodeMCU enables the communication between the sensors in the parking lot and any mobile device via a network cloud service.

- IR Sensor: Arduino Uno can interface with IR sensors to detect vehicle presence in parking spaces, ensuring effective space management and real-timeoccupancy monitoring.
- LCD Display: Utilizing Arduino Uno, LCD displays provide users with visual feedback on parking space availability, guiding them to vacant spots and enhancing overall user

experience in automated parking facility.

- Servo Motor: With Arduino Uno, servo motors can be precisely controlled to open and close parking barriers, allowing vehicles to enter and exit designated areas seamlessly.
- Arduino Uno: Arduino Uno serves as a central unit in automated parking systems, coordinating various components to optimize space usage and streamline operations.
- ESP8266 NodeMCU :WiFi module for connecting the parking lot to a cloud service so that we can be able to access the parking lot over the internet using a mobile phone application
- Power Supply: Provides the necessary power to components of the system.

3.2 FLOW CHART:

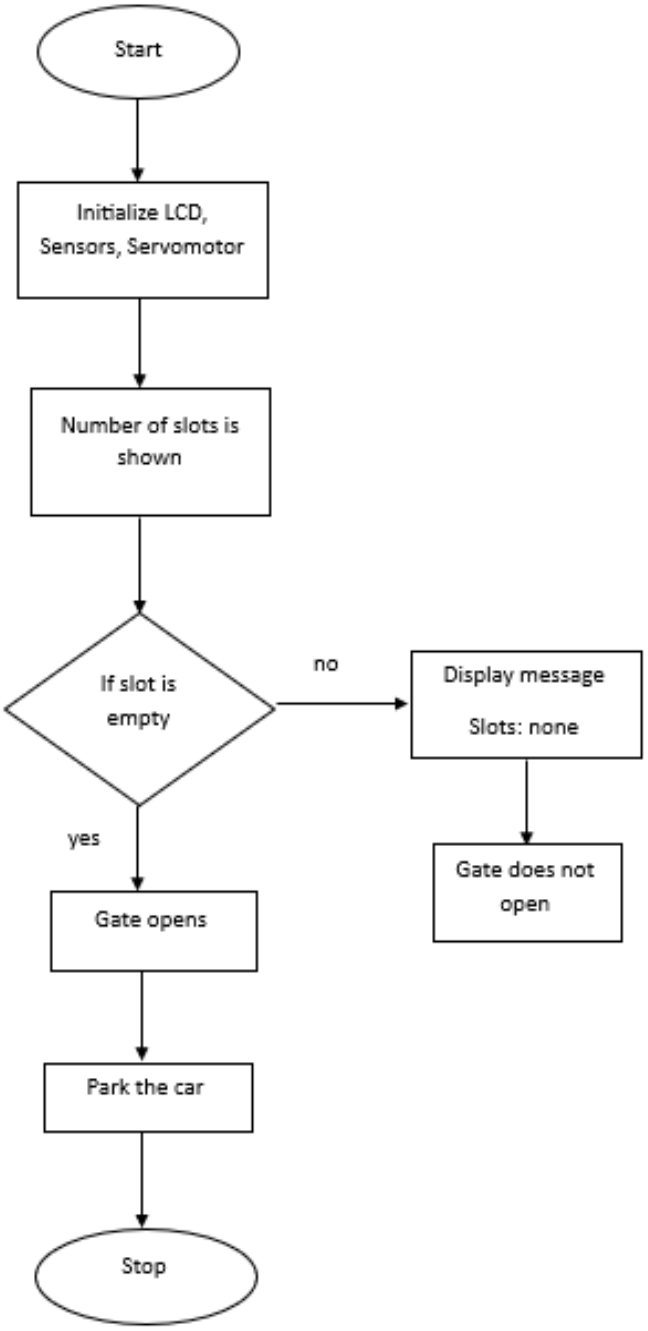

Fig 3.2 Flow chart of car parking system

3.3 REQUIREMENTS AND SPECIFICATION

HARDWARE REQUIREMENTS:

Arduino uno :

The Arduino Uno is a popular open-source microcontroller board based on the ATmega328P microcontroller. It features 14 digital input/output pins (six of which can be used as PWM outputs), six analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button. The Uno can be powered via USB or an external power supply, making it versatile for various electronic projects and prototypes.

Specifications:

- Voltage: 5V
- Digital I/O Pins: 14
- Analog Input Pins: 6
- Clock Speed: 16 MHz

Fig 3.3 Arduino uno board

IR Sensor:

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion.

Specifications:

- Voltage: 3.3V to 5V
- Detection Range: Up to 30 cm
- Output: Digital

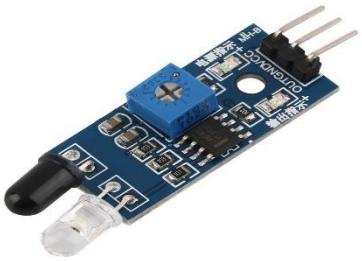

Fig 3.4 IR Sensor

Servo motor:

A servo motor is a rotary actuator that allows for precise control of angular position. It consists of a motor coupled to a sensor for position feedback. It also requires a servo drive to complete the system. The drive uses the feedback sensor to precisely control the rotary position of the motor.

Specifications:

- Voltage: 4.8V to 6V
- Torque: 1.8 kg-cm at 4.8V
- Rotation Range: 0 to 180 degrees

Fig 3.5 Servo motor

ESP8266:

The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to the WiFi network. The ESP8266 is capable of either hosting an application or offloading all WiFi networking functions from another application processor.

Specifications:

- Voltage: 3.3V
- Digital I/O Pins: 11
- Clock Speed: 80 MHz
- Wi-Fi: 802.11 b/g/n

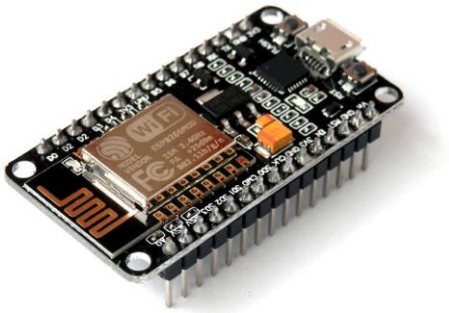

Fig 3.6 ESP8266

LCD with I2C:

The I2C LCD component is used in applications that require visual or textual display. This component is also used where a character display is needed but seven consecutive GPIOs on a single GPIO port are not possible. In cases where the project already includes an I2C master, no additional GPIO pins are required.

Specifications:

- Characters: 16x2
- Voltage: 4.7V to 5.3V
- Interface: 4-bit or 8-bit

Fig 3.7 LCD Display

SOFTWARE REQUIREMENTS

Arduino IDE

The Arduino Integrated Development Environment (IDE) is a software application used for programming Arduino boards. It provides an easy-to-use interface for writing, compiling, and uploading code to the microcontroller. The IDE supports the Arduino programming language, which is based on C/C++, and includes a built-in editor with features like syntax highlighting and automatic indentation. It also offers a library manager for easily including various pre-written code libraries to extend functionality. The Arduino IDE is compatible with Windows, macOS, and Linux, making it accessible for users on different operating systems.

Fig 3.8 Arduino IDE software

Blynk application:

Blynk is a tool that makes it easy for us to control and monitor electronic projects using a smartphone or computer.

1. **Easy to Use**: We can create custom control panels by dragging and dropping elements, so we don't need to be coding experts.
2. **Works with Many Devices**: It supports popular hardware like Arduino, Raspberry Pi, and ESP8266, so we can use it with a wide range of projects.
3. **Remote Control**: Blynk connects our projects to the internet, so we can control them from anywhere in the world.
4. **Custom Widgets**: We can add buttons, sliders, graphs, and more to our control panel to interact with our project.

3.4 IMPLEMENTATION:

Implementing an automated car parking system with an Arduino Uno, IR sensors, NodeMCU ESP8266, servo motors, LCD display, and a mobile application involves integrating these components to manage and control the parking process.

1. Defining System Requirements

- **Parking Slots Management**: We are using IR sensors to detect vehicle presence.
- **Entry and Exit Management**: Controlling entry and exit gates using servo motors.
- **User Interface**: Develop a mobile application (Blynk app) for user interaction.
- **Communication**: NodeMCU ESP8266 for Wi-Fi connectivity to communicate with the mobile app.
- **Local Display**: We are using an LCD display to show slot availability and status updates.

2. Components Needed

- **Microcontrollers**: Arduino Uno and NodeMCU ESP8266.
- **Sensors**: IR sensors for detecting vehicle presence.
- **Actuators**: Servo motors for gate control.
- **Communication Modules**: NodeMCU ESP8266 for Wi-Fi.
- **Display Units**: LCD display and the mobile app for displaying slot availability.
- **Power Supply**: Adequate power supply for all components.
- **Software**: Arduino IDE for programming, mobile app for user interaction.

3. Setup Hardware

- **Parking Slot Sensors**: Install IR sensors in each parking slot to detect vehicle presence.
- **Entry/Exit Gates**: Install servo motors to control the gates.
- **Central Controller**: Connect sensors to the Arduino Uno and use NodeMCU ESP8266 for communication.
- **LCD Display**: Connect an LCD display to the Arduino Uno to show real-time slot availability and other status updates.

4. Develop Software

- **Arduino Programming**:
  - Write code for the Arduino to read sensor data, control actuators, and update the LCD display.
  - Use the Arduino IDE for programming.
- **NodeMCU programming**:
  - Write code for esp8266 to read sensor data and send the data to the mobile app.
  - We should ensure real-time updates are sent to the mobile app and the LCD display.
- **Mobile Application Development**:
  - Developing the Blynk app to interact with the parking system.
  - Displaying slot availability through app.

5. Testing and Calibration

- **Unit Testing**:
  - Individual components such as IR sensors, servo motors, LCD display, and communication modules are tested for accurate output.
- **Integration Testing**:
  - The entire system is tested to ensure all components work together seamlessly.
  - Verifying that data from sensors is accurately reflected on the LCD display and the mobile app.
- **Calibration**:
  - Calibrating sensors to accurately detect vehicles.
  - Adjust gate control mechanisms.
  - Ensuring the LCD display shows accurate and real-time information.

By following the defined system requirements and carefully selecting the necessary components, we can build a robust system that accurately detects vehicle presence, controls entry and exit, and provides real-time updates to users through both a mobile app and an LCD display. The integration of NodeMCU ESP8266 ensures seamless communication between the hardware and the mobile app, enabling remote monitoring and control.

Circuit diagram:

- The parking is divided into two lots with each parking having two parking slots. These slots have IR sensors attached to analog pins A0,A1,A2 and A3 of Arduino. Two other IR sensors are placed at the entrance and exit of the parking and attached to Arduino digital pins 5 and 7.
- Two servo motors are used to move toll gates at the entrance and exit and these are attached to Arduino digital pins 9 and 10.
- LCD display is connected to A4 and A5.
- IR sensor with detect the 4 slots and send the data to both Arduino(A0,A1,A2&A3) and ESP8266(D3,D4,D5&D6). The servo motor, IR sensor and LCD are supplied with 5V power supply from Arduino and all these components are properly grounded.

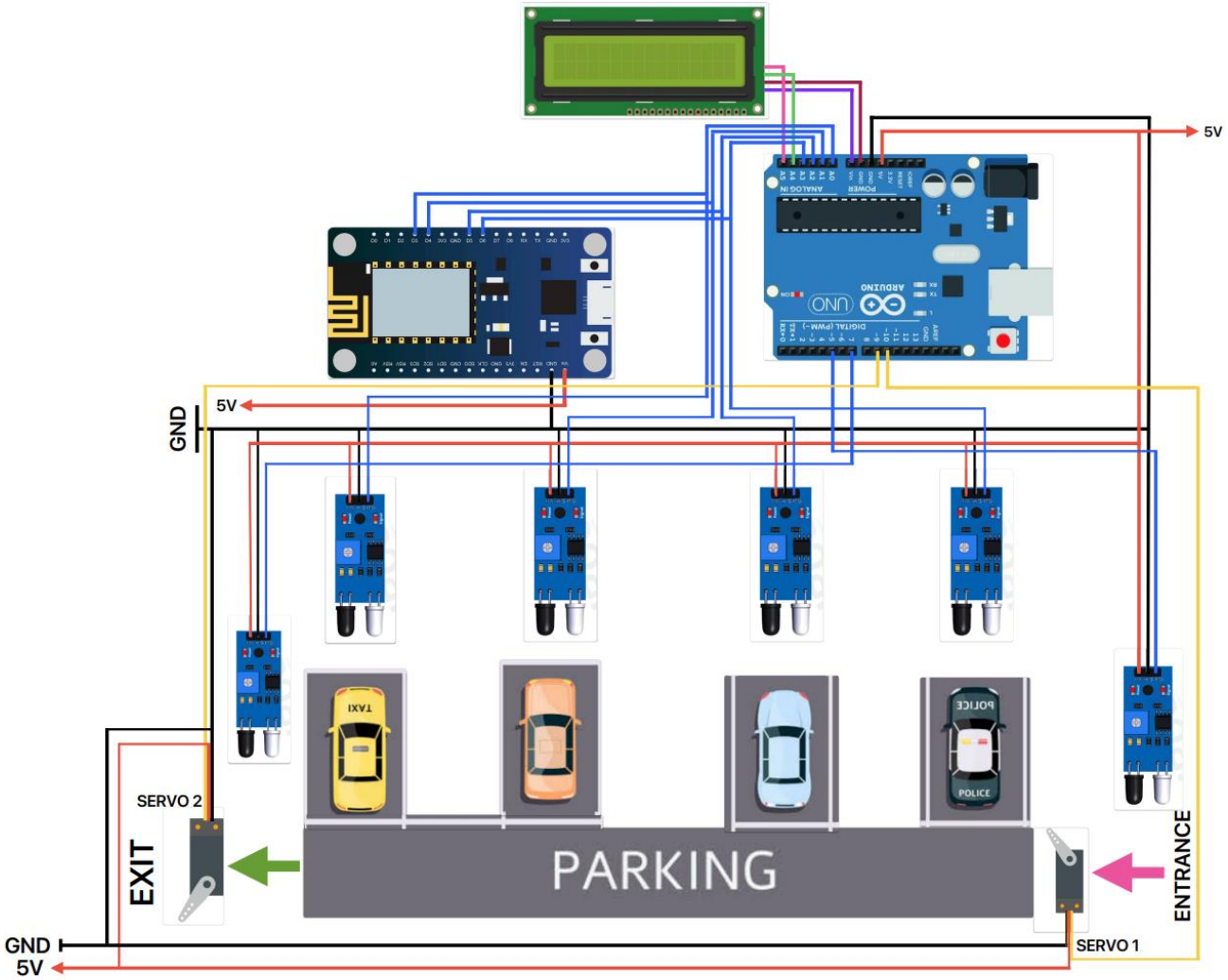

Fig 3.9 Circuit diagram of Automated car parking system

CHAPTER 4

4.1 RESULTS :

Our automated car parking system project achieved great success by effectively managing parking slots using IR sensors to detect vehicle presence with high accuracy. The servo motors, responded quickly and reliably to sensor inputs, ensuring seamless vehicle movement. The user interface, built with the Blynk mobile application, allowed users to check slot availability and control the gates remotely. This was facilitated by the NodeMCU ESP8266, which provided robust Wi-Fi connectivity for real-time communication. Additionally, the on-site LCD display provided clear and immediate updates on slot availability and gate status, enhancing the user experience. The seamless integration of all components, including IR sensors, servo motors, LCD display, and NodeMCU, resulted in a system that performed consistently and reliably. Users found the system intuitive and convenient, benefiting from the remote monitoring and control capabilities. Furthermore, the system's design allows for easy scalability, making it adaptable for future expansions. This project highlights the potential of IoT solutions in modern infrastructure, offering a smart, efficient, and user-friendly approach to managing parking spaces.

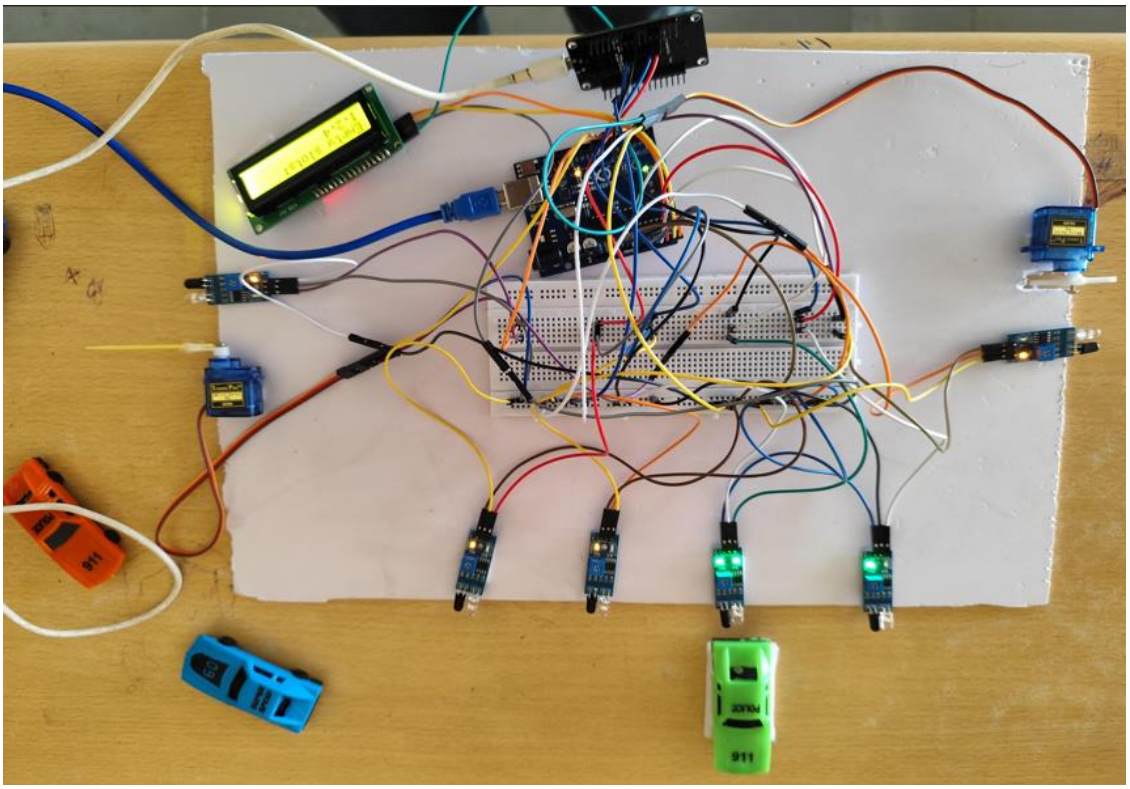

Fig 4.1 working model

4.2 APPLICATIONS:

1. Urban Areas:

- Commercial Buildings: Office buildings, shopping centers, and hotels in densely populated areas where space is limited.
- Residential Buildings: High-rise apartments with limited parking space.

2. Transport Hubs:

- Airports: To accommodate large numbers of vehicles in a limited area and improve the passenger experience.
- Train Stations and Bus Terminals: To efficiently manage parking for commuters.

3. Hospitals and Medical Facilities:

- To provide convenient and efficient parking for patients, visitors, and staff, often in areas where parking demand is high.

4. Entertainment and Sports Venues:

- To handle large volumes of vehicles during events and reduce congestion.

4.3 ADVANTAGES:

1. Space Efficiency:

- Maximizes Space Utilization: parking systems can park more cars in a given space compared to traditional parking lots because they eliminate the need for driving lanes and ramps.

2. Time Savings:

- Quick Parking and Retrieval: Automated systems can significantly reduce the time it takes to park and retrieve vehicles.
- Reduced Search Time: Drivers don't have to search for parking spots, which can be especially beneficial in large and crowded areas.

3. Cost Efficiency:

- Lower Operating Costs: parking systems often require less lighting, ventilation, and maintenance compared to traditional parking facilities.

4. Environmental Benefits:

- Reduced Emissions: Less idling and searching for parking spots reduce vehicle emissions.

4.4 DISADVANTAGES:

- **Initial Costs**: Getting started with automated parking systems can be costly upfront. It's important to budget wisely to balance these expenses against the expected long-term savings and efficiency benefits.

- **Maintenance Needs**: Keeping the system running smoothly requires regular upkeep and robust security measures. This ongoing maintenance ensures reliable performance but demands dedicated attention and resources.

By approaching these considerations proactively, we can ensure that our automated car parking system not only meets but exceeds the expectations of our users, offering a reliable, efficient, and sustainable parking solution for our facility.

CHAPTER 5

CONCLUSION AND FUTURE SCOPE

5.1 CONCLUSION:

Automated car parking systems are a big step forward in solving parking issues in cities. Our project explores how these systems use advanced technology to make parking easier and save space. They're especially useful in places like hospitals and busy areas because they streamline parking and cut down on costs. By automating parking, we've focused on making it simpler and safer for everyone. These systems also help the environment by reducing emissions and saving energy.

Our project shows how automated parking improves traffic flow and safety by taking away the need for manual parking. Looking ahead, we believe these systems will be vital in making cities better and meeting the growing need for improved parking solutions. Embracing this technology sets the stage for smarter, more sustainable urban development and sets new standards for parking convenience and accessibility.

5.2 FUTURE SCOPE:

Integration with smart cities: As cities become smarter, automated car parking systems can be integrated with urban infrastructure to provide real-time parking information, optimize traffic flow, and reduce congestion.

Enhanced user experience: The system can be integrated with mobile apps, providing users with real-time parking availability, navigation, and payment options, making the parking experience more seamless and convenient.

Enhanced safety features: The system can be designed to include advanced safety features, such as collision detection, fire detection, and emergency response systems, to ensure a safe parking environment.

Cost effective solutions: The use of Arduino and ESP8266 can provide cost-effective solutions for parking operators, reducing the need for expensive hardware and infrastructure.

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