

AUTOMATIC PARKING SYSTEM

Submitted to:

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TEAM INTRODUCTION

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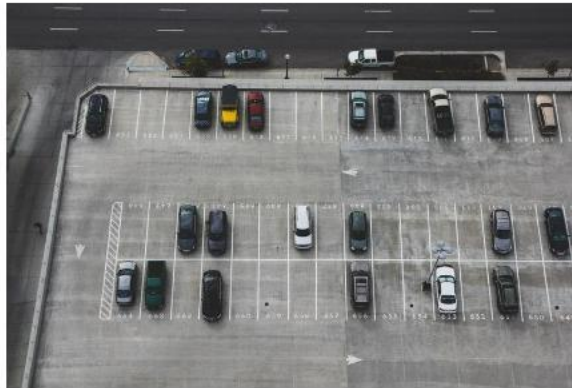




- ❖ A parking system is a comprehensive solution designed to efficiently manage the process of vehicle parking within a designated area, such as a parking lot, hospitals, shopping malls.
- ❖ Effective parking management has become a crucial aspect of urban planning, infrastructure development, and overall transportation efficiency.
- ❖ Parking systems utilize various technologies and strategies to streamline the process of finding, accessing, and paying for parking spaces.
- ❖ These systems offer convenience to both vehicle owners and parking operators while optimizing the use of available parking resources.

MAJOR PROBLEM

- Parking management influences drivers search time and cost for parking spaces.
- It may also causes traffic congestion.
- Finding a parking space in most metropolitan areas, especially during the rush hours, is difficult for drivers.
- Difficulty arises from not knowing where the available spaces may be at that time traffic congestion may occur.



To achieve the goals of building a traffic free society the following tasks should be executed.

These are the some tasks in order to achieve them automatic parking system should be developed

- Convenience and Time-Saving
- Reduced Traffic Congestion
- Enhanced Safety
- Improved Space Utilization:
- Eco-Friendly Solution
- Accessibility and Inclusivity
- Integration with Smart Cities
- User-Friendly Interface



LITERATURE SURVEY

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JOURNAL DETAILS

“Automatic Parking Space Detection System”

Nazia Bibi
Muhammad Nadeem Majid
Hassan Dawood
Ping Guo

Published in: 2017 2nd
International Conference on
Multimedia and Image Processing
(ICMIP)
Date of Conference: 17-19 March
2017
Date Added to IEEE *Xplore*: 25
December 2017
Publisher: IEEE
Conference Location: Wuhan,
China

SUMMARY

- The proposed system in this paper is a vision-based automatic parking system that uses a camera to detect the presence or absence of cars in parking spaces.
- The system first segments the parking area into blocks, and then classifies each block to identify cars and intimate the driver about the status of parking either reserved or free.

ADVANTAGES

- It is low-cost, as it only requires a camera and a computer.
- It is easy to install and maintain.
- It is accurate, as it can detect cars even in difficult conditions such as shadows and occlusions.

DRAWBACKS

- It is not as accurate as sensor-based systems in detecting cars in poor weather conditions.
- Among 600 vehicles 552 vehicles only detected with error of 8.5%.
- It requires regular calibration to ensure accurate results



LITERATURE SURVEY

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JOURNAL DETAILS	SUMMARY	ADVANTAGES	DRAWBACKS
<p>“Research on Automatic Parking Systems Based on Parking Scene Recognition”</p> <p>Shidian Ma Haobin Jiang Mu Han Ju Xie Chenxu Li</p> <p>Published in: IEEE Date of Publication: 18 October 2017 Publisher: IEEE</p>	<ul style="list-style-type: none">➤ The paper introduces an automatic parking system based on parking scene recognition.➤ Aims to address limitations of existing systems in vehicle control.➤ Utilizes machine vision and pattern recognition for intelligent parking scenario recognition.➤ Focuses on increasing parking convenience and reducing accidents.	<ul style="list-style-type: none">➤ Enhanced Scene Recognition: Integrates ultrasonic and vision sensors for accurate parking scene recognition.➤ Improved Space Utilization: Optimal use of parking spaces through intelligent parking path planning.➤ Parking Convenience: Enhances driver comfort by minimizing manual intervention	<ul style="list-style-type: none">➤ Complex Implementation: Integration of multiple sensor technologies might result in a complex setup.➤ Sensor Reliance: System heavily relies on accurate sensor data for successful parking operations.➤ Ultrasonic sensors suffer from limited range, susceptibility to environmental conditions.



LITERATURE SURVEY

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JOURNAL DETAILS	SUMMARY	ADVANTAGES	DRAWBACK
<p>“Rfid Based Automatic Car Parking System Using Iot”</p> <p>S Subaselvi V Muhin T R Mohanraj C N Kesava Sai Raam</p> <p>Published in: 2023 9th International Conference on Electrical Energy Systems (ICEES) Date of Conference: 23-25 March 2023 Date Added to IEEE Xplore: 01 May 2023</p>	<ul style="list-style-type: none">➤ The system utilizes IR sensors, LCD display, and RFID reader to automate the parking process and provide real-time parking space updates.➤ By connecting to an IoT platform, users can access parking availability information through a mobile app.➤ The proposed system aims to optimize parking utilization.	<ul style="list-style-type: none">➤ Efficient Parking Management: The IoT-based system make better parking operations by offering real-time updates on parking space availability, eliminating the need for manual search.➤ User-Friendly Interface: The mobile app and LCD display provide intuitive interfaces for users to access parking information.	<ul style="list-style-type: none">➤ Sensor Reliability: The system heavily relies on accurate sensor data (IR sensors and RFID) for effective parking operations. Sensor malfunction could lead to inaccuracies.➤ Initial Setup Complexity: Implementing the IoT-based system requires setting up hardware components (sensors, readers) and establishing the necessary software infrastructure.



LITERATURE SURVEY

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JOURNAL DETAILS	SUMMARY	ADVANTAGES	DRAWBACKS
<p>“Automatic Car parking system using Google Assistant”</p> <p>Salve Gatha Daule Pratiksha Karande Pranita Ingale Sneha Shilpa Rudrawar</p> <p>Published in: 2021 International Conference on Communication information and Computing Technology (ICCICT) Date of Conference: 25-27 June 2021 Date Added to IEEE Xplore: 12 August 2021</p>	<ul style="list-style-type: none">➤ The proposed prototype uses advanced technologies such as Internet of Things (IoT) and Google Assistant to achieve smart parking.➤ The user initiates parking through voice commands to Google Assistant, and the car autonomously navigates to an available parking slot.➤ The system notifies the user about parking status via mobile notifications and email.	<ul style="list-style-type: none">➤ Reduced Accidents: Ultrasonic sensors help detect obstacles, reducing the likelihood of accidents during parking.➤ User-Friendly Interface: Voice commands to Google Assistant make system easy to use for users.➤ Notifications: Users receive notifications and emails about parking status and details.	<ul style="list-style-type: none">➤ Complex Implementation: The implementation involves integrating various components such as sensors, microcontrollers, and cloud services, requiring technical expertise.➤ Limited Parking Locations: The system's effectiveness might be limited to areas equipped with the necessary infrastructure and components.



LITERATURE SURVEY

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JOURNAL DETAILS

“Smart Parking System With Automatic Cashier Machine Utilize the IoT Technology”

Agustina Ampuni
Sopater Fonataba
Adi Fitrianto
Gunawan Wang

Published in: 2019
International Conference on
ICT for Smart Society (ICISS)
Date of Conference: 19-20
November 2019
Date Added to
IEEE *Xplore*: 28 January 2020

SUMMARY

- Real-time parking spot monitoring: The system uses sensors to track the status of all parking spots in a given area.
- Cars check in and out: Drivers can use the mobile app to check in and check out to a parking spot.
- Image processing: The system uses image processing to automatically scan license plates when drivers check in and out of parking spots.

ADVANTAGES

- Efficiency: The system can help drivers to find available parking spots more quickly and easily.
- Convenience: Drivers can use the mobile app to check in and out of parking spots, and to pay for parking.
- Security: The system uses image processing to help to prevent fraud.

DRAWBACKS

- Cost: The system requires the installation of sensors and cameras, which can be expensive.
- Privacy: Some drivers may be concerned about the privacy implications of having their license plates scanned.
- Accuracy: The system must be accurate in tracking the status of parking spots and in calculating parking fees.



LITERATURE SURVEY

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JOURNAL DETAILS	SUMMARY	ADVANTAGES	DRAWBACKS
<p>“Automatic Parking Space Detection System”</p> <p>Nazia Bibi Muhammad Nadeem Majid Hassan Dawood Ping Guo</p> <p>Published in: 2017 2nd International Conference on Multimedia and Image Processing (ICMIP)</p> <p>Date of Conference: 17-19 March 2017</p> <p>Date Added to IEEE Xplore: 25 December 2017</p>	<ul style="list-style-type: none">➤ The proposed system utilizes cameras to capture parking lot images and employs image processing techniques to segment the parking area, classify blocks, and determine the availability of parking slots.➤ The system generates virtual parking lines, identifies free and reserved parking slots, and displays this information to drivers in real-time.	<ul style="list-style-type: none">➤ Cost-Effectiveness: Vision-based systems can be cost-effective compared to hardware solutions.➤ Real-Time Updates: Drivers receive real-time updates about parking, improving the parking experience.➤ Flexibility: The system can be implemented in different parking areas without the need for extensive infrastructure changes.	<ul style="list-style-type: none">➤ Environmental Factors: Vision-based systems may be affected by environmental conditions such as lighting, occlusions, and shadows, potentially impacting accuracy.➤ Limited Parking Types: The system's effectiveness could vary in different types of parking environments, such as indoor and outdoor lots or multi-level garages.



LITERATURE SURVEY

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JOURNAL DETAILS	SUMMARY	ADVANTAGES	DRAWBACKS
<p>“A unique automatic parking system by using RFID card and IoT”</p> <p>Ratna Priya Amit Abhishek Ankur Utsav</p> <p>Published in: 2021 6th International Conference on Communication and Electronics Systems (ICCES) Date of Conference: 08-10 July 2021 Date Added to IEEE Xplore: 02 August 2021</p>	<ul style="list-style-type: none">➤ The proposed smart parking system uses the internet of things (IoT) to provide a more efficient and convenient way for drivers to find and pay for parking.➤ Ways like<ol style="list-style-type: none">1. Use mobile app2. Pre-booking3. Sensor based management	<ul style="list-style-type: none">➤ Convenience: Drivers can use the mobile app to find a parking spot, pay for parking spot in advance.➤ Security: The system uses data encryption and authentication to protect user data.➤ Environmental benefits: The system can help to reduce traffic congestion and air pollution by reducing the amount of time drivers spend looking for parking.	<ul style="list-style-type: none">➤ Cost: The system requires the installation of sensors and cameras, which can be expensive.➤ Privacy: Some drivers may be concerned about the privacy implications of having their location tracked.➤ Accuracy: The system must be accurate in tracking the status of parking spots and in calculating parking fees.



LITERATURE SURVEY

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JOURNAL DETAILS	SUMMARY	ADVANTAGES	DRAWBACKS
<p>“Smart Parking Using IOT”</p> <p>Himanshu Chambhare Pranav Rathi Rahul Tekam Shoheb Shaikh Leela Bitla</p> <p>Published in: 2023 4th International Conference for Emerging Technology (INCET) Date of Conference: 26-28 May 2023 Date Added to IEEE Xplore: 10 July 2023</p>	<ul style="list-style-type: none">➤ The paper presents a smart parking system that utilizes IoT technology to simplify the process of finding parking places.➤ The system involves updating parking space availability status on an IoT-enabled website and displaying information on an Android app.➤ An LCD display is used to show available parking spots, and RFID technology is used for automated payment of parking fees.	<ul style="list-style-type: none">➤ Time and Fuel Savings: The system helps users find available parking spaces quickly, leading to reduced time and fuel consumption.➤ Automated Payment: RFID technology enables automated payment of parking fees.➤ Customizable Solutions: The proposed system can be expanded to cover public and private parking lots.	<ul style="list-style-type: none">➤ Maintenance: Ongoing maintenance of the system's hardware and software components is necessary to ensure its continued functionality.➤ Initial Investment: The implementation of IoT-based systems may involve initial costs related to hardware, software and infrastructure.

OBJECTIVES

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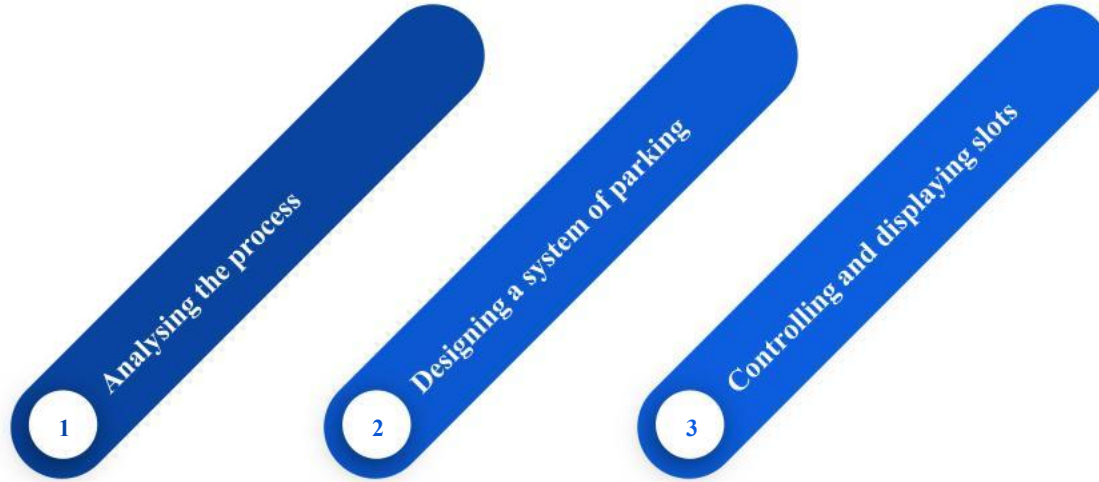
- ✓ Automated Parking Management
- ✓ IoT Integration
- ✓ Enhanced User Experience
- ✓ Space Utilization Optimization
- ✓ Remote Access and Control
- ✓ Efficient Gate Operation
- ✓ Data Logging and Analysis
- ✓ Reduced Traffic Congestion
- ✓ Demonstration of IoT Applications
- ✓ Reliability and Accuracy





METHODOLOGY

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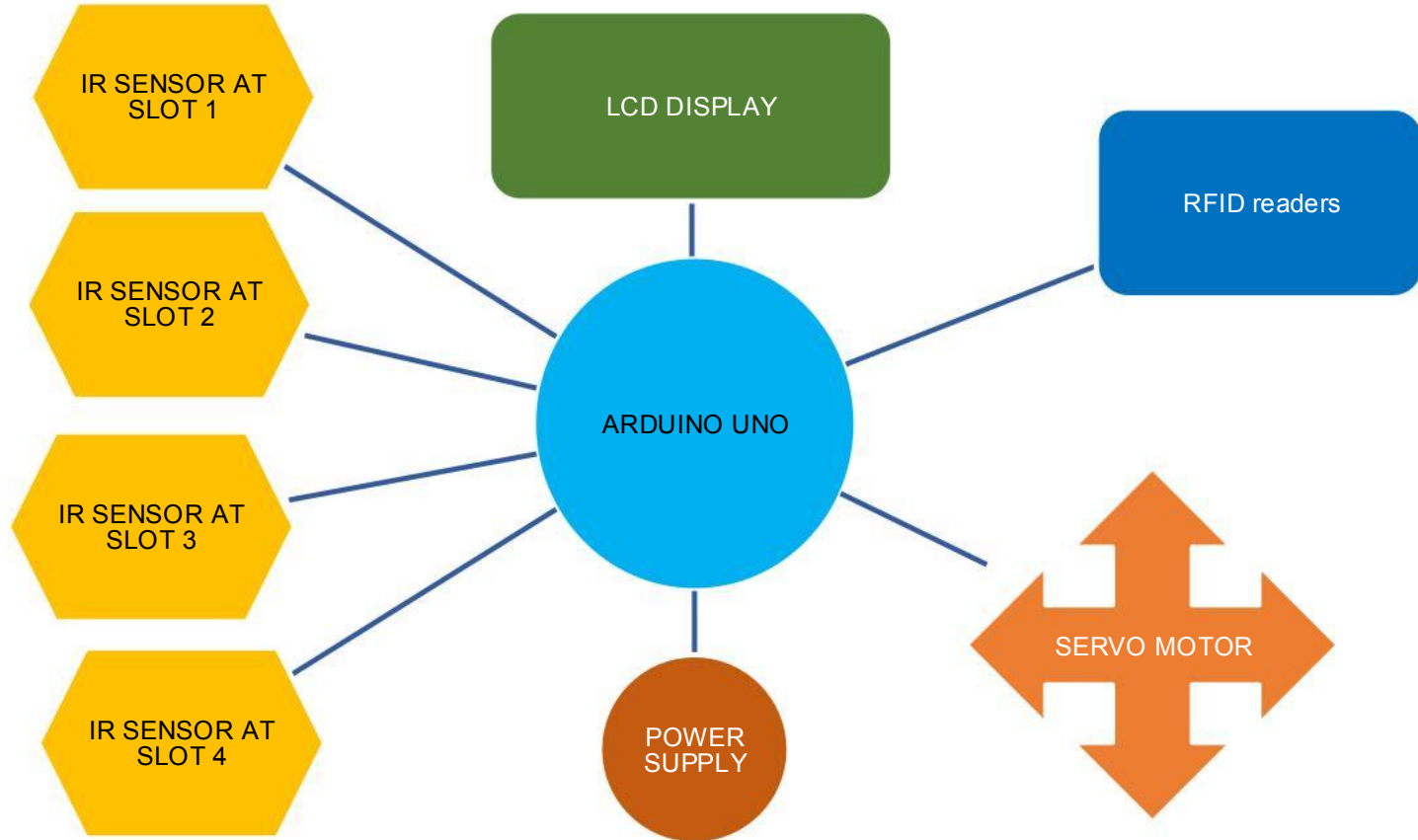
COMPONENTS TO BE USED

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- Arduino UNO
- IR sensors
- RFID reader and tag
- Servo motor
- Jumper wires and a breadboard
- 16×2 LCD and an I2C module



BLOCK DIAGRAM



MATHEMATICS:

➤ **Geometry:**

- **Angles and Trigonometry:** Angles play a role in positioning the servo motor to control the gate's movement. Trigonometric functions (sine, cosine) can be used to calculate the angle of rotation for the servo motor.

➤ **Algebra:**

- **Equations and Variables:** Equations can be used to model relationships, such as the number of available parking slots based on sensor readings. Variables are used to represent quantities like the slot count.

➤ **Arithmetic and Calculations:**

- **Addition and Subtraction:** Calculations involving the number of filled parking slots and available slots are essential for displaying information on the LCD.
- **Multiplication and Division:** These operations are used to calculate slot availability and make decisions based on the number of slots.

➤ **Logic and Conditional Statements:**

- **Boolean Logic:** The code uses conditional statements (if-else) to make decisions about opening the gate and displaying information on the LCD based on sensor readings and available slots.

➤ **Statistics:**

- **Data Analysis:** The system collects data from IR sensors and processes it to determine if parking slots are filled or empty. Basic statistical analysis could be applied to this data, such as calculating the mean occupancy rate.

➤ **Measurement:**

- **Units and Conversions:** The system involves measurements like angles, distances, and time. Proper unit management and conversions are important for accurate calculations and control.

➤ **Calculus (Basic):**

- **Rates of Change:** Calculus concepts like differentiation and integration might not be explicitly used in this context, but the understanding of rates of change can be useful for analyzing how certain variables change over time (e.g., gate opening/closing speed).

➤ **Numerical Control:**

- **Control Algorithms:** Concepts from control theory, such as PID (Proportional-Integral-Derivative) controllers, might be applied to control the gate's movement and improve its stability.

➤ **Digital Logic (For Microcontroller):**

- **Binary Representation:** Inside the microcontroller, digital logic is used to process data. Understanding binary representation can help in debugging and optimization.

➤ **Probability (RFID Detection):**

- **Random Events:** When an RFID card is presented, the system needs to handle random events (e.g., whether the parking slots are available or not). Basic probability concepts can aid in decision-making.

PHYSICS

➤ Servo Motor:

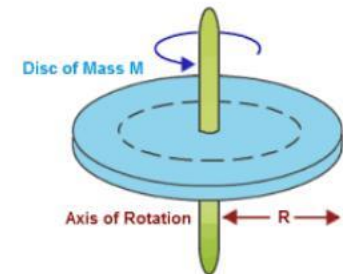
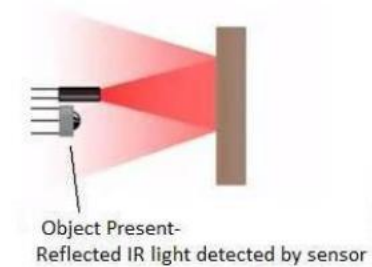
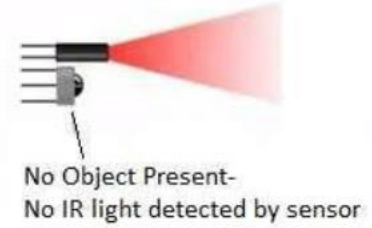
- **Angular Motion:** The servo motor's movement is described in terms of angular motion, involving concepts like angle (degrees), angular velocity, and angular acceleration.

➤ Infrared (IR) Sensors:

- **Light Detection:** IR sensors work based on the detection of infrared light. They utilize the physics of light emission, reflection, and detection.
- **Reflection:** IR sensors detect the presence of objects by emitting infrared light and measuring the reflection. The amount of reflected light can be used to determine if an object is present.

➤ Gate Mechanism:

- **Rotational Motion:** The gate mechanism controlled by the servo motor involves rotational motion. Physics concepts such as torque, angular displacement, and rotational equilibrium play a role in its operation.





➤ **RFID (Radio-Frequency Identification):**

- **Electromagnetic Waves:** RFID technology uses electromagnetic waves to communicate between the reader and the RFID card.
- **Inductive Coupling:** The communication between the RFID reader and the card is based on inductive coupling, a phenomenon in electromagnetism where changing magnetic fields induce voltage and current in nearby conductors (the RFID card's coil).

➤ **LCD Display:**

- **Liquid Crystals:** LCDs work by manipulating liquid crystals using electric fields. The crystals change their orientation based on the applied voltage, allowing or blocking light to create visible images and text.

➤ **Motion and Kinematics:**

- **Position, Velocity, and Acceleration:** The system's operation involves tracking the motion of the gate and the car. Concepts from kinematics, such as position, velocity, and acceleration, come into play.

➤ **Mechanical Equilibrium:**

- **Force and Torque:** The balance of forces and torques is crucial for the gate's stability and proper functioning. The servo motor and the gate need to exert appropriate forces to open and close smoothly.

➤ **Mechanical Interactions:**

- **Contact Forces:** When the car enters the parking space, there are contact forces between the tires and the ground, the gate and the car, etc.

➤ **Energy Conservation:**

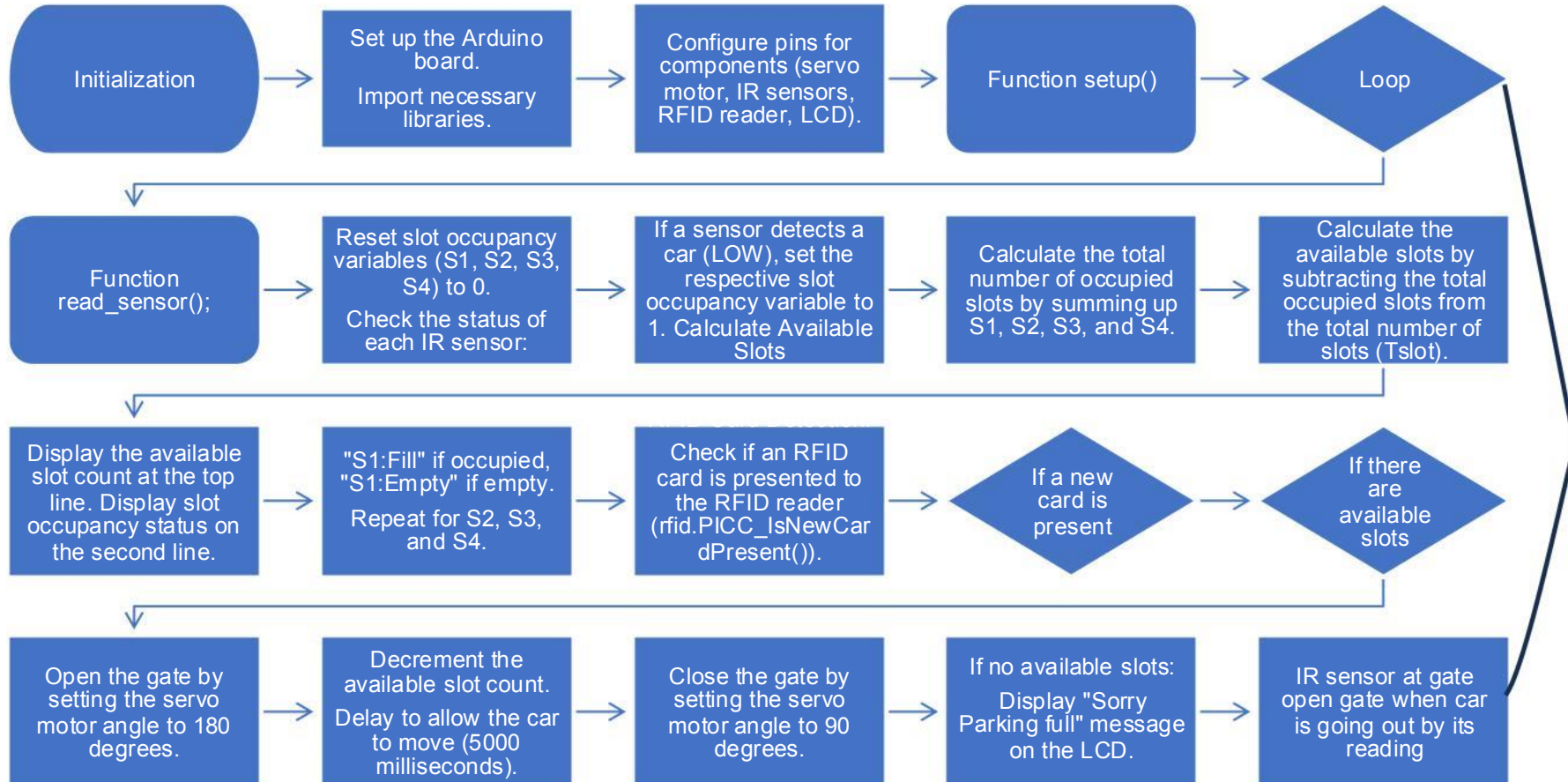
- **Potential and Kinetic Energy:** When the gate opens, potential energy is converted into kinetic energy as the gate moves. When the gate closes, kinetic energy is converted back into potential energy.

➤ **Circuitry and Electronics:**

- **Electromotive Force (EMF):** The operation of various components, such as servos and sensors, involves electricity and circuits. EMF is relevant for power supply.

ARCHITECTURE DIAGRAM

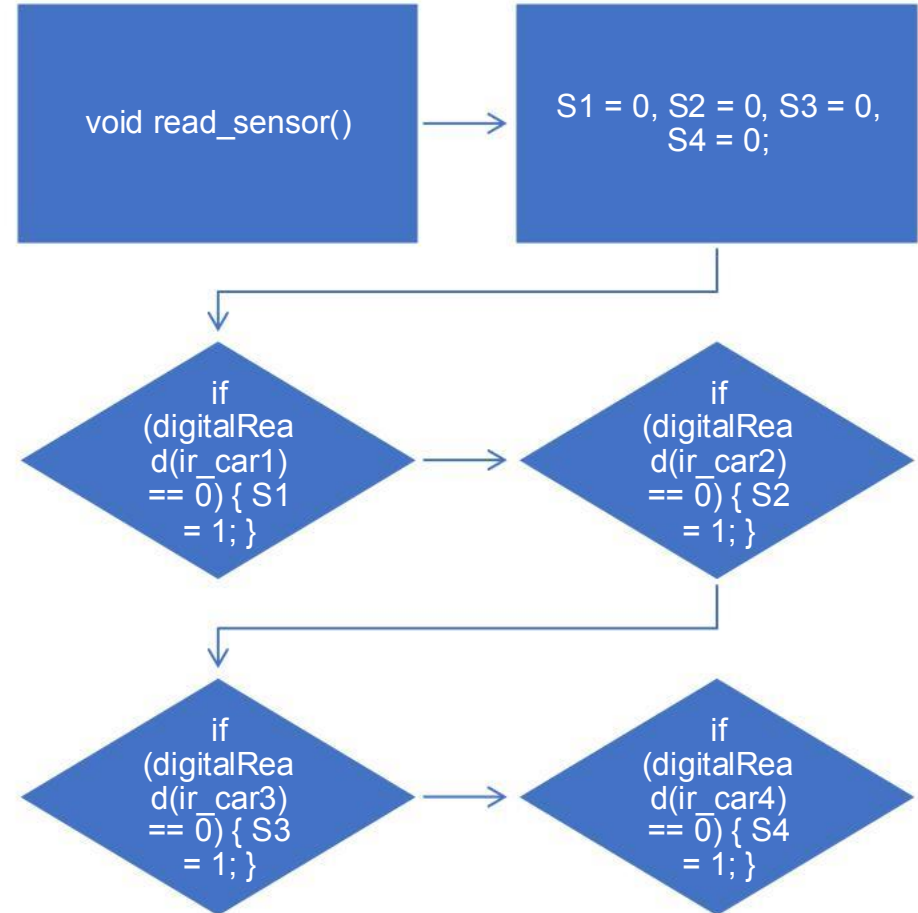
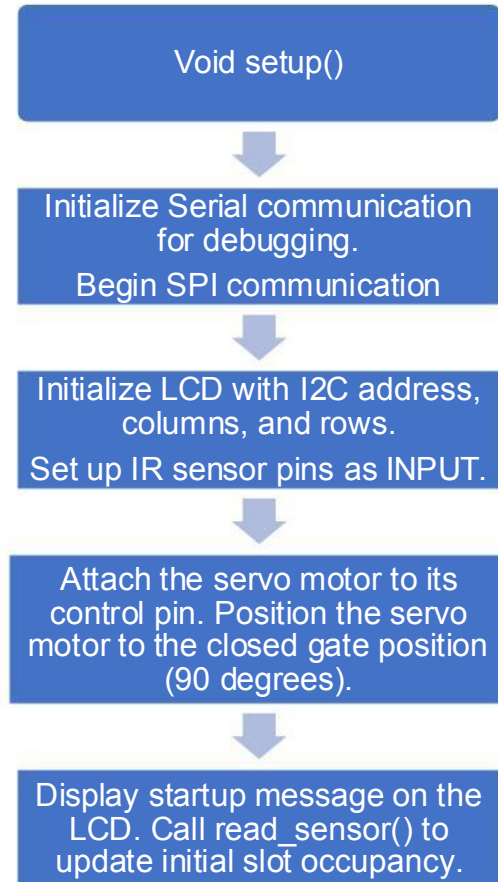
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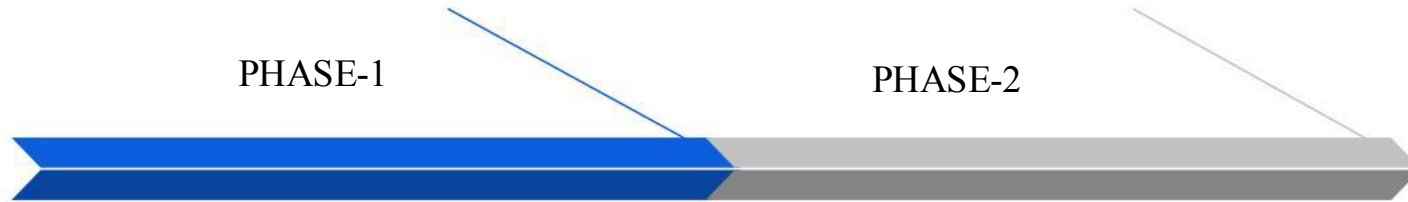




FUNCTIONS

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Identified Problem Statement
Conducted literature Reviews.

Acquired knowledge for achieving
objective.

Designing prototype for the
automatic parking system using
arduino and components

➤ **Societal results**

- Drivers save a lot of time thanks to the automatic parking system, which directs them to accessible spots without requiring them to look for them manually.
- The technology helps to reduce traffic congestion in congested regions by maximising parking space utilisation and offering effective parking recommendations.
- The technology reduces the chance of accidents and vehicle damage when parking by performing precise parking manoeuvres and detecting obstacles.
- By making the most of available parking spots, the technology enables parking lot operators to fit more cars in the same space.
- User satisfaction is increased by drivers' comments about how simple and convenient the automatic parking system is to operate.

➤ Project components range

- **IR Sensors (Infrared Sensors):**

- **Detection Range:** IR sensors typically have a detection range of a few centimeters to a few tens of centimeters. The exact range depends on factors like the sensor's design and the reflectivity of the object being detected.

- **Servo Motor:**

- **Rotation Angle:** Servo motor rotation range of 90 to 180 degrees. The specific range can vary depending on the servo model.
- **Torque:** The torque output of a servo motor can vary widely, ranging from a few newton-centimeters to tens of newton-centimeters. The torque affects the servo's ability to move objects, like opening and closing a gate.

- **RFID Module:**

- **Read Range:** The read range of an RFID module depends on the type and frequency of the RFID technology used. Common RFID read ranges can be from a few centimeters to several meters.
- **Frequency:** The most common RFID frequencies are 125 kHz (low frequency) and 13.56 MHz (high frequency). Different frequencies offer different read ranges and compatibility with various RFID cards.

- S Subaselve, V Muhin, T R Mohanraj, C N Kesava Sai Raam **“RFID based Automatic car parking system using IOT”** Published in: 2023 9th International Conference on Electrical Energy Systems (ICEES) Date Added to IEEE Xplore: 01 May 2023.
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- Nazia Bibi, Muhammad Nadeem Majid, Hassan Dawood, Ping Guo **“Automatic parking space detection system”** Published in: 2017 2nd International Conference on Multimedia and Image Processing (ICMIP) Date Added to IEEE Xplore: 25 December 2017



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