Automated Car Parking System using ATmega328P

A PROJECT REPORT

Submitted by

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ABSTRACT

In this paper, an automated parking system constructed with an Arduino and an I2C LCD display is designed and developed. Through the detection and monitoring of available spaces, the system is intended to improve overall parking efficiency and minimize the need for human intervention in parking management. The Arduino microcontroller uses IR sensors to detect the presence of vehicles and analyzes the data to control parking flow. Drivers can find open spots more easily thanks to the I2C LCD display, which gives them real-time updates on available spots. Many settings, such as public garages, shopping centers, and office buildings, can benefit from this affordable and scalable solution. Additionally, the paper explores the system's potential to improve space utilization and lessen traffic congestion, as well as the hardware setup and programming details.

OBJECTIVES

- **Reduce human intervention :** Minimize the need for manual oversight in parking management by automating the detection and allocation of parking spaces.
- **Futurization :** Embrace modern technology to create a forward-looking, innovative parking solution that supports smart city initiatives.
- **Enhance User Convenience :** Simplify the parking experience for users by providing real-time information on available spaces and guiding them to open spots.
- **Optimize Space Utilization :** Maximize the efficiency of parking areas, ensuring that spaces are used to their full potential and reducing unnecessary congestion.
- **Provide a Cost-Effective Solution :** Offer an affordable and scalable system suitable for diverse settings such as shopping malls, office complexes, and public garages.

CHAPTER 1

INTRODUCTION

In today's rapidly advancing technological landscape, automation has become an integral part of daily life, with parking systems serving as a prime example. Automated parking systems not only add convenience but also address the challenge of managing limited parking spaces. This blog post explores a project centered on building an "Automatic Car Parking System" using Arduino. This innovative approach aims to enhance the efficiency of parking facilities through automation, utilizing Arduino and an I2C LCD Display.

This smart solution automates the parking process, leveraging Arduino's versatile open-source electronics platform. By integrating sensors and actuators, the system provides real-time data on an I2C LCD Display, detects vehicle presence, and guides drivers to available spaces. This optimizes space usage and improves the organization and convenience of parking. Through clever automation and an intuitive interface, this project demonstrates how technology can simplify and enhance modern vehicle infrastructure.

CHAPTER 2
LITERATURE SURVEY

Study	Authors	Year	Objective	Methodology	Conclusion
1	P. Dhavale and s. Kadam	2021	Develop an automatic car parking system using Arduino	Utilized IR sensors for car detection and a servo motor for gate control; included an LCD display for status	Optimized space utilization and reduced human intervention in parking
2	M. Kumar et al.	2021	Apply IR sensors with Arduino for real-time parking management	Used IR sensors to monitor space occupancy; data processed by Arduino and shown on an I2C LCD	Enhanced parking efficiency and reduced traffic congestion
3	R. K. Patel and M. Mishra	2018	Present an automatic parking system using Arduino and RFID technology	Integrated RFID for vehicle authentication; used ultrasonic sensors for monitoring and an LCD for display	Highlighted secure and efficient parking solutions for restricted areas
4	S. Jadhav et al.	2021	Explore automatd multilevel parking system with Arduino	Used IR sensors for detection and stepper motors for movement; managed by Arduino with an I2C LCD for status	Improved space utilization and reduced search time for parking in high-density areas

CHAPTER 3

SYSTEM DESCRIPTION

HARDWARE SPECIFICATIONS

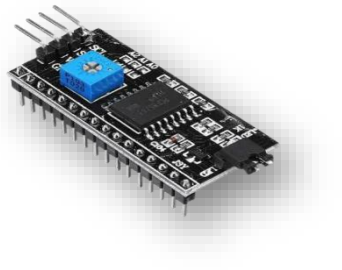
(a) Arduino Uno

It is an easy USB interface. This allows interface with USB as this is like a serial device. The chip on the board plugs straight into your USB port and supports on your computer as a virtual serial port. The benefit of this setup is that serial communication is an extremely easy protocol the microcontroller brain which is the ATmega328 chip. It has more number of hardware features like timers, external and internal interrupts, PWM pins and multiple sleep modes.

(b) Lcd 20x4

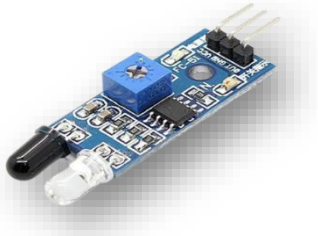
A 20x4 LCD is a liquid crystal display with 20 columns and 4 rows, allowing it to display up to 80 characters at once. Commonly used in embedded systems, microcontrollers, and hobby projects, this LCD provides clear alphanumeric output and is typically based on an HD44780 controller, making it compatible with many libraries for easy integration. The backlit screen and adjustable contrast improve readability, making it ideal for status displays and user interfaces in compact devices.

(c) I2c Module



The I2C module for a 20x4 LCD is a small interface board that simplifies communication between a microcontroller (like Arduino) and an LCD display. It connects to the LCD through a 4-pin interface (GND, VCC, SDA, and SCL) and reduces the number of pins required for the connection from 16 to just 2. Using I2C protocol, data is sent serially, which is ideal for complex projects with limited I/O pins. This module typically uses an I2C address (often 0x27 or 0x3F) to send commands to the display, allowing easy control of text and symbols on the LCD..

(d) IR Sensors



An IR (Infrared) sensor detects infrared light emitted by objects and is commonly used for proximity and motion detection. It consists of an IR transmitter (usually an LED) and a receiver, which detect IR reflections from nearby objects. When an object is close, the IR light reflects back to the receiver, triggering a response in the sensor. IR sensors are popular in applications like obstacle detection, line-following robots, remote controls, and even simple temperature measurement, as different surfaces and distances alter the IR reflections.

(e) Mini Servo Motor Sg90

The Mini Servo Motor SG-90 is a small, lightweight servo motor offering precise 180-degree rotation, commonly used in robotics and electronics. Controlled by PWM signals, it operates on 4.8V-6V, making it ideal for small mechanisms in hobby projects.

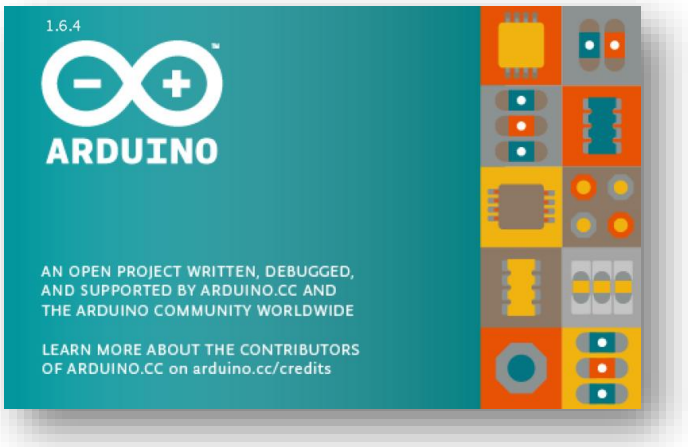
SOFTWARE SPECIFICATIONS

Arduino ide

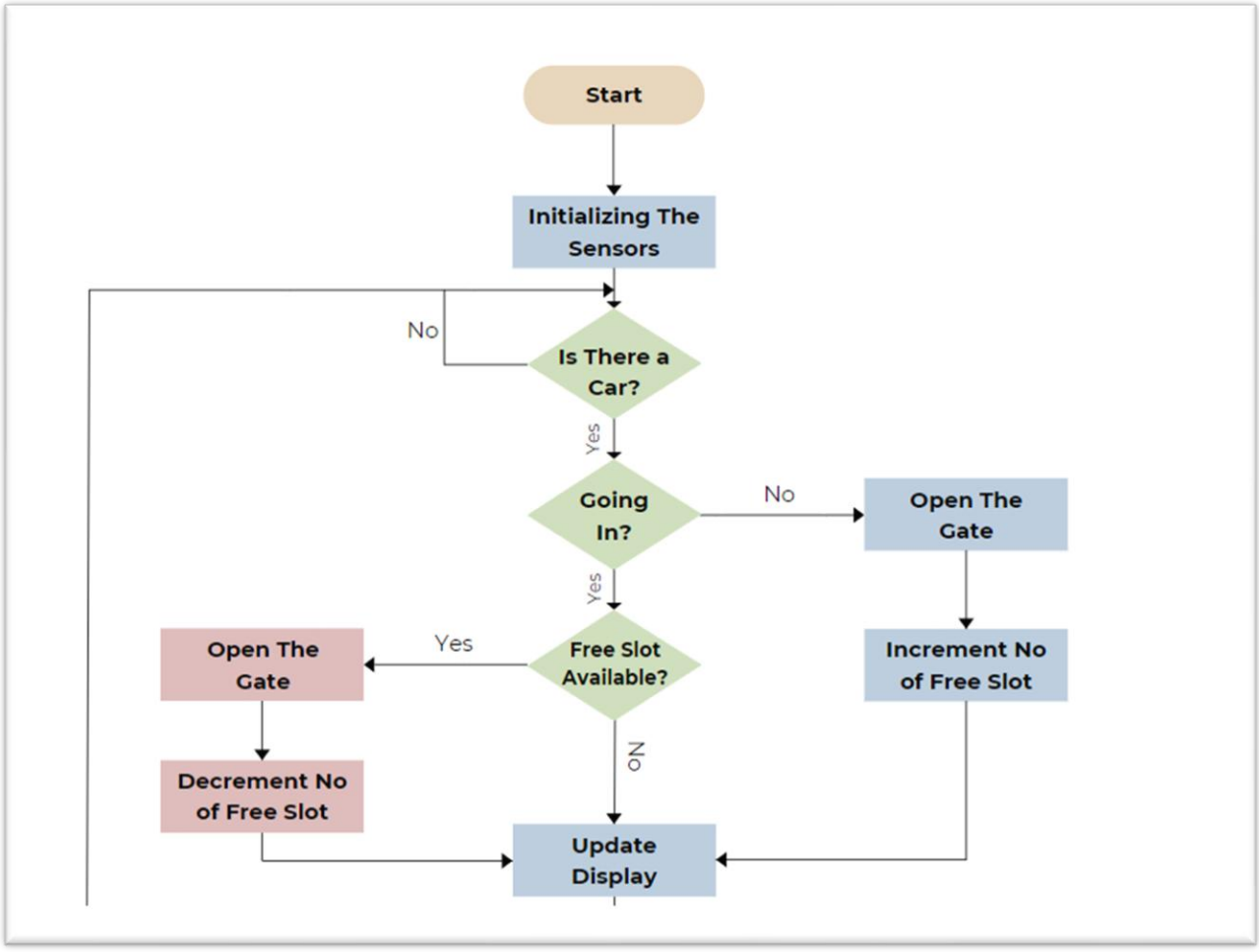
Arduino is an open-source platform designed for building electronics projects, consisting of both a programmable circuit board (microcontroller) and an Integrated Development Environment (IDE) that runs on your computer. The Arduino IDE is a user-friendly software application used to write and upload code directly to the Arduino board. It features a simple interface, allowing users to easily create programs using a language based on C/C++. The IDE includes built-in libraries that simplify complex tasks, making it accessible for beginners while still powerful enough for advanced users.

This platform has gained widespread popularity among hobbyists and professionals interested in creating interactive devices or environments. Arduino boards can interface with various components, including buttons, LEDs, motors, speakers, GPS modules, cameras, the internet, and even devices like smartphones and TVs.

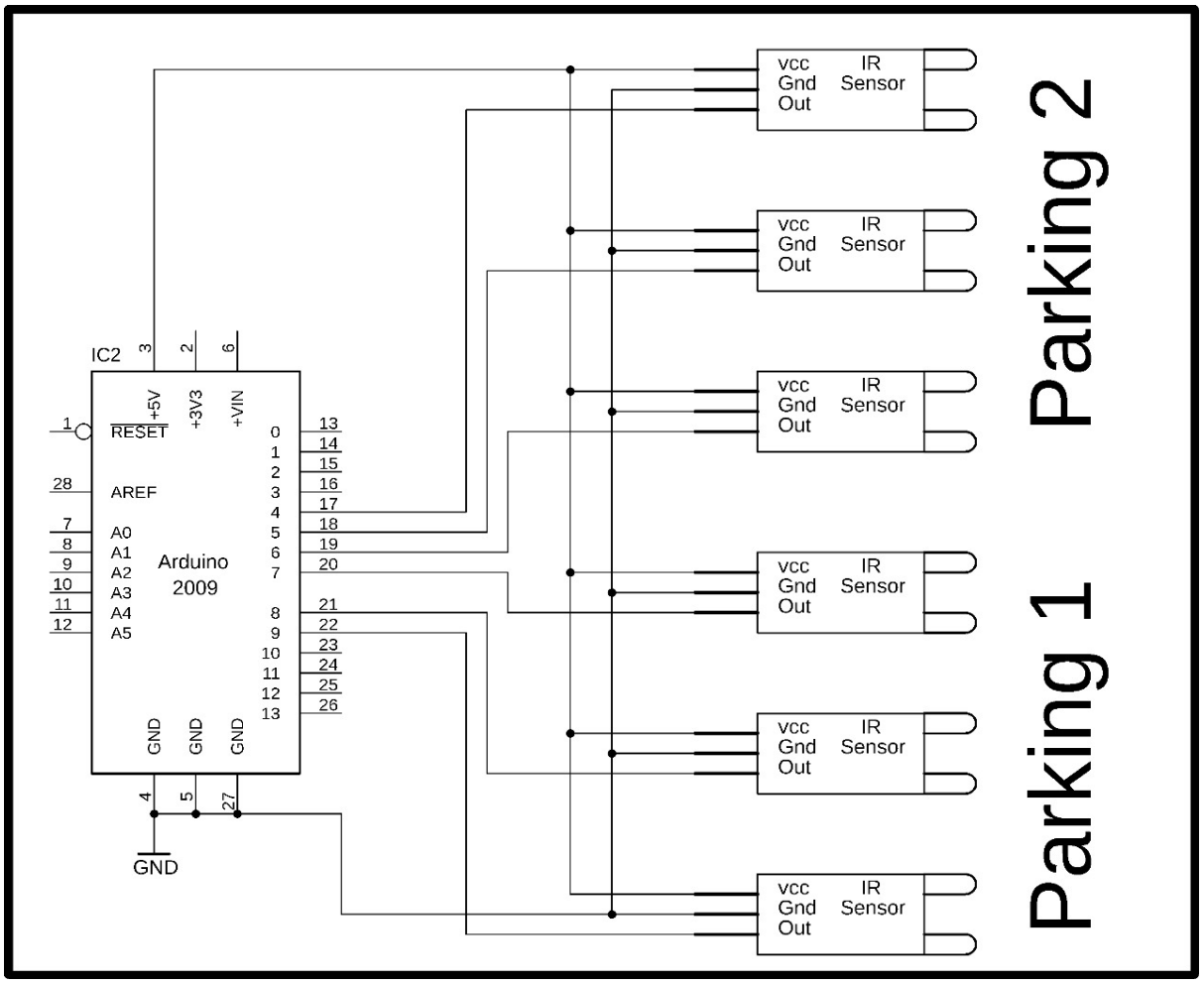
Arduino's flexibility, combined with free software, low-cost hardware, and an easy learning curve, has led to a large, active community of users who contribute code and provide tutorials for a vast array of Arduino-based projects. Numerous types of Arduino boards are available, each suited to different applications. While some boards may vary in appearance, most Arduinos share key components and follow a similar setup, enabling users to explore and expand their creations seamlessly.



Block diagram

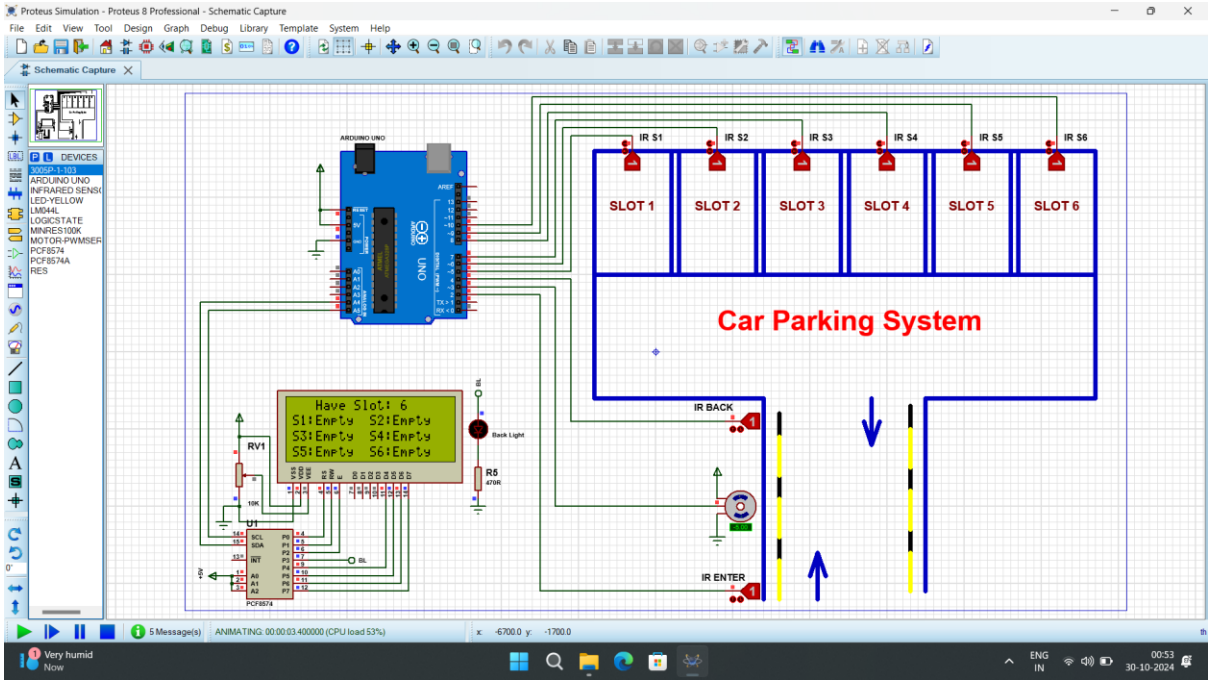


Circuit Diagram



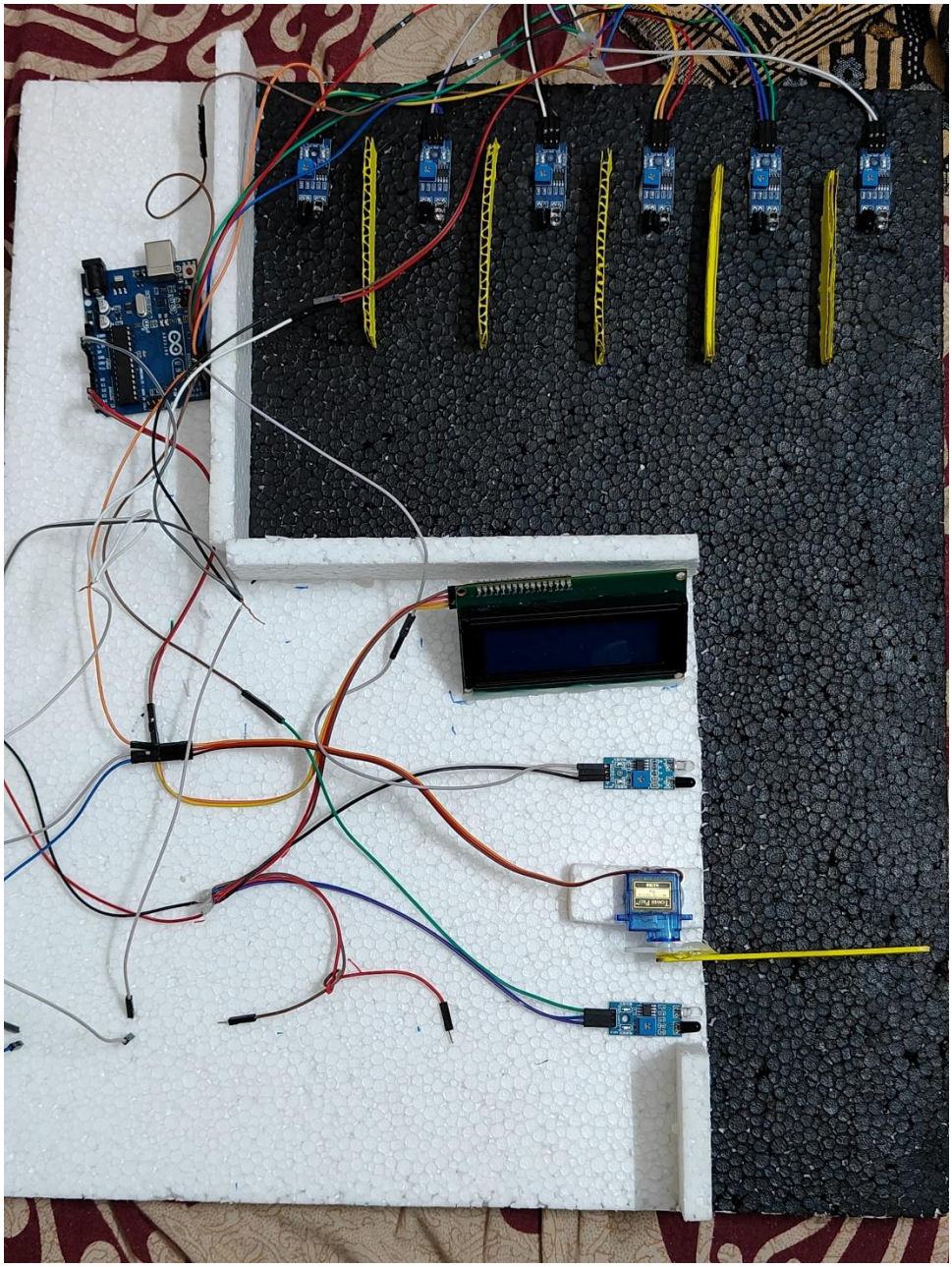
CHAPTER 4

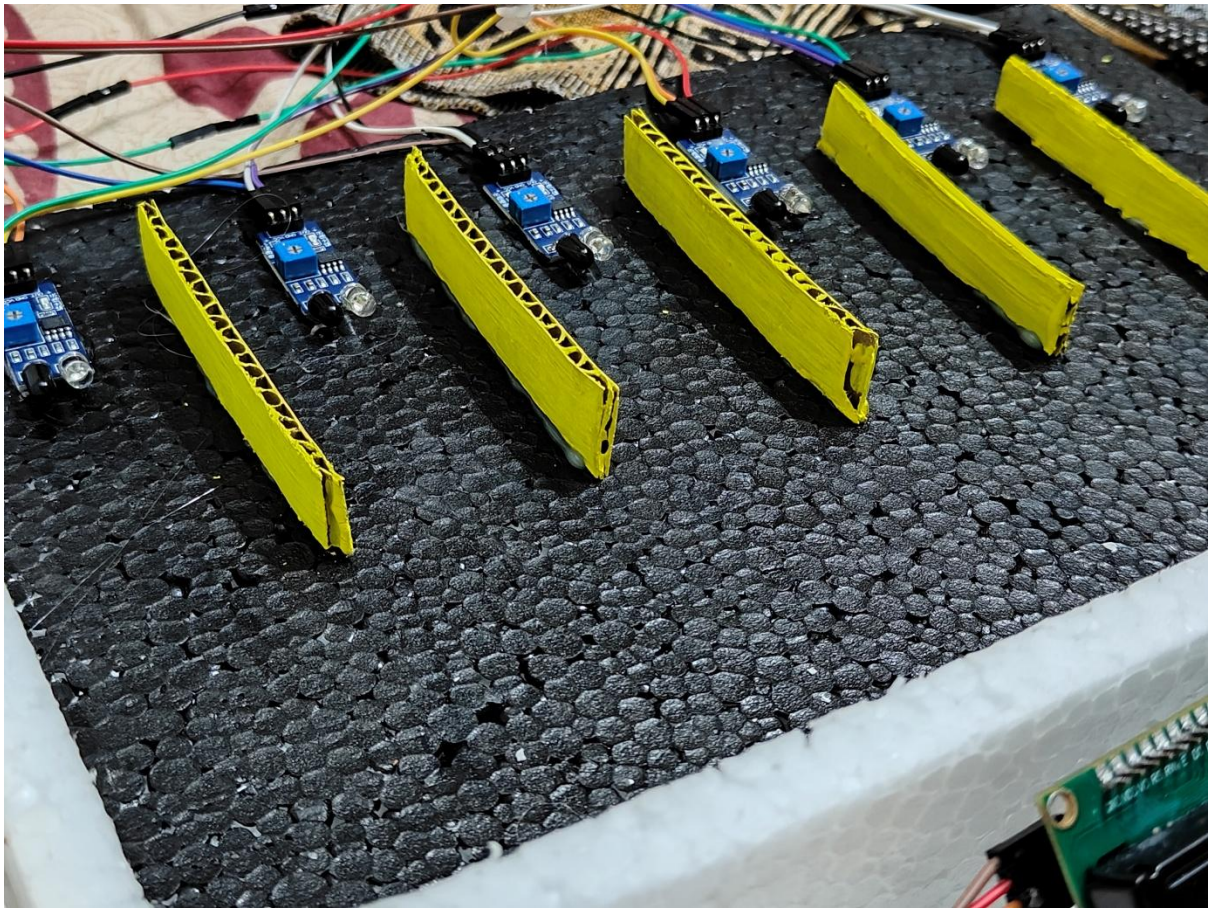
Software model development



We developed an automated car parking system using Arduino and IR sensors, simulated in Proteus software. In this setup, IR sensors detect vehicle presence in parking slots, and the Arduino processes this data to display parking availability on a 20x4 LCD screen. Additionally, a servo motor acts as the parking gate, controlled by the Arduino to allow or restrict entry based on space availability. This Proteus simulation enabled us to visualize and test the interactions between components IR sensors, Arduino, LCD, and servo motor providing a reliable virtual environment to refine our design before moving to physical implementation.

Hardware model development





We developed a car parking system using Arduino, IR sensors, and a servo motor as a parking gate, with real-time data displayed on a 20x4 LCD. In this hardware setup, IR sensors detect vehicle presence in each parking spot, while the Arduino processes these signals to update slot availability and control the servo motor, which acts as an automated gate. When a vacant spot is detected, the servo motor opens the gate to allow vehicle entry. The 20x4 LCD displays the status of each parking slot, making the system clear and user-friendly. Through hardware testing, we confirmed the seamless interaction between sensors, the Arduino, the LCD, and the servo motor, resulting in a practical and efficient solution for automated parking management.

CHAPTER 5

CONCLUSION

Finally, this project exhibits the power of automation or microcontroller-based control systems. You may construct an effective and user-friendly parking solution by integrating Arduino, several sensors, and a servo motor. The benefits of such a system are improved management of parking, fewer human interactions, and more client convenience. This project exemplifies how technology advancements may improve the efficacy and management of urban surroundings. This project provides an excellent chance to gain knowledge about and experiment with various electronic components and code, whether you are an enthusiast for technology or a hobbyist. Now that you've completed this intriguing Car Parking System project, you're ready to dive into the realm of automatic parking.

REFERENCES

https://youtu.be/H5HNCOP2qdE?si=530zLJKYCctC8rNK

Automatic Car Parking System Using Arduino And I2C LCD Display :

https://marobotic.com/2023/10/18/how-to-make-car-parking-system-using-arduino-and-i2c-lcd-display-automatic-car-parking-system/