AUTOMATED CAR PARKING SYSTEM

A Project Report

SUBMITTED BY

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1. AIM : To design and develop an automated car parking system using Arduino for efficient parking slot management and vehicle guidance.

2. HARDWARE REQUIRED :

1. Arduino UNO
2. 16 MHZ Microcontroller
3. Potentiometer
4. Servo Motor
5. Cylinder battery
6. IR Sensor
7. 16*2 LCD Display
8. Power Supply
9. Battery
10. Switch

3. THEORY :

a) INTRODUCTION: Over the decades our country has been developed drastically, now we are in this that state we have lots of well contacted roads, commercial building and increasing number of automobiles. Automobiles are synonyms for mobility and freedom. An amazing increase in the growth of population in this world leads to the rapid increase in the automobiles being used. While parking these automobiles in the parking space, we use the manual procedure of parking, in which most of the case is unplanned and lack of discipline . Drivers in our country cannot properly park their vehicle in the parking slot because of improper parking system. Sometimes when they do not find any parking space, they park their vehicle in the roadside and as a result roads become so narrow. As a result of this, a huge traffic jam takes place in that place. Also, sometimes it seems that people start fighting for parking slot in the parking lot. Because from outside people cannot understand weather there is any parking slot is available or not. It also wastes our lot of time. This is also an economical loss as we need to repair our damaged car. As we are advancing with time, the manual car parking system is creating hurdles which is causing wastage of time and some economic losses as well. Therfore, we need a solution which can overcome these problems. This situation calls for the need for an automated parking system that not only regulates parking in a given area but also keeps the manual control to a minimum. Automatic car parking systems is the sole solution to parks as many cars as possible in as little space as possible. Automatic car parking systems are based on the most modern technology of storage systems.Our demonstration facility presents a miniature model of an automated car parking system that regulates the number of cars that can be parked in a given space at any given time based on the parking space availability.

b) PARKING : Parking is the act of stopping and disengaging a vehicle and leaving it unoccupied. Parking on one or both sides of a road is often permitted, though sometimes with restrictions.[5] Parking facilities are constructed in combination with some buildings, to facilitate the coming and going of the building's users.

c) MODES OF PARKING :

a) Parallel
b)Perpendicular
c) Angle

d) **AUTOMATED PARKING SYSTEM :** An automated parking system (APS) is a mechanical system designed to minimize the area and/or volume required for parking cars.[2] Like a multi-story packing garage, an

APS provides parking for cars on multiple levels stacked vertically to maximize the number of parking spaces while minimizing land usage. The APS however, utilizes a mechanical system to transport cars to and from parking spaces in order to eliminate much of the space in a multi story parking garage.

e) **DIFFERENT TYPES OF AUTOMATED PARKING SYSTEM :** There aremainly 6 different types of APS:

AVG SYSTEM
CRANE SYSTEM
PUZZLE SYSTEM
RGC SYSTEM

AVG SYSTEM : Automated Guided Vehicle known as AGP technology has been introduced in automated parking system most recently through AGV's has been used in automated warehousing for decades. The vehicles are parked on pallets in the parking space which are collected from the parking entrance by the AGV's driving beneath the vehicle pallet,lifting it and then parking it in the parking space. The number of AVG's in the system is fleible.[3] Generally AVG systems operate on solid finished concentrate that can move in both lengthways and sideways directions along fixed paths and are able to rotate on the spot. It also allows for the multiple simultaneous parking and retreival movements along paths system.

Fig 1 : AVG SYSTEM

CRANE SYSTEM : The Crane System is a type of Automated Parking System that uses overhead cranes to move vehicles to and from parking spaces. The system consists of a grid of parking spaces with a crane that travels along the grid, lifting and moving vehicles to their designated parking spaces. The crane is typically controlled by a computer system that directs it to the correct parking space, and the vehicle is then stored in a secure and compact manner.[6] The Crane System is ideal for high-density parking applications and can be used in both above-ground and underground parking facilities, providing a efficient and space-saving solution for parking needs.

Fig 2: Crane System

PUZZLE SYSTEM : The Puzzle System is a type of Automated Parking System that uses a puzzle-like mechanism to park and retrieve vehicles.[2] The system consists of a grid of parking spaces with movable platforms and lifts that can be rearranged to accommodate different vehicle sizes and shapes. When a vehicle enters the system, the platforms and lifts are rearranged to create a parking space, and the vehicle is then parked in a compact and secure manner. The Puzzle System is designed to maximize parking density and can be used in a variety of settings, including urban areas where space is limited, providing a efficient and innovative solution for parking needs.

Fig 3 : PUZZLE SYSTEM

SHUTTLE SYSTEMS : The Shuttle System is a type of Automated Parking System that uses automated shuttles transport vehicles to and from parking spaces. The system consists of a network of tracks and shuttles that move vehicles through the parking facility, using sensors and navigation systems to guide them to their designated parking spaces. When a vehicle enters the system, it is loaded onto a shuttle, which then transports it to a parking space, where it is then parked and secured[8]. The Shuttle System provides a fast and efficient way to park and retrieve vehicles, minimizing the need for manual labor and reducing the risk of damage to vehicles, making it an ideal solution for high-volume parking facilities.

Fig 4: SHUTTLE SYSTEM

f) DESCRIPTION OF THE IMPORTANT COMPONENTS:

ARDUINO UNO : As a programming level circuit, it helps us to communicate between the programming of the router and the sensory level components. [1]

Fig 5 : ARDUINO UNO

IR SENSOR : The Infrared (IR) sensor is a non-contact proximity detector that emits infrared light to objects or obstacles within its range, providing digital output signals for applications like obstacle avoidance, motion detection, and proximity sensing.[3]

Fig 6. SENSOR

MICROCONTROLLER : The 16MHz microcontroller is a 16-bit processor operating at 2 MHz, featuring 16 KB flash memory, multiple I/O pins, and UART, SPI, and I2C interfaces, ideal for embedded systems, robotics, and automation.[9]

FIG 7 : 16MHZ MICROCONTROLLER

LCD DISPLAY : The 16x2 LCD display is a compact, dot-matrix liquid crystal display showing 16 characters per row on 2 rows, ideal for industrial control panels, medical devices, and IoT projects.[5]

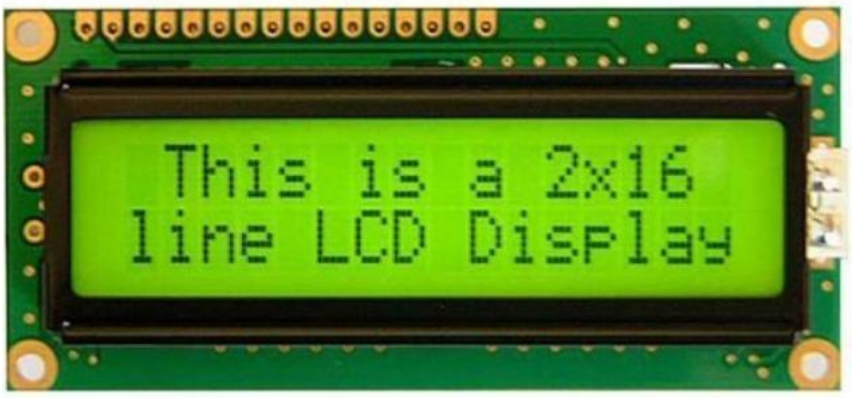


*FIG 8 : 16*2 LCD DISPLAY*

POTENTIOMETER: The Potentiometer is a variable resistor that converts mechanical rotation or linear displacement into an analog electrical signal, commonly used for volume control, position sensing, and adjustment applications.

FIG 9: POTENTIOMETER

CYLINDER BATTERY: The Cylinder Battery, also known as an AA/AAA battery, is a compact, cylindrical-shaped rechargeable or non-rechargeable power source commonly used in portable devices, electronics, and appliances.

FIG 10 : CYLINDER BATTERY

g) Construction and working principle:

The construction and working of the project are divided into two parts: -

1) Entry part :

The project is a sensor based automatic system. The Entry Part of the project consists of Arduino Mega microcontroller to which a servo motor, IR sensor, LCD and ultrasonic sensor are interfaced. The servo motor acts as a gate at the entrance and it opens and closes when the IR sensor detects presence of car. The input IR sensors reads presence of any car and sends to the controller Arduino UNO board. While entry IR sensor detect car, it opens the door in condition of having available slot. After entering the car, the gate gets closed with the help of servo motor.[3] The motor gets instruction from the board. The LCD displays the parking slots which are empty for the car drivers. While A car gets into a slot,

the corresponding slot status in the LCD display shows "Have space". At the time of exiting a slot, the status of the slot changed to "Vacant".[7] When all the slots are booked, the system doesn't allow the fourth car to enter, and shows "Sorry parking full". The ultrasonic sensors detect the presence and absence of car in each parking slot.

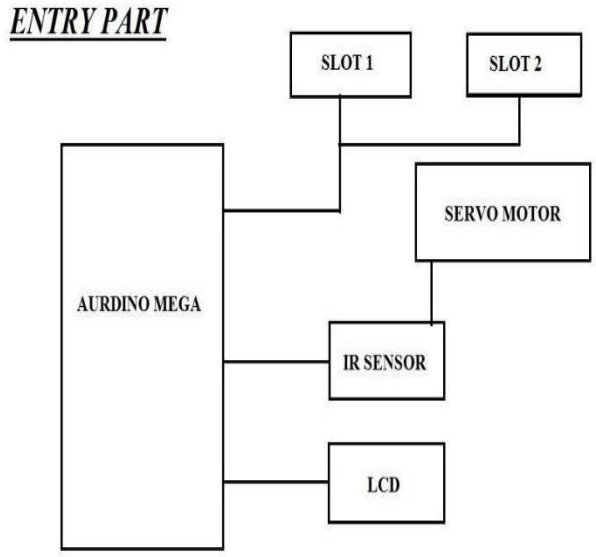


FIG 11 : ENTRY PART OF CAR PARKING SYSTEM

2) Exit Part :

The Exit Part of the project consists of Arduino Uno to which a servo motor, IR sensor and the object counter are interfaced. The servo motor acts as a gate at the entrance and it opens and closes when the IR sensor detects presence of car.[6] When a car exits from a slot, the exit IR sensor detects the car and opens the gate with the servo motor. Then total available free slot count increase by 1 in the screen.[3]

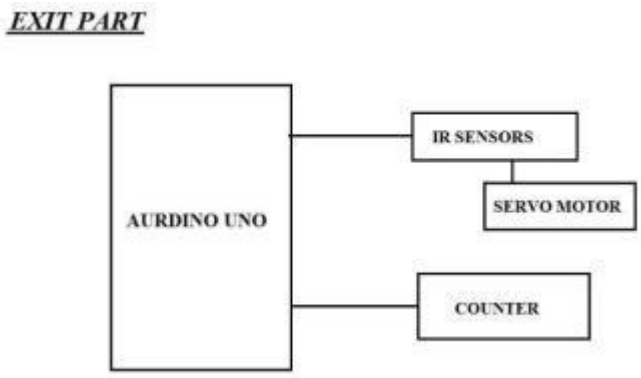


FIG 10 : EXIT PART OF CAR PARKING SYSTEM

h) BLOCK DIAGRAM OF THE PROPOSED PROJECT:

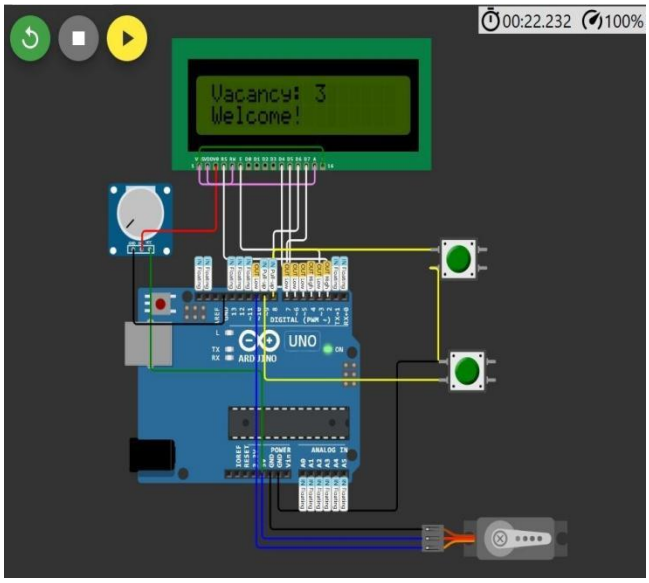


FIG 11 : 1st SIMULATION

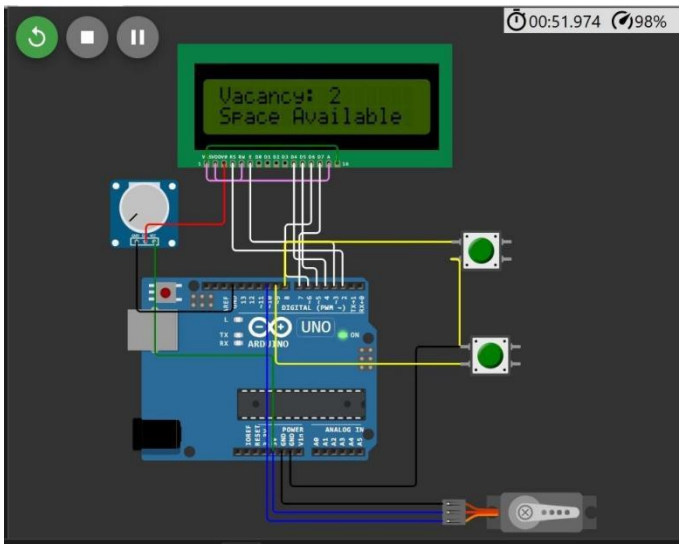


FIG 12 : 2nd SIMULATION

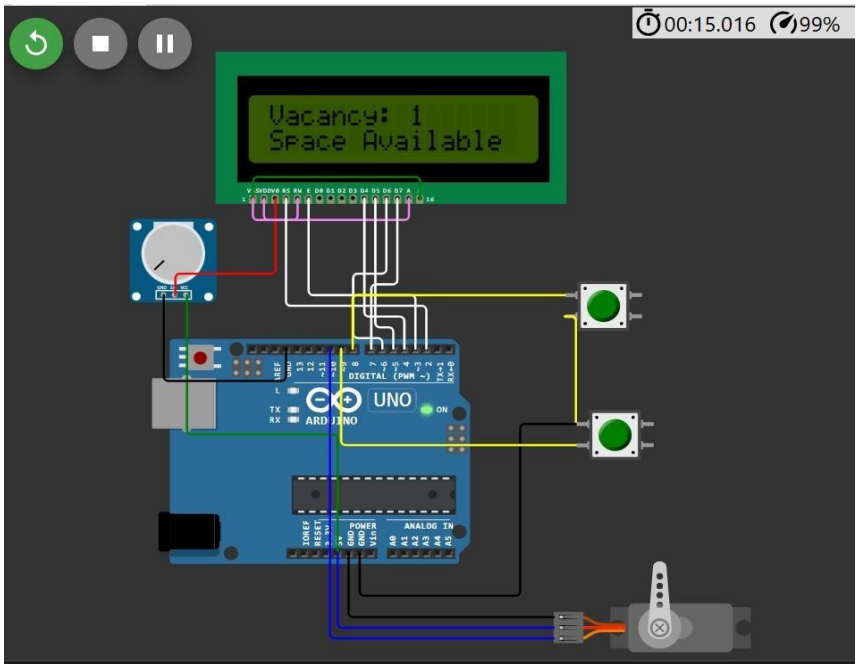


FIG 13 : 3rd SIMULATION

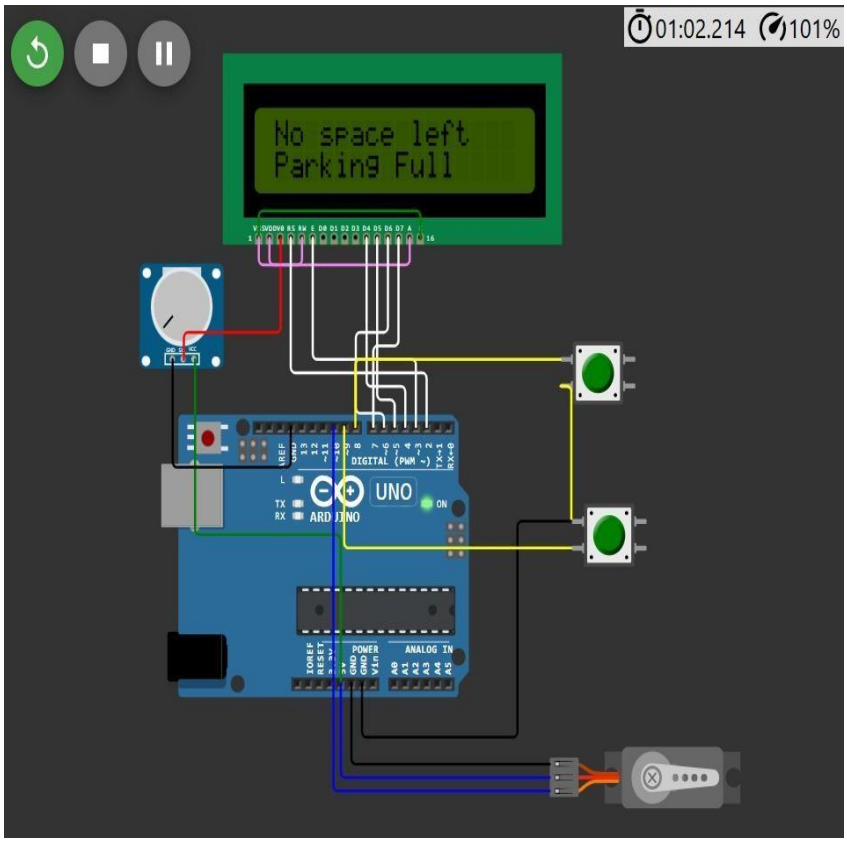


FIG 14 : NO SIMULATION

i) Advantage of automated car parking system :

1.. Reduced traffic

2. Reduced pollution

3. Enhanced User Experience

j) Disadvantage of AUTOMATED CAR PARKING SYSTEM :

1. It achieves wireless technology with limited options of connecting to particular device only

2. It does not know who the driver in the car is, checks only the key placed

3. Node-to-node implementation requires more time.

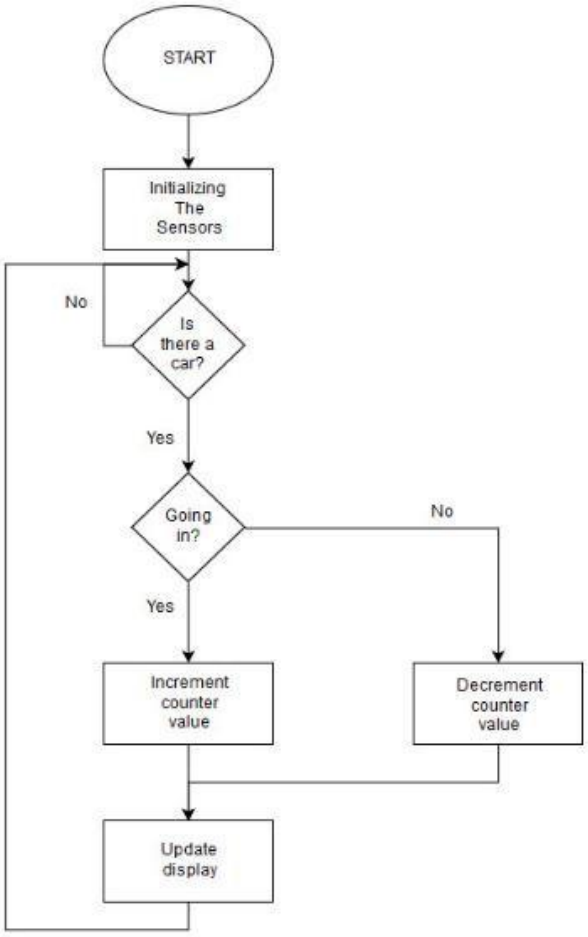
k) APPLICATIONS OF AUTOMATED CAR PARKING SYSTEM:

1. Commercial Parking Garages: Increase parking capacity and efficiency in urban areas.

2. Shopping Malls: Provide convenient and secure parking for customers.

3)Airports: Streamline parking processes for travelers and reduce congestion

.4.ALGORITHM :



5) DUMMY CODE:

1) · Initialize LCD and Servo Components:
2) · Set up the LCD display using designated pins.
3) Attach the servo motor to the specified pin, setting it to the initial closed position.
4) · Define Infrared (IR) Sensor Pins:
5) · Assign the entryIR pin to detect cars at the entry gate.
6) Assign the exitIR pin to detect cars at the exit gate.
7) · Set Parking Lot Variables:
8) · Initialize carCount to 0, representing the number of cars currently in the lot.
9) Define maxCars as the maximum parking lot capacity (e.g., 3 cars).
10) · Setup Function (Runs Once at Startup):
11) · Begin the LCD with a 16x2 display configuration.
12) Set IR sensor pins as inputs with pull-up resistors.
13) Attach the servo motor to the gate and set it to the closed position initially.
14) Display initial information on the LCD:
15) Show "Vacancy:" and the current number of available spaces.
16) Show "Welcome!" on the second line.
17) · Loop Function (Runs Continuously):
18) ·
19) Monitor IR Sensors:
20)
21) Continuously check the entry and exit sensors to detect car movements.
22)
23) If a Car Enters the Parking Lot:
24)
25) If the entry sensor is triggered and the parking lot is not full:
26) Increment carCount by 1.
27) Call the updateDisplay() function to refresh the display with the current vacancy status.

28) Open the gate using the openGate() function.
29) Wait for 3 seconds to allow the car to pass through.
30) Close the gate using the closeGate() function.
31)
32) If a Car Exits the Parking Lot:
33)
34) If the exit sensor is triggered and there are cars in the lot:
35) Decrement carCount by 1.
36) Call the updateDisplay() function to refresh the display with the current vacancy status.
37) Open the gate using the openGate() function.
38) Wait for 3 seconds to allow the car to pass through.
39) Close the gate using the closeGate() function.
40)
41) Add a Delay to Avoid Rapid Triggering:
42)
43) Pause briefly to prevent sensors from triggering too quickly in succession.
44) · Gate Control Functions:
45) · openGate(): Set the servo to open the gate.
46) closeGate(): Set the servo to close the gate.
47) · Display Update Function (updateDisplay()):
48) · Clear the LCD display.
49) If parking spaces are available:
50) Display "Vacancy:" followed by the number of available spaces.
51) Display "Space Available" on the second line.
52) If the parking lot is full:
53) Display "No space left" on the first line.
54) Display "Parking Full" on the second line.

RESULT :

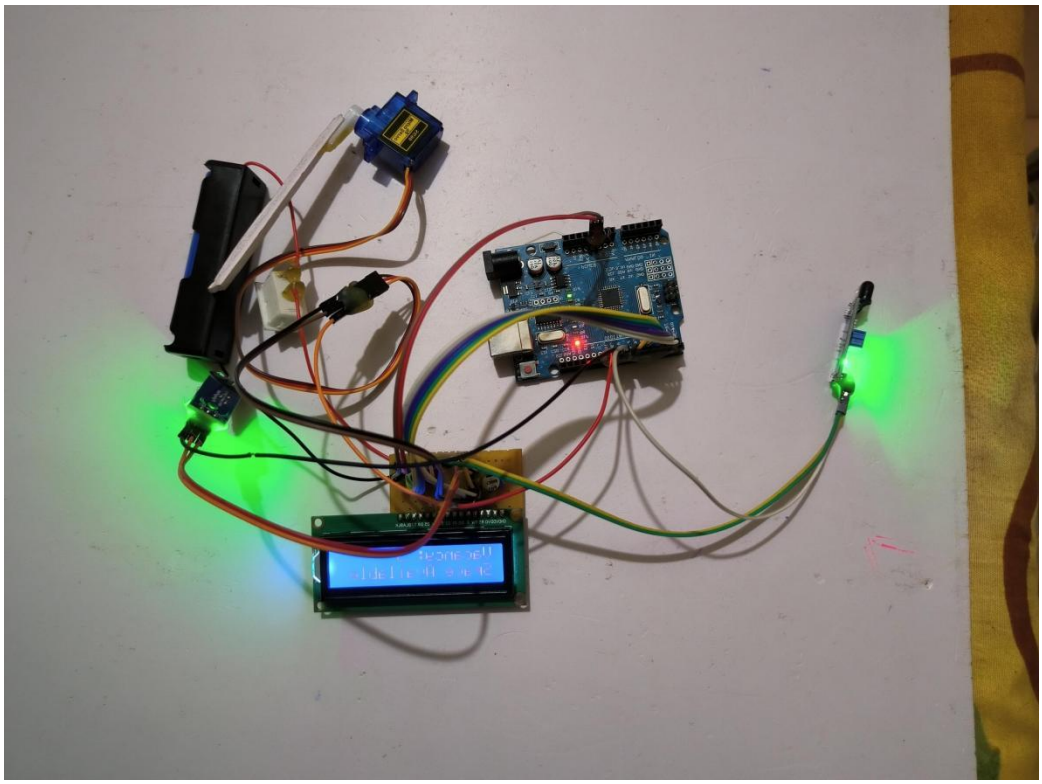


FIG 15 : AUTOMATED CAR PARKING SYSTEM

In our project on the automated car parking system, we designed a solution that efficiently manages

parking spaces while minimizing human intervention. The system utilizes advanced sensors and microcontrollers to detect available parking spots and guide vehicles to their designated areas. Our hardware setup includes components such as sensors for distance measurement, a microcontroller for processing data, and motors to control the movement of the parking platform. The accompanying picture showcases the hardware configuration we implemented, highlighting the integration of these components[1]. As the simulation software doesn't have IR sensor ,it uses push button to apply the entry and exit condition. This project not only demonstrates our technical skills but also addresses the growing need for smart parking solutions in urban environments, ultimately enhancing convenience and efficiency for drivers.

7 .CONCLUSIONS: In conclusion, the automatic car parking system using microcontrollerr(Arduino) has proven to be a successful solution in automating the parking process and improving efficiency. With accurate obstacle detection, reliable vehicle presence determination, precise gate control, and real-time updates on parking space availability, the system has demonstrated its effectiveness in addressing the challenges of urban parking. The integration of ultrasonic and IR sensors, a servo motor, and an object counter has provided a robust foundation for the system's

functionality. Moving forward, future endeavors include the integration of advanced computer vision techniques to enhance obstacle detection and vehicle recognition capabilities. Wireless communication can be incorporated for remote monitoring and seamless integration with mobile applications[6]. Optimizing energy consumption and scalability for larger parking facilities are additional areas of focus. By pursuing these enhancements, the automatic car parking system can continue to evolve, offering improved performance, expanded features, and adaptable solutions for diverse parking environments. This project serves as a stepping stone towards more efficient and intelligent parking systems that minimize congestion and provide a seamless parking experience for drivers.

8.REFERENCES :

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