IOT Enabled Vehicle Parking System

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Abstract:- Autonomous four-wheel drive smart car parallel to its own parking lot is an advanced technology designed to change the way the car stops in parallel parking. This cutting-edge technology allows the vehicle to stop autonomously and correctly without affecting the driver. Parallel automated stations use a complex set of products and technologies to complete their work. The main components include ultrasonic sensors, central processing unit (CPU), steering control mechanism and user interface. Ultrasonic sensors are placed around the vehicle to detect the distance between the vehicle and its surroundings. These sensors provide instant feedback to the CPU, which processes the data and counts the best stations. The system uses advanced algorithms to determine the precise steering angle and maneuvering braking required to complete paralleling. The CPU analyzes sensor data and steers the car safely and efficiently. The user interface provides additional convenience and control for drivers to initiate individual parking modes and monitor the parking progress. Using this autonomous parking system provides many benefits to drivers. First, it eliminates the stress and problems associated with parallel parking. Since the system controls the entire process, the driver does not need to waste time and effort to maneuver the car into a narrow parking space. Additionally, technology increases safety by reducing the risk of accidents. The exact location and orientation provided by the system reduces the risk of impact and damage to the vehicle or surrounding property.

Keywords: Ultrasonic sensor, servo motor, IR sensor, LCD, buzzer, AT-mega microcontroller, motor driver.

1. INTRODUCTION

Parking connections can be challenging for drivers. Today's cars do not have the technology to make parking easier. The main purpose of this project is to create a useful parking lot that can be parallel parking. The system will include several proximity sensors as well as a central microprocessor that

controls the vehicle. The system is suitable for car scale models and life-size cars. This project explores how sensor devices and algorithms can be used in real-world applications. This article describes the various components used to build the station, including the At-mega microprocessor, ultrasonic and infrared sensors, H-bridges, and servo motors. It also includes the parking algorithms used in the system. As the population of the city increases, car use also increases. It causes parking problems, which leads to accidents, driving stress and air pollution. Going to many public places such as shopping malls, cinemas and restaurants during festivals or holidays creates more parking problems. A recent study found that drivers spend approximately 8 minutes parking because it takes more time to find a parking space. 30 to 40 percent of traffic accidents are caused by investigations. Here we look at how parking equipment can reduce parking problems by improving infrastructure, creating a more efficient and effective urban environment, improving public transportation, reducing traffic congestion, and making citizens safer and more involved in cities to transform urban communities. Parking is an important issue both locally and regionally

2. Problem Statement: -

Implementation of automatic forward smart car parallel self-parking system. Most of the drivers nowadays having a problem of parking especially when the parking space is tight. The driver will normally take some times to parking and even sometimes it will result not that nice. Therefore, this research has carried out to help the drivers to save time, easy parking and gives them safety.

3. Motivation: -

Nowadays, drivers often face parking problems, especially when parking spaces are narrow. Therefore, this study was conducted to help drivers save time, park easily and stay safe. The process of finding parking is time-consuming, confusing and wasteful. This might cause frustration for the drivers. Unskillful drivers park very badly consuming extra parking space which leads to lack of parking space. Parallel parking can be a challenging and time-consuming task for many drivers. Byintroducing an automatic forward smart car parallel self- parking system, the process becomes much simpler and less stressful. Drivers can save time and effort by allowing the car to handle the parking maneuver, especially in crowded urban areas where parking spaces are limited. Parallel parking requires precise maneuvering and spatial awareness, which can be difficult for inexperienced or nervous drivers. An automatic self-parking system utilizes sensors, cameras, and advanced algorithms to detect obstacles, calculate distances accurately, and execute parking maneuvers with precision. This helps reduce the risk of accidents, scratches, and dents caused by human error during parking. Self-parking systems are designed to park vehicles with minimal gaps, maximizing the utilization of available parking spaces. This can help alleviate parking congestion in cities and improve efficiency in crowded parking lots. Parallel parking can be a challenge for people with certain physical disabilities or mobility limitations. Automatic self-parking systems enable individuals who may have difficulty performing.

4. Literature Survey: -

[1]. "Automatic Self-Car Parking Using IoT" by Rahul Scanda Vadde, Sayooj Dinan, and N. Krishnaraj (International Journal of Engineering Science and Innovative Technology, April 2021): Vadde, Dinan, and Krishna raj propose an automatic parking system that leverages IoT (Internet of Things) technology. The study emphasizes the integration of sensors and devices to enable real-time monitoring and control of the parking process. By utilizing IoT-based communication and control protocols, the system achieves autonomous parking, enhancing convenience for drivers. The authors discuss the implementation of various sensors such as ultrasonic sensors, cameras, and GPS modules to collect parking-related data and make informed decisions during the parking maneuver. The IoT framework enables seamless communication between these devices and the central control unit, ensuring accurate and efficient parking operations.

[2]. "Smart Parking System Using IoT and Deep Learning" by Akshay Shingte, Mukesh Paliwal, Sachin Kumar Yadav, and Linda John (IOSR Journal of Engineering, 3 April 2020): Shingte, Paliwal, Yadav, and John present a framework that combines IoT and deep learning techniques for smart parking systems. The study focuses on image processing algorithms and deep learning models to detect and recognize parking spaces. By collecting and processing parking data using IoT devices, the system enables efficient parking management and navigation. The authors highlight the use of computer vision techniques, including object detection and classification algorithms, to identify and analyze parking spots in real-time. Deep learning models such as convolutional neural networks (CNNs) are employed to accurately recognize empty parking spaces and guide vehicles to those available spots. The integration of IoT technology facilitates seamless communication and data sharing between parking infrastructure, vehicles, and drivers, resulting in an intelligent and responsive parking system

[3]. "Design and Implementation of Self-Navigation and Self-Parking Systems Using Sensors and RFID Technology" by Madhuri M. Bijamwar and Prof. S.S. Savkare (International Journal of Engineering Research and General Science, May-June 2016): Bijamwar and Savkare propose a self-navigation and self-parking system that incorporates sensors and RFID (Radio Frequency Identification) technology. The study emphasizes the integration of ultrasonic sensors and RFID tags to enable precise parking and navigation. Ultrasonic sensors are used to measure the distance between the vehicle and obstacles, providing real-time feedback to the control system for accurate parking maneuvers. RFID tags are employed to mark parking spaces and guide the vehicle through predefined routes within the parking area. The system utilizes a combination of sensor data and RFID information to execute parking operations with high precision. By integrating these technologies, the system enhances the accuracy and efficiency of parking maneuvers, reducing the risk of collisions and increasing overall parking success rates.

[4]. "Autonomous 4WD Smart Car Parallel Self-Parking System by Using Fuzzy Logic Controller" by Md Mamunur, Md Rashidul, and Abubakar (American International Journal of Sciences and Engineering Research, Vol. 2, Issue 2, 2019): The literature review highlights the rapid growth in smart parking systems, particularly in Europe, the United States, and Japan. These systems integrate advanced technologies and research from diverse academic disciplines to address the challenges of parking in urban and metropolitan areas. The need for an automatic parking system is emphasized to reduce manual work and facilitate careful parking of cars and other vehicles, ultimately improving the efficiency of parking operations.

Furthermore, the review indicates that various researchers have proposed automatic car parking systems using different technologies. This suggests a growing interest and investment in developing innovative solutions to address the challenges associated with parking, particularly in crowded urban environments. The literature review sets the stage for the current research by highlighting the existing efforts and the need for further advancements in automatic parking systems.

[5]. "Automatic Car Parking System" published in the International Journal of Electrical Engineering andTechnology (IJEET). The paper is authored by P. Elakiya, S. Akilan, B. Haridharani, B. Arjun kumar, and R. Karthik- Volume 12, Issue 3, March 2021: The paper begins with an introduction to the concept of automated car parking systems (APS) and their importance in modern cities. The authors then describe the proposed system, which is a microcontroller-based project that uses ultrasonic and IR sensors to detect the distance of the vehicle and display the available parking space on an LCD display. The paper also includes a block diagram of the proposed system. The working methodology of the proposed system is described in detail, including the use of a microcontroller, ultrasonic range finder, LCD, motor drive, door sensor, and IR sensor. The authors explain how the ultrasonic sensor measures the distance to an object using ultrasonic sound waves and how the motor drive controls the steering of the vehicle. The paper also includes a simulation output of the state of the car.

The results and discussion section of the paper describes how the proposed system is effective in places like shopping centers and other comparable spots. The authors state that the average time for users to park their vehicles is effectively reduced in this system, and most of the vehicles find a free parking space successfully. The paper concludes that the proposed system provides better performance, low cost, and efficient large-scale parking.

[6]. "Automated Car Parking System Commanded by Android Application," International Journal of Computer Science and Information Technologies. The paper is authored by D. J. Bonde, Rohit S. Shende, Ketan S. Gaikwad, Vol. 5 (3), 2014: The literature overview in the provided paper discusses the existing systems and their limitations, highlighting the need for an automated parking system with minimal human intervention. It mentions the challenges faced in finding parking spaces in public areas and the time-consuming nature of the process, especially in multi- story parking facilities. The paper aims to address these challenges by proposing an autonomous car parking system commanded by an Android application. The literature survey also mentions various methods for developing autonomous or intelligent parking systems and emphasizes the need to reduce human intervention in the functioning of such systems. It compares the proposed system with existing ones, pointing out the limitations of the current systems and the advantages of the proposed automated parking system. Furthermore, the paper discusses the limitations of existing systems, such as the need for background color to be black and character color to be white, and the analysis being limited to number plates with just one row. It also mentions a smart parking system that uses image processing for number plate capture and database storage for comparison to avoid illegal car entry. The proposed system aims to overcome these limitations and represent a fully automated model with minimum human intervention.

4. Hardware requirements: -

Following are the hardware used for designing this system

1. At mega 32A Microcontroller
2. 16*2 LCD
3. 5V Servo Motor
4. DC Gear Motor
5. L293D Motor Driver
6. HC-SR04 Ultrasonic Sensor
7. Obstacle Sensor (IR Sensor)
8. Door sensor
9. Alcohol sensor
10. Buzzer
11. 5V DC-DC Converter 12V, 1.2A Adapter

5. DESIGN AND IMPLEMENTATION

The methodology of the project includes the sensor, microcontroller. Here we use ATmega32A microcontroller the methodology has the microcontroller give input to the obstacle sensor it sense the obstacle near by the car during parking, and the door sensor is used to detect whether the doors are open or close if the door is not closed properly the car do not move , and also we use the alcohol sensor which sensor the alcohol content if the person or drive enters the car by consuming alcohol it detects and it do not move further, we also implement the ultrasonic sensor is used to measure the obstacle distance and it give the in how much distance the obstacle is situated, here we also implement the motor which is used to moving of car , also used LCD for display purpose. The smart car is equipped with a variety of sensors to gather information about the environment. These sensors may include ultrasonic sensors, cameras, radar, and lidar. Ultrasonic sensors are commonly used to detect obstacles and measure distances, while cameras, radar, and lidar provide additional information about the surroundings. The data from the sensors is processed using algorithms to extract relevant information. The algorithms analyse the sensor data to identify parking spaces, measure their dimensions, detect obstacles, and determine the trajectory required for parking. The system uses the sensor data and image processing techniques to identify suitable parking spaces alongside the road. It analyses the size and shape of available spaces to ensure that the car can fit into them safely. Once a suitable parking space is detected, the system calculates the trajectory required to park the car. It takes into account the dimensions of the parking space, the current position and orientation of the vehicle, and any surrounding obstacles. Control system of the smart car receives the trajectory information from the planning module and uses it to control the steering, throttle, and brakes. The control system ensures smooth and precise manoeuvring of the vehicle during theparking process. The system may include an interface that allows the driver to activate the self-parking feature and monitor the progress. The HMI may provide visual and auditory feedback to guide the driver and ensure they are aware of the system's actions.

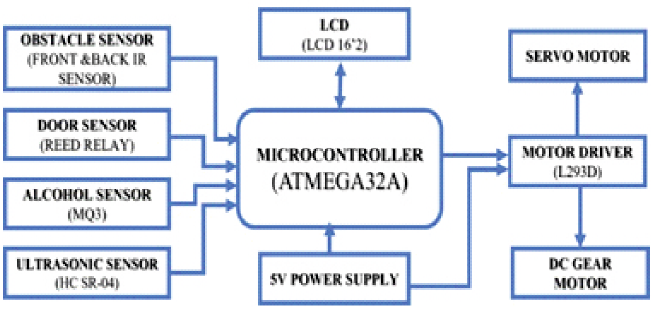


Figure 1: Design of the proposed system

The Block Diagram consisting of Obstacle Sensor, Door sensor, ATmega32A, Ultrasonic Ranging Module HC -SR04, Infrared Sensor, L293D Motor Driver, LCD, Buzzer as shown in figure 1. The interfacing of Ultrasonic Sensor using ATMEGA 32A Micro Controller, the specific details and parameters of the data used in self-parking systems may vary depending on the manufacturer and the specific implementation of the technology. Different vehicles and systems may utilize different types and configurations of sensors, cameras, and algorithms to achieve the self-parking functionality. The sensors receive the information continuously and send the signal to microcontroller, in which obstacle sensor sense the information from front and back side of the car by using the IR sensor, and the door sensor observes the vehicle door is close or not, if not it will send the data to controller and then it gives the warning to the driver by using buzzer and the same way the alcohol sensor will work. The ultrasonic sensor calculates the distance of the obstacle and sends the information to controller and displayed through LCD. The servo motor and the dc gear motor help to move the vehicle.

Experimental Result: -

Case 1: If the scale is larger than the car and less than the length of the car, parallel parking will work. In this case, the vehicle passes a parking space and stops when the two sensors on the side see the wall again. He came back a little, then turned 45 degrees to the right. As he moves backwards, rear sensors measure when he enters the parking space and begins to turn left. When moved to the left, the edge sensor continuously measures and the two sensors continue to rotate to the left until the measurement is equal. Stop when you reach balance. The front sensor makes a measurement and moves forward until it shrinks 10 cm and stops when it shrinks 10 cm. Parking is over. Case 2: If the measured value is greater than the vehicle length, the robot will stop vertically. If the sensors on the side measure more than the length of the car, the car stops and turns 90 degrees to the left. They started walking towards the parking lot. Mean-while, the front sensor makes a measurement and the vehicle stops if the measurement is less than 10 cm. Parking is complete.

Chapter 3: Parking. In this case, the vehicle passes through the parking lot and stops when the two sensors on the side detect the wall again. It backed up a bit, then turned 45 degrees to the right. When moving in reverse, the rear sensor makes a measurement and enters the parking position and starts to turn left. When moved to the left, the sensor on the edge continuously measures and continues to rotate left until the two sensors measure equal. Stop when you reach balance. The front sensor measures and moves forward until it is 10 cm smaller, stopping when it is 10 cm smaller. Parking is over.

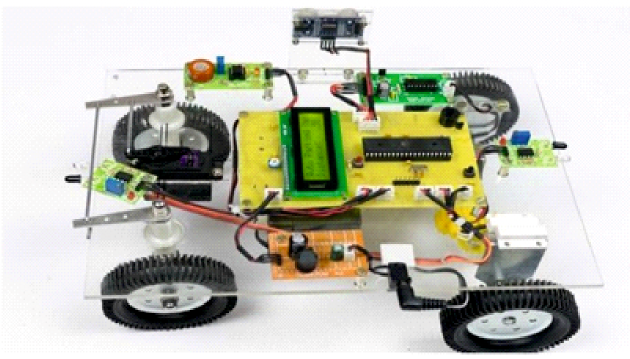
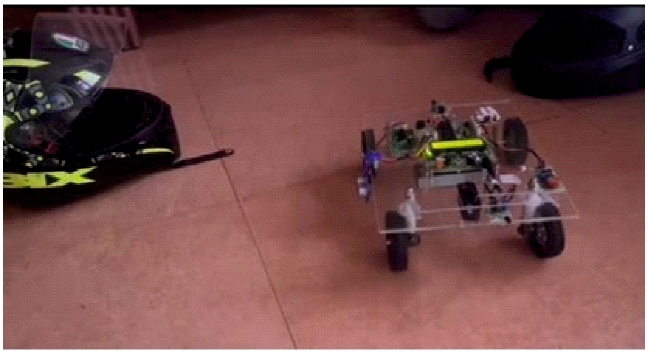
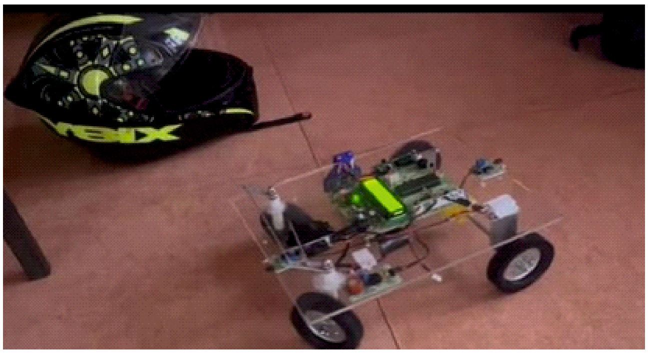


Figure 2: Experiment model

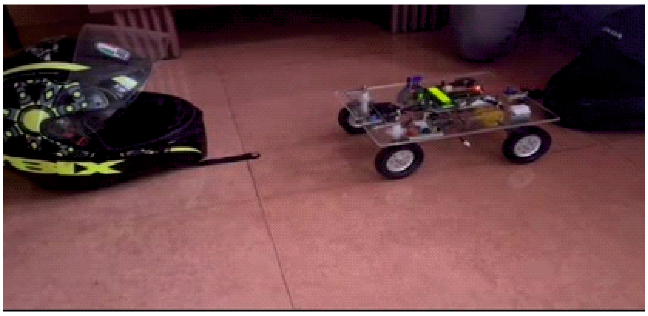
A). Parking space Identified:



B). Car arriving at parking space:



C). Car Parked:



In this case, the vehicle passes through the parking lot and stops when the two sensors on the side detect the wall again. He backed up a bit and turned 45 degrees to the right. When moving backwards the rear sensor switches the indicator to park position and starts turning left. When moved to the left, the sensor on the edge continuously measures and continues to move to the left until the two sensors measure equal. Stop when you reach balance. Front sensor measures and moves forward until it shrinks 10cm, stops when it shrinks 10cm

7. CONCLUSION: -

Automatic parking, traffic, complexes, apartments, shopping malls, etc. It is an important area for Parking here is automatic and requires no human intervention; That is, if the driver stops it, the system turns on and the elevator takes the car to the parking lot. In summary, automotive robots designed using fuzzy logic (FL) have the advantages of being efficient, flexible and robust. According to the results obtained, the goals of the project were achieved.

The robot intelligently finds an empty parking space in a special environment. The time required for the robot to complete 20 cycles is also reduced. Moreover, the idea of using all possible for all sensors, considering all 3 rules, has a good effect on the movement of the robot compared to using a single rule on random sensors. Autonomous parking is very important in today's world. Finding a small space has become a big problem. This system is currently used in many cars around the world. Automatic forward smart car parallel to self-parking has great potential for future development. Making the system flexible for different parking types, such as angled or vertical, is a potential area of improvement. Another area of growth could be combined with other smart car technologies such as automatic collision or collision detection. Additionally, the system can be integrated into existing smart cities such as parking lots or traffic lights. Overall, automatic forward smart cars parallel to self-parking have great potential for future innovation and development.

Today we see many driverless cars being tested on the roads in a controlled environment, in a safe and environmentally friendly way, and under the supervision of human drivers. Researchers estimate that there will be approximately 8 million autonomous or self-driving vehicles on the road by 2025. Driverless cars must first reach the level of driver support before being integrated into the road. Autonomous Advanced Smart Cars One area of future development for autonomous parking connectivity is to make it accessible to a variety of drivers. This might include making the system cheaper or easier to install or more accessible to less tech-savvy users. In addition, the ability to enhance the system makes it autonomous, allowing the vehicle to stop on its own without the need for driver intervention.

8. Future Scope: -

Unmanned car parking systems offer a solution to a common problem faced by ordinary people when trying to locate parking slots in crowded areas, particularly in the basements of malls, hotels, and lodges. These systems use a combination of sensors and closed-circuit cameras (CC cameras) to provide real-time information on parking slot availability. This data is accessible to drivers through a mobile app, making it easier for them to find the nearest available parking space. By implementing such a system, the stress and frustration of searching for a parking spot in busy areas can be significantly reduced. The mobile app is designed to guide drivers directly to an available slot by identifying it at the entrance or beginning of the parking area, even specifying the exact slot number. This not only enhances the convenience of the parking experience but also encourages customers to visit such establishments more frequently.

One of the primary advantages of this unmanned car parking system is the reduction in operational costs. Traditional parking lots often require personnel, such as guides or attendants, to assist drivers in finding parking spaces. With this system in place, the need for manual guidance is greatly diminished, leading to cost savings for the businesses operating these parking facilities. Automatic car parking systems are becoming increasingly important due to the challenges people face when parking in busy city areas and parking lots. These systems use sensors to detect available parking spaces, helping users find the nearest available parking area. The primary goal is to reduce the time spent searching for parking spots and to minimize unnecessary driving through crowded parking lots. This not only saves time but also reduces fuel consumption and, consequently, carbon emissions.

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