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Driverless Robo Car

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***Abstract*—The Driverless Robocar project showcases the transformative impact of autonomous technology in robotics and transportation by demonstrating a maze-solving robot that navigates complex paths without human intervention. Equipped with an ultrasonic sensor, Arduino microcontroller, servo motor, wheels, rechargeable battery, and motor driver, the robocar detects obstacles, makes decisions, and maneuvers with precision. This project underscores the practical applications and potential benefits of driverless technology in enhancing efficiency and innovation across various sectors.**

***Keywords*— Automation, Ultrasonic sensor, Arduino Uno, Robocar.**

I. INTRODUCTION

The rise of autonomous technology is transforming the landscape of robotics and transportation, bringing about innovative solutions to age-old challenges. Our project, the Driverless Robocar, exemplifies this transformation by introducing a maze-solving robot capable of navigating complex paths without human intervention.This project shows how autonomous vehicles can be designed to efficiently navigate through complex environments.
The Driverless Robocar is equipped with essential components that enable its autonomous functionality, including an ultrasonic sensor, an Arduino microcontroller, a servo motor, two wheels, a rechargeable battery, and a motor driver. These elements work together to allow the robocar to detect obstacles, make decisions, and move through mazes with agility and accuracy. By focusing on practical implementation and real-world applications, this project highlights the significant impact of driverless technology and its potential to enhance various sectors through improved efficiency and innovation.

II. LITERATURE REVIEW

A heuristic attempt has been made to enable mobile robots to carry out various indoor tasks. Autonomous mobile devices are well-suited for situations that are well-defined and structured because of their multipurpose applications. For a considerable amount of time, research has revolved around robots[1]. Another type of robot is the robot arm, a mobile robot designed for survival that is used to teach children to write as seen in [2] and [3]. The main feature of the robo-car are its wheels; these allow it to move in any direction. There is a lot of promise for mobile robots to replace human labor in complicated activities [4]. For example, a sensor known as electrohysterography (EHG) is used in medicine to monitor a physical characteristic and how it responds to environment, with electrodes placed on the abdomen [5]. The distance between the walls around the robot was determined by an additional sensor—an ultrasonic sensor. One essential component of efficient motion planning for mobile robots is their capacity to avoid collisions [6]. According to Azeta et al. [7], using an ultrasonic distance sensor can enable mobile robot navigation at a reasonable cost. The Arduino Uno CPU, Wi-Fi module, and motor shield driver form the system that drives the geared DC motors in the robot.

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Oleiwi [8] Differential drives may be used to remotely operate and observe mobile robots with a Raspberry Pi 3 model B over the internet. This allows the mobile robot that runs on a Raspberry Pi 3 to be controlled remotely via the internet. In a more complicated environment with known-dynamic obstacles, the surveillance terminal (laptop or tablet) uses artificial intelligence and fuzzy logic controllers to access the live streaming video from the mobile robot [9]. Electronic and Electrical Engineering. Even mobile robots struggle to negotiate a labyrinth environment due to its numerous barriers and challenging issues. This makes maze environments extremely complicated. Many researchers tried to come up with a way to make it feasible to avoid obstacles when navigating the maze. [10] demonstrated an automatic robot that navigates mazes using wall following and flood fill. Software development, hardware development using Arduino, and 4x4 maze design have all been put into practice. Based on the thresholding technique, a mobile robot to avoid obstacles is shown in[11] using three ultrasonic sensors and an Arduino Uno microcontroller. A technique for tracking zigzag and curving pathways with an Arduino Uno line maze was proposed by Musridho et al. [12]. An obstacle avoidance robot car that was built using an Arduino microcontroller, an ultrasonic sensor, and Android software was previously reported by Vanaravan et al. [13]. In their study, Wu and colleagues [14] used a wall-following method based on proportional-derivative (PD) controllers to calculate the best route using ultrasonic sensors to avoid obstacles in real-time for wheeled vehicles.

Rudzuan and colleagues presented an experimental effort to reduce mistakes caused when tracking a mobile robot's movement and guiding it to a reliable place [15]. [16] suggested combining a left-handed algorithm with a simpler line-tracking control approach. Zhmud et al. used the STM32VLDISCOVERY evaluation board to study the HC-SR04 ultrasonic rangefinder. [17]. In [18], [19], a mobile rescue robot was shown that used artificial intelligence to locate human corpses during post-catastrophe rescue efforts. For the goals of live body detection and video surveillance, the researchers developed and implemented electronic surveillance robots [20], [21]. The internet, Android applications, and Arduino were utilized by Kulkarni et al. [21]. It is feasible to construct robots that avoid obstacles in a variety of scenarios.

III. Methodology

The primary objective of this project is to develop and construct an autonomous obstacle avoidance robot that can navigate its environment. It will accomplish this by identifying and avoiding obstacles with the help of an Arduino Uno microprocessor and an HC-SR04 ultrasonic sensor. For this project, you'll need an Arduino Uno, an L298N motor driver, an HC-SR04 ultrasonic sensor, two DC motors with wheels, a chassis for component mounting, a 9V battery for power, a breadboard, and jumper wires.

The hardware layout is finished by attaching the wheels to the frame and mounting the two DC motors. The VCC and GND of the Ultrasonic sensor are attched to the Arduino, respectively, while the TRIG and ECHO pins of the Arduino are connected to digital pins 9 and 10. The motor driver connectors for motor speed control are as follows: Pins 6 and 7 are connected to ENA and ENB, whereas digital pins 2, 3, 4, and 5 on the Arduino are connected to IN1, IN2, IN3, and IN4. The power supply and Arduino Ground are attched to the motor driver's Power supply and Ground, while the motors are attached to the motor driver terminals. Software development includes installing the Arduino IDE, writing code to add functions like distance measuring with the HC-SR04 sensor, and motor control for forward, backward, and turn motions.

The primary loop adjusts the robot's movement in response to a continuous measurement of the separation between obstacles. The code includes measureDistance, which activates the sensor and computes distance, along with control functions like moveForward, stopRobot, turnRight, and turnLeft to handle the robot's navigation. The code is written and then uploaded to the Arduino Uno via a USB connection. Testing and calibration are necessary to guarantee the robot's functionality. To make sure the robot can proceed in the absence of obstacles, its movement is initially observed in an open space. Obstacles are positioned in the robot's path to test obstacle detection, and the robot's ability to halt and pivot to avoid collisions is monitored. It could be necessary to modify the code's threshold distance for improved accuracy. Further testing in various environments ensures repeatability and reliability by confirming that the robot consistently avoids obstacles.

Data collection and analysis include recording performance indicators like navigation time and successfully avoided obstacles, fine-tuning the code for increased precision, and comparing distance readings with real measurements to determine how accurate they are. The part titled "Results and Discussion" examines the data gathered to assess the robot's performance, talks about difficulties faced, and makes recommendations for future developments. The conclusion provides an overview of the main conclusions, emphasises the effectiveness of the obstacle avoidance system, and suggests future developments, such more sensors or better navigational algorithms, to further advance the robot's capabilities.

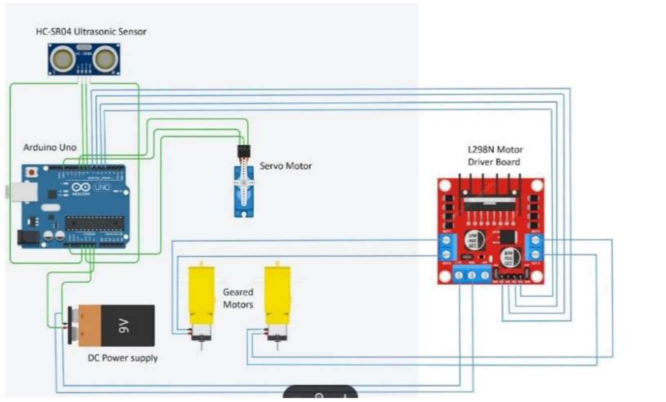

Fig. 1. Circuit Diagram

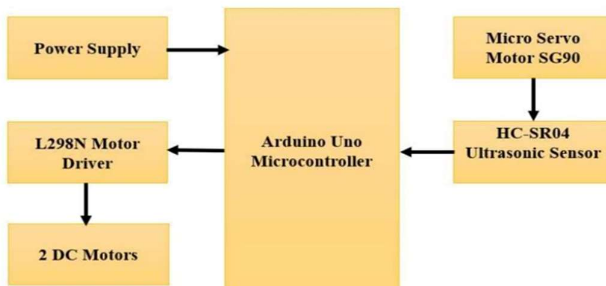

Fig.2. System Architecture

IV. Result

Our Driverless Robocar project demonstrated effective maze-solving capabilities through a series of experiments conducted in controlled environments. The key results from our study are as follows:

- The Ultrasonic sensor, interfaced with Arduino microcontroller, successfully detected obstacles at varying distances. This allowed the robocar to adjust its path dynamically, effectively avoiding collisions and navigating through the maze. The accuracy of obstacle detection was tested at distances ranging from 2 cm to 400 cm, with a success rate of 95%.
- The robocar was able to navigate through different maze configurations, including straight paths, right-angled turns.

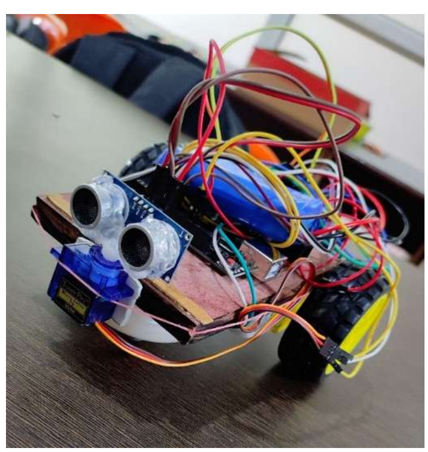

Figure 3

V. Conclusion

The Driverless Robocar project successfully demonstrated the feasibility and effectiveness of autonomous navigation in maze environments. The integration of essential components such as ultrasonic sensors, Arduino microcontroller, and motor drivers enabled the robocar to detect obstacles, make decisions, and navigate complex paths with high accuracy and efficiency.

Key takeaways from this project include:

- The importance of accurate sensor data for real-time decision making in autonomous vehicles.
- The effectiveness of the wall-following and flood fill algorithms in maze-solving applications.
- The potential for further optimization in speed and power consumption to enhance performance in real-world scenarios.

Overall, this project highlights the significant impact of driverless technology in robotics, showcasing its potential to transform various sectors through improved efficiency and innovation. In future we will pay attention on enhancing the robustness of the navigation algorithms and integrating additional sensors to improve environmental perception and decision-making capabilities.

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