ARDUINO POWERED SONIC EVASION ROBOTIC CAR

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Abstract:
This paper introduces the development and implementation of an obstacle-avoiding robotic car powered by Arduino technology. The primary objective of the paper is to design a robotic car capable of autonomously navigating in an environment, while intelligently circumventing obstacles in its path. The robotic car integrates ultrasonic sensors to detect nearby obstacles and employs Arduino microcontroller logic to process sensor data and make informed decisions about its trajectory. By combining distance measurement and real- time obstacle detection algorithms, the system ensures efficient obstacle avoidance. The Arduino-controlled robotic car offers a practical demonstration of sensor integration, algorithmic decision-making, and autonomous navigation. The paper establishes the viability and effectiveness of the obstacle-avoidance, thus contributing to the various field of robotics and automation. This Paper has a wide range of applications across various sectors such as Security and Surveillance, Search and Rescue, Mining and Construction, Health Sector and many more.

Keywords—**Arduino UNO, Motor Driver (L293D), Ultrasonic Sensor**.

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I. INTRODUCTION

A. *SONIC EVASION*

Sonic Evasion draws inspiration from echolocation, a natural ability found in creatures like bats and dolphins. This cutting-edge technology utilizes sound to enhance the awareness and adaptability of autonomous vehicles and robots. At its core, Sonic Evasion employs advanced ultrasonic sensors that emit high-frequency sound waves. These waves bounce off objects in the surrounding environment and their return time is precisely measured, creating a real-time, three-dimensional map. This innovative system enables autonomous systems to detect obstacles, make informed decisions, and navigate complex environments, thus avoiding collisions. The applications of Sonic Evasion are vast and include autonomous cars, drones, robotic arms, and accessibility devices. By incorporating this technology, safety, precision, and accessibility are significantly improved. Sonic Evasion represents a groundbreaking innovation that envisions a future where autonomy is enriched by the power of sound, fostering a safer and more efficient interaction between technology and the world.

B. *SCOPE AND OBJECTIVES*

SCOPE:

The main focus of this paper, focuses on the development of a robotic car that integrates Sonic Evasion technology for obstacle evasion. The scope covers the comprehensive creation of both hardware and software components, addressing the challenges of real-time obstacle detection.

OBJECTIVE:

The primary goals outlined in this paper revolve around the successful real-time navigation of the robotic car, prioritizing safety, energy efficiency, and the prospect of future enhancements. The key objectives include the seamless avoidance of obstacles, ensuring the car's ability to adapt dynamically to varying environments

II. SYSTEMDESCRIPTION

A. *HARDWARESETUP*

1. The Arduino: The core component of the system is an Arduino microcontroller, such, as the Arduino Uno. This microcontroller acts as the brain of the car executing control algorithms and managing sensor data.
2. Ultrasonic sensor: For sensing its surroundings the car is equipped with sensors (a module like HCSR04). These sensors emit waves. Analyze their reflections to determine distances to nearby objects. They are strategically positioned to provides 360^0 degrees view around the car.
3. Motor Controller: To control its movement motor controllers are incorporated into the system. These controllers enable management of the robotic car wheels for forward, backward and turning motions.
4. Power supply: To ensure operation a suitable power source such as batteries provides the required voltage and current, for both motors and electronics in the robotic car.
5. Chassis and wheels: The physical structure of the car consists of a chassis and wheels that allow it to move effortlessly across surfaces.

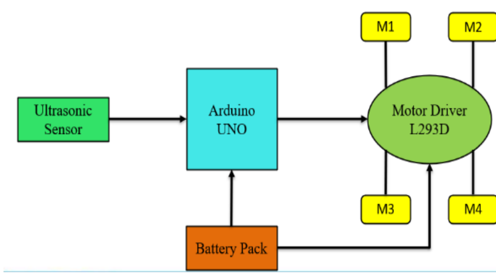


Fig no. 1. Block Diagram of Arduino powered Sonic Evasion Robotic Car

B. SYSTEM OPERATION

Arduino Powered Sonic Evasion Robotic Car, uses an integratedsystemconsistingofanArduinoUno,amotor driverL293,andanultrasonic sensor to navigate autonomously. The Arduino Unoservesasthevehicle'sbrain,coordinating theentireprocess.Ultrasonicsensorsareinstalledatthefrontofcar stomeasurehowlongittakes forhigh-frequencysoundwavestobouncebackafterhittingobstacles.

It allows the robotic car to calculate how far it is from the nearestobject in front of it. Based on this distance, the Arduino Unodecides whether the robotic car needs to take corrective action toavoid a collision, when an obstacle is detected within a set range,theArduinosendscontrolsignalstothemotordriverL293.

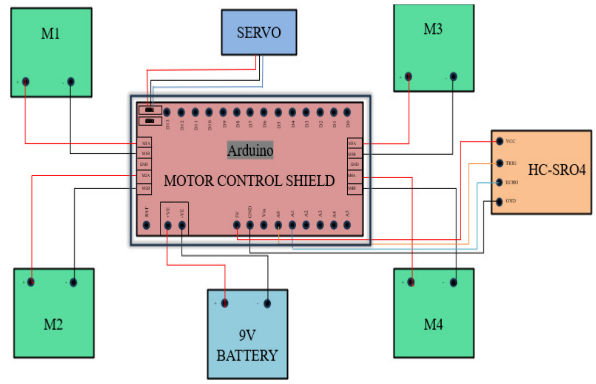


Fig no. 2.Schematic Diagram ofSonic Evasion Robotic Car

The motor driver interprets these signals and adjusts the speed and direction of the car's motors accordingly. By controlling the rotation of the wheels through the motor driver, the vehicle can maneuver around obstacles and continue on its designated path safely and without obstructions. This feedback loop, involving the ultrasonic sensor, Arduino Uno, and motor driver, ensures that the robotic car can promptly detect and respond to obstacles in real- time, allowing it to move smoothly and avoid collisions while following its intended route.

III. SOFTWARE ALGORITHM

Step 1: Start

Step 2: Include necessary libraries and define constants.

Step 3: Initialize variables, objects, and setup pin configurations.

Step 4: Set motor speeds and establish initial conditions.

Step 5: Continuously perform obstacle avoidance.

Step 6: Measure distance using the ultrasonic sensor.

Step 7: If obstacle detected within a certain range (distance <= 20):

- Stop the car.
- Move backward briefly.

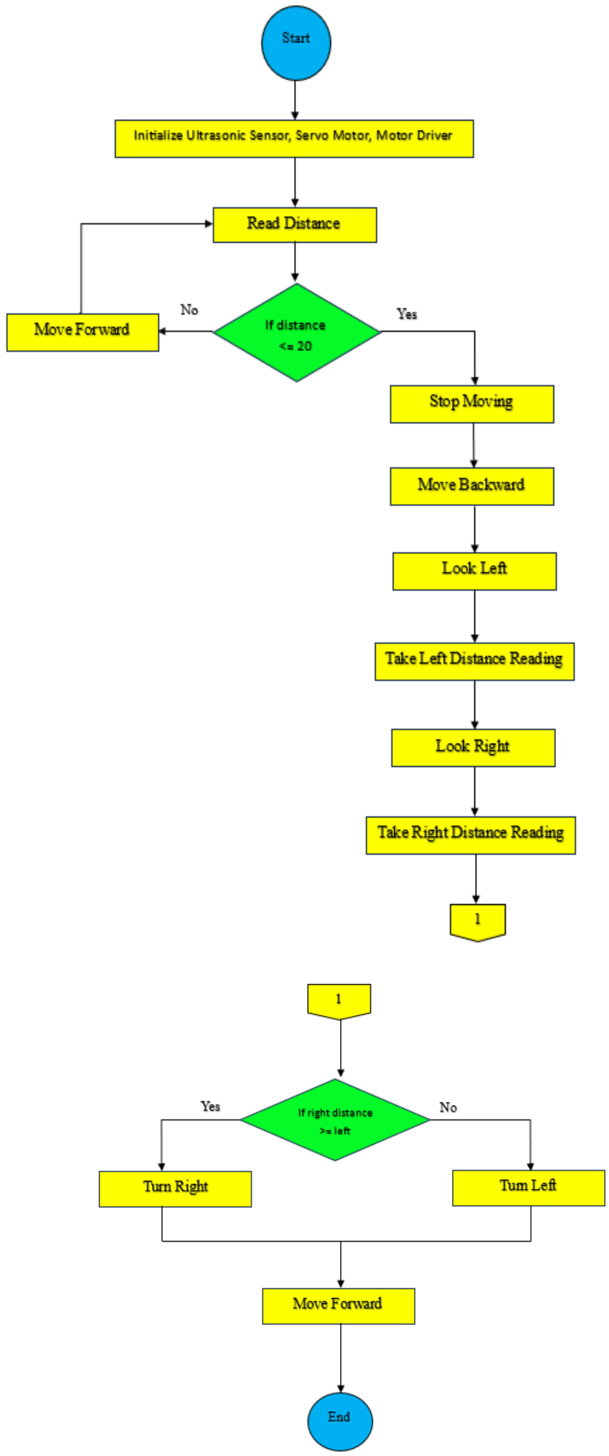
Step 8: Use ultrasonic sensors to determine direction with more space.

Step 9: Turn the car accordingly (left or right) based on measured distance.

Step 10: If no obstacle, move the car forward.

Step 11: Stop.

IV. FLOW CHART



RESULTS AND DISCUSSIONS

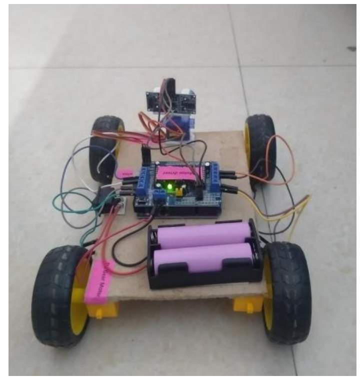


Fig no. 3. ArduinopoweredSonicEvasionRoboticCar

The above figure no. 3 explains that Arduino powered sonic evasion robotic car detecting no obstacle present in its path, so it will move forward without any disturbance.

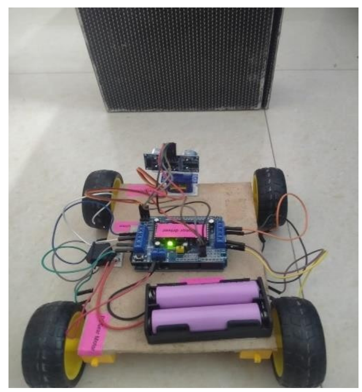


Fig no. 4. Robotic Cardetectingtheobstacle Car

The abovefigure no. 4explainsthatArduinopoweredsonicevasionrobotic car detecting the obstacle which is present in its path withthehelpofultrasonicsensor, andstopsmovingforward.

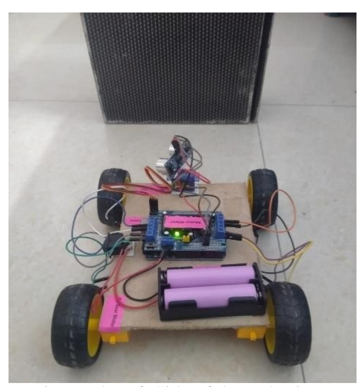


Fig no. 5. Left Side of the Robotic car

The above figure no. 5 explains that arduino powered sonic evasion robotic car measuring left side distance using ultrasonic sensor and as well as sensing presence of obstacle on the left side.

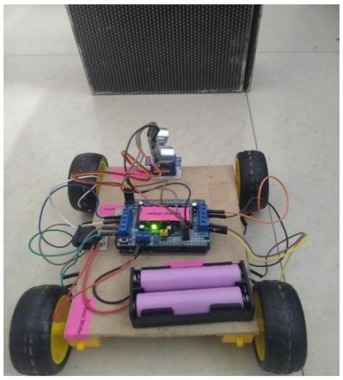


Fig no. 6. Right Side of the Robotic car

The above figure no. 6 explains that arduino powered sonic evasion robotic car measuring right side distance using ultrasonic sensor and as well as sensing presence of obstacle on the right side.

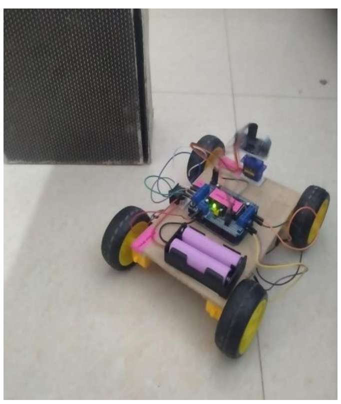


Fig no. 7. RoboticcarevadingtheObstacle

The above figure no. 7 explains that based on the measuring distance and presence of obstacle the Arduino powered sonic evasion robotic car is evading the obstacle by predefining its path towards right side.

CONCLUSION

In conclusion, The Arduino-based robotic car that evades obstacles using sound is an exciting innovation that showcases the capabilities of self-driving vehicles. The robotic car evades the obstacles which is present in its path by combining distance measurement and obstacle detection algorithm. Its efficient navigation and obstacle avoidance capabilities are a testament to the progress made in robotics and AI. As technology advances, these vehicles offer the potential for safer and more effective transportation solutions. Continued research and development will be crucial in realizing the transformative impact of obstacle- avoiding robotic cars in the automotive
industry.

FUTURE SCOPE

1. Autonomous Transportation: The automotive and logistics industries are highly focused on developing fully autonomous vehicles, including cars, trucks, and delivery drones. The use of obstacle-avoidance technology will be critical in ensuring the safety and efficiency of these vehicles on the road.
2. Urban Mobility: Robotic cars equipped withobstacle-avoidance capabilities are poised to become essentialcomponents of smart city transportation systems. By reducing traffic congestion and improving traffic flow, they offer convenient, on-demand transportation services within cities.
3. Agriculture and Farming: Precision agriculture is benefitingfrom the use of obstacle-avoiding robotic tractors and drones. These advanced machines are capable of efficiently planting, harvesting, and monitoring crops, leading to improved productivity and reduced environmental impact.
4. Environmental Monitoring: Autonomous vehicles have thepotential to be deployed in remote or hazardous environments for environmental monitoring purposes. Whether it's assessing air quality, tracking wildlife, or inspecting infrastructure, these vehicles can play a vital role
5. Security and Surveillance: Autonomous vehicles can be employed for security patrols, surveillance, and monitoring in a variety of environments, ranging from corporate campuses to public spaces. Space Exploration: Autonomous rovers and vehicles fitted with obstacle-avoidance capabilities are crucial for planetary exploration. These technologies enable the navigation of challenging terrains on other planets and moons

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BIOGRAPHIES

Dr. S. Mani Kuchibhatla. HOD EEE, ACE Engineering College, India. She was born in the year 1979 and having 20+ years of Teaching Experience. She did her B.Tech from JNTU Kakinada; M.Tech from NIT Warangal & Awarded Ph.D. from JNTU Kakinada .She has several International and National Journal Publications. She is Reviewer for several Peer-Reviewed Journals. She organized several Workshops & National Conferences. She is Lifetime member of Indian society of Technical Education (ISTE) and also life time member of Indian institute of Electronics & Telecommunications (IETE). Her areas of interests are power quality improvement, Flexible AC Transmission, PLC& SCADA.

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