PROTOTYPE DESIGN OF ROBOT WITH OBSTACLE AVOIDANCE

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Abstract. Obstacle detection and avoidance is the of ubiquitous problems with mobile robot design. themselves. Obstacle Avoiding Robot. An Obstacle Avoiding Robot is designed that sense the obstacles in its way and move around them without making any collisions.This robot uses an Arduino Microcontroller and 3 ultrasonic distance sensors to detect obstacles. A board from Arduino Software was chosen for implementation for the microcontroller platform. There is now greater accuracy in detecting obstacles around you from using three ultrasonic distance sensors.It is a completely autonomous robot, which operates perfectly well in a never-seen atmosphere with no collision. The robot created using these components is very generic and cheap and can be made cost-effective as it gets only small off-the-shelf components.This robot has a very prominent improvement in the research of mobile robots and makes them more robust while running. This is a holistic method that combines various sub-methods. Robot obstacle avoidance is divided into front part, super core, and rear control completion.The heart of it contains algorithmic models similar to robot obstacle avoidance and path planning, analogous to how a human brain has decision-making involved in its core. The first segment uses a front camera or radar to take in obstacle information and mimic what a person sees. So just like in the human nervous system, the back-end part is now used for automatic control to get signals from the brain and send them to body parts so that they do as they are told.

Keywords: Robotic Concept, Obstacle detection prototype, Proteus

1 Introduction

An obstacle avoiding Robot is an autonomous device that can sense obstacles in its path and avoid them by successfully changing the direction of navigation. This feature enables the robot to wander in an undiscovered location without colliding any things and it's a must-function for every separate mobile robot. The Arduino Microcontroller is the driving CPU of the robot, and it uses ultrasonic distance sensors to know when obstacles are in their way [1]. The mechanism involves the sensor transmitting ultrasonic waves and detecting them when they hit an object.

The time for the waves to return is used for calculating the distance of the obstruction. These robots have been used in different sectors such as industrial automation, self-driving cars, drones, and even space exploration. A typical obstacle avoidance robot design entails the synthesis of a myriad of sensors as per their responsibilities. Bump sensors, infrared sensors, and ultrasonic sensors are some of the frequently used distance or obstacle detection sensors [2,3]. As seen in the working of a robotic vehicle with obstacle avoidance: ultrasonic sensors are used for its movements. This operation is generally done on a microcontroller of the 8051 family. The robot has an ultrasonic sensor placed in the front which continuously sends out topographical waves from a point on its sensor head. It reflects the ultrasonic waves, on detecting an obstacle in front of it and then informs this information to the microcontroller. The sensors work and send the signals to a microcontroller to control motors back, front, left, or right [4,10]. A program will control the robot's movements using sensor input from the microcontroller Obstacle detection via ultrasonic sensors. The sensor data is read by the microcontroller which in turn calculates the distance to any obstacles [5,11]. The base of the software design is an obstacle avoidance algorithm. This algorithm will receive the sensor data and decide in which way (Turn Left, Turn Right, or Move forward) is the right path to avoid obstacles. The microcontroller is also programmed to run the motors of the robot based on what it will send from the detection algorithm. It helps the robot to take turns and avoid obstacles [7].

The main goal is to sense and keep away from obstacles in its path, avoiding possible collisions. The robot must be able to navigate independently in an unknown environment. Avoiding obstacles, the robot ensures the safety of itself and its surroundings. The robot must be able to find the most efficient path to the goal despite obstacles. A robot must be versatile enough to be used in different fields such as, self-driving vehicles, drones, industrial automation and also space exploration. Designing an obstacle robot involves the incorporation of some sensors according to its task [8,9].

2 Block Diagram Representation

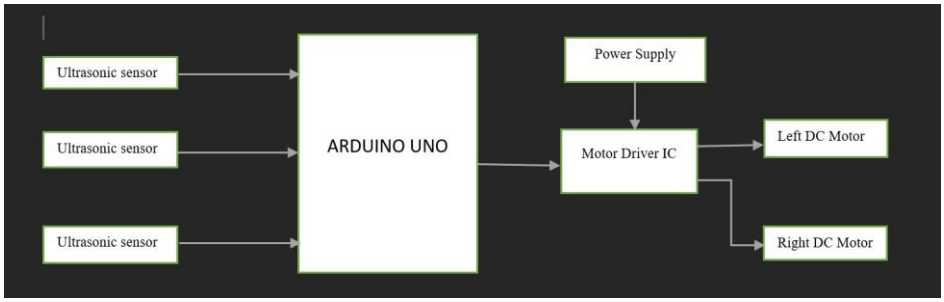

Fig. 1. Block Diagram of Obstacle Avoidance Robot

Ultrasonic Sensor: This sensor measures distance by emitting sound waves and measuring how long it takes for the sound to recover. It is often used in robotics for obstacle detection or navigation.
Arduino Uno: This is the brain of the system. It receives input from the ultrasonic sensor and sends commands to the motor controller.
Driver IC: This type of motor driver IC can be able to manage the path and speed of DC motors.
Left DC Motor and Right DC Motor: These are the motors that move the robot or device. The motor controller controls these motors.
Power supply: This is the power supply for the entire system. There are two power supplies, one for the Arduino and one for the DC motors [2,4].

3 Circuit Design using Proteus

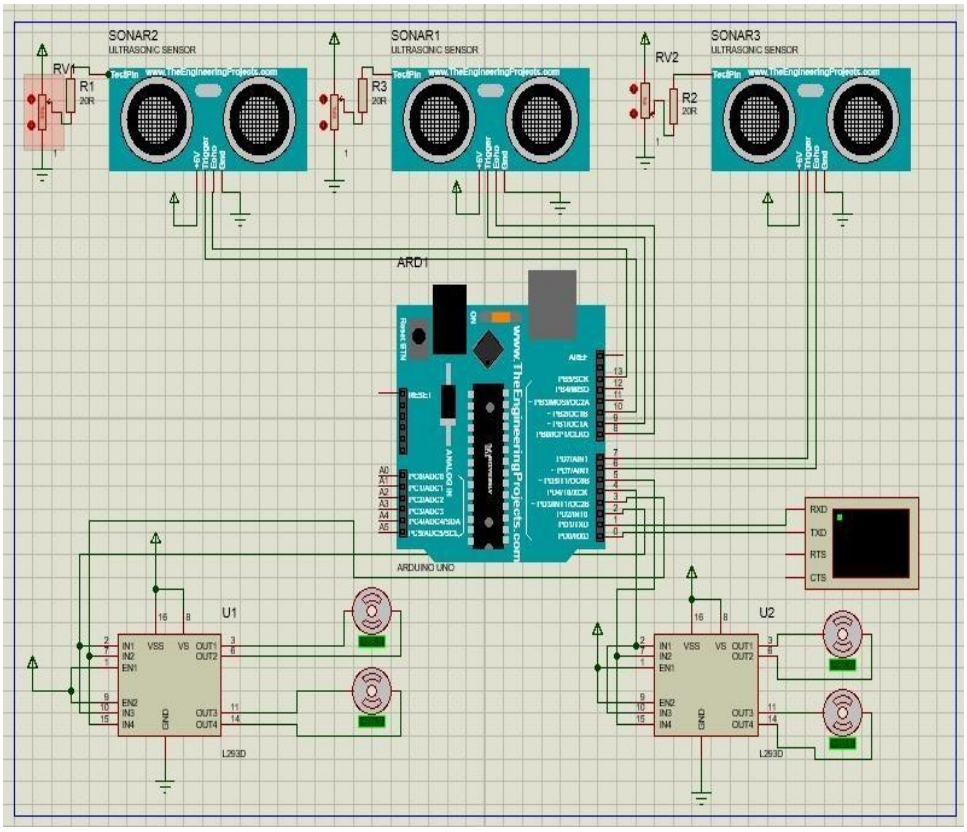

Fig. 2. Circuit Diagram of Obstacle Avoidance Robot using Arduino and Ultrasonic Sensor

Ultrasonic sensors (SONAR1, SONAR2, SONAR3): These sensors measure the distance to an object by emitting sound waves and measuring the time it takes for the echo to return.
Arduino Uno microcontroller: This is the brain of the robot, responsible for processing sensor data and controlling the robot's movement.
Resistors (R1, R2, R3, R4): These are used to limit the current flowing through the ultrasonic sensors.
LEDs (D1, D2, D3): These can be used to indicate the status of the robot, such as whether it has detected an obstacle.
Buzzer (BZ): This can be used to alert the user of an obstacle.
Motor driver (L293D): This is used to control the direction and speed of the robot's motors.
Motors: These are used to propel the robot forward, backward, and turn.
Power supply: This provides the power for the circuit [3,5].

4 Result Analysis and Discussion

The ultrasonic sensors emit sound waves.The sound waves bounce off of objects in front of the robot and return to the sensors. The Arduino Uno microcontroller measures the time it takes for the echo to return and calculates the distance to the object. If the distance to the object is less than a certain threshold, the robot avoids the obstacle by turning or stopping. If there are no obstacles detected, the robot moves forward.

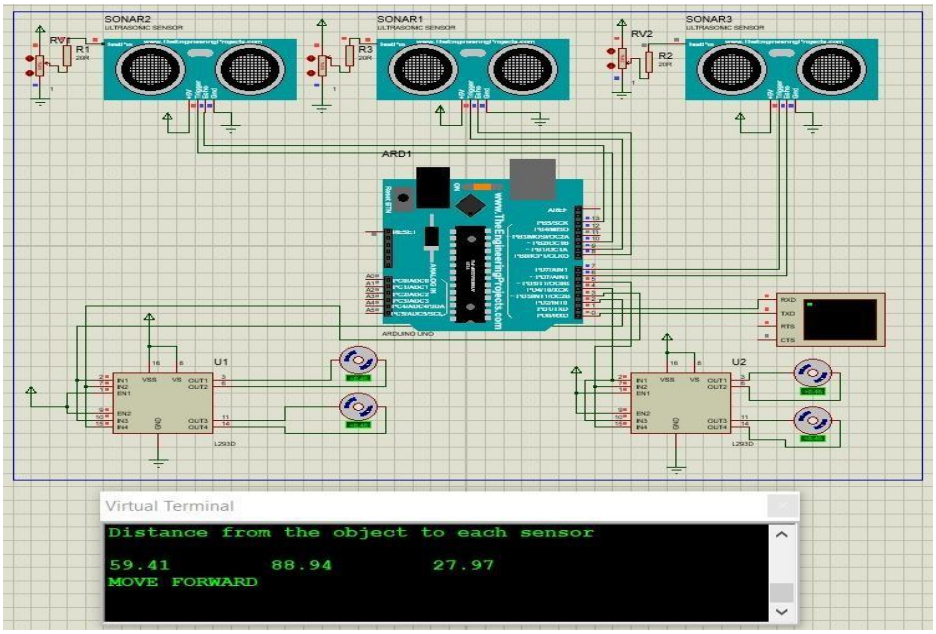

Fig. 3. Obstacle Avoidance Robot Moving Forward

The "Virtual Terminal" window in the image shows the distances measured by the ultrasonic sensors and the command "MOVE FORWARD" indicating that the robot is currently moving forward.

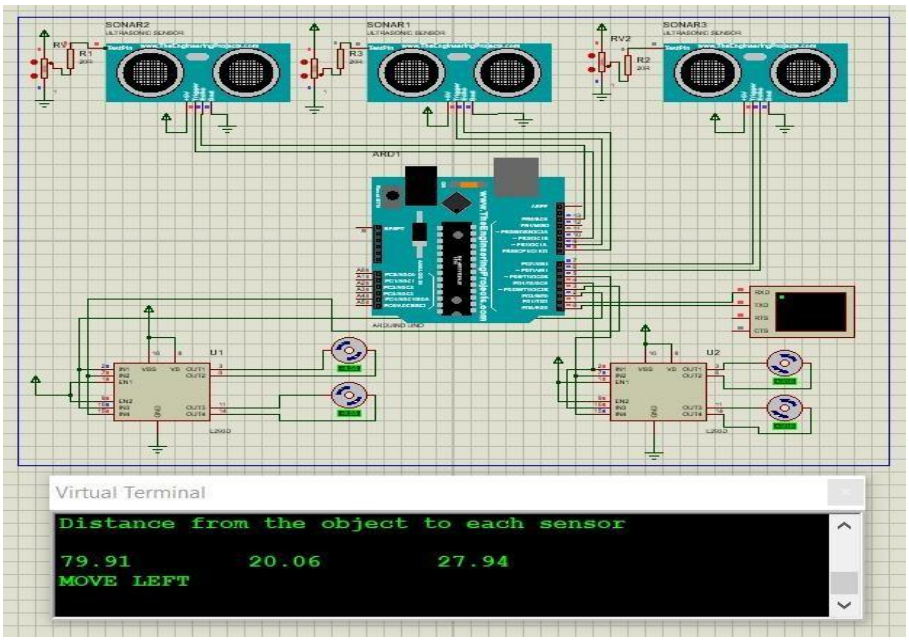

Fig. 4. Obstacle Avoidance Robot Moving Left

The "Virtual Terminal" window in the image shows the distances measured by the ultrasonic sensors and the command "MOVE LEFT" indicating that the robot is currently turning left to avoid an obstacle.

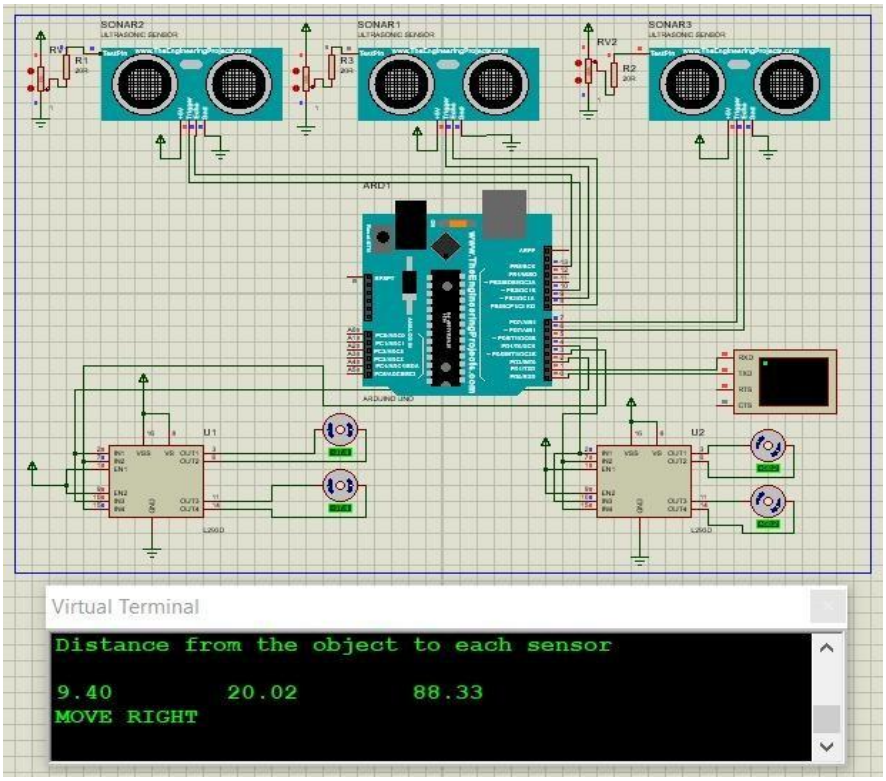

Fig. 5. Obstacle Avoidance Robot Moving Right

The "Virtual Terminal" window in the image shows the distances measured by the ultrasonic sensors and the command "MOVE RIGHT" indicating that the robot is currently turning right to avoid an obstacle.

5 Conclusion

Usually, the work produces an autonomous robot that is both successful and economical, able to navigate a variety of situations and cleverly avoid obstacles. Using parts like an Arduino microprocessor, an ultrasonic sensor, a servo motor, and geared motors, the robot shows off useful uses for robotics and automation. Learning Experience: The research provides a thorough investigation of the field of automation and robotics. It imparts practical programming and electrical skills along with nurturing creativity, ingenuity, and problem-solving abilities. The effort frequently creates avenues for advancement and development in the future. For example, the robot's performance can be improved by including more sophisticated algorithms or adding additional sensors.

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