WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Obstacle Detection Avoiding Robot

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ABSTRACT –

The "Obstacle Avoiding Robot" project focuses on the design and implementation of a robotic system capable of autonomously navigating through an environment while avoiding obstacles in its path. Utilizing an Arduino Uno microcontroller board and an ultrasonic sensor (HC-SR04), the robot detects obstacles in real-time and adjusts its movement to evade collisions. This project serves as an educational endeavor, providing insights into robotics, sensor integration, and algorithmic control. The project begins with the assembly of the robot's hardware components, including the chassis, motors, wheels, Arduino Uno board, ultrasonic sensor, and motor driver. The ultrasonic sensor is strategically positioned to provide a forward-facing view, enabling the robot to detect obstacles within its vicinity. Through meticulous wiring and connection, the hardware setup ensures seamless communication between the sensor, Arduino Uno, and motor driver.

I. INTRODUCTION

When its ultrasonic sensor detects an obstacle or an edge, It sends a command to the microcontroller. The microcontroller, Based on the received input signal, directs the robot to push in an Alternative direction by actuating the motors that are interfaced With it via a motordrive.

The aim of an obstacle detection and avoidance robot is to navigate through its environment while avoiding obstacles in its path. It typically involves using sensors to detect obstacles, processing that information, and then controlling the robot's movements to navigate around them. The ultimate goal is to ensure safe and efficient movement without human intervention.

II. LITERATURE REVIEW

1) We reviewed different obstacle detecting robot mechanisms that have been built by a lot of students and other practitioners that are in existence. For an autonomous mobile robot performing a navigation-based task in a vague environment, to detect and to avoid encountered obstacles is an important issue and a key function for the robot body safety as well as for the task continuity. Obstacle detection and avoidance in a real world environment that appears so easy to humans is a rather difficult task for autonomous mobile robots and is still a well- researched topic in robotics. In many previous works, a wide range of sensors and various methods for detecting and avoiding obstacles for mobile robot purpose have been proposed.

2)Robotics is an interdisciplinary research area at the interface of computer science and engineering. Robotics involves the design, construction, operation, and use of robots. The goal of robotics is to design intelligent machines in order to help human beings in their daily activities. This technology has resulted in automated machines that can replace humans in manufacturing processes or dangerous environments. These robots have numerous structures depending on their functions.

3) Robotic navigation research is beginning to gain momentum on its own. Robotics experts started to create various free routes finding algorithms. The navigation system is regarded as being of paramount importance since the robot must be able to be securely controlled from the starting point to the target (destination).

4) “Obstacle Avoidance Robotic Vehicle Using Ultrasonic Sensor, Android and Bluetooth for Obstacle Detection” has been designed and developed by Vaghela et.al has mentioned that enormous amount of work has been done on wireless gesture controlling of robots. Various methodologies have been analyzed and reviewed with their merits and demerits under various operational and functional strategies.

5) The first step of this project was to formulate the research questions. The next step was to gather information about autonomous robots and obstacle detection. This was done by reading articles and investigating projects from previous years related to the subject. From the literature study, components that were needed for the prototype could be determined. A prototype was then made. The program Autodesk Fusion was used to create a design. Axles and brackets for the sensors were 3D-printed.

6)The challenge of designing and programming a robot that avoids obstacles can be implemented from schools to science museum and science fair workshops. The primary aim of this activity is to motivate students and young people to become interested in science and engineering.

Sensor Input: The Arduino is connected to sensors such as ultrasonic sensors, infrared sensors, or LiDAR sensors. These sensors emit signals and measure the time it takes for the signals to bounce back after hitting an obstacle. Based on the time taken and the speed of the signal, the distance to the obstacle is calculated.

Data Processing: The Arduino reads the sensor data and processes it to determine the distance to the nearest obstacle in its path. This data is then used to make decisions about how the car should maneuver to avoid collisions.

Decision Making: Using programmed logic and algorithms, the Arduino decides how to react based on the sensor data. For example, if an obstacle is detected too close to the car, it might decide to stop or back up. If the obstacle is farther away but still within a certain range, it might decide to steer the car to avoid it.

Motor Control: The Arduino sends commands to the car's motors or servos to control its movements. This could include commands to accelerate, decelerate, steer, or reverse, depending on the obstacle's position and the desired avoidance strategy.

Feedback Loop: The Arduino continuously monitors the sensor data and adjusts the car's movements as needed to navigate around obstacles. This creates a feedback loop where the Arduino constantly assesses the environment and adjusts the car's behavior in real-time.

IV. Circuit Diagram

Hardware Used:

1) ARDUINO UNO :

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input

/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC- to-DC adapter or battery to get started.. You can tinker with your UNO without worring too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases.

2) Ultrasonic Sensor:

Four ultrasonic sensors of type HC-SR04 were used in this project, These sensors can identify a distance from 2-400 cm. They require a current con-direction of the robot; in the front, to the left, to the right and in the back. The robot is programmed to stop when an obstacle occurs within 15 cm ahead of it, this is due to the problem brought up about measurement problems. To minimise the risk of the robot hitting an obstacle due to miscalculations it is good to make it stop when there is still some distance left to the obstacle.

3) MOTOR DRIVER :

Motor drivers take a low current control signal but provide a higher current signal, thus acting as a current amplifier. The higher current signal drives the motors. L293D is a motor driver that allows direct current (DC) motor to drive on either direction. It contains two inbuilt H-bridge driver circuits. To rotate the motor in clockwise or anticlockwise direction, voltage need to change its direction. H-bridge is a circuit that allows voltage to be flown in either direction. Hence H-bridge IC are ideal for driving a DC motor

4) SERVO MOTOR :

Two servo motors of model Tower Pro SG-5010 were used for the two wheels that were driven with differential drive, they can be seen in figure3.4. This servo motor is continuous and can turn 360°. Its dimensions are 40.8 x 20.1 x 38 mm and its weight 40 g. It requires a 4.8-6 V power.

V. Flow Chart

Flowchart was created to describe the algorithm that the robot uses. The flowchart can be seen in Fig. The robot started with driving forward. If it encountered an obstacle in front of its path it checked if there was an obstacle to the right, if not it turned 90° to the right and then continued to drive forward. In the occasion it was an obstacle to the right as well the robot checked to its left and if there was no obstacle there it would turn 90° left and continue forward. In the case where there were obstacles both in front and to both sides the robot would check behind and if the way was free there it would reverse and then again check its right and left sides. If a situation occurred where there were obstacles all around the robot the motors would stop and the robot would have to be moved manually.

VI. Conclusion

In conclusion, an obstacle detection circuit was successfully Implement using ultrasonic sensors modules which were placed At the front of the car to throw both light and sound waves at Any obstacle and when a reflection is received. In conclusion, the "Obstacle Avoiding Robot" project represents a

rewarding journey into the world of robotics, offering valuable learning experiences, practical skills, and innovative insights. Through the design, construction, and programming of an autonomous robot capable of navigating through environments while avoiding obstacles, participants embark on a hands-on exploration of robotics concepts, sensor integration, and algorithmic control.

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