THE TECHFEST 1.0

2K23

NAME OF THE PROJECT: OBSTACLE AVOIDANCE ROBOT

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OBSTACLE AVOIDANCE ROBOT

Introduction :

An obstacle avoidance robot is an autonomous robot which is able to avoid any obstacle it face when it moves. Simply, when it met an obstacle while it moving forward, automatically stop moving forward and makes a step back then it takes a little turn and moves forward with the same loop. This obstacle avoidance robot, we are demonstrating here is very helpful and this is a simple demonstration of obstacle avoiding process for sophisticated technologies and machines. It is the base of many large projects such as Automatic cars, robots used in manufacturing factories, even in robots used in spacecraft's or interplanetary robotic missions like Mars rover.

Objective :

The primary objective of an obstacle avoidance robot is to autonomously navigate its surroundings, detect obstacles and adjust its path to avoid collisions, ensuring safe and efficient movement. It encompasses the development of a robotic system equipped with sensors and efficient algorithms to autonomously explore and navigate diverse environments.

Algorithm Design :

An algorithm is a step by step process or set of rules designed to perform a specific task or solve a particular problem. Algorithms are fundamental in computer science, mathematics, robotics and various fields for solving problems and automating processes.

1. **Sensor Data Acquisition :** Use sensors to gather information about surroundings.
2. **Data Processing :** Process sensor data to interpret the environment.
3. **Obstacle Detection :** Identify obstacles based on processed sensor readings.
4. **Decision Making :** Determine appropriate actions, such as turning or stopping, in response to detected obstacles.
5. **Path Planning :** Devise a strategy to navigate around obstacles and reach the destination.
6. **Motor Control :** Implement commands to control robot movements.
7. **Feedback Loop :** Continuously update sensor data and adjust robot behaviour in real time.
8. **Collision Prevention :** Integrate measures to prevent collisions and ensure safety.

9. **Autonomous Operation :** Combine the algorithm with a control system for autonomous navigation.

Technologies Used :

- **Ultrasonic sensor :** Used to detect obstacles by emitting ultrasonic waves and measuring the time it takes for the waves to bounce back.
- **Adruino UNO :** Arduino is an open-source electronics platform based on easy-to-use hardware and software. Such as Adruino UNO microcontroller, which act as the brain of the robot, processing sensor inputs and making control decisions.
- **C / C++ Programming Language :** Code the logic for decision making, motor control and communication with sensors.
- **L293 Motor Driver :** The L293 motor driver is an integrated circuit designed for controlling the direction of rotation and speed of DC motors.
- **BO Motors :** "B.0." typically stands for "Battery Operated" in the context of motors used in robotics and electronics. These DC gear motors are used for driving wheels or other mechanical components.

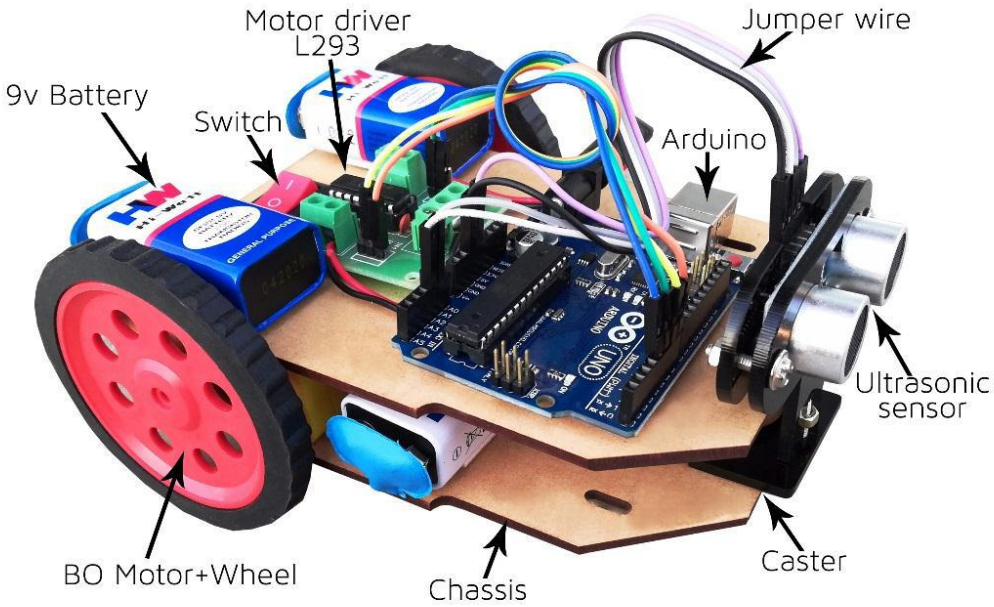
Working Methods :

1. **Obstacle Detection :** The ultrasonic sensor has a signal generator and a receiver. The signal generator generates an ultrasonic wave and transmits in the forward direction. The transmitted wave strikes any obstacle in its path and a huge part of it gets reflected. The receiver receives the reflected wave. The obtained values from the ultrasonic sensor need to be calibrated in order to get a meaningful data (distance). The distance of the object is calculated on the basis of the time taken by the wave in the process of transmission, reflection and collection.

2. **Data Processing & Decision Making :** To avoid the obstacle in the path, a condition is put in the system which says: if the distance between the robot and the object gets below a certain level, stop the robot and take a backward motion and then turn the robot into other direction and continue the loop. This logic is applied to the system by writing the code in the Arduino.
3. **Motor Control :** Motor driver is used to send the commands to motors according to signal received from Arduino.

4. **Motor Rotation and Direction Change :** Two motors are used in this process : left motor and right motor. To move the robot car forward, both the motors are turned on. For backward step, both motors need to run in opposite direction. To turn the robot car to avoid obstacle, one of the motor is reversed for a while, keeping the other motor forward.
5. **Feedback Loop :** A feedback loop is established to continually update the sensor data. This ensures the robot can adjust its actions based on the most recent information from its environment.
6. **Autonomous Operation :** Integrate algorithms, sensor input and motor control for autonomous navigation. Enable the robot to operate independently, making decisions without constant human interventions.
7. **Continuous Monitoring :** Continuously monitor the environment for new obstacles or changes. Adjust the robot's behaviour dynamically to ensure ongoing obstacle avoidance.

Visual Representation :



Future Scopes :

- **Advanced Sensing Technology :** Integration of more advanced sensors, such as 3D cameras, advanced Lidar systems or multispectral sensors to enhance [erce[tion and object recognition capabilities.
- **Swarm Robotics :** Collaborative efforts among multiple obstacle avoidance robots, forming a swarm for more efficient exploration and problem solving in large dynamic environment.
- **Autonomous Vehicles and Transportation :** Incorporation of obstacle avoidance systems into autonomous vehicles, drones and other forms of transportation for enhanced safety and reliability.
- **Environmental Monitoring :** Application of obstacle avoidance robots in environmental monitoring scenarios, such as inspecting hazardous areas, collecting data in disaster-sticken regions or monitoring wildlife.
- **Integration with Smart Cities :** Incorporation of obstacle avoidance robots into smart city infrastructure for tasks like surveillance, maintenance and ensuring pedestrian safety.
- **Miniaturization and Micro-Robotics :** Development of smaller and more agile obstacle avoidance robots for applications in confined spaces or areas where larger robots may be impractical.
- **Humanitarian and Healthcare Applications :** Deployment of obstacle avoidance robots in healthcare settings for tasks like delivering medical supplies, assisting in patient care or operating in hazardous environments.

Conclusion :

The obstacle avoidance robot successfully navigates its environment by employing sensors to detect obstacles and adjusting its path accordingly. This enhances its ability to operate autonomously, promoting efficiency and safety in various applications such as home automation or industrial settings.

References :

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