International Islamic University Chittagong

Combines Quality with Morality

| Project Report |

Project Title :

Obstacle - Avoiding ROBOT

Team Name: 2XBots

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1 Introduction

An obstacle-avoiding robot is an autonomous wheeled vehicle that can detect obstacles in its path using sensors and intelligently change direction to avoid collisions while continuing to move forward. This project integrates fundamental concepts of digital logic design, sensor interfacing, motor control, and embedded programming using the Arduino platform.

2 Motivation

The rapid growth of automation in industries, homes, and public spaces demands reliable, low-cost robots that can operate safely around humans and objects. This project is motivated by the need to understand real-time sensor-based decision-making and motor control using simple digital systems. It provides practical exposure to embedded programming, sensor interfacing, and autonomous navigation — essential skills for future developments in robotics, self-driving vehicles, and smart automation — while keeping the design affordable and easy to replicate.

3 Objective

- Design and construct a four-wheeled autonomous robot equipped with an ultrasonic sensor for obstacle detection.
- Implement real-time obstacle-avoidance algorithms using Arduino programming.
- Enable directional scanning by mounting the ultrasonic sensor on a servo motor to evaluate left and right clearance.
- Select and move toward the direction with the maximum open space based on sensor readings.
- Maintain a low overall project cost by utilizing affordable and easily available components.

4 Components

Component	Quantity	Purpose
Arduino Uno R3	1	Main microcontroller
L293D Motor Driver Shield	1	Drives four DC motors
HC-SR04 Ultrasonic Sensor	1	Measures distance to obstacles
SG90 Servo Motor	1	Rotates sensor for left/right scan
4-Wheel Robot Chassis Kit	1	Base, motors, and wheels
Jumper Wires (M-F)	–	Connections
7.4V Lithium-ion Batteries (18650 × 2)	2	Power supply
Switch & Battery Holder	1	Power control

5 Social Impacts

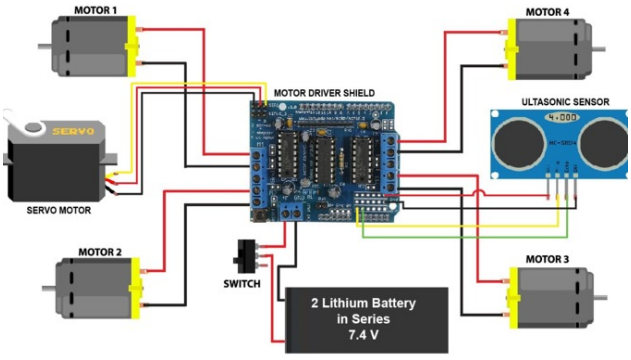
- Enhances safety by reducing human presence in hazardous areas (factories, disaster zones, mines).
- Supports automation in warehouses, hospitals, and homes, increasing efficiency and reducing manual labour.
- Serves as an affordable educational tool for teaching robotics, programming, and embedded systems.
- Can be adapted for assistive devices for elderly and disabled persons.
- Promotes precision agriculture and eco-friendly tasks by minimizing human intervention in fields.

6 Cost Analysis

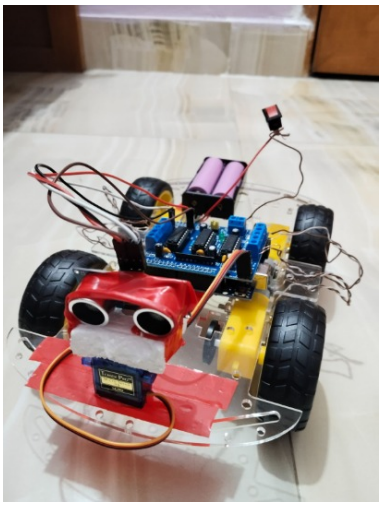
Component	Price (BDT)
Arduino Uno R3	800
L293D Motor Driver Shield	200
HC-SR04 Ultrasonic Sensor	90
SG90 Servo Motor	150
Robot Chassis Kit	900
Jumper Wires & Accessories	100
Battery + Holder + Charger	370
Miscellaneous (switch, screws)	180
Total	**2,790/-**

7 Output

The robot moves forward smoothly until an obstacle is detected within 25 cm. It stops, scans left and right using the servo-mounted ultrasonic sensor, chooses the clearer direction, and continues moving. It consistently avoided obstacles during real-time testing.



(a) Circuit diagram of the robot



(b) Final assembled robot

Figure 1: Circuit and Robot Overview

8 Summary

This project successfully developed a low-cost and fully working obstacle-avoiding robot using an Arduino Uno, HC-SR04 ultrasonic sensor, SG90 servo motor, and an L293D motor driver shield. The robot measures distance in real time and automatically stops whenever an obstacle is within 25 cm. At that point, the servo rotates the ultrasonic sensor to the right and left to check both directions, compares the distances, and chooses the side with more free space. Before turning, the robot slightly moves backward for safety and then rotates in the selected direction.

When the path is clear, the robot moves forward at different speeds depending on how far the next obstacle is. The total project cost stayed under 3,000 BDT, making it suitable for students and beginners. This work shows how digital logic design, sensor interfacing, and basic embedded programming can be used to build a reliable autonomous robot using simple and affordable components.