Obstacle Avoiding Robot

Prepared by:
Seif Eldin Walid Ali
Youssif Nasrat Rassem

1. Introduction

Obstacle avoiding robots can detect and avoid objects in their path without human control. The robot uses a basic ultrasonic sensor, servo motor, and DC motors which are controlled by a microcontroller. Embedded systems programming, AMIT coding standards, and a modular structure have been used in the design for clarity and scalability.

2. Objectives

- Build a self-driving vehicle capable of avoiding obstacles using an ultrasonic sensor.

- Develop modular C programming for embedded systems, adhering to AMIT coding standards.

- Set up code in Microchip Studio to control servo and DC motors.

- Organize the project such that components of the code are reusable and expandable.

3. System Components

3.1 Hardware Components:

- Arduino Uno (ATmega328P microcontroller)

- Ultrasonic Sensor (HC-SR04)

- Servo Motor (SG90)

- L298N Motor Driver Module

- DC Motors with wheels

- AAA battery pack or USB power bank

- Robot chassis and internal wiring

- ### **3.2 Software Components:**

- Microchip Studio 7 (formerly Atmel Studio)

- Arduino IDE

4. Circuit Diagram

A two-wheel drive system is used. Motors are connected through the L298N motor driver. The ultrasonic sensor is mounted on a servo motor, allowing it to scan left and right. Arduino Uno is responsible for all control logic and decision-making.

5. Working Principle

As the robot moves forward, it continuously monitors for obstacles. When it detects an obstacle within 30 cm:

- It stops moving.

- Reverses briefly.

- Rotates the servo to scan left and right for clearer paths.

  Turns toward the direction with the most available space.

6 . Code Structure

The code is structured into sections called modules.
In main.c, the main control flow happens.
motor_control.c manages motor movement.
It handles the operations of the ultrasonic sensor.
This file helps control the servo positioning.
Every module includes both prototypes and definitions for its functions, so each piece of logic is organized separately.

7. Implementation Details

7.1 Motor Control

The two motors are controlled with PWM and digital outputs. Functions include:

- moveForward
- moveBackward
- moveStop
- turnRight
- turnLeft

7.2 Working with Ultrasonic Sensor

Time is measured using trigger and echo pins to find out how far an object is from the sensor.

The process of servo scanning uses many motor smaller than on earlier machines.

The servo is rotated to 0° and then 180° to see where it hits right and left. Then it goes back to forming an angle of 90°.

8. Tests & Outcomes

Different scenarios were created by changing the obstacles in the testing areas for the robot. It successfully:

• Ward off stationary dangers.
• Picked the most suitable path of motion using sensor feedback.
• Handled both corners and tight passages.

9. Conclusion

The project shows a basic approach to building an obstacle avoiding robot using C code and Microchip Studio. It explains methods used in designing embedded systems, modular programming and using sensors to make decisions.

10. Future Improvements

• Enabling IR sensors will permit more accurate detection of the ball from the side of the field.
• Control speed according to how close obstacles are.
• Allow overriding the system with a remote control over Bluetooth or Wi-Fi.
• Make sure to use better controllers like STM32 or Raspberry Pi for including mapping and Artificial Intelligence.