DEVELOPMENT OF AN ARDUINO-BASED OBSTACLE AVOIDANCE SYSTEM ON A ROBOT CAR

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ABSTRACT

The use of autonomous systems worldwide to carry out important and delicate tasks is rapidly increasing. However, their application across different fields cannot be overstated. This paper introduces an obstacle detection and avoidance system for an unmanned robotic car. The micro-servo motor redirects the robot to move in a different direction by controlling the motors to avoid detected obstacles. An ultrasonic sensor detects any obstacle in front of it and sends a command to the microcontroller. Based on the received input signal, the microcontroller adjusts the robot's direction by controlling the motors, which are connected through a motor driver.

INTRODUCTION

Robotics is an integral part of today’s world. An obstacle-avoiding robot is an intelligent device capable of automatically detecting and overcoming obstacles in its path. Motion, a crucial characteristic of mobile robots in obstacle avoidance and path recognition, significantly influences how people respond to and perceive autonomous systems. This capability allows an autonomous robot to navigate from one location to another without human intervention. Primary object detection methods used in mobile robots include computer vision and range sensors.

METHODOLOGY

Hardware:

- Arduino Uno Board
- HC-SR04 Ultrasonic sensor
- DC Motors
- Motor driver IC (L293D)
- Battery (9V)
- Jumper Wires
- Chassis
- Wheels

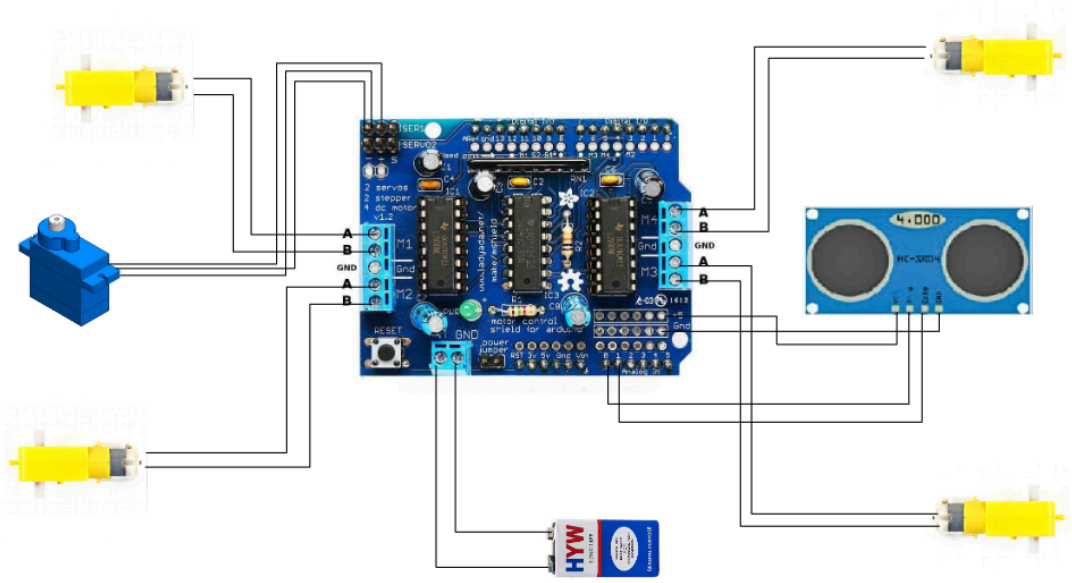


Figure 1.1 - Circuit diagram design

The basic block diagram of the obstacle-avoiding car is illustrated in the figure 1.1. This block diagram primarily includes the components listed above in the Hardware section.

Software:

The system was implemented in C++ using the Arduino software. Figure 1.2 displays a snapshot of the code. Libraries such as AFMotor.h, Servo.h

were used to configure the wheels and servo motor with Arduino board. Max speed was also set so as to not let the robot car go out of control.

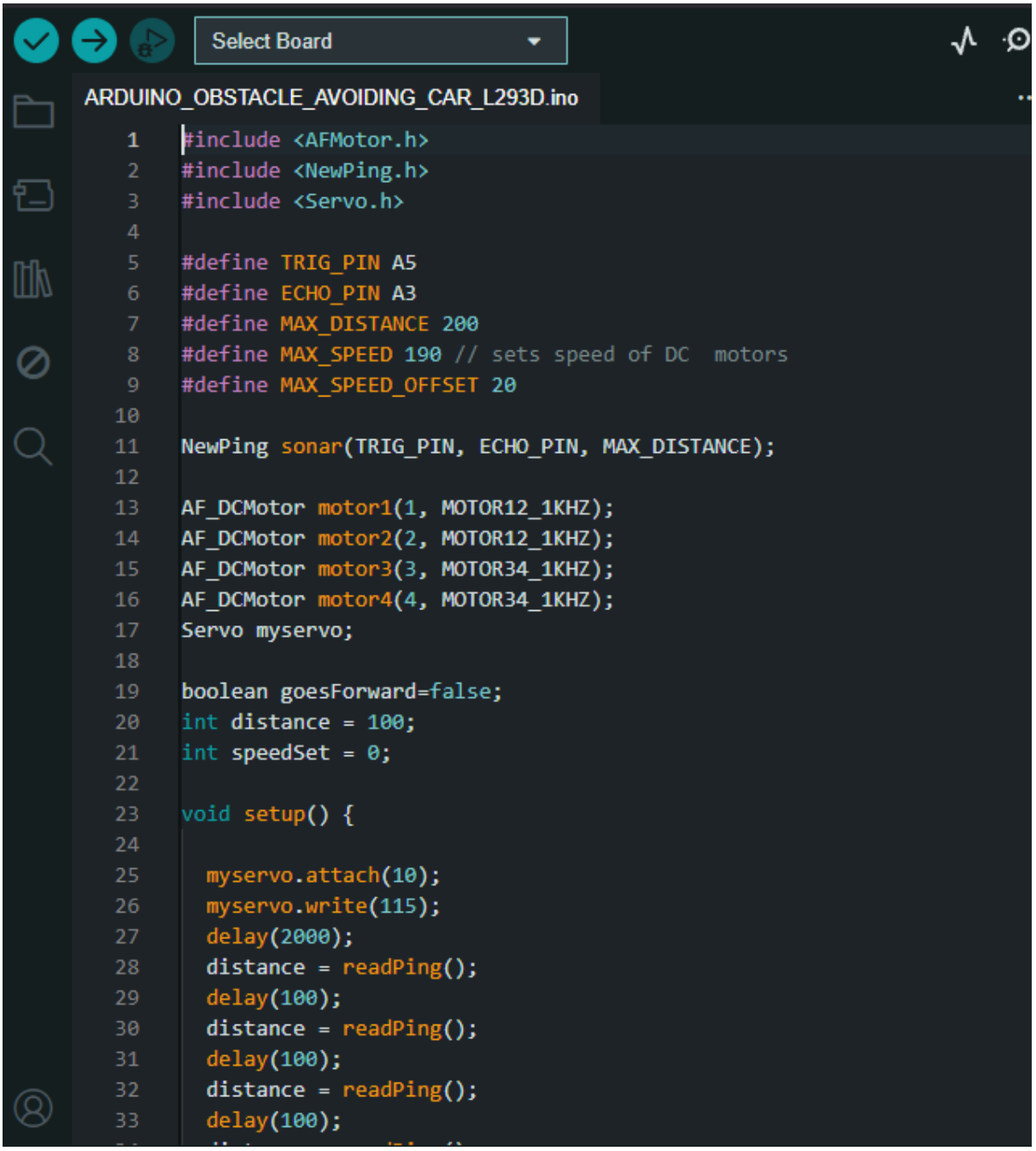


Figure 1.2 - Snap of the C++ code written in Arduino Software

CHASSIS DESIGN AND MAKING

A sketch of the car was created using SolidWorks software. Throughout the design process, various modifications were made to the sketch, and

errors were corrected to ensure proper meshing of parts and simulation. The design was fabricated using a plastic plate.

The robotic framework is rectangular in shape, featuring two rear wheels and two front wheels, all made of plastic.

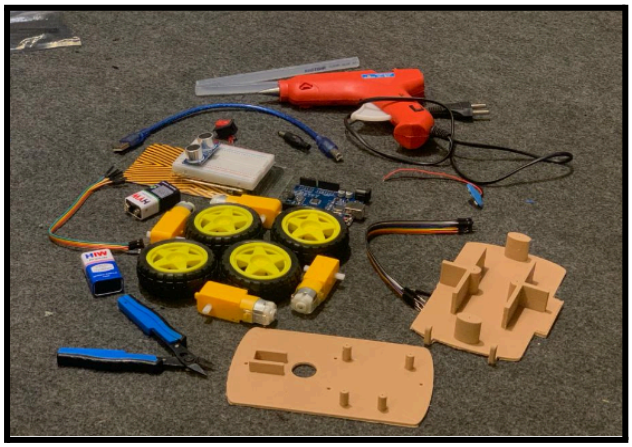
APPLICATION

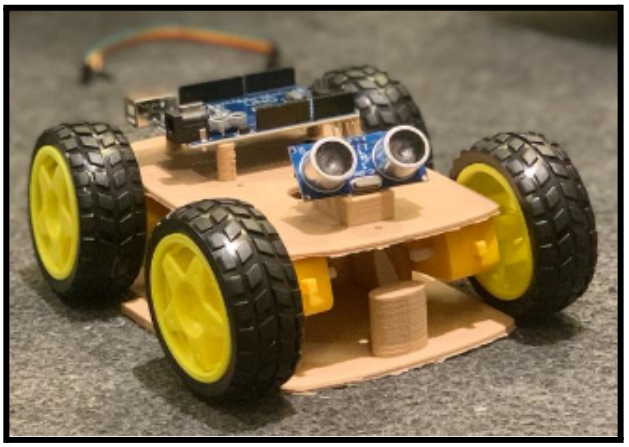
This device has applications in surveying and mapping different landscapes. It can also be used in commercial devices such as:

- Automated lawn mowers
- Smart room cleaners
- Obstacle-avoiding robots for mobile navigation systems
- Dangerous environments where human entry could be hazardous
- Unmanned vehicle operation

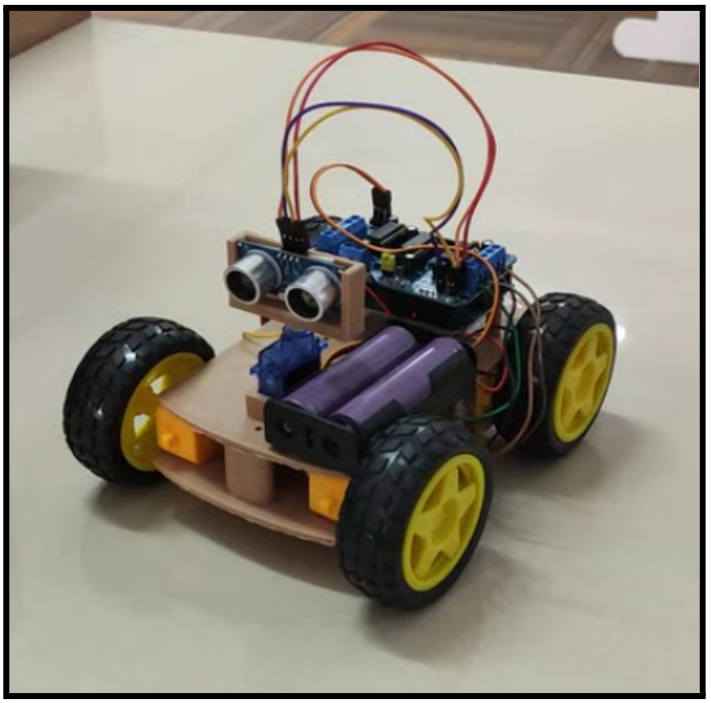
RESULT AND DISCUSSIONS

The results for the obstacle-avoiding robot using Arduino show that the robot moves forward until it detects an obstacle. When an obstacle is detected, the robot checks other directions and moves in the direction where no obstacles are present. An ultrasonic sensor is used to sense obstacles, and a servo motor rotates the ultrasonic sensor to scan for obstacles. The robot's working principle involves transmitting the sensed signals to the microcontroller, which then controls the DC motors to navigate around obstacles. The microcontroller directs the motors to move either clockwise or counterclockwise based on the detected obstacles.





CONCLUSION



This paper presents a simple and cost-effective obstacle detection and avoidance system for a robot car. The goal of the project is to develop an autonomous robot that intelligently detects obstacles in its path and navigates based on predefined actions. The Arduino controller and ultrasonic sensors were examined, leading to the selection of the HC-SR04 ultrasonic sensor for this application. Obstacle avoidance has significant applications and can be especially useful in hostile environments, as well as in defence and security sectors.

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