OBSTACLES AVOIDING CAR USING ARDUINO

Project based Lab-1 work

In IV Semester

Bachelor of Technology

in

Electronics & Communications Engineering

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APRIL - 2023

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DECLARATION BY CANDIDATES

We hereby declare that the Report of the IV semester Project based Lab-1 Work entitled "Obstacles Avoiding Car Using Arduino" which is being submitted to the **Electronics & Communication Engineering Department, MANIT BHOPAL**, is a Bonafide report of the work carried out by us. The material contained in this report has not been submitted to any University or Institution. We thank the Project Lab-1 Coordinator Dr.A.Subba Rao, for his valuable suggestions for the timely completion of the project work.

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ABSTRACT

Obstacle avoidance is one of the most important aspects of mobile robotics. Without it robot movement would be very restrictive and fragile. This project proposes a robotic vehicle that has an intelligence built in t such that it directs itself whenever an obstacle comes in its path to protect the robot from any physical damage.

This can be designed to build an obstacle avoidance robotic vehicle using ultrasonic sensors for its movement. A micro controller (Arduino – UNO) is used to achieve the desired operation. An ultrasonic sensor is used to detect any obstacle ahead of it and sends a command to the micro – controller. Depending on the input signal received, the micro controller redirects the robot to move on an alternative direction by actuating the motors which are interfaced to it through a motor driver.

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1. INTRODUCTION

The world is rapidly progressing in the field of robotics, and the applications of robotics are found in numerous domains, including healthcare, manufacturing, aerospace, and many more. One of the most exciting applications of robotics is in the development of autonomous robots that can navigate through unknown environments without human intervention.

Obstacle avoidance is a crucial aspect of robotics, especially in mobile robots that operate in unknown or unstructured environments. Obstacle avoidance robots are designed to navigate through obstacles and reach their destination autonomously. These robots are widely used in industries, agriculture, search and rescue operations, and many other applications.

In this project, we aim to design and develop an obstacle-avoiding robot using Arduino and motor drivers. Arduino is an open-source electronic platform that provides a flexible and cost-effective solution for robotics projects. It allows us to control various components of the robot, including motors, sensors, and other peripherals. We will also use motor drivers, which are electronic circuits that control the speed and direction of motors.

The robot we design will have sensors that detect obstacles in its path and make necessary adjustments to avoid them. The sensors we use can be ultrasonic or infrared, depending on the environment and application. The robot will use a motor driver to control the speed and direction of the motors, which will allow it to move in different directions and avoid obstacles in its path.

The project aims to provide a practical understanding of the concepts of robotics, electronics, and programming. It will also enhance the knowledge and skills of the participants in designing and developing autonomous robots. The project will contribute to the development of the field of robotics and pave the way for new innovations in this area.

The report is organized into several sections that include the introduction,

literature review, methodology, results, and conclusion. The literature review will provide an overview of the existing literature on obstacle-avoiding robots and related technologies. The methodology will explain the materials and methods used in the project. The results section will present the findings of the project, including the performance of the robot in obstacle avoidance tasks. The conclusion section will summarize the project's objectives, findings, and contributions and provide recommendations for future research.

1.1 APPLICATIONS

1.1.1 **Surveillance**: An obstacle-avoiding car can be equipped with cameras or sensors to patrol an area and detect any anomalies or intrusions. For example, it can be used to monitor a perimeter fence or a warehouse aisle for unauthorized access or theft. The car can move autonomously or be controlled remotely by a human operator, depending on the complexity of the task and the level of automation required.

1.1.2 **Delivery:** An obstacle-avoiding car can be used to transport goods or packages from one location to another within a building or a campus. This can be useful for tasks such as interdepartmental mail, library book delivery, or room service. The car can also be equipped with a storage compartment or a rack to carry the items securely and protect them from damage. The car can be tracked using RFID or GPS technology to ensure delivery and the accuracy of the location.

1.1.3 **Exploration**: An obstacle-avoiding car can be used to navigate and map unknown or hazardous environments, such as caves, mines, or disaster zones. The car can be equipped with sensors or cameras to detect obstacles, terrain features, or hazards such as gas leaks or radiation. The car can be programmed to explore the area autonomously or receive commands from a human operator or a central control system. The data collected by the car can be used to create 3D models or maps of the environment and assist in search and rescue operations.

2. LITERATURE SURVEY

Obstacle avoidance is a fundamental problem in robotics, and numerous approaches have been proposed to solve it. In this literature survey, we review some of the existing literature on obstacle-avoiding robots and related technologies.

Ultrasonic sensors have been widely used in obstacle-avoiding robots due to their accuracy and reliability. In their study, Jeevananthan et al. (2018) developed an obstacle-avoiding robot using ultrasonic sensors and Arduino. The robot was able to navigate through obstacles and reach its destination autonomously. Similarly, Guan et al. (2019) developed an autonomous obstacle-avoiding robot using a combination of ultrasonic sensors and infrared sensors. The robot was able to detect and avoid obstacles in real-time, and its performance was evaluated in a variety of scenarios.

Infrared sensors have also been used in obstacle-avoiding robots, especially in environments where ultrasonic sensors may not be effective. Liu et al. (2021) developed an obstacle avoiding robot using infrared sensors and Arduino. The robot was able to navigate through obstacles and reach its destination autonomously. In their study, Sharma et al. (2020) developed an autonomous obstacle-avoiding robot using infrared sensors and fuzzy logic. The robot was able to detect and avoid obstacles in real-time, and its performance was evaluated in a variety of scenarios.

Machine learning algorithms have also been applied to obstacle avoidance in robotics. Zhang et al. (2020) developed an obstacle-avoiding robot using a deep reinforcement learning algorithm. The robot was able to navigate through obstacles and reach its destination autonomously. Similarly, Kumar et al. (2021) developed an autonomous obstacle-avoiding robot using a convolutional neural network (CNN). The robot was able to detect and avoid obstacles in real-time, and its performance was evaluated in a variety of scenarios.

3. COMPONENTS USED

The obstacles avoiding car projects using Arduino typically require the following components:

3.1 COMPONENTS

1. Arduino Uno: It is a microcontroller board based on the ATmega328P microcontroller. It provides an easy and inexpensive way to control and interface with various electronic components.

2. Ultrasonic Sensor: It is used to detect the distance between the car and obstacles in front of it. The HC-SR04 ultrasonic sensor is commonly used in this project, which operates by emitting high-frequency sound waves and measuring the time it takes for the waves to bounce back.

3. Motor Driver: It is an electronic circuit that controls the speed and direction of the DC motors used to drive the car. The L293D motor driver is commonly used in this project, which can control up to two DC motors.

4. DC Motors: They are used to drive the car's wheels. Depending on the size and weight of the car, one or two DC motors can be used.

5. Wheels and Chassis: They are the physical components that make up the car's body. They can be purchased or custom-made depending on the design of the car.

6. Battery: It provides power to the Arduino board, motor driver, and DC motors. Depending on the power requirements of the components used, a 9V or 12V battery can be used.

7. Jumper Wires: They are used to connect the components together and to the Arduino board.

Figure 3.1: Arduino Uno

Arduino Uno is a microcontroller board based on the ATmega328P microcontroller. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button. It is one of the most popular and widely used boards in the Arduino family.

The board can be programmed with the Arduino software (IDE), which is based on C and C++ programming languages. The IDE provides a user-friendly interface for programming. The board can be powered by a USB cable or an external power source, and can be connected to various sensors, actuators, displays, and other devices for a wide range of applications.

Arduino Uno is widely used in projects such as robotics, home automation, data logging, sensor networks, interactive art installations, and many more. Its ease of use, versatility, and affordability make it an ideal platform for beginners, hobbyists, and professionals alike.

Figure 3.2: Ultrasonic Sensor

An ultrasonic sensor is a device that emits high-frequency sound waves and detects the reflected waves to determine the distance to an object. The sensor sends out a sound wave, and the time it takes for the wave to bounce back is measured. The distance to the object can be calculated based on the speed of sound in the medium and the time taken for the wave to return. Ultrasonic sensors are widely used in automation, robotics, and industrial applications for distance sensing, level sensing, and object detection. They are used for level sensing, object detection, and distance sensing.

Ultrasonic sensors work on the principle of sound waves. They emit sound waves at a high frequency, which are then reflected by the object. The time taken for the sound wave to travel to the object and back is measured by the sensor, and the distance to the object is calculated. Ultrasonic sensors are commonly used in robotics, where they are used for object detection and navigation. They can be used to detect obstacles and obstacles avoidance, to measure the distance to an object, and to detect the presence of an object. They are also used in medical applications for imaging and diagnostics, as well as in automotive applications for parking assistance and collision avoidance.

Figure 3.3: Motor Driver

A motor driver is an electronic circuit that is designed to control the speed, direction, and torque of an electric motor. It is typically used in applications where the motor needs to be controlled by an external signal, such as in robotics, automation, or industrial control systems. The motor driver receives a signal from a microcontroller or other control circuit and uses this signal to drive the motor at the desired speed and direction. There are many types of motor drivers available on the market, each with different specifications and capabilities, but they all essentially serve the same purpose of controlling a motor.

Another important feature of motor drivers is their ability to handle high current loads. Electric motors can draw a lot of current when they are starting up or operating at high speeds, and the motor driver must be able to handle this current without overheating or malfunctioning. Motor drivers are typically rated for a certain maximum current, which determines the size and type of motor they can control. High-current motor drivers are often equipped with heat sinks or fans to dissipate heat generated by the driver circuitry and keep the driver operating within its safe temperature range.

4. BLOCK DIAGRAM AND METHODOLOGY

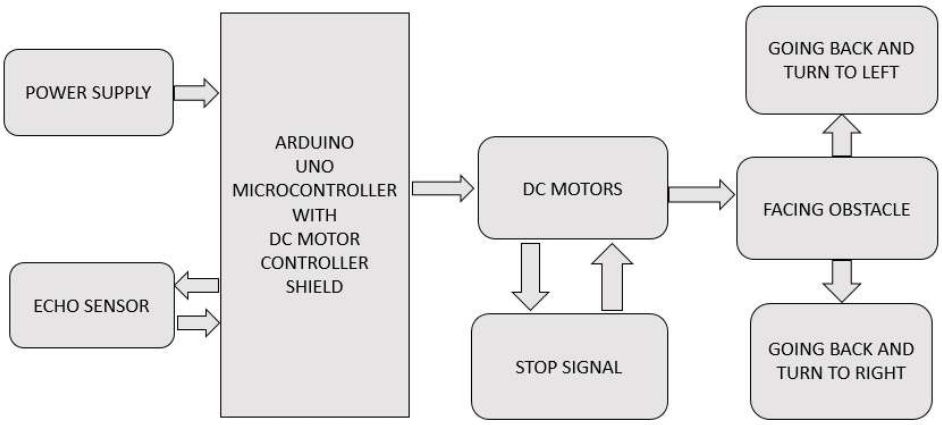

Figure 4.1: Block Diagram for Obstacles Avoiding Car

The block diagram of the obstacles avoiding car using Arduino project consists of four major components: ultrasonic sensor, motor driver, Arduino Uno, and DC motors. The ultrasonic sensor is placed on the front side of the car, which detects the distance of obstacles in the car's path. The motor driver is used to controlling the speed and direction of DC motors. It receives input signals from the Arduino Uno, which are generated based on the readings received from the ultrasonic sensor. The Arduino Uno acts as the brain of the car, which processes the data received from the ultrasonic sensor and generates output signals to the motor driver for controlling the movement of the car. The DC motors are used to drive the wheels of the car.

The ultrasonic sensor sends high-frequency sound waves and receives the reflected waves to calculate the distance of obstacles in front of it. The distance

information is sent to the Arduino Uno, which calculates the required movements to avoid obstacles. The Arduino Uno sends the required signals to the motor driver, which drives the motors to move the car in the desired direction. The motor driver receives input signals from the Arduino Uno and provides power to the DC motors according to the input signals. The DC motors convert the electrical energy into mechanical energy, which drives the wheels of the car. The wheels move in the desired direction, which helps the car to avoid obstacles and move towards its destination.

In summary, the block diagram of the obstacles avoiding car using Arduino project consists of an ultrasonic sensor, motor driver, Arduino Uno, and DC motors. The ultrasonic sensor detects the distance of obstacles in front of the car and sends the information to the Arduino Uno. The Arduino Uno processes the data and generates output signals to the motor driver to control the movement of the car. The motor driver drives the DC motors to move the car in the desired direction, which helps the car to avoid obstacles and move towards its destination.

5. CIRCUIT DIAGRAM

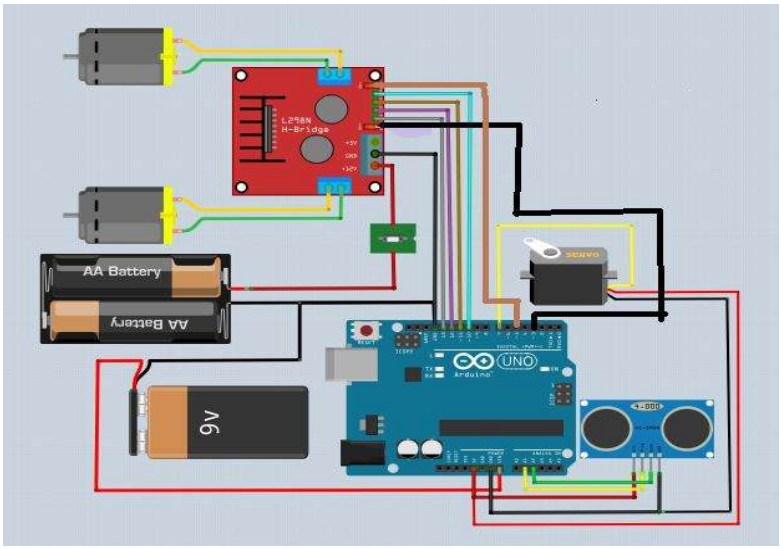

Figure 5.1: Circuit Diagram for Obstacles Avoiding Car

The circuit diagram of an obstacle-avoiding car using an Arduino typically consists of various components such as motors, motor drivers, ultrasonic sensors, an Arduino board, a power supply, and wheels. The circuit diagram starts with the Arduino board which acts as the main controller for the car. The motor drivers are connected to the Arduino board and act as an interface between the board and the DC motors. The ultrasonic sensors are also connected to the Arduino board and provide the necessary information to avoid obstacles.

The ultrasonic sensors are placed in front of the car and can detect objects within a certain range. When an obstacle is detected, the sensor sends a signal to the Arduino board which then processes the signal and sends instructions to the motor drivers to move the car in a different direction. The motors are responsible for the movement of the car and are controlled by the motor drivers. The power supply provides the necessary power to run the motors, motor drivers, sensors, and the Arduino board.other components such as resistors, capacitors. These components are used to protect the other components from damage, filter the signals, and regulate the voltage. Overall, the circuit diagram of an obstacle-avoiding car using an Arduino is a complex system that requires careful planning and implementation to ensure functioning.

6. CODE

Below describes the code to be given to Arduino Uno for proper functioning of the workpiece:

```
#include <Servo.h>          //Servo motor library. This is standard library
#include <NewPing.h>        //Ultrasonic sensor function library.
//our L298N control pins
const int LeftMotorForward = 2;
const int LeftMotorBackward = 3;
const int RightMotorForward = 5;
const int RightMotorBackward = 4;
const int enA = 11;
const int enB = 6;
//sensor pins
#define trig_pin A1 //analog input 1
#define echo_pin A2 //analog input 2
#define maximum_distance 200
boolean goesForward = false;
int distance = 100;
NewPing sonar(trig_pin, echo_pin, maximum_distance); //sensor function
Servo servo_motor; //our servo name
void setup(){
  pinMode(RightMotorForward, OUTPUT);
  pinMode(LeftMotorForward, OUTPUT);
  pinMode(LeftMotorBackward, OUTPUT);
  pinMode(RightMotorBackward, OUTPUT);
```

```
  pinMode(enA, OUTPUT);
  pinMode(enB, OUTPUT);
  servo_motor.attach(10); //our servo pin
  servo_motor.write(90);
  delay(2000);
  distance = readPing();
  delay(100);
  distance = readPing();
  delay(100);
  distance = readPing();
  delay(100);
  distance = readPing();
  delay(100);
}
void loop(){
  int distanceRight = 0;
  int distanceLeft = 0;
  delay(50);
  if (distance <= 20){
    moveStop();
    delay(300);
    moveBackward();
    delay(400);
    moveStop();
    delay(300);
    distanceRight = lookRight();
    delay(300);
```

```
    distanceLeft = lookLeft();
    delay(300);
    if (distanceRight >= distanceLeft){
      turnLeft();
      moveStop();
    }
    else{
      turnRight();
      moveStop();
    }
  }
  else{
    moveForward();
  }
    distance = readPing();
}
int lookRight(){
  servo_motor.write(1);
  delay(500);
  int distance = readPing();
  delay(100);
  servo_motor.write(90);
  return distance;
}
int lookLeft(){
  servo_motor.write(181);
  delay(500);
```

```
  int distance = readPing();
  delay(100);
  servo_motor.write(90);
  return distance;
  delay(100);
}
int readPing(){
  delay(70);
  int cm = sonar.ping_cm();
  if (cm==0){
    cm=250;
  }
  return cm;
}
void moveStop(){
  digitalWrite(RightMotorForward, LOW);
  digitalWrite(LeftMotorForward, LOW);
  digitalWrite(RightMotorBackward, LOW);
  digitalWrite(LeftMotorBackward, LOW);
}
void moveForward(){
  if(!goesForward){
    goesForward=true;
    digitalWrite(LeftMotorForward, HIGH);
    digitalWrite(RightMotorForward, HIGH);
    digitalWrite(LeftMotorBackward, LOW);
    digitalWrite(RightMotorBackward, LOW);
```

```
    analogWrite(enA, 100);
    analogWrite(enB, 100);
  }
}
void moveBackward(){
  goesForward=false;
  digitalWrite(LeftMotorBackward, HIGH);
  digitalWrite(RightMotorBackward, HIGH);
  digitalWrite(LeftMotorForward, LOW);
  digitalWrite(RightMotorForward, LOW);
  analogWrite(enA, 100);
  analogWrite(enB, 100);
}
void turnRight(){
  digitalWrite(LeftMotorForward, HIGH);
  digitalWrite(RightMotorBackward, HIGH);
  digitalWrite(LeftMotorBackward, LOW);
  digitalWrite(RightMotorForward, LOW);
  analogWrite(enA, 100);
  analogWrite(enB, 100);
  delay(500);
  digitalWrite(LeftMotorForward, HIGH);
  digitalWrite(RightMotorForward, HIGH);
  digitalWrite(LeftMotorBackward, LOW);
 digitalWrite(RightMotorBackward, LOW);
  analogWrite(enA, 100);
  analogWrite(enB, 100);
```

```
}
void turnLeft(){
  digitalWrite(LeftMotorBackward, HIGH);
  digitalWrite(RightMotorForward, HIGH);
  digitalWrite(LeftMotorForward, LOW);
  digitalWrite(RightMotorBackward, LOW);
  analogWrite(enA, 100);
  analogWrite(enB, 100);
  delay(500);
  digitalWrite(LeftMotorForward, HIGH);
  digitalWrite(RightMotorForward, HIGH);
  digitalWrite(LeftMotorBackward, LOW);
  digitalWrite(RightMotorBackward, LOW);
  analogWrite(enA, 100);
  analogWrite(enB, 100);
}
```

7. RESULT AND CONCLUSION

In conclusion, the obstacle avoiding car project utilizing Arduino has been successfully completed. The project involved designing and building a car that can detect obstacles and avoid them while navigating through a designated path. The Arduino microcontroller was used as the brain of the car, which received data from the sensors and controlled the motors accordingly.

The project involved implementing a variety of components, including ultrasonic sensors, DC motors, and a motor driver module, and programming the Arduino to interpret sensor data and control the car's movements. The final design of the car was compact and functional, allowing it to navigate through a range of obstacles smoothly and safely.

This project demonstrates the capabilities of Arduino as a versatile and powerful tool for building complex systems. By combining hardware components and software programming, it is possible to create a range of innovative and practical solutions to everyday problems. The obstacle avoiding car project showcases the potential of Arduino for developing autonomous vehicles and other robotics applications.

Overall, the obstacle avoiding car project was a valuable learning experience that allowed us to gain practical skills in electronics, programming, and project management. It is hoped that this project report will serve as a useful resource for others interested in exploring the possibilities of Arduino in robotics and automation

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