SHRI GURU GOBIND SINGHJI INSTITUTE OF ENGINEERING & TECHNOLOGY, NANDED (M.S.)

Department of Electronics and Telecommunication Engineering

Academic year (2023-24)

A MICRO PROJECT REPORT

On

OBSTACLE AVOIDING ROBOTIC CAR USING ARDUINO UNO

Submitted By

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Guided By

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CERTIFICATE

SHRI GURU GOBIND SINGHJI INSTITUTE OF ENGINEERING AND TECHNOLOGY NANDED (M.S.)

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This is to Certify that the report entitled,

OBSTACLE AVOIDING ROBOTIC CAR USING ARDUINO UNO

Is submitted as partial fulfilment of micro project report by,

Yashomati Vasantrao Bawane (2021BEC093)

ACADEMIC YEAR (2023-24)

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ACKNOWLEDGMENT

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of the people whose constant guidance and encouragement made it possible. I take pleasure in presenting before you, my project which is result of studied blend of research and knowledge.

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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 robotic vehicle that has an intelligence built in it such that it directs itself whenever an obstacle comes in its path. So, to protect the robot from any physical damages. This can be design to build an obstacle avoidance robotic vehicle using ultrasonic sensors for its movement. A micro-controller 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 in an alternate direction by actuating the motors which are interfaced to it through a motor driver.

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CHAPTER 1

1.1 INTRODUCTION

Robotics is part of Todays communication. In today's world ROBOTICS is fast growing and interesting field. It is simplest way for latest technology modification. Now a days communication is part of advancement of technology, so we decided to work on ROBOTICS field, and design something which will make human life simpler in day today aspect. Thus we are supporting this cause.

An obstacle avoiding robot is an intelligent device, which can automatically sense and overcome obstacles on its path. Obstacle Avoidance is a robotic discipline with the objective of moving vehicles on the basis of the sensorial information. The use of these methods front to classic methods (path planning) is a natural alternative when the scenario is dynamic with an unpredictable behaviour. In these cases, the surroundings do not remain invariable, and thus the sensory information is used to detect the changes consequently adapting moving. It will automatically scan the surrounding for further path.

This project is basic stage of any automatic robot. This ROBOT has sufficient intelligence to cover the maximum area of provided space. It has a ultrasonic sensor which are used to sense the obstacles coming in between the path of ROBOT. It will move in a particular direction and avoid the obstacle which is coming in its path. We have used four D.C motors to give motion to the ROBOT. The construction of the ROBOT circuit is easy and small The electronics parts used in the ROBOT circuits are easily available and cheap too.

1.2 OBJECTIVE

Object detection technique is used to identify required objects in video sequences and to cluster pixels of these objects. The detection of an object in video sequence plays a major role in several applications specifically as video surveillance applications.

1.3 WORKING PRINCIPLE

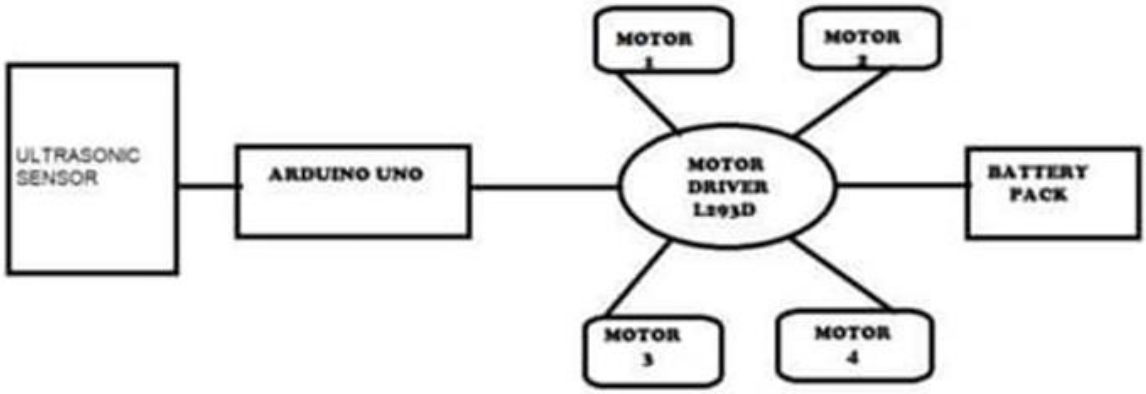
The obstacle avoidance robotic vehicle uses ultrasonic sensors for its movements. Arduino is used to achieve the desired operation. The motors are connected through motor driver IC to Arduino. The ultrasonic sensor is attached in front of the robot.

Whenever the robot is going on the desired path the ultrasonic sensor transmits the ultrasonic waves continuously from its sensor head. Whenever an obstacle comes ahead of it the ultrasonic waves are reflected back from an object and that information is passed to the arduino. The arduino controls the motors left, right, back, front, based on ultrasonic signals. In order to control the speed of each motor pulse width modulation is used (PWM).

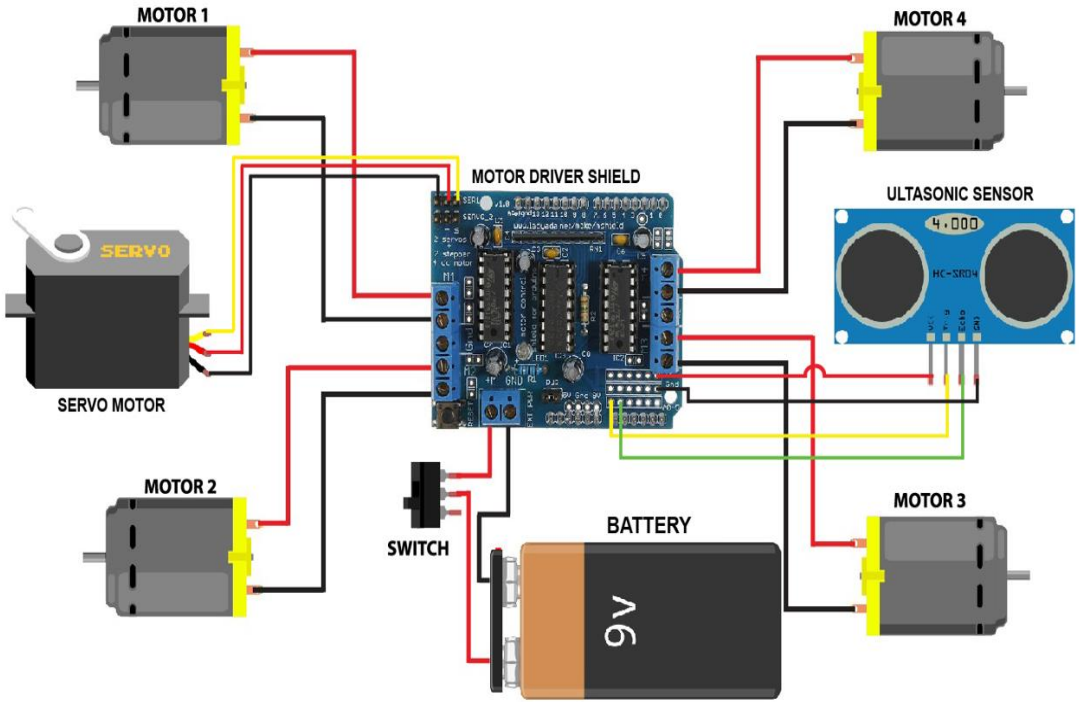
When ultrasonic sensor detect the object which is kept inside the path it will send the signal toward the arduino uno and according to that it will it will rotate the motor M3 & M4 in forward direction and rotate the motor M1 & M2 in reverse direction such way that the car get moving in left direction

Similarly in every time when ever an obstacle in found to be in path of car it will detect it and rotate the car in left direction to avoid the obstacle.

1.4 BLOCK DIAGRAM



1.5 CIRCUIT DIAGRAM



CHAPTER 2

2. List and Description of components

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2.3 Wheels

2.4 TT Gear Motor

2.5 Servo Motor

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2.7 18650 Li-on Battery

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Description of components

2.1 Arduino UNO

Arduino is a most commonly used physical computing platform and an interactive developing environment. It is a standalone platform that interacts with arduino software on the computer. The arduino software consist of an arduinoIDE (Integerated Development Environment).Arduino IDE is used for programming. Ardunio uno is the most frequently used development board though it is not a first board in the market. Arduino uno is a microcontroller based on ATmega328p. It consists of crystal oscillator, voltage regulator, communication protocol etc. It has 14 digital input/output pins, out of which 6 can be used for PWM and 6 analog pins.

Figure 1: Arduino Uno

Table 1: Aurduino board specifications

Microcontroller Features	ATmega328P
Operating Voltage	5V
Input Voltage	7-12V
Clock Speed	16MHz
Digital I/O Pins	14(of which 6 provides PWM output)
Analog Input Pins	6
Flash Memory	32KB (ATmega328)
SRAM	2KB

2.2 Motor Driver Shield

Motor Driver Shield is a board which gives possibility to control 4 DC motors or 2 step motors (unipolar or bipolar) and 2 servo motors additionaly by stacking on Arduino.

There are 2 L293D motor driver IC on board which means it can drive 0.6A 4 seperate DC motors or 0.6A 2 seperate step motors. You can control speed and direction of motors independently. Motor controls are done by AF Motor Library.

Features:

5-12V operating voltage

L293D motor controller

Independent control of 4 DC motor

Independent control of 2vstep motor

3-pin socket for 2 servo motor

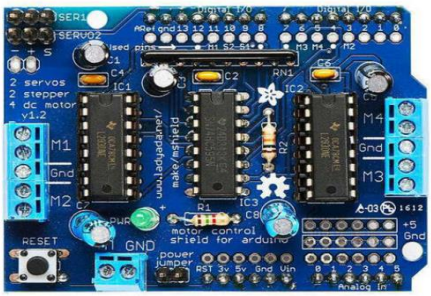
0,6A constant current on each channel

Free analog input pins for sensor connections

Compatible with Arduino Uno

Product Dimensions: 69x53x14,3mm

Weight: 32g



2.3 Wheels

The robot is designed to use 4 motors (2 wheels at front, 2 at back) which is shown in Fig. 1. The two wheels which are presented on the right side of the robot are connected to the motor drive. Likewise, left side motors are also connected to other output pins of the motor drive. Motor drive makes the robot move in the desired direction based on the sensor output information. A 12V DC motor is used in this project. This motor provides a rotation speed of about 8000rpm. For a smooth operation of the robot, the

vibration has to be kept minimum. Silicon based rubber is the most suitable for wheels.

2.4 TT Gear Motor

These inexpensive and reliable TT Gear Motors are an easy, low-cost way to get your projects moving. These gear motors require a voltage of 3-6VDC with a no load current of less than 150mA at 3V and possess a stall torque of 0.8kg.cm at 6V, a gearbox ratio of 48:1, and it comes with 2 x 200mm wires with breadboard-friendly 0.1" male connectors. Perfect for plugging into a breadboard or terminal blocks.

These gear motors have no built-in encoders, speed control or positional feedback. There will be variation from motor to motor, so a separate feedback system is required if you need precision movement.

2.5 Servo Motor

A servo motor is a self-contained electrical device that moves parts of a machine with high efficiency and great precision. In simpler terms, a servo motor is a BLDC motor with a sensor for positional feedback. This allows the output shaft to be moved to a

particular angle, position, and velocity that a regular motor cannot do. However, a servo motor is only one part of a closed-loop motion control system. A complete motion system includes an amplifier, control circuit, drive gears, potentiometer, shaft, and either an encoder or resolver as well as the servo motor

2.6 Ultrasonic Sensor

An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object.

It emits an ultrasound at 40 000 Hz which travels through the air and if there is an object or obstacle on its path It will bounce back to the module. Considering the travel time and the speed of the sound you can calculate the distance.

The HC-SR04 Ultrasonic Module has 4 pins, Ground, VCC, Trig and Echo. The Ground and the VCC pins of the module needs to be connected to the Ground and the 5 volts pins on the Arduino Board respectively and the trig and echo pins to any Digital I/O pin on the Arduino Board.

In order to generate the ultrasound you need to set the Trig on a High State for 10 µs. That will send out an 8 cycle sonic burst which will travel at the speed sound and it will be received in the Echo pin. The Echo pin will output the time in microseconds the sound wave traveled.

2.7 18650 Li-on Battery

Lithium-ion (Li-ion) batteries are a type of rechargeable battery commonly used in portable electronic devices and power tools. They are favored for their high energy density, low self-discharge, and long cycle life.

2.8 Male and Female Jumper Wire

Jumper wires typically come in three versions: male-to-male, male-to-female and female-to-female. The difference between each is in the end point of the wire. Male ends have a pin protruding and can plug into things, while female ends do not and are used to plug things into.

2.9 DC Power Switch

DC switches, on the other hand, are designed to handle direct current (DC), which flows steadily in one direction without changing polarity. Direct current is commonly used in batteries, electronic devices, and certain industrial applications.

CHAPTER 3

3.1 Applications

This device has application in surveying different landscapes and mapping them. It can also be used in commercial devices like:

- Automated lawn mover
- Smart room cleaner etc

Obstacle avoiding robots can be used in almost all mobile robot navigation systems. They can also be used in dangerous environments, where human penetration could be fatal. Unmanned vehicle driving Mining Vehicle that uses Obstacle Detection.

3.2 Advantages

Building an obstacle-avoiding robotic car using Arduino Uno offers several advantages:

- **Educational Purpose**: These cars are excellent for learning about robotics and automation.
- **Autonomous Navigation**: With the help of ultrasonic sensors, the car can navigate around obstacles without human intervention.
- **Efficiency**: Obstacle avoidance in robots provides flexibility in varying environments, making them more efficient.

3.3 Disadvantages

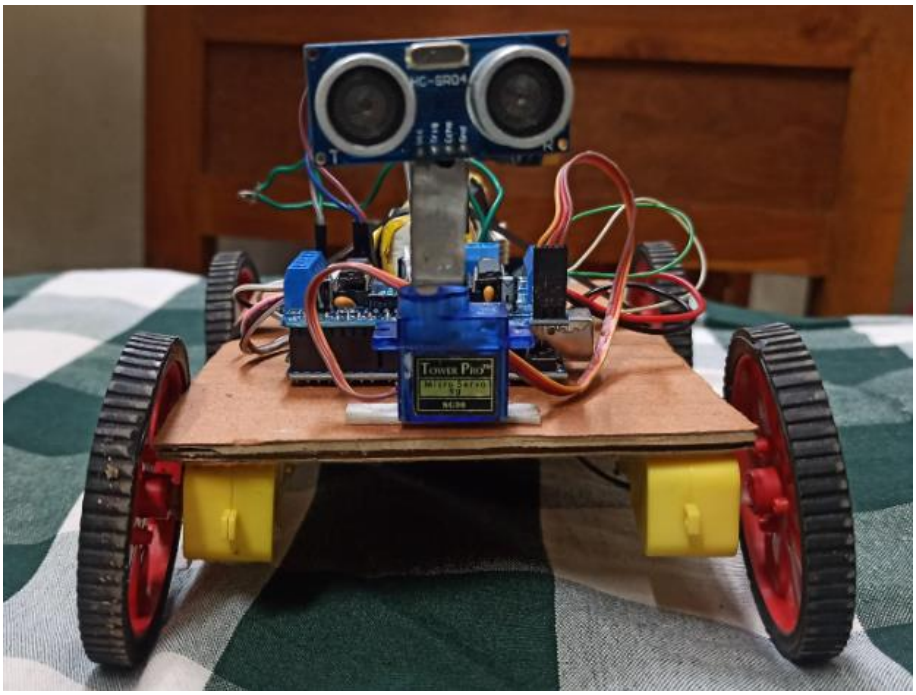
- It is time consuming project.
- It is use for short distance bely.
- It is not recommended to keep the range very long because this would cause the ROBOT keep moving forward and backward as it senses arry obstacle, even far away from it.

3.3 Conclusion

The goal of our project is to create a autonomous robot which intelligently detects the obstacle in his path and navigate according to the actions we set for it. In conclusion, the obstacle-avoiding robotic car project utilizing Arduino UNO has been successfully implemented and tested. Through the integration of ultrasonic sensors and motor control mechanisms, the car demonstrates efficient obstacle detection and avoidance capabilities. Throughout the project, several challenges were encountered and overcome, including sensor calibration, motor synchronization, and algorithm optimization. By employing a combination of hardware and software solutions, we were able to achieve smooth navigation and reliable obstacle avoidance functionality. Furthermore, the project provided valuable insights into robotics, embedded systems, and sensor integration. It offered hands-on experience with Arduino programming, circuit design, and troubleshooting techniques. In the future, enhancements such as incorporating advanced sensors, implementing machine learning algorithms for decision-making, and refining the car's design for better performance could be explored. Overall, this project serves as a solid foundation for further exploration and innovation in the field of robotics and automation.

3.5 Result

The results of an obstacle-avoiding robotic car project using Arduino UNO typically include the performance of the car in avoiding obstacles, the accuracy of its navigation, and any limitation or areas for improvement identified during testing.



3.6 References

- https://youtu.be/1n_KjpMfVT0?si=SVeUZ91fRAABHC2Q
- https://www.slideshare.net/shubhamthakur614/final-report-obstacle-avoiding-roboat