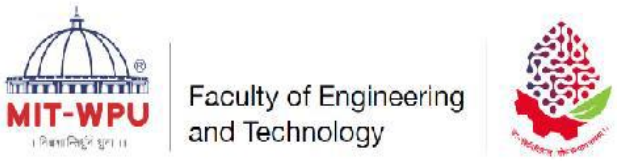


Embedded Systems and Internet of Things

Mini Project Report

On

Obstacle Avoidance Car

By

Hetvi Mehta (roll number : 72)
Aditya Mourya (roll number : 67)
Ridham Sarodiya (roll number : 78)
Saloni Kumbhar (roll number : 52)

Under the guidance of

Dr. Aditi Jahagirdar

Department of Computer Engineering and Technology
School of Computer Science and Engineering
Dr. Vishwanath Karad MIT World Peace University
AY 2023-24 Semester IV

ABSTRACT

One of the key components of mobile robotics is obstacle avoidance. Robotic movement would be extremely limited and delicate without it.
This project suggests creating a robotic vehicle with artificial intelligence that can self-direct when it encounters an impediment. Consequently, to shield the robot from any physical harm. This idea can be used to create a robotic vehicle that avoids obstacles by moving using ultrasonic sensors. Utilizing an AT mega 328P micro-controller, the intended function is accomplished. Any obstruction in front of it is detected by an ultrasonic sensor, which then instructs the microprocessor. By activating the motors that are interfaced to it by a motor driver, the micro-controller can reroute the robot to move in a different direction based on the input signal it receives.

CONTENTS

CHAPTER NO: 1

INTRODUCTION

PROBLEM STATEMENT

Design an obstacle-avoiding car capable of autonomously navigating its environment using ultrasonic sensors to detect obstacles and employing intelligent algorithms to calculate alternative paths or take evasive actions to avoid collisions.

INTRODUCTION

There is a growing need for autonomous systems that can navigate complex environments in this age of rapid technological advancement. Robots that avoid obstacles are particularly noteworthy because they are cleverly designed to navigate cluttered areas while reducing the likelihood of collisions. Advanced algorithms are combined with cutting-edge sensor technologies, like ultrasonic sensors, to enable these robots to recognize obstacles in their path and autonomously plan detours or take evasive measures to prevent collisions. Obstacle-avoiding robots are a fusion of robotics, artificial intelligence, and engineering creativity, with uses ranging from industrial automation to domestic tasks and search and rescue missions. The present introduction establishes the framework for an examination of the advancements, uses, and consequences of obstacle-avoiding robots in the ever-changing field of technology.

CHAPTER NO: 2

NEED OF PROJECT

AND OBJECTIVES

NEED OF PROJECT

The need for the obstacle-avoiding car project arises from the increasing demand for autonomous systems capable of safely navigating complex environments without human intervention. Existing solutions may lack robustness or adaptability, leading to potential collisions or inefficient navigation. Therefore, there is a pressing need for a reliable and efficient obstacle avoidance system that utilizes advanced sensors and intelligent algorithms to enhance the autonomy and safety of vehicles.

OBJECTIVES

- Autonomous Navigation
- Obstacle Detection
- Intelligent Decision-Making
- Efficiency and Adaptability
- Safety Enhancement
- Testing and Validation

CHAPTER NO: 3

COMPONENTS

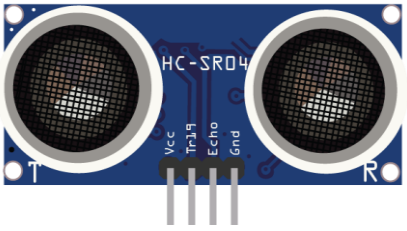
1) Arduino Uno -

Arduino Uno is an ATmega 328p Microcontroller based prototyping board. It is an open source electronic prototyping platform that can be used with various sensors and actuators. It is used for controlling all the operation and assign task to each device.

- Digital pins: 14 digital pins (0 – 13)
- Two different states of voltage: HIGH (5V) / LOW (0V)
- When set as input, read voltage – When set as output, apply voltage
- PWM pins: Pulse Width Modulation
- Pins marked with "~" 11, 10, 9, 6, 5, 3
- TX and RX: 0 and 1
- T = Transmit / R = Remove
- LED :- Digital pin 13 (For easy debugging)
- Analog pins: A0 to A5

2) Ultrasonic sensor -

It is an Ultrasonic Range Finder Sensor. It is a non-contact based distance measurement system and can measure distance of 2cm to 4m. It emits ultrasonic pulses and measures the time taken for the echoes to return, enabling distance calculations. Ultrasonic sensor is mainly use to detect the obstacle



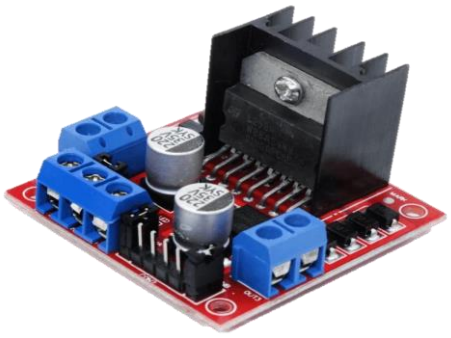
3) Robodo Motor driver -

It is a motor driver which can provide bi-directional drive current for two motors.

- Driver: L298N Dual H Bridge DC Motor Driver IC
- Driven part of the terminal supply area Vs: +5 V ~ +35 V; such as the need to

take power within the board, the supply area Vs: +7 V ~ +35 V

- Driven part of the peak current Io: 2A
- The logical part of the terminal supply area Vss: +5 V ~ +7 V (can take power within the board +5 V)
- The logical part of the operating current range: 0 ~ 36mA
- Storage temperature: -25 Deg C ~ +130 Deg C
- Other Extensions: control of direction indicators, the logic part of the plate to take power interface.
- Driver Board Size: 55mm * 60mm * 30mm
- Drive plate Weight: 33g



4)Servo Motor -

Servo motors enable precise angular positioning through a motor and feedback sensor setup, commonly found in robotics and mechatronic systems.

5)Chassis -

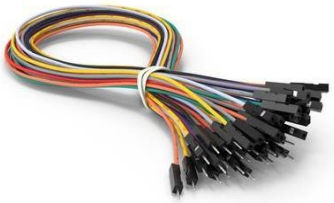
The chassis serves as the structural foundation for mounting components, providing support and defining the form of the robot or vehicle.

6)Geared Motor -

Geared motors convert electrical energy into mechanical motion via electromagnetic induction, widely used in robotics and automation for continuous rotary motion.

7)Jumper Wires -

Jumper wires facilitate easy and flexible connections between electronic components on prototyping platforms like Arduino, aiding in quick experimentation and prototyping.



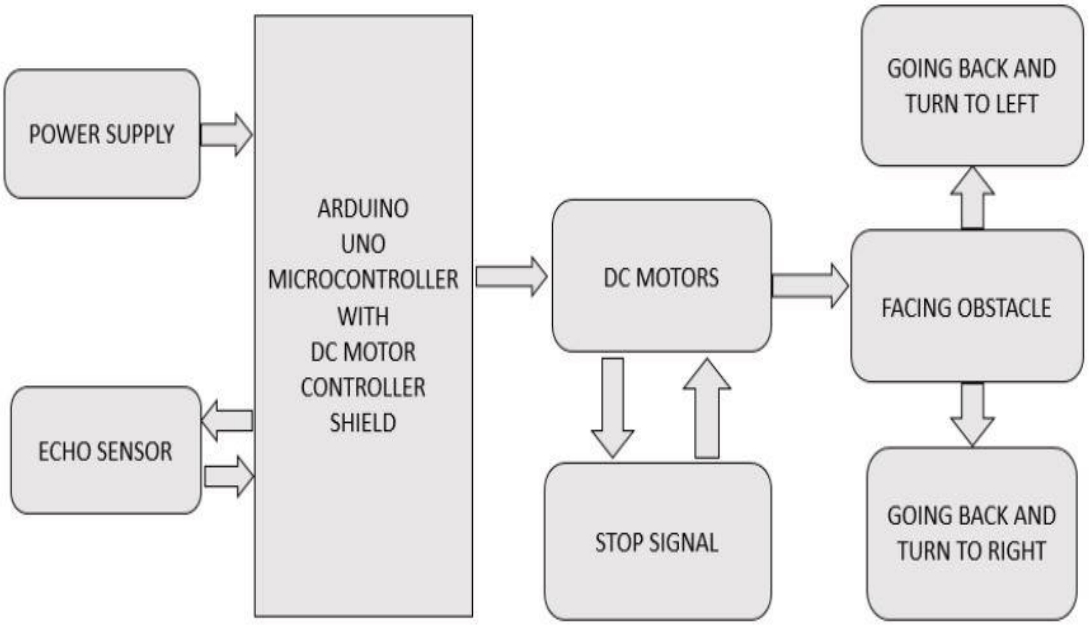
8)Battery -

9)Switch -

CHAPTER NO:4

BLOCK DIAGRAM

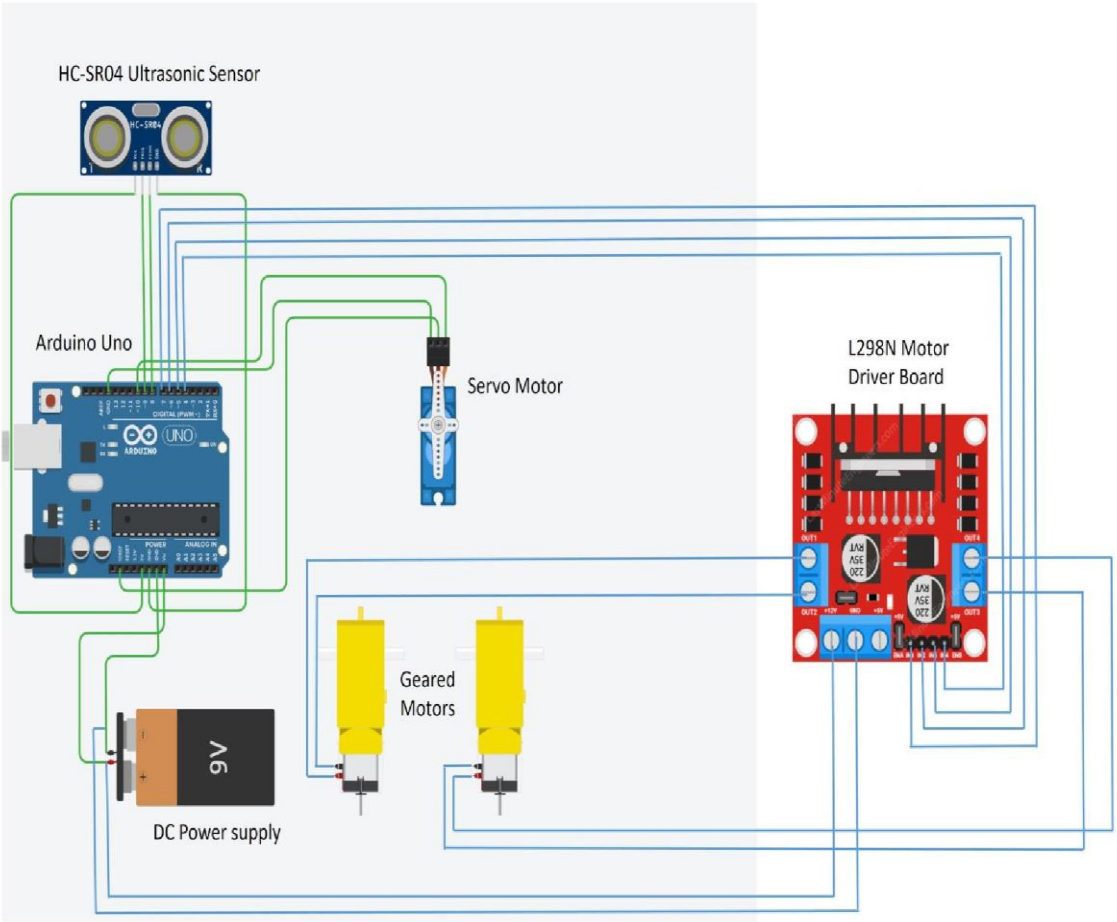
BLOCK DIAGRAM



CHAPTER NO:5

CIRCUIT DIAGRAM

CIRCUIT DIAGRAM



CHAPTER NO:6

APPLICATIONS

APPLICATIONS

1.Industrial Automation: Autonomous robots optimize production processes and ensure worker safety by navigating around machinery in manufacturing plants.

2.Warehousing and Logistics: Obstacle-avoiding robots improve efficiency in warehouses by managing inventory, picking orders, and transporting goods without human intervention.

3.Home Cleaning Robots: Robotic vacuum cleaners equipped with obstacle-avoidance technology navigate rooms while avoiding obstacles like furniture.

4.Security and Surveillance: Autonomous robots with obstacle-avoidance capabilities enhance security measures by patrolling indoor and outdoor spaces, such as airports and shopping malls.

5.Search and Rescue Operations: Obstacle-avoiding robots aid in search and rescue missions by exploring hazardous environments to locate survivors while avoiding obstacles and hazards.

6.Agricultural Robotics: Autonomous robots assist in agriculture by monitoring crops, detecting weeds, and spraying pesticides while navigating fields and avoiding obstacles.

7.Personal Assistance Robots: Obstacle-avoiding technology enables personal assistance robots to help individuals with disabilities or elderly people navigate indoor environments safely and independently.

8.Educational Robotics: Obstacle-avoiding robots serve as educational tools in schools and universities to teach robotics, programming, and artificial intelligence concepts through hands-on experimentation.

CHAPTER NO: 7

PROGRAM

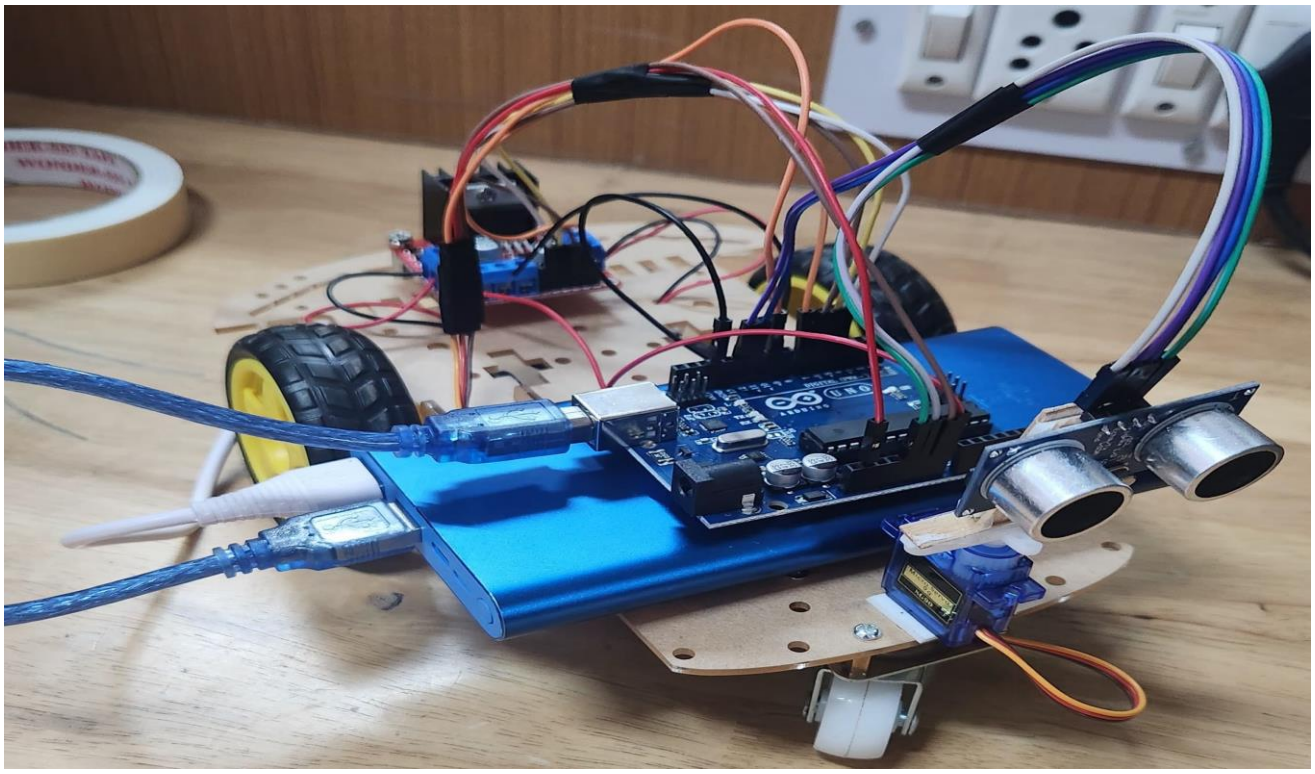
```
#include <Servo.h>
Servo Myservo;
#define trigPin 11     // Trig Pin Of HC-SR04
#define echoPin 12    // Echo Pin Of HC-SR04
#define MLa 4        //left motor 1st pin white
#define MLb 5        //left motor 2nd pin Yellow
#define MRa 6       //right motor 1st pin Brown
#define MRb 7       //right motor 2nd pin Orange
#define servoPin 9 //servo motor pin orange

long duration, distance;
int leftDistance, rightDistance;

void setup()
{
  Serial.begin(9600);
  pinMode(MLa, OUTPUT); // Set Motor Pins As O/P
  pinMode(MLb, OUTPUT);
  pinMode(MRa, OUTPUT);
  pinMode(MRb, OUTPUT);
  pinMode(trigPin, OUTPUT); // Set Trig Pin As O/P To Transmit Waves
  pinMode(echoPin, INPUT); //Set Echo Pin As I/P To Receive Reflected Waves
  Myservo.attach(servoPin);
}
void loop()
{
  Serial.begin(9600);
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH); // Transmit Waves For 10us
  delayMicroseconds(10);
  duration = pulseIn(echoPin, HIGH); // Receive Reflected Waves
  distance = duration * 0.0343 / 2;   // Convert duration to distance in centimeters
  Serial.println(distance);
  delay(10);
  if (distance> 15) // Condition For Absence Of Obstacle
  {
    Myservo.write(90);
    digitalWrite(MRb, HIGH); // Move Forward
    digitalWrite(MRa, LOW);
    digitalWrite(MLb, HIGH);
    digitalWrite(MLa, LOW);
  }
   else if ((distance < 10)&&(distance> 0)) // Condition For Presence Of Obstacle
```

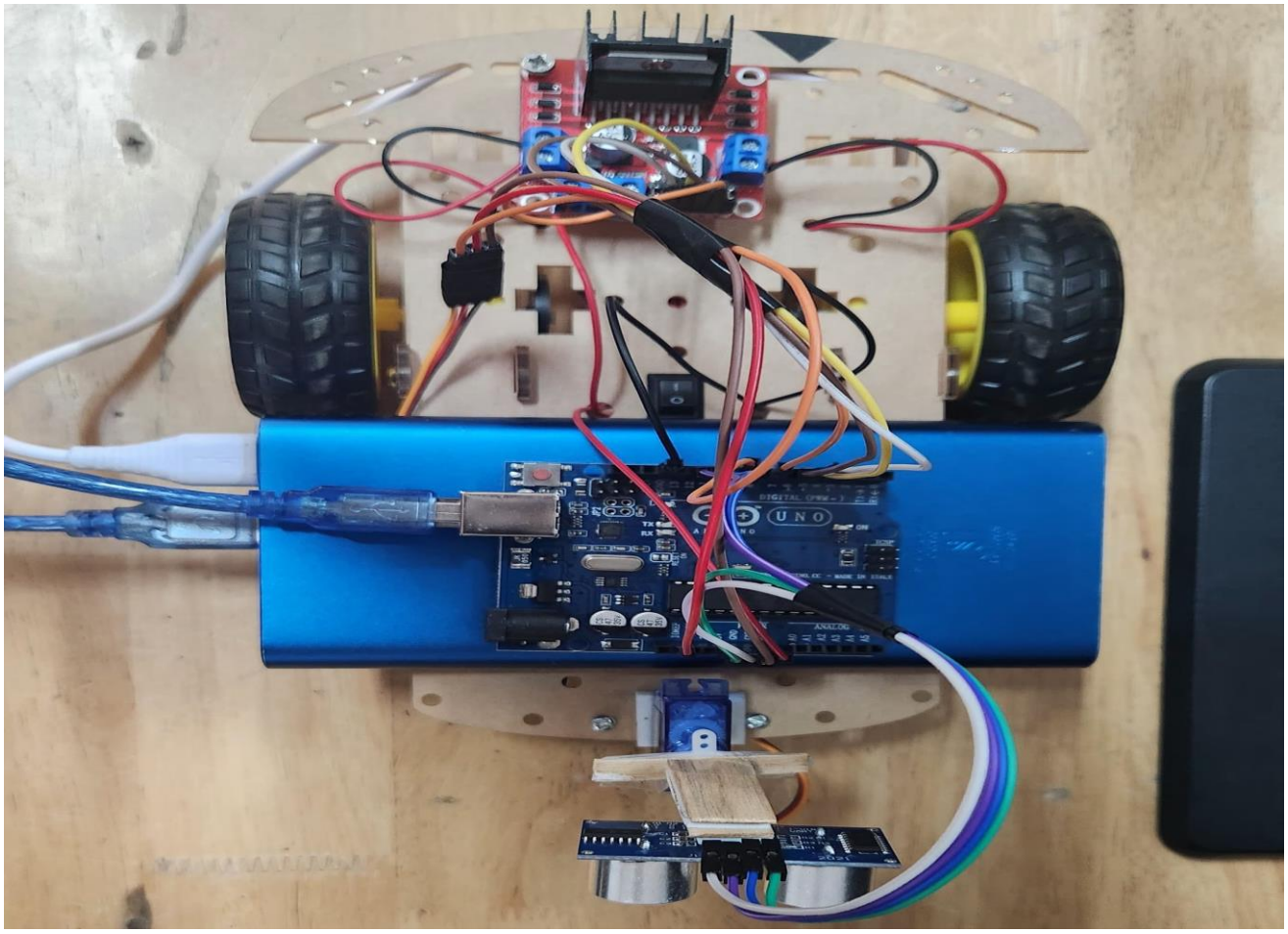
```
{
  stopMotors(); //Stop
  delay(100);

  Myservo.write(0);
  delay(500);
  leftDistance = getDistance();
  Serial.print("Left distance: ");
  Serial.println(leftDistance);

  Myservo.write(180);
  delay(500);
  rightDistance = getDistance();
  Serial.print("Right distance: ");
  Serial.println(rightDistance);

  Myservo.write(90);
  delay(500);

  digitalWrite(MRb, LOW); // Move Backward
  digitalWrite(MRa, HIGH);
  digitalWrite(MLb, LOW);
  digitalWrite(MLa, HIGH);
  delay(500);

  stopMotors(); //Stop
  delay(100);

  digitalWrite(MRb, HIGH); // Move Left
  digitalWrite(MRa, LOW);
  digitalWrite(MLa, LOW);
  digitalWrite(MLb, LOW);
  delay(500);

  if (leftDistance > rightDistance)
  {  // Turn left if more space on the left
    digitalWrite(MRb, HIGH); // Move Left
    digitalWrite(MRa, LOW);
    digitalWrite(MLa, LOW);
    digitalWrite(MLb, LOW);
    delay(500);
  }
```

```
else
   {  // Turn right if more space on the right or equal space on both sides
     digitalWrite(MRb, LOW);  // Turn Right
     digitalWrite(MRa, LOW);
     digitalWrite(MLb, HIGH);
     digitalWrite(MLa, LOW);
   }
  }
}

void stopMotors()
{
   digitalWrite(MRb, LOW);  // Stop
   digitalWrite(MRa, LOW);
   digitalWrite(MLb, LOW);
   digitalWrite(MLa, LOW);
}

int getDistance()
{
   long duration, distance;
   digitalWrite(trigPin, LOW);
   delayMicroseconds(2);
   digitalWrite(trigPin, HIGH);
   delayMicroseconds(10);
   digitalWrite(trigPin, LOW);
   duration = pulseIn(echoPin, HIGH);
   distance = duration * 0.0343 / 2;
   return distance;
}
```

CHAPTER NO: 8

OUTPUT / PHOTOGRAPHS





CHAPTER NO: 9

CONCLUSION

CONCLUSION

The robot that avoids obstacles offers a practical and effective way to navigate intricate spaces while reducing the chance of collisions. Its integration of intelligent algorithms and sensor technologies with applications ranging from industrial automation to search and rescue operations improves efficiency, safety, and autonomy across several domains. This technology improves efficiency and streamlines operations while advancing robotics, artificial intelligence, and human-robot interaction. It also makes autonomous navigation and obstacle avoidance possible. As obstacle-avoiding robots continue to be developed and refined, they have the potential to completely transform a number of sectors and enhance people's lives by creating robotic systems that are safer, more effective, and more autonomous.

CHAPTER NO: 10

REFERENCES

REFERENCES

[1] Amir attar, aadilansari, abhishek desai, shahid khan, dip ashrisonawale "line follower and obstacle avoidance bot using arduino" International Journal of Advanced Computational Engineering and Networking, vol. 2, pp. 740-741, August 1987.

[2] Aniket D. Adhvaryu et al "Obstacle-avoiding robot with IR and PIR motionSensors" IOP Conference Series: Materials Science and Engineering, vol. A247, pp. 529-551, April 2005.

[3] Vaghela Ankit1, Patel Jigar2, Vaghela Savan3 "Obstacle Avoidance Robotic Vehicle Using Ultrasonic Sensor, Android And Bluetooth For Obstacle Detection" International Research Journal of Engineering and Technology (IRJET), vol. A247, pp. 29-32, 2005.

[4] Paul Kinsky,Quan Zhou "Obstacle Avoidance Robot" Worcester polytechnic institute.

[5] FaizaTabassum, SusmitaLopa, Muhammad MasudTarek& Dr. Bilkis Jamal Ferdosi "obstacle avoidance car"Global Journal of Researches in Engineering: HRobotics & Nano-Tech.

[6] Bhagya shree S R , Manoj kollam "Zigbee Wireless Sensor Network For Better Interactive Indus

WEBSITES:

- https://www.ijcaonline.org/archives/volume56/number5/8885-2882
- https://ieeexplore.ieee.org/document/4725791
- https://www.sciencedirect.com/science/article/pii/S1877050917302107
- http://www.datasheetcatalog.com
- http://www.instructabal.com
- http://en.wikipedia.org/wiki/Artificial_intelligence
- http://science.howstuffworks.com/robot2.htm
- http://arduino.cc/en/Main/arduinoBoardUno
- http://203.201.63.46:8080/jspui/bitstream/123456789/6289/1/PR3264%20Obstacle%20Avoidance%20Robotic%20Vehicle%20Using%20Ultrasonic%20Sensor%20And%20Arduino%20Controller%20Jeevan%20M%20Ms.%20Parvathy%20Thampi%20M.s-Aug-2021.pdf
- https://www.researchgate.net/figure/Block-diagram-of-obstacle-avoider-robot-using-echo-sensor-Module-1_fig2_337049857

CONTRIBUTION TABLE

Hetvi Mehta	Explored sensor technologies and it advancements, Code Development
Aditya Mourya	Managed model assembling and integrating hardware components
Ridham Sarodiya	Integrating hardware components and ensuring mechanical stability
Saloni Kumbhar	Block Diagram, Circuit Diagram & Documentation