Mini Project Report

on

OBSTACLE AVOIDING ROBOT USING ARDUINO NANO

In partial fulfillment of the requirements for the award of the degree of

BACHELOR OF TECHNOLOGY

in

Electronics and Communication Engineering

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CERTIFICATE

This is to certify that the internship report titled **OBSTACLE AVOIDING ROBOT USING ARDUINO NANO** being submitted by **B. Keerthan Sai Reddy, K. Akanksha, K. Kiran Babu** bearing Roll Numbers **18R11A0404,18R11A0424, 18R11A0426** respectively, in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology in **Electronics and Communication Engineering** is a record of bonafide work carried out under our guidance and supervision.

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With Regards

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SYMBOLS & ABBREVIATIONS

- **IDE:** Integrated Development Environment
- **DIP:** Dual In-Line Package
- **KB:** Kilo Bytes
- **PWM:** Pulse Width Modulation
- **SRAM:** Static Random-Access Memory
- **EEPROM:** Electrically Erasable Programmable Read Only Memory
- **USB:** Universal Serial Bus
- **VCC:** Voltage Common Collector
- **PCB:** Printed Circuit Board
- **CW:** Clockwise
- **CCW:** Counter Clockwise
- **STBY:** Standby Mode
- **RPM:** Revolutions Per Minute

ABSTRACT

Obstacle detection and avoidance is the most common issue in designing autonomous mobile robots. Idea of this project is to provide the robots which can sense the obstacles and traverse in unfamiliar environments without any collisions and damaging itself. An Obstacle Avoiding Robot is designed which can detect obstacles in its path and maneuver around them without making any collision. It is a robot vehicle that works on Arduino Microcontroller and employs an ultrasonic sensor to detect obstacles. The Arduino board was selected as the microcontroller platform and its software counterpart, Embedded C, was used to carry out the programming. The integration of ultrasonic sensor with the robot provides higher accuracy in detecting obstacles in its way. Being a fully autonomous robot, it is successfully maneuvered in unknown environments without any collision. The hardware used in this project is widely available and inexpensive which makes the robot easily replicable in real world.

Obstacle avoiding robots can be used in almost all mobile robot navigation systems. They can be used for household work like automatic vacuum cleaning. It can also be used in automated vehicles so that whenever another vehicle or barrier is detected it avoids collision immediately. They can also be used in dangerous environments, where human penetration could be fatal.

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

Autonomous robots are freely moving and can operate without direct human supervision. They are capable of making their own decisions based on its perception and has been programmed to recognize. They sense obstacles in the path, avoid it and resumes its running. All mobile robots feature some kind of collision avoidance, ranging from primitive algorithms that detect an obstacle and stop the robot in order to avoid a collision, using some sophisticated algorithms that enable the robot to detour obstacles. The latter algorithms are more complex, since they involve detection of an obstacle as well as some kind of quantitative measurements concerning the obstacle's dimensions. In obstacle avoidance, obstacle detection is important element to decide the motion and direction of the mobile robot. For example, a mobile robot will be accelerating until optimum speed if obstacle is far from the mobile robot while mobile robot will decelerate if obstacle is close to it and make a turn.

1.2 PURPOSE & MOTIVATION

We proposed a robot that avoids the obstacle which comes in its path this robot is introduced because in many of the industries it is observed that many heavy components which they have to move for one place to another place which is not possible without the help of machines.

The purpose of the obstacle avoidance strategy is to prevent the robot from any collision with any object or obstacle which may cause damage to the obstacles and the mobile robot itself. In aerospace industry, numerous mobile robots are used in an unknown place which does not have information of the obstacle around the place while in manufacturing or chemical industries, raw materials, machines, parts and products are the examples of the obstacles for mobile robot. Thus, it is also important to prevent any damage on the component. With this we have initiated an idea to introduce the robot named as Obstacle avoidance robot using Arduino. In today’s world robotics is a fast growing and interesting field. Robot has sufficient intelligence to cover the maximum area of provided space. Autonomous Intelligent Robots are robots that can perform desired tasks in unstructured environments without continuous human guidance. The obstacle detection is primary requirement of this autonomous robot. The robot gets the information from surrounding area through mounted sensor on the robot.

We have made use of sensor to achieve this objective. We have used N-20 battery operated motors. The reason behind using motors is it consumes less power supply and can work properly. The construction of the robot circuit is easy and small. The main component behind this robot is ATmega328p microcontroller which is a brain of this robot. The idea proposed in this paper is by using machine vision to guide the robot. The field of machine vision is growing at a fast pace. Machine vision applications can be divided into four types from a technical point of view. They can be used to locate, measure, inspect and identify. The hardware used in this project is widely available and inexpensive which makes the robot easily replicable in real world. This robotic vehicle is built, using an Arduino nano. An ultrasonic sensor is used to detect any obstacle ahead of it and sends a command to the Arduino.

1.3 METHOD

The first step of this project is to formulate the research questions. The next step is to gather information about autonomous robots and obstacle detection. This is done by reading articles and investigating projects from previous years. From the literature study, components that were needed for the prototype could be determined. A prototype is then prepared. When the construction is completed, the Arduino software Integrated Development Environment (IDE) was used to program the algorithm. To avoid collisions, the robot must be able to identify all obstacles in its path. In order to achieve this, the robot is equipped with ultrasonic sensor to detect objects. Tests are made where obstacles were placed in front of the robot while it was driving forward to investigate what is the best placement for the sensor. Then it is tested if it collides or drives in other ways.

1.4 ARDUINO NANO

The Arduino Nano is an Arduino board based on ATmega328 microcontroller. The connectivity is the same as the Arduino UNO board. It is developed by Arduino.cc in 2008. It has 30 pins and configured in DIP. The main advantage of the Arduino nano is smaller in size**.**

Arduino Nano Pinout contains 14 digital pins, 8 analog Pins, 2 Reset Pins & 6 Power Pins. It is programmed using Arduino IDE, which can be downloaded from Arduino Official site. Arduino Nano is simply a smaller version of Arduino UNO, thus both have

almost the same functionalities. It comes with an operating voltage of 5V, however, the input voltage can vary from 7 to 12V.Arduino Nano's maximum current rating is 40mA, so the load attached shouldn't draw current more than that. Each of these Digital & Analog Pins is assigned with multiple functions but their main function is to be configured as Input/Output.

Figure 1. Arduino Nano

NANO FEATURES	VALUE
Microcontroller	Atmega328p
Crystal Oscillator	16MHz
Operating Voltage	5V
Input Voltage	6V-12V
Maximum Current Rating	40mA
USB	Type-B Micro USB
ICSP Header	Yes

Table 1. Specifications of Arduino NANO

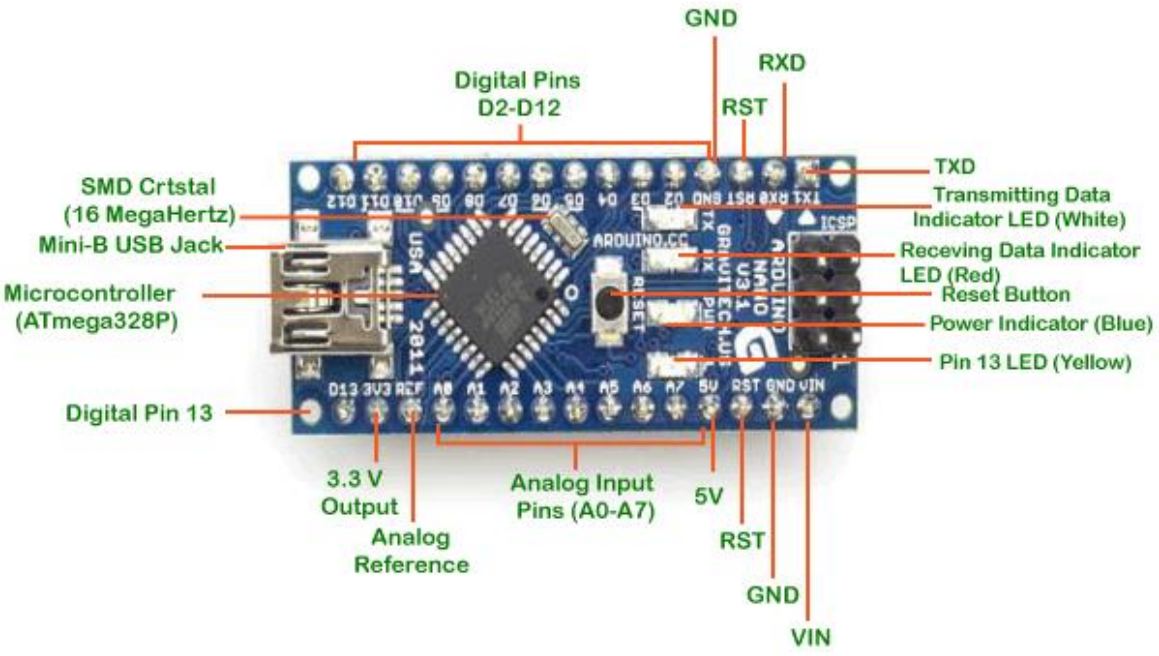


Figure 2. Arduino Nano PINOUT

1.5 ULTRASONIC SENSOR (HC – SR04)

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic sensors have two main components: the transmitter (which emits the sound) and the receiver (which encounters the sound after it has travelled to and from the target).

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.

An ultrasonic sensor requires two parts, both a transmitter and a receiver. In the most standard configuration, these are placed side-by-side as close together as reasonably possible. With the receiver close to the transmitter, sound travels in a straighter line from the transmitter to the detected object and back to the receiver, yielding smaller errors in the measurements. There are also ultrasonic transceivers where the transmitter and

receiver functions are integrated into a single unit, minimizing error as much as physically possible while also significantly reducing the PCB footprint.

The working principle of this module is simple. It sends an ultrasonic pulse out at 40kHz which travels through the air and if there is an obstacle or object, it will bounce back to the sensor. By calculating the travel time and the speed of sound, the distance can be calculated. The formula for this calculation is **D = ½ T x C** (where D is the distance, T is the time, and C is the speed of sound).

Figure 3. Ultrasonic Sensor

The ultrasonic receiver shall detect signal from the ultrasonic transmitter while the transmit waves hit on the object. The combination of these two sensors will allow the robot to detect the object in its path. The ultrasonic sensor is attached in front of the robot and that sensor will also help the robot navigate through the hall of any building.

Ultrasonic sensors are a great solution for the detection of clear objects. For liquid level measurement, applications that use infrared sensors, for instance, struggle with this particular use case because of target translucence. For presence detection, ultrasonic sensors detect objects regardless of the color, surface, or material (unless the material is very soft like wool, as it would absorb sound.) To detect transparent and other items where optical technologies may fail, ultrasonic sensors are a reliable choice.

- Operating voltage: +5V
- Measuring Distance: 2cm to 450cm
- Measuring angle:15°
- Accuracy: 3mm
- Operating Current: <15mA
- Operating Frequency: 40Hz

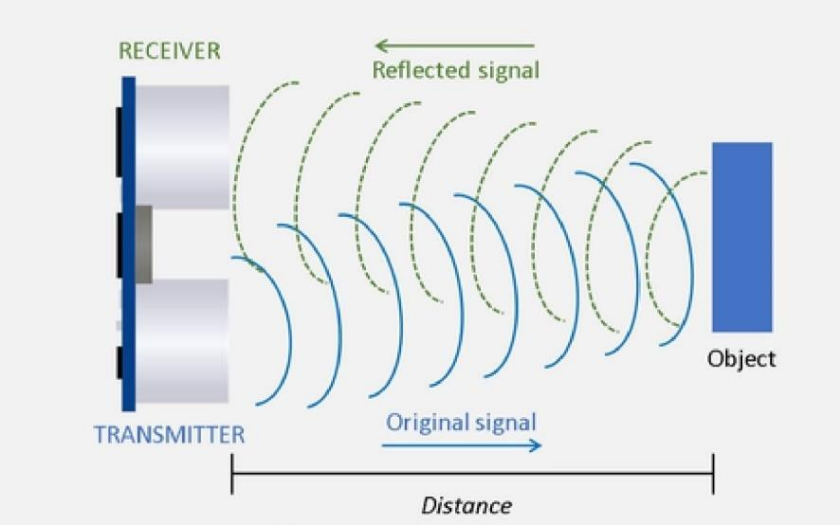


Figure 4. Ultrasonic Sensor Transmission and Reception

1.6 TB6612FNG MODULE

The TB6612FNG is an easy and affordable way to control motors. It is capable of driving two motors at up to 1.2A of constant current. Two input signals (IN1 and IN2) can be used to control the motor in one of four function modes: CW, CCW, short-brake and stop. The two motor outputs (A and B) can be separately controlled, and the speed of each motor is controlled via a PWM input signal with a frequency up to 100kHz. The STBY pin should be pulled high to take the motor out of standby mode.

Logic supply voltage (VCC) can be in the range of 2.7--5.5VDC, while the motor supply (VM) is limited to a maximum voltage of 15VDC. The output current is rated up to 1.2A per channel (or up to 3.2A for a short, single pulse). Decoupling capacitors are included on both supply lines. All pins of the TB6612FNG are broken out to two 0.1”

pitch headers and the pins are arranged such that input pins are on one side and output pins are on the other.

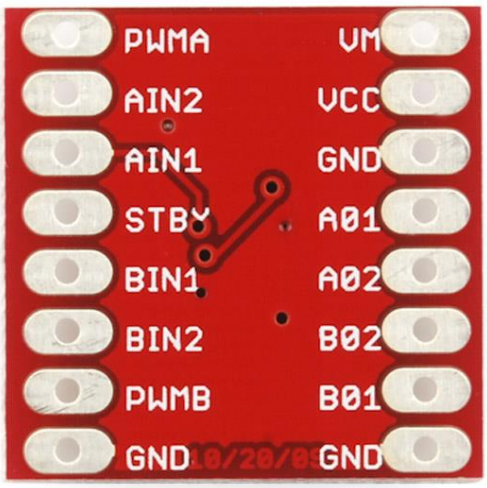


Figure 5. TB6612FNG Driver Module

1.7 N20 MOTOR

The N20 DC Motor (High Torque) is lightweight, high torque, and low RPM motor. It is equipped with gearbox assembly so as to increase the torque of the motor. It has a cross-section of 10 × 12 mm, and the D-shaped gearbox output shaft is 9 mm long and 3 mm in diameter. It has a very small size so as fit in complex spaces of small-scale application. One can connect this Micro Gear Motor to wheels to drive them from one place to other while carrying high loads.

It has small volume, torsion big, all metal gear, durable, not easy to wear. Great replacement for the rusty or damaged DC geared speed reduce motor on the machine. Widely used on Boat, Car, Electric Bicycle, Fan, Home Appliance.

Figure 6. N20 Motor

- Rated voltage: 3V – 12V
- Speed: 1RPM – 200RPM
- Applications: Models, Toys, Medical Equipment etc.

CHAPTER 2: LITERATURE SURVEY

2.1 AUTONOMOUS ROBOT

Autonomous robots are independent of any controller and can act on their own. The robot is programmed to respond in a particular way to an outside stimulus. The bump-and-go robot is a good example. This robot uses bumper sensors to detect obstacle. When the robot is turned on, it moves in a straight direction and when it hits an obstacle, the crash triggers its bumper sensor. The robot gives a programming instruction that asks the robot to back up, turn to the right direction and move forward. This is its response to every bump. In this way, the robot can change direction every time, it encounters an obstacle.

A more elaborate version of the same idea is used by more advanced robots. Roboticists create new sensor systems and algorithms to make robots more perceptive and smarter. Obstacle avoidance can be implemented as a reactive control law whereas path planning involves the pre computation of an obstacle free path which a controller will then guide a robot along.

Some mobile robots also use various ultrasound sensors to see obstacles or infrared. These sensors work in a similar fashion to animal echolocation. The robot sends out a beam of infrared light or a sound signal. It then detects the reflection of the signal. The robot locates this distance to the obstacles depending on how long it takes the signal to bounce back. Some advanced robots also use stereo vision. Two cameras provide robots with depth perception. Image recognition software then gives them the ability to locate, classify various objects. Robots also use smell and sound sensors to gain knowledge about its surroundings. More advanced robots are able to analyze unfamiliar environments and adapt to them. They even work on areas with rough terrain. This kind of robots can associate particular terrain patterns with particular actions.

2.2 RESEARCH BACKGROUND

“Ultrasonic anti crashing system for automobiles” IEEE paper published in 2013, attempted to develop an anti-crash warning system combined with ultrasonic ranging technology and sensor technology for automobiles. It mainly focusses on obstacles on the road and its detection and hence automatic or manual reduction in the speed of the vehicle in order to avoid crashing. In “Cooperative vehicle collision avoidance using inter-vehicle packet forwarding” IEEE paper publishes in 2005, proposes a broadcast-oriented packet forwarding mechanism for intra-platoon cooperative collision avoidance (CCA) using Dedicated Short-Range Communication (DSRC) based wireless networks. Using an implicit acknowledgement strategy, it is shown that with inter-vehicle spacing of nearly one second, the proposed mechanism is capable of saving up to 90 percent of vehicles in a platoon from chain crashes following emergency events at the front of the platoon.

2.3 LITERATURE REVIEW

"Obstacle avoidance robot using Arduino" has been designed and developed by Aamir attar, Aadilansari, Abhishek Desai, Shahid khan, Dipashrisonawale to create an autonomous robot which intelligently detects the obstacle in its path and navigates according to the actions that user set for it. So, this system provides an alternate way to the existing system by replacing skilled labor with robotic machinery, which in turn can handle more patients in less time with better accuracy and a lower per capita cost.

"Obstacle-avoiding robot with IR and PIR motion Sensors" has been designed and developed by Aniket D. Adhvaryu et al has proposed that developed robot platform was not designed for specific task but as a general wheeled autonomous platform. It can therefore be used for educational, research or industrial implementation.

"**Obstacle Avoidance Robotic Vehicle Using Ultrasonic Sensor for Obstacle Detection**" has been designed and developed by Vaghela Etal has mentioned that enormous amount of work has been done on wireless gesture controlling of robots. Various methodologies have been analyzed and reviewed with their merits and demerits under various operational and functional strategies.

"Obstacle Avoidance Robot" has been designed and developed by Paul Kinsky, Quan Zhou mentioned that robot with a few mechanical components to add two more functions to the main body, namely the laptop holder and the camera holder. AT89S52 development board is designed, developed and tested in a large scale, which was used to control the motors smoothly. the cameras with relatively low cost are fixed and adjusted on the camera holder for good calibration of the computer vision. Users establish the serial communication method between the upper laptop and the lower development board with USB port. The laptop will send out a signal of the motor condition to the development board.

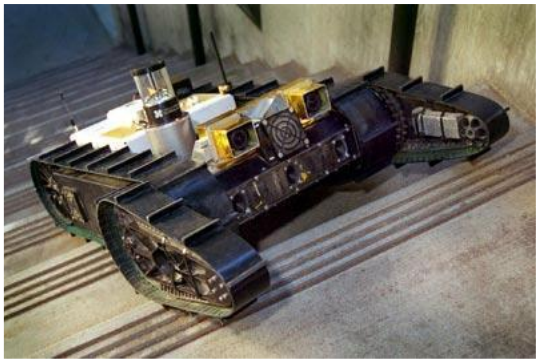


Figure 7. Autonomous Uribe developed by NASA, is designed for various urban operations, including military reconnaissance

The robot can move into household easily also into forest so it makes this different from drone since it can't enter forests or house hold. If we use robot detachable from drone, we can increase speed of robot.

CHAPTER 3: DESIGN OF ROBOT

3.1 BLOCK DIAGRAM

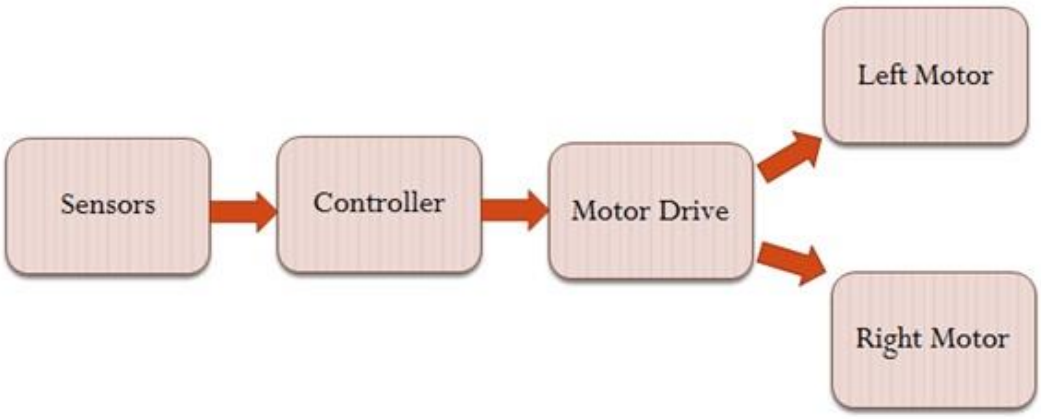


Figure 8. Block Diagram of Obstacle Avoiding Robot

The Ultrasonic sensor gives the time taken by sound wave to travel to and fro towards the target. The time in converted into distance by the controller i.e., Arduino board. Then the controller checks the distance with threshold if the obstacle is present in its way, then it changes its course by using the motors. The controller sends the commands to motor driver module it in turn rotates the motors accordingly. The motors can turn in both ways so as to make easy movement of bot.

3.2 CIRCUIT DIAGRAM

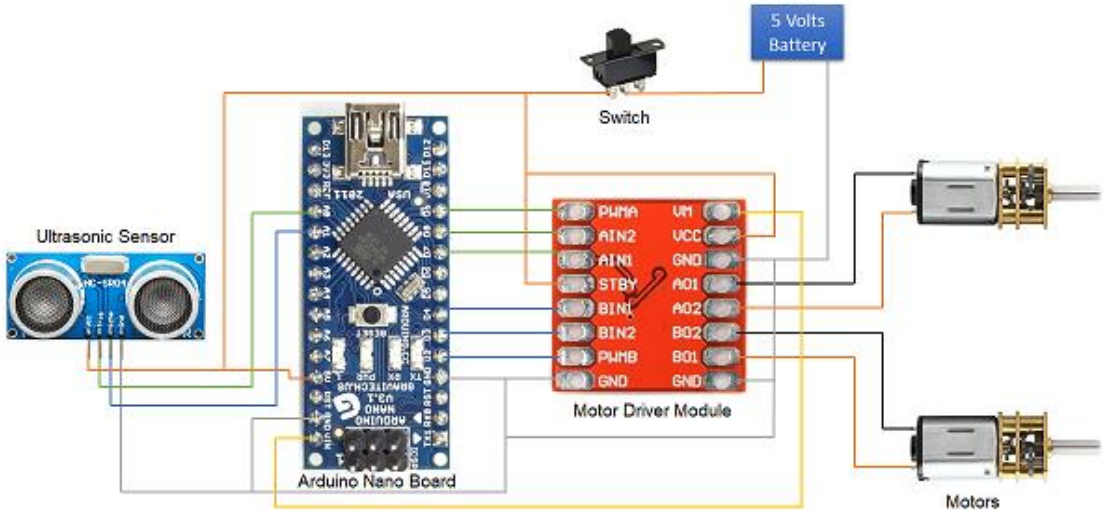
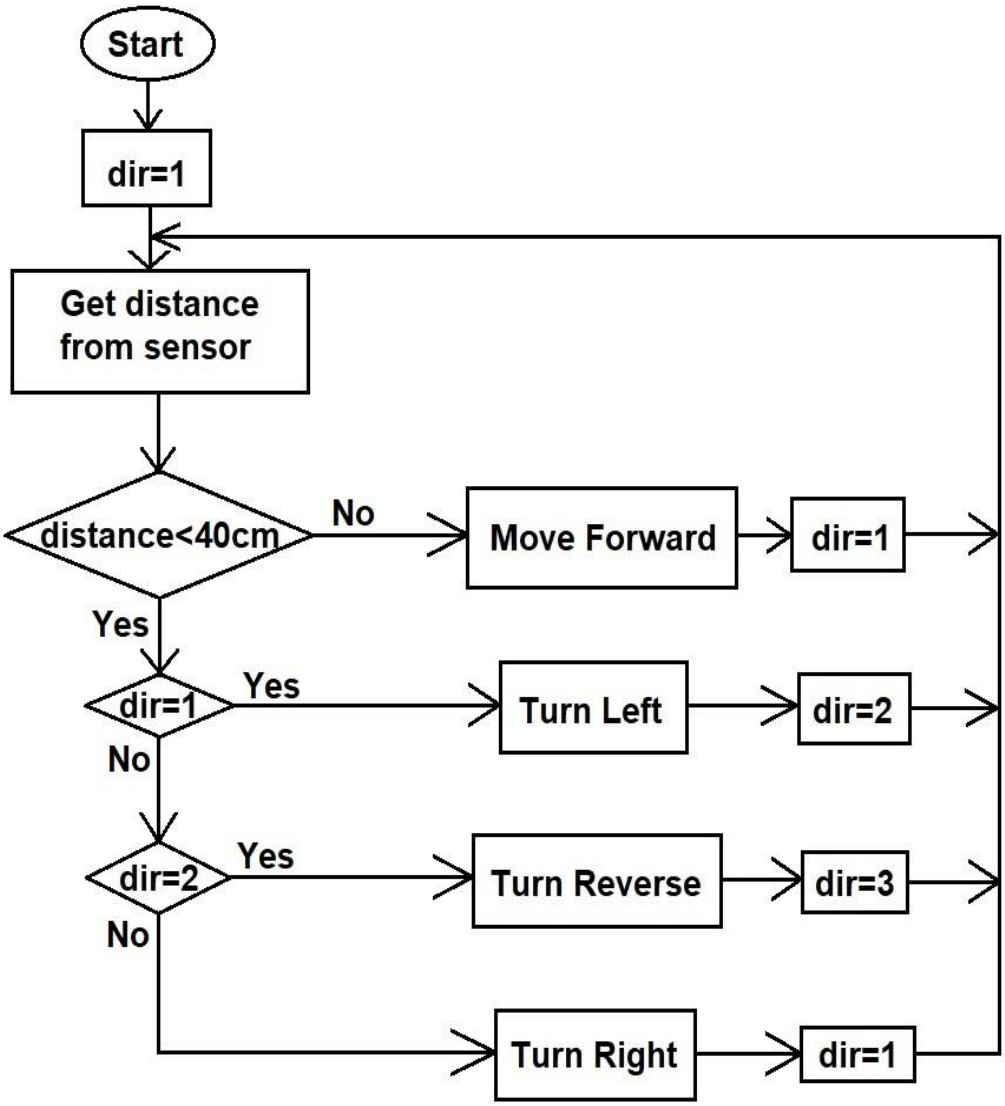


Figure 9. Circuit Diagram of Obstacle Avoiding Robot

After turning ON the robot then the Arduino sends command to ultrasonic sensor to fetch the distance in front. After finding distance to nearest object in front it checks the value with threshold. If the obstacle is nearer to the bot, then Arduino sends a command to motor driver to stop the bot, then the bot is turned left and proceeds forward. If obstacle is on left it turn to right then even it has obstacle in way then it returns to original path.

The motor driver can drive two motors a time and it needs 6 inputs i.e., 3 for each motor. The inputs needed are direction (forward &backward) and speed. Using these commands, the driver sends commands to the motors connected to it. Each motor can be controlled individually. The power supply of 5V is given to both Arduino and Motor driver which in turn powers the motors and also sensors.

3.3 FLOW CHART



3.4 PROGRAM

```
#include <NewPing.h>
NewPing sonar(A0, A1, 1000);
const int PWMA = 9;
const int AIN2 = 8;
const int AIN1 = 7;
const int BIN1 = 4;
const int BIN2 = 3;
const int PWMB = 2;
int dist = 0;
int dir=1;

void setup()
{
  //Serial.begin(9600);
  pinMode(AIN1, OUTPUT);
  pinMode(AIN2, OUTPUT);
  pinMode(PWMA, OUTPUT);
  pinMode(BIN1, OUTPUT);
  pinMode(BIN2, OUTPUT);
  pinMode(PWMB, OUTPUT);
}
void loop() {
  dist = readPing();
  //Serial.println(dist);
  if (dist<40) {
        if(dir==1){
```

```
                back();
                left();
                dir=2;
        }
        else if(dir==2){
                back();
                reverse();
                dir=3;
                }
        else{
                back();
                right();
                dir=1;
        }
  }
else{
  forward();
  dir=1;
  }
}

int readPing() {
  unsigned int uS = sonar.ping();
  int cm = uS/US_ROUNDTRIP_CM;
  return cm;
}

void forward(){
  //Serial.println("Forward");
```

```
  digitalWrite(AIN1, LOW);
  digitalWrite(AIN2, HIGH);
  analogWrite(PWMA, 1023);
  digitalWrite(BIN1, LOW);
  digitalWrite(BIN2, HIGH);
  analogWrite(PWMB, 1023);
  delay(300);
}

void back(){
  //Serial.println("Back");
  digitalWrite(AIN1, HIGH);
  digitalWrite(AIN2, LOW);
  analogWrite(PWMA, 1023);
  digitalWrite(BIN1, HIGH);
  digitalWrite(BIN2, LOW);
  analogWrite(PWMB, 1023);
  delay(300);
}

void left(){
  //Serial.println("Left");
  digitalWrite(AIN1, LOW);
  digitalWrite(AIN2, HIGH);
  analogWrite(PWMA, 1023);
  digitalWrite(BIN1, HIGH);
  digitalWrite(BIN2, LOW);
  analogWrite(PWMB, 1023);
  delay(800);
```

```
}
void right(){
  //Serial.println("Right");
  digitalWrite(AIN1, HIGH);
  digitalWrite(AIN2, LOW);
  analogWrite(PWMA, 1023);
  digitalWrite(BIN1, LOW);
  digitalWrite(BIN2, HIGH);
  analogWrite(PWMB, 1023);
  delay(800);
}
void reverse(){
  //Serial.println("Right");
  digitalWrite(AIN1, HIGH);
  digitalWrite(AIN2, LOW);
  analogWrite(PWMA, 1023);
  digitalWrite(BIN1, LOW);
  digitalWrite(BIN2, HIGH);
  analogWrite(PWMB, 1023);
  delay(1450);
}
```

3.5 APPLICATIONS

- ✓ Used in mobile robot navigation systems.
- ✓ Used for household work like vacuum cleaning & lawn cleaning.
- ✓ Can be used in mines and factories.
- ✓ Surface feature detection
- ✓ Used in dangerous environments, where human can't go.
- ✓ Used as fire fighter robot (Forest fires).
- ✓ By adding some components, it can be used as auto pilot vehicle.
- ✓ With proper programming we can use it as Weight Lifter too.
- ✓ Just by making small changes in software this system can be used for avoiding concealed paths.
- ✓ Can be used in military range.

3.6 ADVANTAGES

- ✓ Whenever robot senses any obstacle automatically diverts its position to left or right and follows the path without human guidance.
- ✓ The Programming of the microcontroller is easy.
- ✓ Simple in construction.
- ✓ Portable and easy to use.
- ✓ Low power consumption.
- ✓ Efficient and low-cost design.
- ✓ Easy to maintain and repair.
- ✓ Provides nearly all weather and broadcast imagery.
- ✓ Quick response of time.

3.7 DISADVANTAGES

- It doesn't detect small round objects, so may collide with it.
- If the sensor accuracy is low and also if the sensors are less than the obstacles may not be identified properly.
- It is used for short distance only.
- Low operational speed.
- The measuring angle of ultrasonic sensor is very low below 20° so it may not detect angled obstacles.
- It can't detect sound absorbing material so it may collide if it doesn't detect obstacle.
- It is not recommended to keep the range very long because this would cause the robot to keep moving forward and backward as it senses any obstacle, even far away from it.

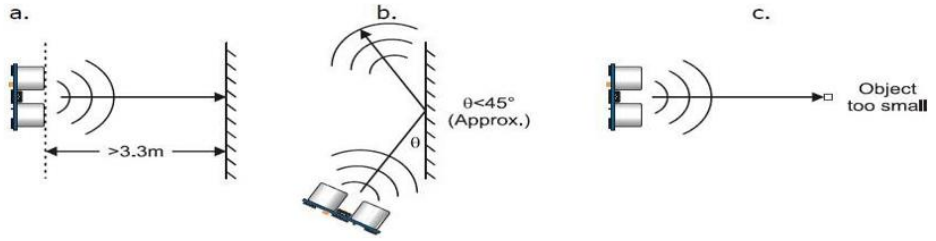


Figure 10. Problems with Ultrasonic Sensor

CHAPTER 4: OPERATING PROCEDURE

Initially whenever we turn on the bot on then the controller sends a command to ultrasonic sensor. The sensor gets the time required by sound to travel to the nearest object present in its way. Sonar system is used in Ultrasonic sensor to determine distance to an object like bats do. The Ultrasonic sensor emits the short and high frequency signal. If they detect any object, then they reflect back echo signal which is taken as input to the sensor through Echo pin.

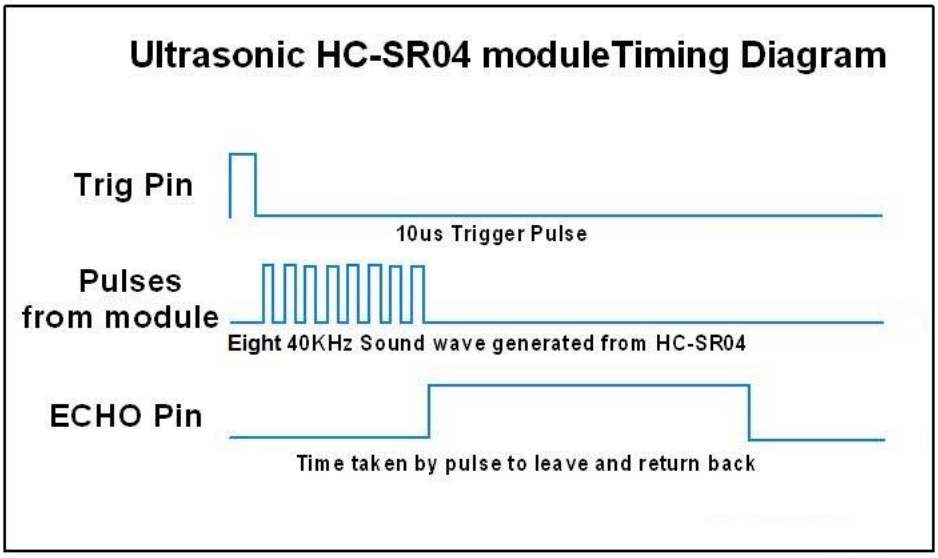


Figure 11. Ultrasonic Sensor Timing Diagram

Firstly, user initialize Trigger and Echo pin as low and push the robot in forward direction. When obstacle is detected Echo pin will give input as high to microcontroller. Pulse In function is used for calculating the time of distance from the obstacle. Every time the function waits for pin to go high and starts timing, then timing will be stopped when pin go to low. It returns the pulse length in microseconds or when complete pulse was not received within the timeout it returns. The timing has been determined by means of length of the pulse and will show errors in very shorter pulses.

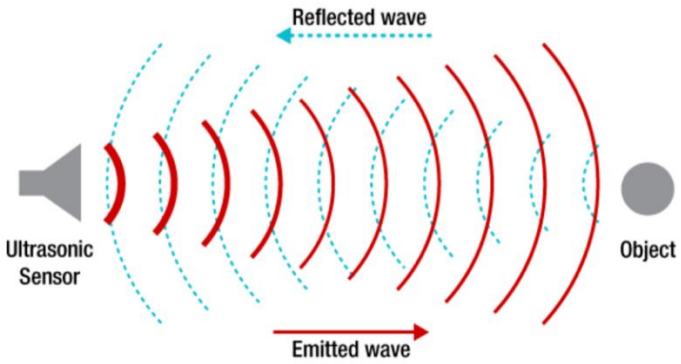


Figure 12. Ultrasonic Sensor Working Diagram

After getting the time it is converted into distance in cm. It can be obtained using the formula D = (T * V_s)/2 where D is distance from the object, T is time given by the sensor, V_s is speed of sound i.e., 340m/s. After converting into distance, the guiding movement is started. At first direction is set to 1 which means bot is moving forward.

When the distance is above 40cm then the robot moves forward but if it is less than that, then the direction is checked if the direction is 1 then it means bot has moved forward and not turned into any direction. So, the bot turns to the left of its path and direction is set to 2. After turning to left the distance is fetched using the ultrasonic sensor. If distance is over 40cm it proceeds forward and direction is set to 1.

If object is nearer than the threshold, again the direction is checked since the direction is 2 then it means bot has turned left but it hasn't moved forward due to obstacle in its path. Now it rotates 180° i.e., towards right of the original path. After turning 180° direction is set to 3. Now again distance is checked if it is more than threshold it moves forward but if it is less than that then again direction is checked. Since the direction is 3 means the bot has obstacle in its way so turned left even in that direction it has an obstacle to the left so it checks right side even to its right it has an obstacle. So the bot is surrounded by 3 sides by the obstacles so it returns through the original path. If it has no obstacle either to the left or right it moves in that direction.

For turning left or right both the motors are employed in opposite direction so that it takes less space for turning. So, for turning left the right motor moves forward whereas left motor rotates backwards. It is vice versa for turning right. The movement of the wheels is shown below table for moving and turning

Motor Driving System (Observed from right side of model)

MOTION	RIGHT MOTOR	LEFT MOTOR
Forward	Clockwise	Clockwise
Back	Anti-Clockwise	Anti-Clockwise
Right	Anti-Clockwise	Clockwise
Left	Clockwise	Anti-Clockwise

Table 2. Motor Driving System

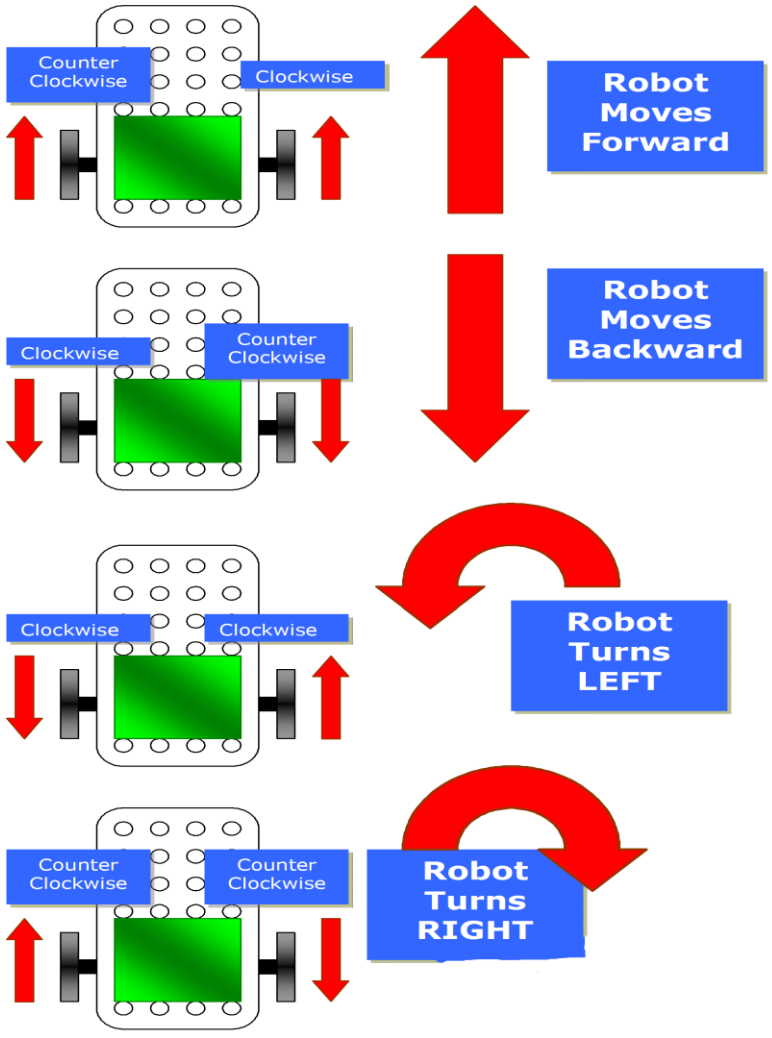


Figure 13. Driver System and Motion when observed from that side

CHAPTER 5: RESULT & DISCUSSION

The result is obtained for obstacle avoidance robot using Arduino, if the robot moves forward if any obstacle detect it turns to other directions and moves where there are no obstacles it moves in forward direction, to sense the obstacle ultrasonic sensor is used

The Arduino board was selected as the microcontroller platform and its software counterpart, Embedded C, was used to carry out the programming. The integration of ultrasonic sensor provides higher accuracy in detecting obstacles in its way. Being a fully autonomous robot, it successfully maneuvered in unknown environments without any collision. The hardware used in this project is widely available and inexpensive which makes the robot easily replicable in real world.

Obstacle avoiding robots can be used in almost all mobile robot navigation systems. They can be used for household work like automatic vacuum cleaning. It can also be used in automated vehicles so that whenever another vehicle or barrier is detected it avoids collision immediately.

They can also be used in dangerous environments, where human penetration could be fatal.
The robot developed in this project is expected to fulfill the following objectives:
• The robot would have the capacity to detect obstacles in its path based on a predetermined threshold distance.
• After obstacle detection, the robot would change its course to a relatively open path by making autonomous decision.
• It would require no external control during its operation.
• It can measure the distance between itself and the surrounding objects in real-time.

Figure 14. Resultant Robot

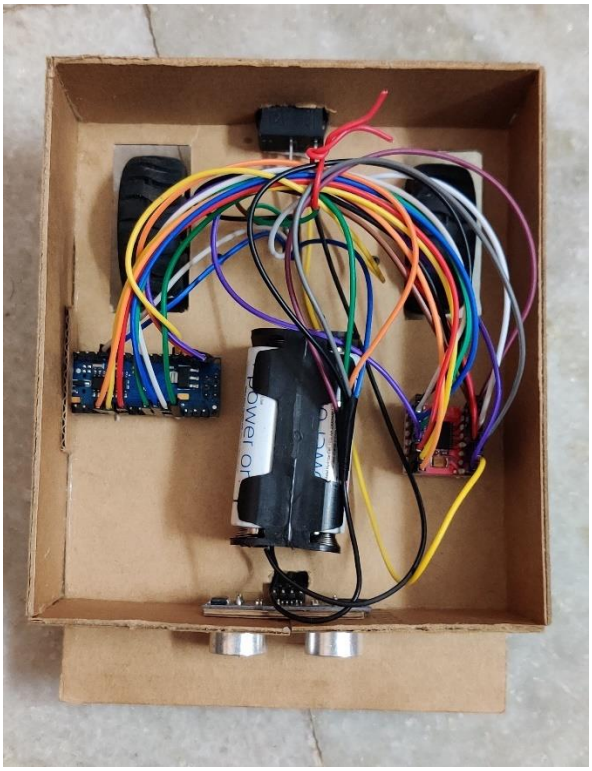


Figure 15. Top view of Bot and the Connections

CHAPTER 6: CONCLUSION

The goal of our project is to create an autonomous robot which intelligently detects the obstacle in his path and navigate according to the actions we set for it.

The robot is fully autonomous and after the initial loading of the code, it requires no user intervention during its operation. When placed in unknown environment with obstacles, it moved while avoiding all obstacles with considerable accuracy. In order to optimize the movement of the robot, we have many considerations for improvement. However, most of these ideas will cost more money and time as well.

The project gives us the idea on different criteria of Understandings and Knowledge.

Understandings:

1. Microcontrollers are used to control many everyday products like robots, garage door openers, traffic lights, and home thermostats.

2. Microcontrollers can be programmed to sense and respond to outside stimuli.

3. Arduino Nano and what parameters does it use in programming code

Knowledge and skills:

Through this project, we gain basic knowledge and skills regarding Arduino, program and mathematics to calculate program values.

It is expected that we understand how to:

1. Program an Arduino.

2. Program and test an autonomous robot.

3. Use mathematics to calculate programming values.

CHAPTER 7: FUTURE SCOPE

- By including a GPS, we can direct the robot towards a specific location also it can map the surroundings.
- Use as a firefighting robot: By adding temperature sensor, water tank and making some changes in programming we can use this robot as firefighting robot.
- Adding a Camera: If the current project is interfaced with a camera (e.g., a Webcam) robot can be driven beyond line-of-sight & range becomes practically unlimited as networks have a very large range.
- Solar panels could be added to help recharge the battery to make the robot more self-sufficient.

To enable robots to be able to adapt to its environment obstacle detection and avoiding is an important domain of robotics research. Whether the environment be underwater, on land, underground, in the air or in space.

A fully autonomous robot has the ability to

- Work for an extended period of time without intervention from human or a need for power supply.
- Avoid situations that are harmful.
- Ability to map its surroundings and doesn't travel in a circular path.

The most effective method to increase the accuracy of this robot is the inclusion of better sensors, although the project cost might increase but the accuracy will definitely increase as well as the problem space where the robot can be used. By enhancing the code, the model's accuracy can be increased.

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- **Idea reference:**

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