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Design and Model of Obstacle Avoidance & Image Detection Robot using Arduino Uno for Future Automation Technology

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Abstract:

In today's growing world robotics is growing fast and appeared as an interesting field. Robotic mechanism has an ample of intelligence to cover the maximum area of provided space. Introducing the design to create an obstacle avoidance robot using image detection through Arduino Uno and Esp32 cam. The design proposes robotic vehicles that has an intelligence built in such that it detects whenever an obstacle covers in its path. This robotic circuit is totally based on by using software simulation Tinkercad. This circuit is very useful for future generation automation industry.

Keyword*- Arduino Uno, Esp32 Cam, Tinkercad, Robot.*

1. Introduction:

Robot Navigation Techniques[1] include things like wall-following, edge recognition, line-following, and many others. Edge detection is a more generic and widely used approach for obstacle avoidance. The necessity for the robot to halt in front of an obstruction in order to obtain a more precise measurement is a drawback of obstacle avoidance based on edge detection Every mobile robot[2] has some sort of collision avoidance, from simple algorithms that detect an obstruction and cause the robot to halt to more complex ones that use sophisticated algorithms. All mobile robots include some form of collision avoidance, from simple algorithms that detect an impediment and cause the robot to stop to avoid a collision to more complex algorithms that allow the robot to avoid collisions altogether.

[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 motion Sensors" IOP Conference Series: Materials Science and Engineering, vol. A247, pp. 529-551, April 2005.

The latter methods required an ultrasonic and both the identification of a barrier and some type of quantitative measurement pertaining to the obstacle's dimensions, making them more difficult. Once these are known, the robot must be guided around the obstruction via the obstacle avoidance algorithm before continuing its path toward the original destination. The robot will not have to halt in front of an obstruction while navigating thanks to the steering algorithm. Any obstruction in front of it is detected by an ultrasonic sensor, which then transmits an instruction to the Arduino Uno[3]

Any obstruction in front of it is detected by an ultrasonic sensor[4], which then sends an instruction to the microcontroller. To navigate smoothly while operating and avoid collisions, the robots may be able to overcome some of the navigational challenges covered above. If the Ultrasonic sensor were used Infrared radiation is used by infrared sensors to gauge an object's distance. There are restrictions on the sensor that are present when the light beam detects an object and returns to the receiver at an angle after reflection. The inability of Ultrasonic sensors to tolerate light reflections from bright objects or ambient light has hampered the ultrasonic performance. For instance, there is no object recognition in the dead zone area[5]

Transparent or brightly coloured materials might also result in false detection results from Ultrasonic sensors. Results of detection are also influenced by the weather, and Ultrasonic sensors' detecting accuracy declines with moisture and humidity. Additionally, Ultrasonic sensors can detect Ultrasonic radiation[6] from sunshine, which can result in output inaccuracies that are either correctable or uncorrectable. Additionally, signal losses will occur at the amplifier ultrasonic circuit if an analog Ultrasonic sensor is employed.Ultrasonic motion sensors, on the other hand, required an ultrasonic lengthy calibration process and are thermal radiation sensitive. In addition, Ultrasonic sensors are not sensitive to extremely slow motions or to objects in a standing state.

In this article authors proposed a design and model of obstacle avoidance and image detection Robot using Arduino Uno and Esp32 Cam[7] including TinkerCad[8] software tools for future automation technology.

[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.

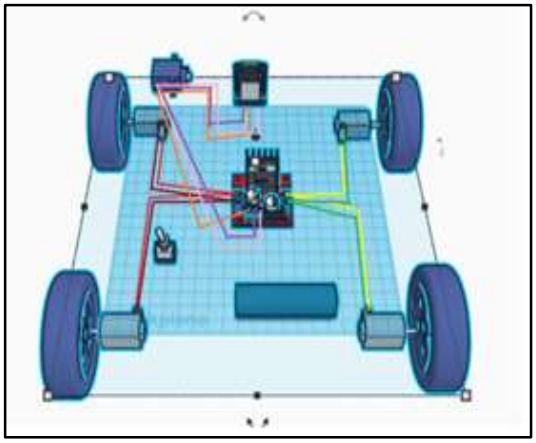
[4]Paul Kinsky,Quan Zhou “Obstacle Avoidance Robot” Worcester polytechnic institute.

[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 Industrial Automation” , proc.of IEEE ICoAC2011,pp 304-308,2011.

[7] Ming Chang, Descriptive Geometry and Engineering Graphics 3 ed. Huazhong University of Science and Technology press, 2004.

3. Circuit Diagram and Working Principle:



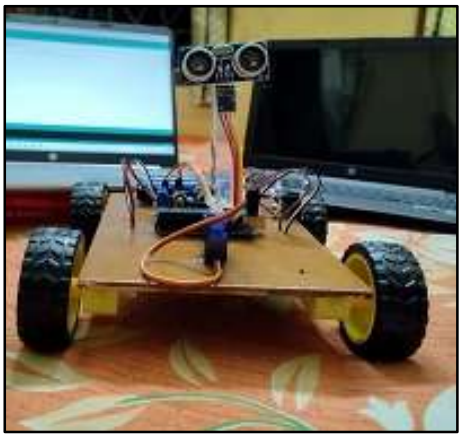


Fig.1: Complete Circuit Diagram of Obstacle Avoidance and Image Detection Robot Using Tinkercad Software and Hardware Prototype Model

(Software Simulation and Hardware Model Design by Authors)

Sometime recently attending to working of the extend, it is important to get it how the ultrasonic sensor works. The fundamental rule behind the working of ultrasonic sensor is as follows: Using an outside trigger flag, the Trig stick on ultrasonic sensor is made rationale tall for at slightest 10µs. A sonic burst from the transmitter module is sent. This comprises of 8 beats of 40KHz. The signals return after hitting a surface and the recipient identifies this flag. The Resound stick is tall from the time of sending the flag and accepting it. This time can be changed over to remove utilizing fitting calculations. The point of this venture is to execute a deterrent dodging robot utilizing ultrasonic sensor and Arduino. All the associations are made as per the circuit graph. The working of the venture is clarified below. When the robot is fueled on, both the engines of the robot will run ordinarily, and the robot moves forward. Amid this time, the ultrasonic sensor persistently calculates the separate wagered. Esp32Cam is useful for image detection surrounding the object where the robot can travel.

Table-1: Parameters of Designing the Circuit

Sl No:	Component Name:	Description:	Quantity:
1	Arduino Uno + Cable	The Cable for Arduino UNO/MEGA (USB A to B) is1feet, you use it to attach "Arduino Uno", "Arduino Mega 2560" or any board with the USB feminine A port of your computer. Length is concerning fifty-two cm. Cable color and form could vary from image as our stock rotates. The cable could be a standard-issue USB two.0 cable.	1
2	DC 3V-6V Motor	A DC motor could be a category of electrical motors that convert electricity current into energy. From the higher than rationalization, we can return to the conclusion that any motor that's operated mistreatment electricity is termed a DC	4

[8] Shiquan Zhou, Fundamentals for Mechanical Manufacturing Process in Huazhong University of Science and Technology press, 2005

		motor.	
3	Plastic Wheels 65x26mm	Solid plastic wheels area unit made up of nylon or plastic. plastic wheels area unit product of high-quality impact-resistant artificial materials. These have a soft and resistance running performance on even floors.	4
4	Ultrasonic Sensor	Ultrasonic detector associate supersonic detector could be a device that measures the space to associate object through supersonic sound waves. associate supersonic detector uses a electrical device to send and receive supersonic pulses that relay back info relating to the object's closeness or proximity.	1
5	Servo Motor	A servomotor could be a mechanism|positioner|actuator} or linear actuator that helps for precise management of angular or linear position, speed and acceleration. It includes of an acceptable motor coupled to a detector for position feedback.	1
6	Esp32 Cam Wi-Fi	ESP32-CAM could be a affordable ESP32-based development board with aboard camera, tiny in size helpful to numerous DIY comes. it's an excellent answer for IoT application, prototypes constructions and DIY comes.	1
7	Battery Holder	A battery holder could be a compartment holder or chamber for holding electric battery. For dry cells, the holder sometimes makes tangency with the battery terminals.	1

4. Circuit Programming Algorithms and Flowchart:

The programming code can be design by following flow chart and algorithms.

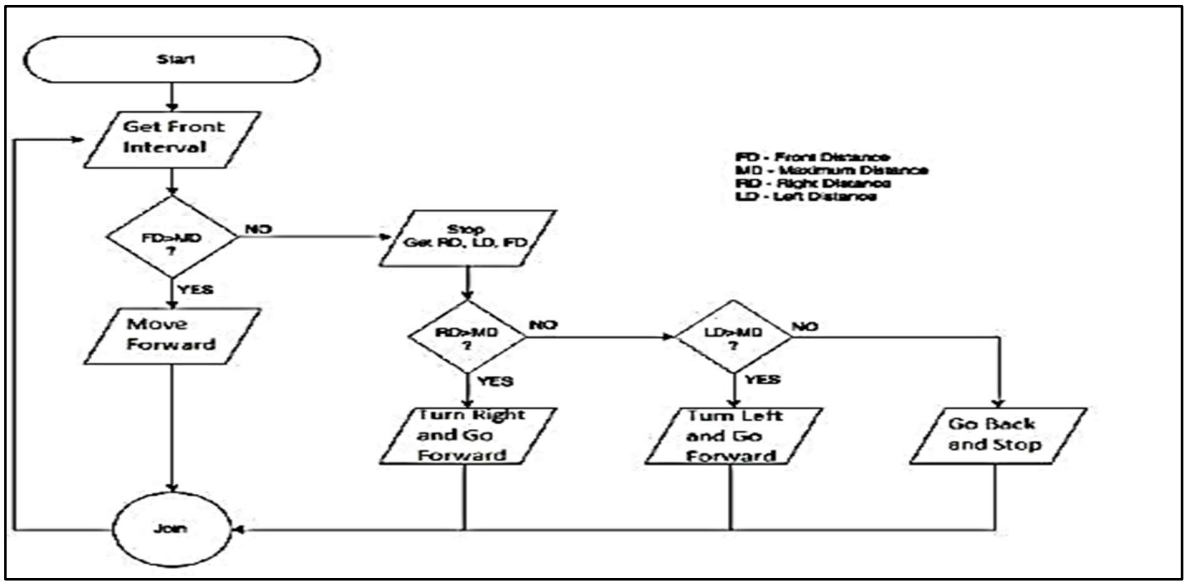


Fig- 2: Flowchart of the Programming Code

The following is a very genuine algorithm for object avoiding robot. We kept this uncomplicated for the amateurs to understand the concept. You may enhance the code by improving the algorithm.

It has the following predefined functions for robot motion as follows:

1. forward() : forward motion of robot.
2. backward() : backward motion of robot.
3. turn_left() : for turning towards left.
4. turn_right(): for turning towards right.
5. halt() : for stopping the robot.

5. Programming Code:

```
//code for obstacle avoiding robot
#include <Servo.h> // Includes servo library.
#include <Ultrasonic.h> // Includes SR-04 Sensor Library.
Ultrasonic ultrasonic(A0,A1); // (Trig PIN,Echo PIN)
Servo servo_1; // Creating Servo object.
// declaring Motor Shield
int dPin = 8;
int lPin = 12;
int cPin = 4;
int en = 7;
// Variable to store distance
int left_d = 0;
int right_d = 0;
int front_d = 0;
int max_d = 50; // Max distance to obastacle
void setup()
{
 // setting up shield.
 pinMode(dPin, OUTPUT);
 pinMode(lPin, OUTPUT);
 pinMode(cPin, OUTPUT);
 pinMode(en, OUTPUT);
 digitalWrite(en, LOW);
 servo_1.attach(10); // Attaching servo to Pin No.10
 servo_1.write(90); // Initial position
 delay(350);
}
void loop()
{
 front_d = ultrasonic.Ranging(CM); // measuring fornt distance
 if (front_d < max_d)
 {
 halt();
 get_d();
 if(right_d > max_d)
 {
 turn_right();
 delay(400);
```

```
 forward();
 }
 else if ( left_d > max_d)
 {
 turn_left();
 delay(400);
 forward();
 }
 else {
 backward();
 delay (500);
 halt();
 }
 }
 else{
 forward();
 }
}
void forward(void){ // function for forward movement.
 digitalWrite(lPin, LOW);
 shiftOut(dPin, cPin, LSBFIRST, 3);
 digitalWrite(lPin, HIGH);
}
void backward(void){ // function for forward movement.
 digitalWrite(lPin, LOW);
 shiftOut(dPin, Pin, LSBFIRST, 164);
 digitalWrite(lPin, HIGH);
}
void turn_left(void){ // function for left turn.
 digitalWrite(lPin, LOW);
 shiftOut(dPin, cPin, LSBFIRST, 161);
 digitalWrite(lPin, HIGH);
}
void turn_right(void){ // function for Right turn.
 digitalWrite(lPin, LOW);
 shiftOut(dPin, cPin, LSBFIRST, 38);
 digitalWrite(lPin, HIGH);
}
void halt(void){ // function for stopping robot.
 digitalWrite(lPin, LOW);
 shiftOut(dPin, cPin, LSBFIRST, 32);
 digitalWrite(lPin, HIGH);
}
void get_d(void) // Fuction to get distances.
{
 servo_1.write(0); // Right Position
 delay(500);
```

```
right_d = ultrasonic.Ranging(CM);
servo_1.write(90); // Front Positon
delay(500);
front_d = ultrasonic.Ranging(CM);
servo_1.write(180); // Left position of servo
delay(500);
left_d = ultrasonic.Ranging(CM);
servo_1.write(90); // back to front
delay(250);
```

Conclusion:

This project created an obstacle avoiding robot to distinguish and maintain a strategic distance from obstacles in its path. The robot is built on the Arduino Uno and Esp32 Cam platform for information preparing and its software partner made a difference to communicate with the robot to send parameters for directing development. For obstacle location, one ultrasonic separate sensor is utilized that given a more extensive field of location. The robot is completely autonomous and after the beginning stacking of the code, it requires no client intercession during its operation. When set in unknown environment with impediments, it moved whereas dodging all deterrents with considerable exacts.

References:

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.

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