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Obstacle Avoiding Robot

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Abstract: The rate of accidents involving the vehicles has been increasing, the desperate need of efficient collision avoidance mechanism has observed a high demand in today's world. In an effort to make our contribution to the society, we have designed an Arduino based obstacle avoidance robot. This robot prevents the moving vehicle from colliding with another physical entity and negates the chances of serious physical injuries.

Keywords: Obstacle, Accident, Ultrasonic sensor, Robot

1. Introduction

The traffic Collision incidents have always been a subject of concern for the government around the world, especially in the low economic nations [1-3]. Regardless of the nation, such accidents cause a great amount of damage to both humanity as well as the resources [4]. In an effort to make our contribution to the society, we have designed obstacle avoidance robot [5-6].

The obstacle avoidance robot works on the phenomenon of receiving echoes of the sound waves [7-8]. After interpreting the received data, the system of the moving vehicle prevents it from colliding with another physical entity [9].

2. Methodology

The developed system consists of Arduino interfaced with ultrasonic sensors to detect the obstacle. H-bridge motor drives are connected with Arduino and DC motors for the movement and left and right turns. The methodology of the proposed system is shown in Fig. 1.

It is discussed in Fig. 1 that first the sound is generated and that is considered as original signal. The sound signal is produced from ultrasonic sensors. After that if any obstacle is there the original sound signal is reflected and it will be measured by ultrasonic sensors. The ultrasonic sensor is the key element behind the design of obstacle detection system. It is interesting to note that several other options such as light is also considered for that but it was analyzed that light is highly directive and objective size as an obstacle is not measurable due to directivity of light and in this regards, the sound waves were best alternative because it can reflect well from the objective entire shape and measurement will not be an issue.

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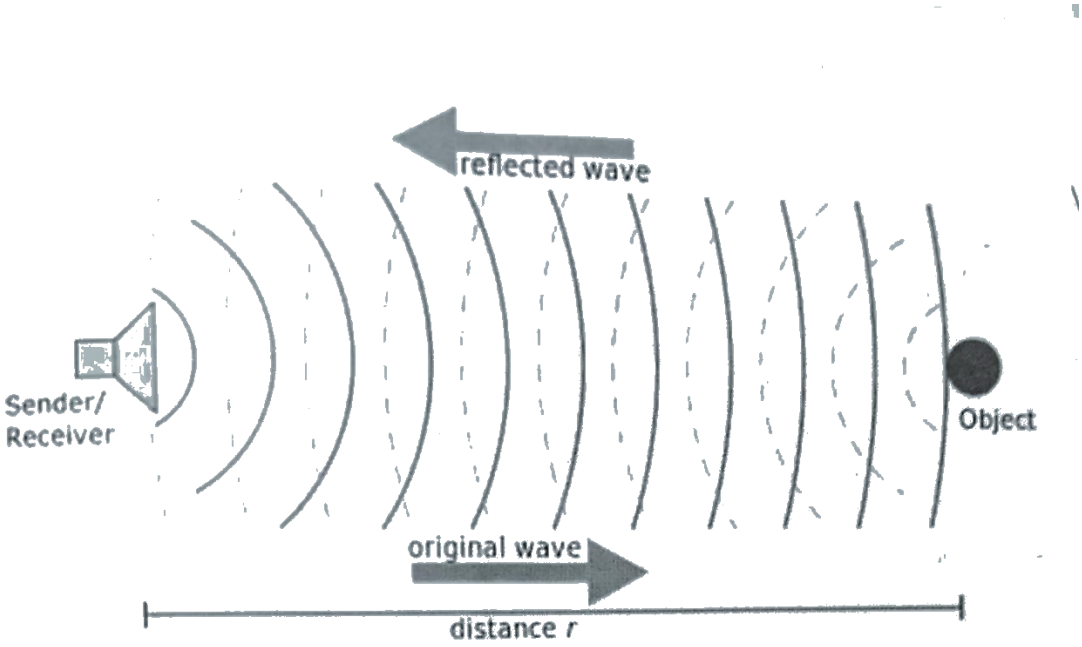

Fig. 1 – Design methodology for Obstacle detection

The Fig. 1 is the main key aspect of designing the obstacle detection. Here it can be seen that the sound waves are transmitted and after striking with object the waves are reflected and the distance is calculated. Now, this distance is very important to understand as it is the measurement that defines how away the object is from this ultrasonic transceiver. According to mathematical equation as shown in Eq. 1:

$$\text{Distance} = (\text{Time} \times \text{SpeedOfSound}) / 2 \quad (1)$$

Sound travels at approximately 340 meters per second. This corresponds to about 29.412µs (microseconds) per centimeter.

3. Project Hardware

The hardware part consists of

- Ultra sonic sensor
- Arduino UNO
- Jumper wires
- Arduino ide software

Arduino UNO, L298N IC, DC Gear motors, and ultrasonic sensor. Arduino UNO: An UNO Arduino is basically a microcontroller board that is based on the ATmega328P. it consists of 14 digital pins of which 6 can be used as PWM. It has 6 analog inputs, a power jack, 16MHz ceramic resonator, a reset button and USB connection as show in Fig. 2.

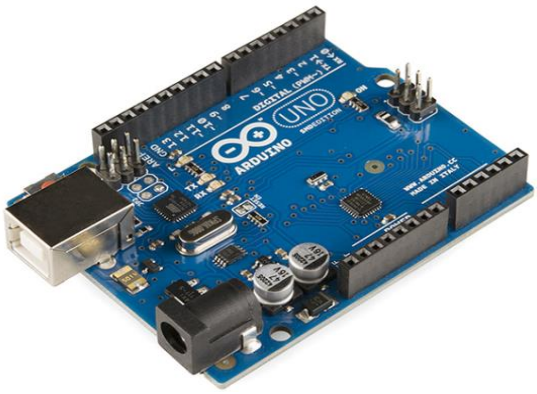

Fig. 2 – Arduino UNO Board

Geared DC Motor: The DC geared motors are an extension of the DC motors and have a gear assembled connected to the motor. RPM represents the rotations of the shaft per minute, as a measure of speed of the motor as shown in Fig. 3. The gear assembly of the motor helps in reducing the speed and increasing the torque, which is called gear reduction. The motor's speed can be reduced according to the need by utilizing the correct combination of the gears.

Fig. 3 – DC Gear Motor

HC-SR04: It is an ultrasonic sensor that uses sonar to calculate the distance to a physical entity. It is very stable in terms of performance and also provide highly accurate distance measurements. It consists of transmitter and a receiver.

Fig. 3 – Ultrasonic sensor

Ultrasonic sensors are useful for measuring distances. Ultrasonic waves are transmitted and whenever these strike an obstacle and return back in the from of an echo. Difference of outgoing sound and returning echo gives us the distance.

Ultrasonic sensor HC-SR04 Consists of 4PINS
PIN1: VCC
PIN2: Triggering (Signal IP/OP)
PIN3: ECHO Signal
PIN4: Ground
Circuit
VCC connection of the sensor attached to +5V
GND connection of the sensor attached to ground
TRIG connection of the sensor attached to digital pin 13
ECHO connection of the sensor attached to digital pin 12

L298N IC: The L298N is a high voltage, high current, full bridge driver. It has an advantage that it the robot to move in either direction. It accept standard TTL logic levels and drive DC and stepping motors, relays and solenoids as shown in Fig. 4.

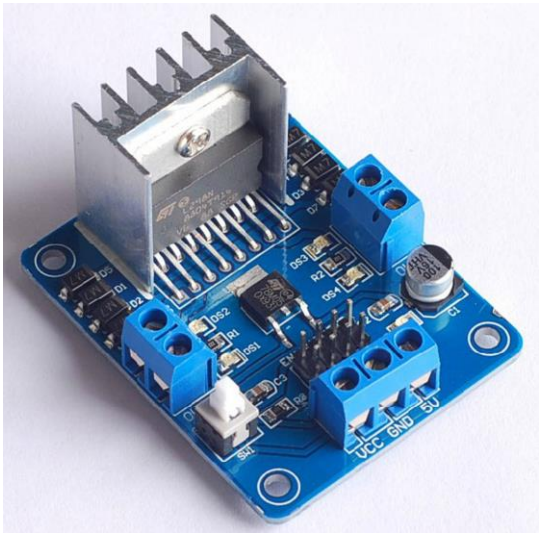

Fig. 4 – L298N Motor Drive

The project complete design is shown in Fig. 5. The design is based on the model of similar to robotic car.

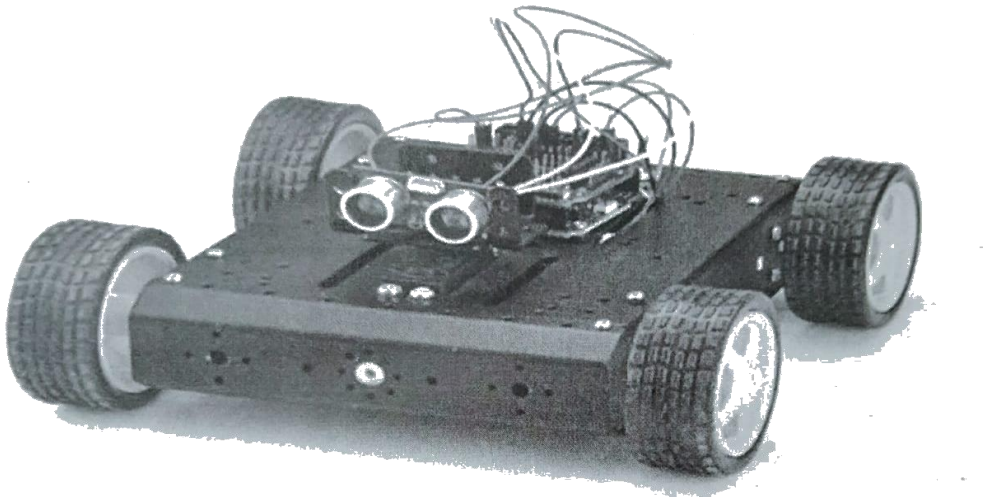

Fig. 5 – Complete Design of Obstacle Design

It is important to note that in Fig.5 all the components including

- Ultra sonic sensor
- Arduino UNO
- Jumper wires
- Arduino ide software

are mounted over that design and design of the assemble is similar to car that will be controllable from the instruction programmed in Arduino. The Simulation and codes are descripted as below

```
const int out=12;
const int in=13;
void setup(){
Serial.begin(9600);
pinMode(in, INPUT);
pinMode(out, OUTPUT);
}
void loop()
{
long dur;
long dis;
long tocm;
digitalWrite(out,LOW);
delayMicroseconds(2);
digitalWrite(out,HIGH);
delayMicroseconds(10);
digitalWrite(out,LOW);
dur=pulseIn(in,HIGH);
tocm=microsecondsToCentimeters(dur);
Serial.println(String(tocm));
delay(100);
}
long microsecondsToCentimeters(long microseconds)
{
return microseconds / 29 / 2;
}
```

The Code is design and demonstrated in the following design steps

- Input from the Sensors Ultra sonic sensor to Arduino
- Arduino UNO measure from the sensor data
- Arduino UNO acknowledge the program from obstacle calculation
- Obstacle calculations are performed
- After that these calculations are given to Arduino
- Servo motors are guided based on calculations
- Arduino recheck from motor movement
- Output by avoiding objetcs

You can observe the output on the Arduino IDE Serial Monitor.

```
const int out=12;
const int in=13;
```

Declaring constants in and out with values 12 and 13.

```
void setup(){
Serial.begin(9600);
pinMode(in, INPUT);
pinMode(out, OUTPUT);
}
```

Writing the code in the setup(). As you already know setup will only run once and is used to initialize and configure.

```
Serial.begin(9600);
```

Begin the serial data transmission at the rate of 9600 bits per second.

```
pinMode(in, INPUT);
pinMode(out, OUTPUT);
```

Set the Input and Output Modes (i, e 13 as Input and 12 as Output)

```
void loop()
{
long dur;
long tocm;
digitalWrite(out,LOW);
delayMicroseconds(2);
digitalWrite(out,HIGH);
delayMicroseconds(10);
digitalWrite(out,LOW);
dur=pulseIn(in,HIGH);
tocm=microsecondsToCentimeters(dur);
Serial.println(String(tocm));
delay(100);
}
```

Declaring long dur=duration, tocm=storing calculated distance in cm from duration

```
digitalWrite(out,LOW);
delayMicroseconds(2);
```

Turn off the Trig pin in case it was on before.

Wait for 2 Micro Seconds.

```
digitalWrite(out,HIGH);
delayMicroseconds(10);
digitalWrite(out,LOW);
```

Turn on and Send a sound wave and wait for 10 Micro seconds so that the operation happens and then turn off the pin.

```
dur=pulseIn(in,HIGH);
```

4. Result And Discussions

When an object comes in front of the robot, the ultrasonic sensor detect the object and send information to the Arduino, the Arduino process the information and send commands to motor drive which drives the motors movements as instructions given Arduino.

5. CONCLUSION

The increasing the number vehicles becomes the cause of accidents, due to which loss of human life and also property occurs. The developed system can easily solve this situation to avoid the human life loss and resources. As the physical object comes in front of the vehicle system detect the presence and change the direction of vehicle to safe side.

6. Future Recommendation

The efficiency and accuracy of system can be increased by using LIDAR or other sensors instead of ultrasonic sensor.

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