IOSR Journal of Engineering (IOSR JEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719,
|| Special Issue || June-2019, || PP 74-83 ||

Anti-Collision Car Side Mirror System

AherK.M.[1], Baviskar H.C.[2]
[1,2](*U G Student, Mechanical Engineering, JSPMNTC, Pune, India*)

Abstract: *In the current phase of the world, we see many automobiles running on the roads. Automobiles rule the roadways. But there are also many problems faced by the automobiles while actually dealing with many situations on roadside. One of the problems generally faced is by the side mirror of the vehicle. If the vehicle comes into the close distance between another vehicle, there may be the chances that the mirror of the vehicle crashes and gets damaged. The motive of our project is to avoid the damage to the side mirrors by use of some sensors and mechanisms. Method for the application of our system is to make use of ultrasonic sensors which control the movement of the motors attached to the mirror, when some solid object comes in the range of the sensors. We are using Arduino boards for this purpose. After the use of such system into the vehicle, the mirror will automatically close when a vehicle comes in the range of the sensor and will open back again when there is no object in its range. In this way we can avoid damage to the mirrors and ultimately to the automobiles and can save the cost of repair, as the mirror is too expensive and it is not repaired but directly replaced.*

Keywords: *Arduino Uno board, Servo motor, Ultrasonic sensor, Mirror, Arduino open source program*

I. Introduction

Today in this world, automobiles rule the roadways. There is no such condition where automotive vehicles are not used. We need automotive in each and every sector of this corporate world. Basically automotive is the heart of the world nowadays. But have we thought of what problems these automobiles might be facing while actually in actual work? There are many problems a vehicle faces while actually travelling on the roads or even when they are in stand still condition. One of the problems faced, are the accidents which damage the *vehicle side mirror.* The side mirrors are one of the most important parts of an automobile. The automobile side-view mirror is a device for indirect vision that facilitates observance the traffic area adjacent to the vehicle which cannot be observed by direct vision. Being able to see what is behind the car is vital when reversing or changing lanes.The mirrors are often situated on, just in front of, the driver's and front passenger's doors. The mirror housing often holds the indicators, illumination features and a blind spot alarm. If these pair of side mirrors gets damaged in the accidents, the driver will not be able to see other vehicles approaching closer to him and this may be the reason for accident. Even the side mirrors of the vehicles are very expensive and one cannot afford constant damaging of the side mirrors. For all these reasons, we need to develop a mechanism or a system, so that it would avoid the damaging of side mirrors till some extent and save the cost of replacement. The basic objective of our project is to avoid the accidents of side mirror of the automobile to maximum extent. This is because firstly any accident of any part is not acceptable. Even the vehicle mirror is not just a mirror installed in the whole mechanism but it consists of motors, linkages (depending on the car model) to make that mechanism work. So the damaging of the whole mechanism is not economical in any aspect and one cannot afford constant damaging of such system. Sometimes even while the vehicle is to be parked, accidents make take place like hitting the pillars in the parking lot, hitting of the mirror to another car and many such examples. In order to avoid all these problems this project idea has been developed, which will surely help in avoiding the accidents to a greater extent. If looked thoroughly and with keen thinking, this project idea has a great scope in upcoming years. We know that the cars manufactured are not that cheap and even the parts from which the car is made are also not so cheap that we can damage the part every month and still be comfortable buying a new one instead. The high end car companies like Audi, Mercedes, BMW, Porsche, etc. have high tech mechanisms installed into them which are not at all cheap. If this project idea is installed in these cars in future, there would be less chances of damage to the mirror and this in turn would increase the productivity of the company and the complaints of damage would be lesser. This would also increase the overall sales of the company and most importantly, there would be customer satisfaction, which is the most important factor a company relies on. The mechanism can also be modified in future, to meet various demands of the roads and safety of the driver.

II. Proposed Mirror System Components

1. Ultrasonic sensor:

Ultrasonic transducers or ultrasonic sensors are a type of acoustic sensor divided into three broad categories: transmitters, receivers and transceivers. Transmitters convert electricalsignals into ultrasound, receivers convert ultrasound into electrical signals, and transceivers can both transmit and receive ultrasound. In a similar way to radar and sonar, ultrasonic transducers are used in systems which evaluate targets by interpreting the reflected signals. For example, by measuring the time between sending a signal and receiving an echo the distance of an object can be calculated. Passive ultrasonic sensors are basically microphones that detect ultrasonic noise that is present under certain conditions Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18 kHz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed. There are two HC SR04 Ultrasonic sensor is used for this experiment.

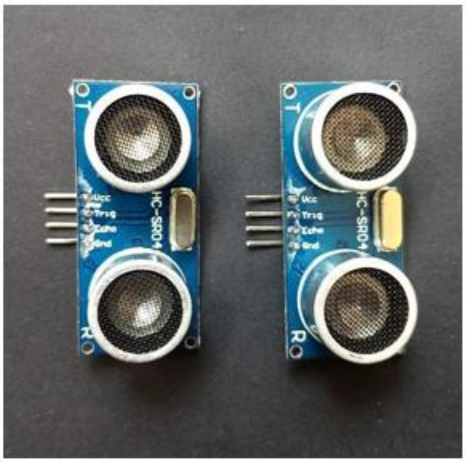

Fig. Ultrasonic sensor

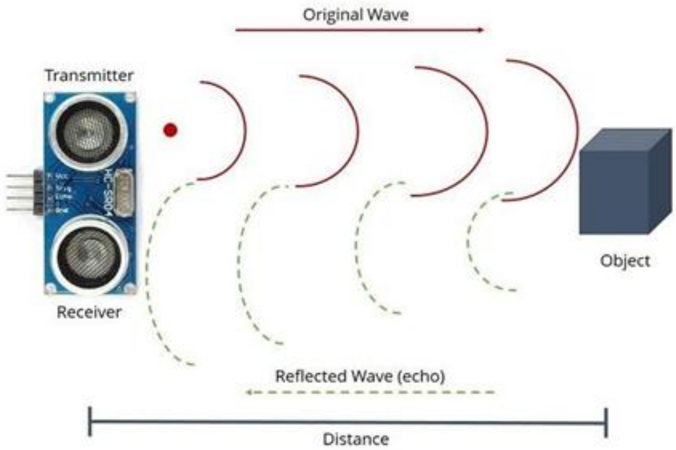

Fig. Working of HC-SR04 Ultrasonic sensor

Ultrasonic transmitter emitted an ultrasonic wave in one direction, and started timing when it launched. Ultrasonic spread in the air, and would return immediately when it encountered obstacles on the way. At last, the ultrasonic receiver would stop timing when it received the reflected wave. As ultrasonic spread velocity is 340m/s in the air, based on the timer record **t**, we can calculate the distance (s) between the obstacle and transmitter, namely:**s=340t/2**,whichisso-calledtime difference distance measurement principle.
The principle of ultrasonic distance measurement used the already-known air spreading velocity, measuring the time from launch to reflection when it encountered obstacle, and then calculate the distance between the transmitter and the obstacle according to the time and the velocity. Thus, the principle of ultrasonic distance measurement is the same with radar. Distance Measurement formula is expressed as: **L= C X T**. In this formula, List the measured distance, C is the ultrasonic spreading velocity in air and T represents time.

2. Servo motor:

A servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft. The motor is paired with some type of encoder to provide position and speed feedback. In the simplest case, only the position is measured. The measured position of the output is compared to the command position, the external input to the controller. If the output position differs from that required, an error signal is generated which then causes the motor to rotate in either direction, as needed to bring the output shaft to the appropriate position. As the positions approach, the error signal reduces to zero and the motor stops.

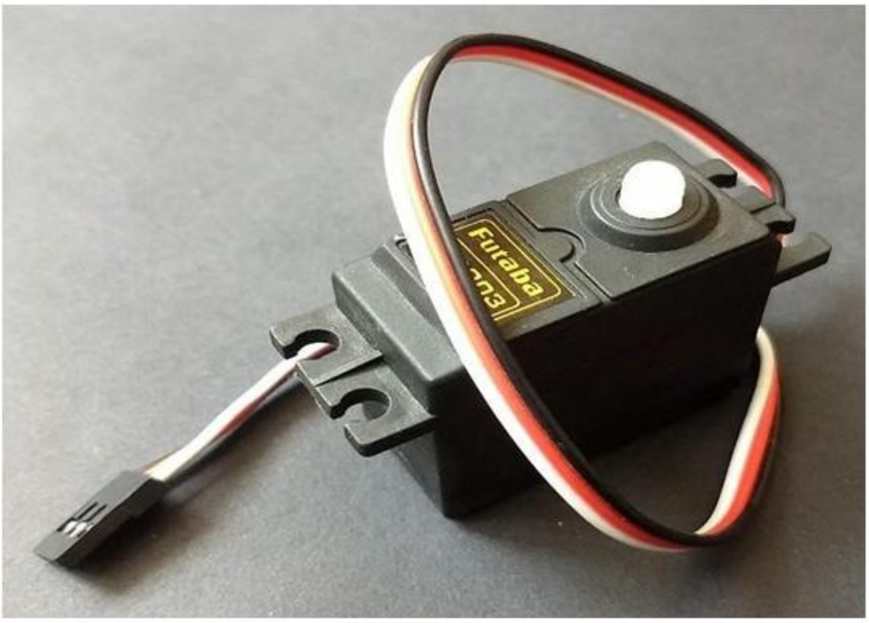

Fig. Servo motor

Controlling Servo Angle:

Servo is controlled on the concept of PWM (Pulse Width Modulation). The refresh interval (the minimum time to refresh servos in microseconds) is 20000, which means that the servo is refreshing at a frequency of 50Hz. For most of the servos, a certain range of PWM correspond to the range of angle servo can rotate. Minimum pulse width is the shortest time for the pulse has been HIGH and maximum pulse width is the longest time for which the pulse is HIGH. Hence if the range of motor angular position is from 0 to 180, then minimum pulse width corresponds to 0 and maximum pulse width corresponds to180.

Servo motor control of the shaft position comes from using a pulse width modulation signal (PWM) to turn the shaft clockwise or counter clockwise, depending on the pulse width of the signal. Typically, a pulse width of 1 ms will rotate the shaft clockwise and a 2 ms pulse will rotate the shaft counter clockwise. To position the shaft ½ way, or in the middle, a 1.5 ms pulse typically works. You will need 20 ms between each pulse. Figure 2 below shows the timing for each position.

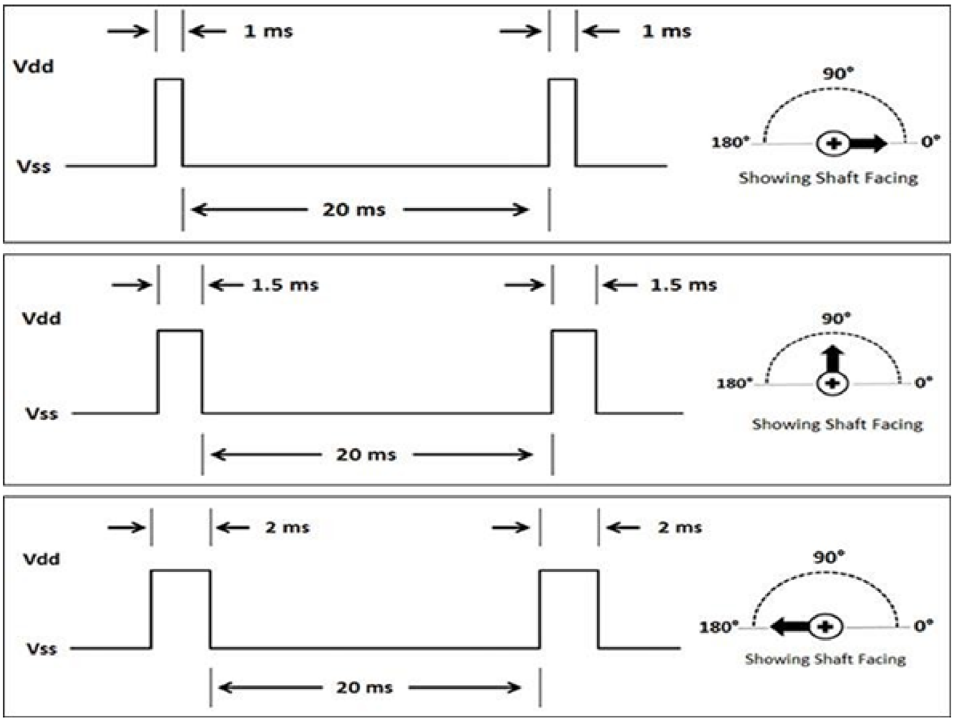

Fig. PWM timing for different shaft positions

3. Arduino sensor:

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

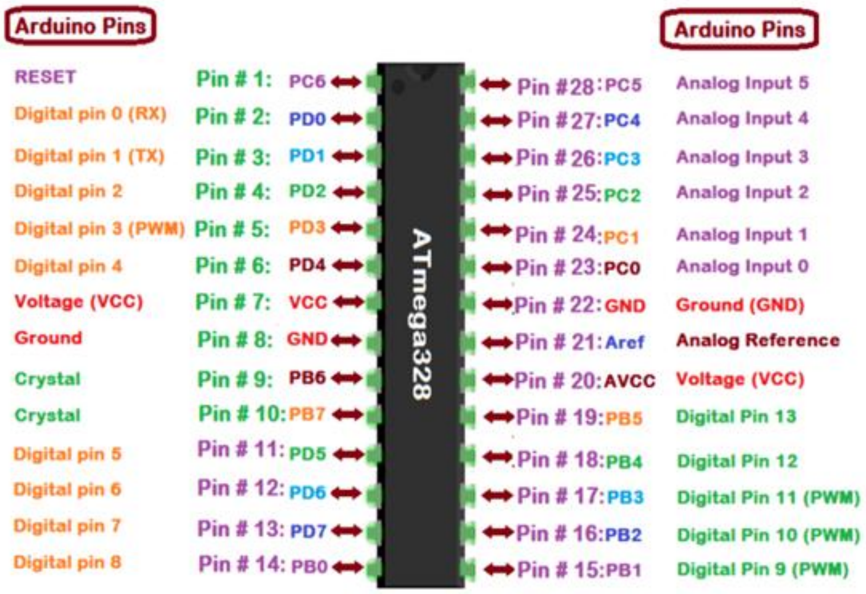

Fig. Circuit diagram of Arduino UNO

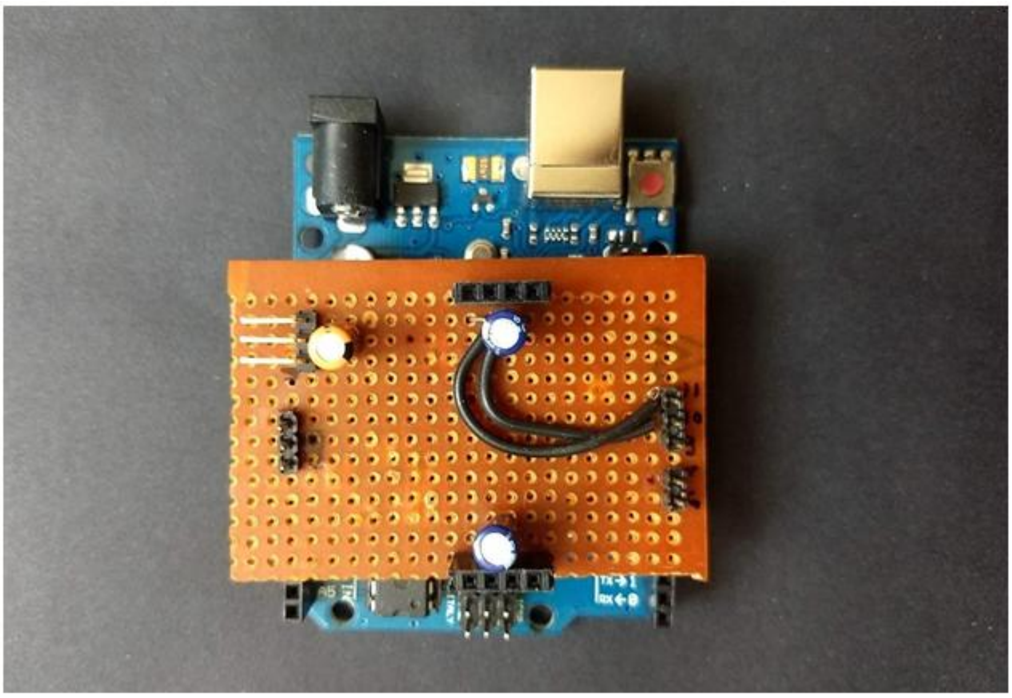

Fig. Arduino uno board

III. Principle Of Operation

Set low the Trig and Echo port when the module initializes, firstly, transmit at least 10us high level pulse to the Trig pin (module automatically sends eight 40K square wave), and then wait to capture the rising output by echo port, at the same time, open the timer to start timing. Next, once again capture the falling edge output by echo port, at the same time, read the time of the counter, which is the ultrasonic running time in the air. According to the formula: test distance = (high level time * ultrasonic spreading velocity in air) / 2, you can calculate the distance to the obstacle. The basic idea behind the use of this mechanism is making use simple ultrasonic sensor and a servo motor to drive the system, sensor and motor work by programmed Arduino board. Trigger pin and echo pin of sensor is connected to pin 7 and pin 6 (PWM) of Arduino board respectively. Motor signal pin is connected to Arduino pin 8 (PWM).

An ultrasonic sensor works on the principle of when they measure distance by using ultrasonic waves, the sensor head trigger an ultrasonic wave and receives the wave reflected back from the target by echo. This allows the sensor to sense the distance of the object on its specified range (10cm to 150cm), this will turn the trigger ON on the Arduino board and ultimately turn the motor to the 90 degree angle cc or ccw. Up next we need to tell the Arduino to create a servo object to control a servo, and then create a variable to store the servo position. We need to set up the variables for the HC-SR04 sensor. We need to tell the Arduino that the Trigger Pin is connected to Digital Pin 10 and 7, and the Echo Pin is connected to Digital Pin 11 and 6. Defining the variables for ultrasonic sensor pins we set the trigPin1 and trigPin2 as an Output and to receive the echo sound we set the echoPin1 and echoPin2 as an Input. The first thing we need to do in our setup is initialize the serial port, and tell it what baud rate to communicate at. Then we need to set up the variables for the Servo.

We need to tell the Arduino to attach a "servo" at digital pin 9. Now we need to trigger the sensor with a high pulse of at least 10 microseconds, but first we need to trigger a very short low pulse to ensure our high pulses are clean and crisp. Now we need to tell the Arduino to listen for the return pulse and read the signal from the sensor: It needs to listen for a HIGH pulse whose duration is the time (in microseconds) from the sending of the ping to the reception of its echo off of an object.

This sketch reads a HC-SR04 ultrasonic sensor rangefinder and returns the distance to the closest object in range. To do this, it sends a pulse to the sensor to initiate a reading, and then listens for a pulse to return. The length of the returning pulse is proportional to the distance of the object from the sensor. The Arduino then takes this information and initiates a series of sweeps. A sweep is defined as a servo moving its horn from the 0 position to 90 and back to then 0 to -90 and back to 0. Calculating the distance of the object nearby in the ultrasonic sensor range with distance time formula, distance2= duration2*0.034/2; Calculated distance will Prints on the Serial Monitor and Arduino sent signal to servo motor thus motor turns 90 degree to the respective ultrasonic sensor measurement.

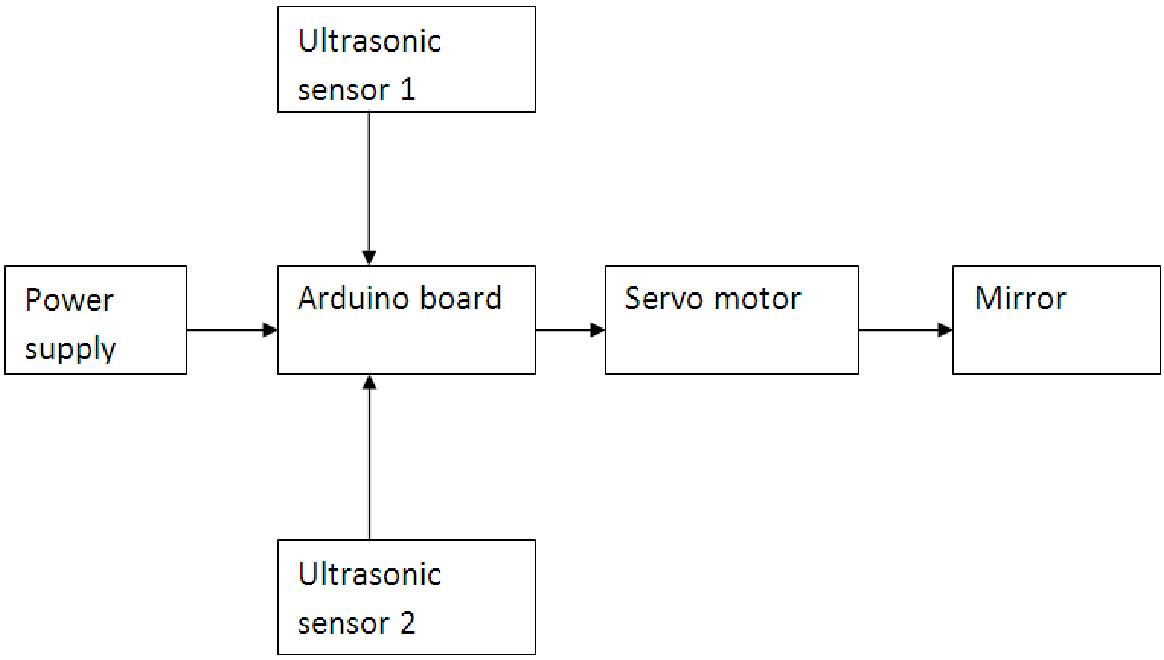

Fig. Block diagram of Interfacing between Arduino board, motor and Ultrasonic sensor

Programme

```
#include <Servo.h>
Servo myservo;
constint trigPin1 = 10;
constint trigPin2 = 7;
```

```
constint echoPin1 = 11;
constint echoPin2 = 6;
long duration1;
long duration2;
int distance1;
int distance2;
void setup() {
pinMode(trigPin1, OUTPUT);
pinMode(trigPin2, OUTPUT);
pinMode(echoPin1, INPUT);
pinMode(echoPin2, INPUT);
myservo.attach(9,600,2300);  // (pin, min, max)
Serial.begin(9600); // Starts the serial communication
}
void loop() {
// Clears the trigPin
digitalWrite(trigPin1, LOW);
delayMicroseconds(10);
digitalWrite(trigPin1, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin1, LOW);
duration1 = pulseIn(echoPin1, HIGH);
distance1= duration1*0.034/2;
delayMicroseconds(2);
Serial.print("Distance1: ");
Serial.println(distance1);
digitalWrite(trigPin2, LOW);
delayMicroseconds(10);
digitalWrite(trigPin2, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin2, LOW);
duration2 = pulseIn(echoPin2, HIGH);
delayMicroseconds(2);
distance2= duration2*0.034/2;
Serial.print("Distance2: ");
Serial.println(distance2);
if(distance1 < 5)
{
myservo.write(1);
delay(1000);
```

```
}
if(distance2 < 6)
{
myservo.write(179);
delay(1000);
}
if(distance1 > 10 )
{ if(distance2 > 10)
  {
myservo.write(90);
delay(1000);
  }


}
```

Actual Working of the Project

Set low theTrigand Echo port when the module initializes,firstly,transmitatleast10us high level pulse to the Trig pin (module automatically sends eight 40K square wave), and then wait to capture the rising output by echo port, at the same time, open the timer to start timing. Next, once again capture the falling edge output by echo port, at the same time, read the time of the counter, which is the ultrasonic running time in theair.

According to the formula: Test Distance = (high level time * ultrasonic spreading velocity in air) / 2, you can calculate the distance to the obstacle.

The basic idea behind the use of this mechanism is making use simple ultrasonic sensor and a servo motor to drive the system, sensor and motor work by programmed arduino board.

Trigger pin and echo pin of sensor is connected to pin 7 and pin 6 (PWM) of arduino board respectively. Motor signal pin is connected to arduino pin 8 (PWM).

An ultrasonic sensor works on the principle of when they measure distance by using ultrasonic waves, the sensor head trigger an ultrasonic wave and receives the wave reflected back from the target by echo.

This allows the sensor to sense the distance of the object on its specified range (10cm to 150cm), this will turn the trigger ON on the Arduino board and ultimately turn the motor to the 90 degree angle cc or ccw.

Working

The phenomenon when actual test on the project was carried on has been discussed on the basis of the three cases of the running of the project. One can clearly get the knowledge of how the project will run by just taking a glance on the further explanation.

Case 1: Mirror in normal position

In this case, the mirror is in the initial position, where no object is approaching the mirror or no object is in the close vicinity of the mirror of the sensor. Hence, in this case, there will be no rotation of the mirror from its in itial position, since the ultrasonic sensor connected to the mirror for sensing of the barrier or obstruction, has not sensed any of those and hence does not send any signals to the Arduino board and ultimately to the servo motor for rotation and the mirror stands still.

Case 2: Object approaching from rear side

In this case, the object approaches the mirror from the back side of the arrangementi.e. when the car is moving on the road and when some other cartries to overtake the vehicle, then this case comes into picture.

At such times, the ultrasonic sensor located at the back end of the mirror mounting is activated since it senses the direct object coming into its range. It sends the signals to the arduino board and the arduino board finally actuates the servo motor, by rotating it by 90° in the direction opposite to the direction of approaching object and hence collision is avoided.

Case 3: Object approaching from front side

In this case, the object approaches the mirror from the front side of the arrangementi.e. if the car is travelling and when the object or barrier comes from the front side of the car into the range of the front side mounted ultrasonic sensor, it senses the object immediately and sends signals to the Arduino board, which in turn sends signals to the servo motor, which rotates the mirror in the opposite direction of the approaching object, in 90° and avoids the collision.

Fig. Case 1: Mirror in normal position

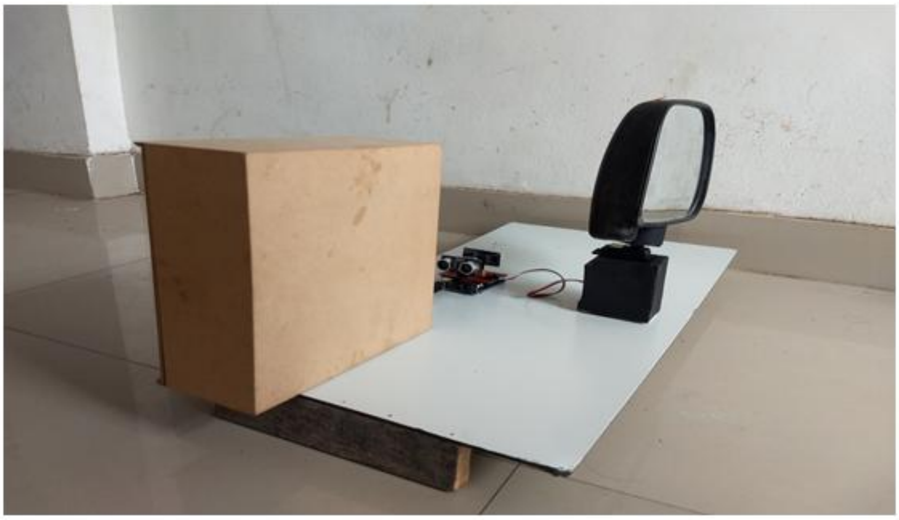

Fig. Case 2: Object approaching from rear side

Fig. Case 3: Object approaching from front side

IV. Simulation

As shown in below interfacing diagram, Trigger pin 1&2 of sensor is connected to pin 10 and pin 7 (PWM) of Arduino board respectively, and echo pin 1&2 of sensor is connected to pin 11 and pin 6 (PWM) of Arduino board Motor signal pin is connected to Arduino pin 9 (PWM). There are three capacitors are used in interfacing, two capacitors are connected to the ultrasonic sensor having capacitance 10uF, and other capacitor is connected to the servo motor having capacitance 1uF. An ultrasonic sensor works on the principle of when they measure distance by using ultrasonic waves, the sensor head trigger an ultrasonic wave and receives the wave reflected back from the target by echo. This allows the sensor to sense the distance of the object on its specified range (10cm to 150cm), this will turn the trigger ON on the Arduino board and ultimately turn the motor to the 90 degree angle cc or ccw.

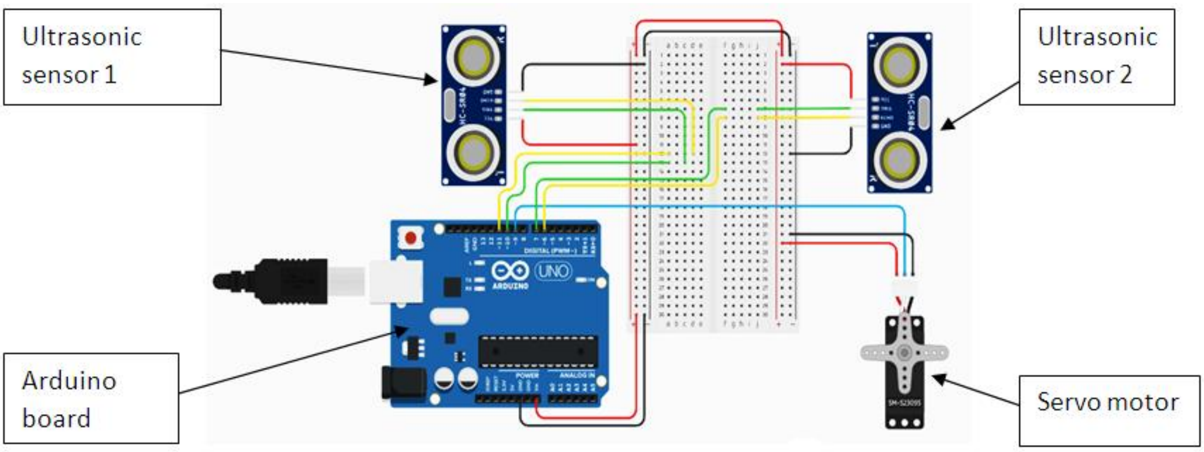

Fig. Interfacing of Arduino UNO, Ultrasonic sensor & Servo motor

Sr. No.	Parameter	Color
1	Voltage input (Vin)	**Red**
2	Ground (Gnd)	**Black**
3	Signal (5V)	**Blue**
4	Trigger pin (trigPin1=7, trigPin2=10)	**Green**
5	Echo pin (echoPin1=6, echoPin2=11)	**Yellow**

V. Conclusion

1) Use of ultrasonic sensor as a sensing medium is more accurate and economical than any other sensors available in the market.
2) Servo motors used in the mechanism is more sturdy and has a quicker response when actually tested on the workbench.
3) Arduino boards as expected give the exact output. It is the most simplest electronic interface we can use in our system, to run the mechanism.
4) By interfacing of these elements into one system, the response time of the system is great and the system works smoothly without any substantial errors.
5) Whenever any object comes into the close range (10-150cm) of the ultrasonic sensor, it sends electrical signals to the Arduino board. The Arduino board is so programmed, that whenever it receives electrical signals from the ultrasonic sensor, it interprets the signals and sends the signals to the motor by the interface between them i.e. the bread board and the motor, after the signals are received, rotates by 180 degrees.
6) The motor is so programmed that when any object comes in between 150-200 cms of the ultrasonic sensor, the motor just rotates by 45 degrees and when the object comes in the close vicinity of 60-150cms, the motor rotates by 180 degrees, which is the ultimate rotational point of the motor.
7) When the object moves away from the ultrasonic sensor, the motor reverts back to its initial position.

References

[1]. Martin Olsson, Designing and Optimizing Side-View Mirrors, Masters Thesis, Chalmers University of Technology, Gothenburg, Sweden 2011. pp.1-66
[2]. Habibovic A, Andersson J, Malmsten Lundgren V, Staf H, Sundberg N, Traffic Safety and Automated Vehicles, RISE Victoria, Scania CV, Stoneridge Electronics, 2017, pp.1-19
[3]. Morten Elkjaer, Svend Emil Mosbaek, Automated Rear View Mirror, Department of Architecture, Design & Media Technology Niels JernesVej12- 14, 2011, pp.7-12
[4]. 10.13189/ujca.2014.020106, Iran, 02.01.2006, Auto-adjusting Wing Mirrors Angles System Based on Fuzzy Logic Control, 2014.
[5]. Ser. No. 654,210, United States, Apr. 22, Automobile Mirror,1957.
[6]. 5,793,542, United States, Aug. 11, Automobile Mirror Assembly,1998.
[7]. NeerajaSoni,Sarita,ShrikantMaheshwari,BasantkumarSahu,BhavishyaJain, GarimaShrivastava, Distance Measurement using Ultrasonic Sensor and Arduino, YITM, Rajnandgaon, India, 2017, pp.5991-5992
[8]. A. K. Shrivastava, A. Verma, and S. P. Singh, Distance Measurement of an Object or Obstacle by Ultrasound Sensors using P89C51RD2, International Journal of Computer Theory and Engineering, Vol. 2, 2010, pp.64-68.
[9]. https://en.wikipedia.org/wiki/Ultrasonic_transducer https://www.theengineeringprojects.com/wp-content/uploads/2017/07/ATmega328-Pinout-768x571.png