International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Interfacing and Programming Arduino for the Automatic Vehicle Diversion with Anti-Collision and Warning System in EV's

[1]Dr. S. Chiranjeeva Rao, [2]G. Nagaraju, [3]D. Sai Shree, [4]G. Dharmendra, [5]B. Uday Kiran, [6]Ch. Sampath Vinayaka and [7]G. Danalakshmi

[1,2,3,4,5,6,7]Department of Mechanical Engineering, GMR Institute of Technology, Rajam, Srikakulam-532127, Andhra Pradesh, India

ABSTRACT:

India, is a country in which every year approximately 1.5 lakh people die in road accidents. Human error, road conditions, over speed are the main causes of road accidents. The vehicle diversion with collision avoidance and warning system can be automated with an Arduino-based coding implementation. This is the technology that helps to prevent vehicle collisions. Here an attempt is made for such type of system which uses an ultrasonic sensor to detect the objects present in the vicinity of the vehicle, it calculates the distance from the obstacle and then sends the signal to Arduino. The Arduino triggers the warning system and also reacts as per the coding to divert the vehicle in a specified path. In difficult situations, the vehicle is trained to decide to stop which minimizes the loss.

Keywords: Collision avoidance, Ultrasonic sensor, Arduino UNO, and Motor driver (L293N)

1. Introduction:

The rate of road accidents is alarming the world. A considerable amount of work has been done in the field of autonomous vehicles and collision avoidance over the past few decades. Because human safety is considered an essential one rather than anything which lead to the development of automobile electronics. Automobile electronics is the integration of electronic systems in the vehicle for the improvement of vehicle performance, driver's safety & comfort and to minimize the rate of road accidents.[1][2]

Traditional vehicles don't provide safety when compared to electronic-embedded vehicles. In automotive systems, more and more equipment is being changed from mechanical systems to electronic systems. The integration of the embedded system in the vehicle led to many innovations like airbag systems, GPS, anti-lock brake systems, fuel injection controller systems, etc.[3] Hence, to provide safety and minimize accidents the Automatic vehicle diversion with an avoidance system and warning system is designed.

Ultrasonic sensors are used in these systems to detect objects in the environment, alerting the driver to take necessary evasive action. Ultrasonic sensors are also used to detect obstacles in the environment, allowing the system to calculate the distance between the vehicle and the obstacles. This allows the system to provide an accurate warning to the driver in the event of an imminent collision. If there is a chance for collision then the vehicle automatically takes a diversion to avoid potential hazards and even if there is no space for diversion then the vehicle automatically stops.[4][5]

1.1 Past Studies:

A dynamic path-finding method with obstacle avoidance is presented which utilizes distance-measuring sensors to avoid obstacles and reach the goal destination using the desired path(Hansine Hansens veg et.al).

The potential field algorithm is the basic algorithm to determine the desired acceleration to avoid the collision, so pedestrian collision avoidance systems by using automatic electric braking control in intersections to prevent accidents(Masao Nagai et.al).

Maximum accident reduction was achieved when using the automatic system, the adaptive system was able to achieve a better balance between safety and the driver's ability to perceive and avoid risky situations(H.Muslim et.al).

It is observed that collision is going to occur in 1 sec or less, assuming that the time necessary to practically generate the automatic action is around 0.3-0.4 sec. Otherwise, it is supposed that a warning generation strategy could be activated.

The real-time collision avoidance control algorithm can avoid the problem of velocity window compared to the dynamic window approach(Wang et.al).

The results demonstrated significant improvements in accuracy and specificity with added visual and physiological features for crash prediction to avoid vehicle collisions. Results supported the effectiveness of crash prediction by quantifying drivers' risky states as inputs(Yutao Baa et.al).

GPS module plays a crucial role to identify the accuracy of the robotic vehicle's auto-navigation movement. Microcontroller acts as the main program which performs the mathematical algorithm and calculations.

This paper is intended to achieve the following objectives:

1. To develop a low-cost automobile with collision avoidance with the help of embedded systems.
2. To develop an automobile that will automatically warn the driver in case of obstacles (pedestrians, walls, vehicles) in front of the vehicle.
3. To develop a system that will overtake the preceding vehicle.

1.2 The Existing System:

1. Collision Avoidance System:

Based on the past papers, it is known that the vehicle will come to a stop position if there is a chance for collision (obstacles present in front of the vehicle). It directly comes to the stop position without any prior indication to the driver. It is the main drawback of a collision avoidance system.

2. Warning System:

Based on past papers, it came to know that the warning system provides only an alert to the driver if any obstacles present or occur suddenly. It doesn't perform any automatic function to avoid accidents or collisions. The main drawback of this system is the entire function will succeed if and only if the driver is conscious of the warning otherwise the accident occurs.

3. Diversion System:

Based on past papers, it can be identified that the diversion system depends on the driver to take the diversion.

1.3 The Proposed System:

The proposed system is a collaboration of a collision avoidance system, warning system, and diversion system. The proposed system increases the effectiveness of the vehicle and the accuracy of preventing accidents. This system alerts the driver about the coming obstacles so that he can act accordingly. This system is equipped with automatic diversion instead of sudden stopping which minimizes the stopping time of the vehicle. If the distance between the vehicle and the obstacle is too low and there is no chance for diversion then the vehicle stops automatically to avoid a collision.

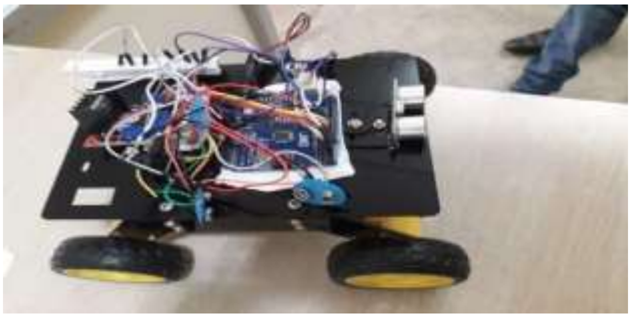

Figure-1: Fabrication of the system on vehicle

2. Methodology Used:

The design of the system produced during the project's design phase is revealed in the figure, which had to be properly implemented during the project's implementation. The widespread adoption of automated technology in an automobile has shown to be cost-effective. The proposed system is capable of transforming automobiles and has an impact on the automobile industry. As a result, this project has been a system-based expert or non-expert approach to monitor the roads for detecting obstacles and acting accordingly.

The methodology adopted is shown in flowchart:1 which describes the entire process in which the system consists. It consists of problem identification and collecting data accordingly. After studying each system an integrated circuit is prepared. An algorithm is prepared for the project. According to the algorithm, code is written in embedded C and it is checked in Arduino IDE software and it is uploaded into Arduino UNO. After that check whether the fabrication is working correctly or not. Then test the project and an analysis of the results is done.

Problem identification & Collection of related data

↓

Study of the individual system (Collision system, Warning system, Diversion system)

↓

Combining all 3 systems & Preparing an integrated circuit diagram based on the project

↓

Prepare a project algorithm

Distance > 30 cm	Distance > 15 cm && < 30 cm	Distance < 14 cm
↓	↓	↓
Vehicle runs	The vehicle overtakes the obstacle and gives a visible warning to the driver	The vehicle stops and gives both visible and audible warnings to the driver

↓

Fabrication and assembly of components on the test rig

↓

Preparation of code and dumping code into Arduino UNO

↓

Analyzing the working of the project and preparing results

Flow chart-1: Methodology used

3.Fabrication:

The design of the circuit is shown in figure:1 which gives a brief idea about the components used and how they are connected.

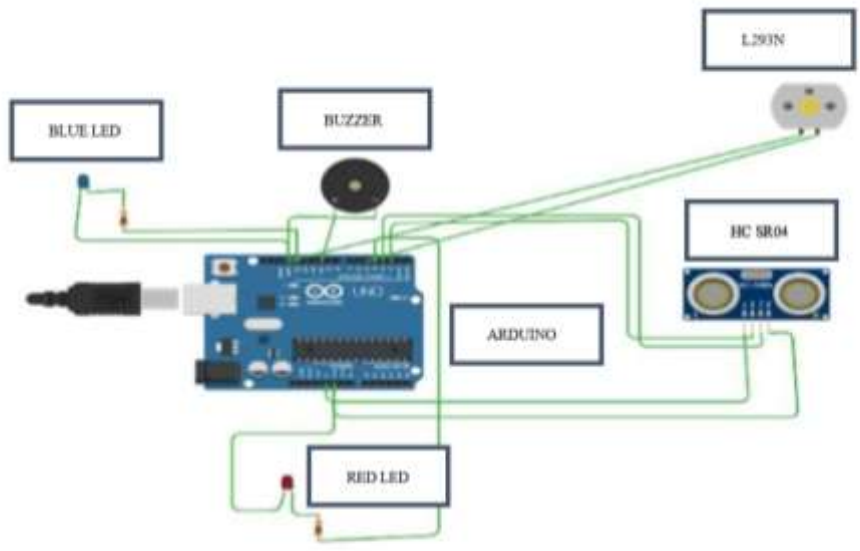

Figure-2: Circuit diagram

Connections:

□ Connecting ultrasonic sensor to Arduino:

- Trig pin to 6

- Echo pin to 7
- VCC to VCC
- GND to GND of Arduino

 Connecting motor driver pins to Arduino:

- In1 to 2
- In2 to 3
- In3 to 4
- In4 to 5
- enA to 9
- enB to 10

 Connecting LEDS to Arduino:

- Connect the red led one pin to 11 pins of Arduino with a resistor and the other to the GND of the breadboard
- Connect blue led one pin to 12 pins of Arduino with a resistor and the other to the GND of the breadboard

 Connecting buzzer to Arduino:

- Connect the +ve terminal of the buzzer to 13 pins and the –ve terminal to the GND of Arduino.

3.1 Algorithm for the Code:

- Step-1: START
- Step-2: DECLARING THE VARIABLES(PINS)
- Step-3: void setup()
- Initialization of the libraries, variables used for the code
- Step-4: void loop()
- This function keeps on repeating the instructions and actively controls and monitors the Arduino
- Step-5: if(distance_cm>25)
- Vehicle moves
- Step-6: else if(distance_cm>=15 && distance_cm<=25)
- The vehicle takes a right turn and a blue LED glows
- Step-7: else
- The vehicle stops and a redLED glows along with a buzzer tone
- Step-8: STOP

3.2 Coding part:

```
int origin = 6;
int echoPin = 7;
int in1 = 2,
in2 = 3,
in3 = 4,
in4 = 5;// motor driver pins
int enA=9, enB = 10;
```

```
int ledR = 11, ledB = 12, buzzer = 13;
float duration_us, distance_cm; void setup()
{
Serial.begin(9600);
pinMode(trigPin, OUTPUT);
pinMode(echoPin, INPUT);
pinMode(enA, OUTPUT);
pinMode(enB, OUTPUT);
pinMode(in1, OUTPUT);
pinMode(in2, OUTPUT);
pinMode(in3, OUTPUT);
pinMode(in4, OUTPUT);
digitalWrite(in1, LOW);
digitalWrite(in2, LOW);
digitalWrite(in3, LOW);
digitalWrite(in4, LOW);
digitalWrite(buzzer,LOW);
digitalWrite(ledR,LOW);
digitalWrite(ledB,LOW);
}
void loop()
{
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW); //measure duration of pulse from ECHO pin
duration_us = pulseIn(echoPin, HIGH); // calculate the distance
distance_cm = 0.017 * duration_us; // print the value to Serial Monitor
Serial.print("distance: ");
Serial.print(distance_cm);
Serial.println(" cm"); if (distance_cm > 25)
  {
digitalWrite(ledB, LOW);
digitalWrite(ledR,LOW);
digitalWrite(buzzer,LOW);
 front_Normal();
 }
else if (distance_cm>=15 && distance_cm<=25)
{
digitalWrite(ledR,LOW);
```

```
digitalWrite(buzzer,LOW);
front_Half_Speed();
  }
else if  (distance_cm>=8 && distance_cm < 15)
 {
 right();
  }
else if (distance_cm < 8)
  {
Stop();
digitalWrite(ledR, HIGH);
digitalWrite(buzzer, HIGH);
delay(2000);
  }
} void front Normal()
{
Serial.print("Robot moving Forward");
digitalWrite(in1, HIGH);
 digitalWrite(in2, LOW);
digitalWrite(in3, HIGH);
digitalWrite(in4, LOW);
analogWrite(enA,100);
analogWrite(enB,100);
}
void front_Half_Speed()
{
  Serial.print("Robot moving Forward with Half speed");
 digitalWrite(ledB, HIGH);
 digitalWrite(in1, HIGH);
digitalWrite(in2, LOW);
digitalWrite(in3, HIGH);
digitalWrite(in4, LOW);
analogWrite(enA,50);
analogWrite(enB,50);
}
void right()
{
Serial.print("Robot moving right");
digitalWrite(in1, LOW);
```

```
digitalWrite(in2, HIGH);
digitalWrite(in3, HIGH);
digitalWrite(in4, HIGH);
analogWrite(enA,25);
analogWrite(enB,25);
delay(1000);
digitalWrite(in1, HIGH);
digitalWrite(in2, HIGH);
digitalWrite(in3, LOW);
digitalWrite(in4, HIGH);
delay(1000);
digitalWrite(in1, HIGH);
digitalWrite(in2, LOW);
digitalWrite(in3, HIGH);
digitalWrite(in4, LOW);
}
void Stop()
{
  Serial.print("Robot Stopped ");
 digitalWrite(in1, LOW);
 digitalWrite(in2, LOW);
digitalWrite(in3, LOW);
 digitalWrite(in4, LOW);
}
```

4. Results and Discussion:

The system gives both audible and visible warnings to the driver if any object is approaching the vehicle. If the distance between the vehicle and the object or obstacle is close then the vehicle is automatically taking a diversion by giving a visible warning to alert the driver. If the distance between the vehicle and the object or obstacle is too closer then the vehicle automatically comes to a stop position by giving both audible and visible alerts to the driver.

The system is tested at different distances which are shown in serial monitor of Arduino IDE software listed in table-1:

Table-1: System performance at different distances (distance between vehicle and object)

Si. No	Distance (cm)	Vehicle condition	Red LED (ON/OFF)	Blue LED (ON/OFF)	Buzzer (ON/OFF)
1	33	Vehicle run	OFF	OFF	OFF
2	25	Vehicle overtake	OFF	ON	OFF
3	13	Vehicle stop	ON	OFF	ON
4	22	Vehicle overtake	OFF	ON	OFF
5	40	Vehicle run	OFF	OFF	OFF
6	38	vehicle run	OFF	OFF	OFF

5. Conclusion and Future Scope:

Overall, the project likely involved a significant amount of work and required expertise in a range of areas, including mechanical engineering, electronics, and software development. By building and testing this system, a contribution had been done to the development of new technologies that can help make vehicles safer and more efficient in the future.

In conclusion, the system represents an important step forward in the development of automated safety systems for vehicles. The system that was designed and built has the potential to save lives and prevent accidents, and the work is a testament to the power of engineering and technology to improve our world

Certainly! The future scope of the project on the design and fabrication of an automatic diversion system for vehicles with collision avoidance and warning systems is quite promising. Here are some potential avenues for further development and research:

1. Integration with other safety systems: The project focused on an automatic diversion system with collision avoidance and warning systems. In the future, you could consider integrating this system with other safety systems, such as lane departure warning or blind spot detection systems.
2. Improving accuracy and reliability: As with any safety system, accuracy and reliability are critical. You could explore ways to improve the accuracy and reliability of your system, such as using more advanced sensors or refining the algorithms used to detect potential collisions.
3. Scaling for different types of vehicles: The project likely focused on a specific type of vehicle. In the future, you could consider scaling the system for use in different types of vehicles, such as commercial trucks or buses.
4. Real-world testing and validation: While likely tested the system extensively during the fabrication process, further testing and validation in real-world scenarios could help to refine the system and ensure that it works effectively in a range of situations.
5. Commercialization: Finally, it could consider the commercial potential of the system. With further development and refinement, it could potentially be marketed to automakers or other companies involved in the development of automated safety systems for vehicles.

Overall, the project has the potential to pave the way for further development and innovation in the field of automated safety systems for vehicles. The future scope of this project is wide open, and there are many exciting avenues for further research and development.

References:

1.Changrui Ren, F.: collision avoidance system in the road traffic environment using gsm/GPS, International Journal for Research in Applied Science & Engineering Technology 7(11), 698-704 (2016).

2. Pongsathorn Raksincharoensak, F., Masao Nagai, S: Autonomous Braking Control System for Pedestrian Collision Avoidance by Using Potential Field.In; 7th IFAC Symposium on Advances in Automotive Control The International Federation of Automatic Control 2013, vol.634, pp.4-7, Tokyo, Japan (2013).

3. H.Muslim, F., M.Itoh, S.:Trust, and Acceptance of Adaptive and Conventional Collision Avoidance System, In; IFAC conference papers archive (IEEE) (2019), volume;52,pp:55-60.

4. Erik Coelingh, F., Andreas Eidehall, S, Mattias Bengtsson, T,: Collision Warning with Full Auto Brake and Pedestrian Detection – a practical example of Automatic Emergency Braking, Annual Conference on Intelligent Transportation Systems, vol(52), pp-5-11, Madeira Island, Portugal, (2010)

5. Dr.Yogesh Misra, F,: "A textbook of Programming and Interfacing with Arduino", 1st edition CRC Press, Taylor & Francis Group, GMRIT(2022).