

## Sensor Fusion for Obstacle Detection using Machine Learning

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### Abstract :

*Now-a-days accident is a major concern. One of the reason behind the deaths of people is due to accidents which happens when the vehicle is in high speed, heavy rain, wrong driving, improper turns, drunk driving, etc. There are multiple techniques also used to detect the obstacle but accident was not prevented successfully and those methods were not useful. In this paper the system using fusion of sensors like ultrasonic sensors, power steering sensor described and this is attached to the embedded system. When there is a possibility of an accident this sensors will detect the obstacle and alert the driver. The machine learning is used to train the system , so as to detect the sudden change in the axes of vehicle with threshold sensing.*

**Keywords :** Obstacle detection, Arduino, ultrasonic sensor.

### I. INTRODUCTION

In present days the rate of accidents are increasing rapidly. Due to increase in population the usage of vehicles are increased, because of this peoples are going under risk of their over speed and accidents are happened. To reduce the accident rate, the technique Sensor fusion for obstacle detection using machine learning is introduced. The main aim is to detect and prevent the accidents which involves Ultrasonic Sensors which will detect the coming vehicles, Accelerometer(ADXL-345) to measures the static acceleration in tilt sensing and to detect the sudden change in the axes of vehicles, Adapter is used to increase the range of ultrasonic sensor. when the obstacle comes from other side this sensors will detect the obstacle and alert the driver by blowing the buzzer and this method is cost effective and time efficient. The accident can be detect by ultrasonic sensor which is used as major module in the system.

Another system had ultrasonic sensors mounted on front and back of four wheeler but sensor position was inappropriate for detecting the obstacle resulting in less accuracy of the system. Some system used LED light for curve road which glows when vehicle comes from the other side of the curve but it is suitable only used for curve roads. The efficiency was reduced when used on intersecting roads.

### II. LITERATURE REVIEW

The previous inventors works on the similar system. The “Automatic Road Accident Detection Techniques” was done by Usman Khalil and Tariq Javid in 2017 they used sensors that have many aims like detect the objects and check the driver health conditions such as (heard rate, drunk, & illness). In this project the addition is that the system were added by camera, RADAR and laser by (GPS) and (GSM). The main goal of this system was to save thousands of life and this system play a big role in safety technology for the vehicles. Using all these tools and technologies they made one system to avoid the accident as much as possible and send the useful report for drivers family or the police if any cause happen with driver.

“A Survey on Car Collision Avoidance System” which was implemented by Abubaker Makki Abdalla , Mohamed Abaker in 2016 that automatically detect an accident in appreciably less amount of time and sends information about accident to the emergency centre they used GSM and GPS, VANET, mobile and smart phones. They uses two ultrasonic sensors attached to the embedded system one sensor in front side and another is at the back. When accident happens this system sends information to the emergency service.

The “Traffic Jam and Accident Detection Techniques” system was made by Raveena Shaili and Sunil Pathania, for preventing accidents from the various dangerous road like narrow curve road and also

for the roads which is in remote areas. For avoiding this problem the solution is alerting the driver about the vehicle coming from opposite direction. This all done by alerting the drivers by LED light that light glows when vehicle comes from the other side of the curve. The vehicle detect by the ultrasonic sensor that are interfaced to the microcontroller and Arduino UNO. By this system we can save the thousands of live in mountain road.

The “Review on Sensor Parameter Analysis for Forward Collision Detection System” was proposed by Vaishali Gadekar and Savita Pawar which consists of radio detection and ranging (RADAR) sensor, collision avoidance system, leaser imaging detection and ranging (LIDAR) sensor, camera sensor, Azimuth -Elevation system field of view for preventing the forward collision. They assist drivers in two ways, warning and overriding accordingly to dynamic situations. Sometimes system can be complex and critical to detect collision and also due to using lots of sensors the system is complexed.

”Sensor Based Accident Prevention System” which is implemented by Aravinda B, Chaithralakshmi, Deeksha, Ashutha which detects the traffic jam and accidents on the road. This system measures the density on either side of roads and control the traffic lights accordingly. It is implemented with the help of the image taken from the camera or mobile phone using image processing.

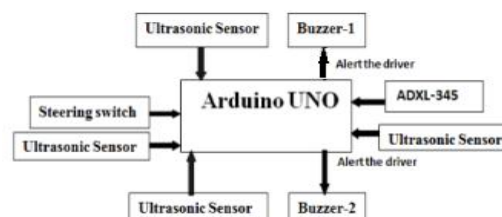
The proposed system using fusion of sensors to detect obstacle and avoid accident is described in next section.

### III. PROPOSED SYSTEM

This system proposes a method using ultrasonic sensor technology that will detect the vehicles or obstacle and alert the driver with the help of buzzer about vehicles that approaches on all sides using four ultrasonic sensors attached to the embedded system. One ultrasonic sensor is placed at the front side of the vehicle and another one in Back, Right and Left side of the vehicle. When the ultrasonic sensor detect the obstacle in 2 meters range this will alert the driver by blowing buzzer below fig 3.1 shows the hardware design of Arduino UNO which is programmed by using Arduino 1.8.1 IDE tool which is open source software. Programming can be done by using embedded C.

The main advantage of ultrasonic sensor is that it provides highest reliability in getting proximity and has lesser absorption than Radio and Infrared frequencies. To extract this information, it uses different sensors (Ultrasonic sensor, Accelerometer, power steering sensor, driving switches) to acquires road traffic data followed by detection and clarification of vehicles. The main aim of this system to avoid loss of life, this system play a big role in safety technology for the vehicle.

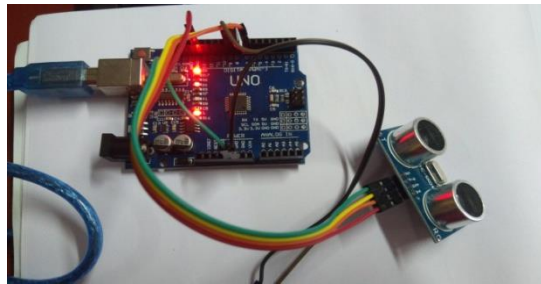
#### Experimental Setup :-



**Fig 3.1: Hardware Setup of obstacle detection.**

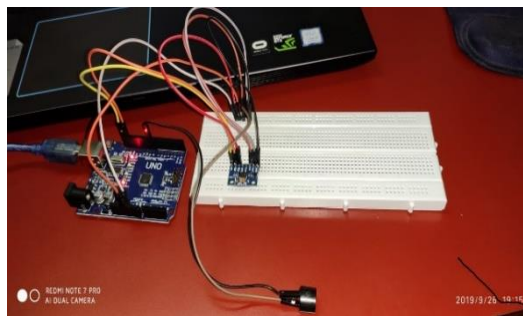
In this system Arduino is used for controlling the whole process with Accelerometer(ADXL345), Ultrasonic sensor, buzzer. Four ultrasonic sensors attached to the embedded system, One ultrasonic sensor is placed at the front side of the vehicle another are in back, Right, Left side of the vehicle, accelerometer(ADXL-345) detects the sudden change in the axes of vehicle with threshold sensing, which measures the static acceleration in tilt sensing it detects the sudden change in the axes of vehicle, The default axes values of the vehicle will be stored.if the axes values are found different

with the default values the system will alert the driver by blowing the buzzers and driver accident can be prevented.



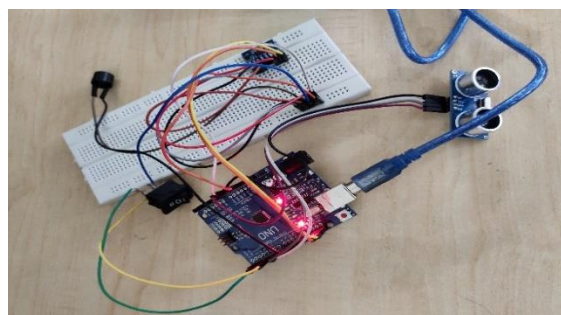
**Figure 3.2 : Interface of Ultrasonic Sensor and Buzzer**

The first module is about interfacing of ultrasonic sensors and buzzer to determine the distance between two vehicles or obstacles and displaying the distance on the serial monitor with the help of Arduino IDE Software. In that speed is directly proportional to the range of ultrasonic sensors. For ex. if the speed of vehicle is low then the range of ultrasonic sensor is low otherwise it is high if the speed is high.



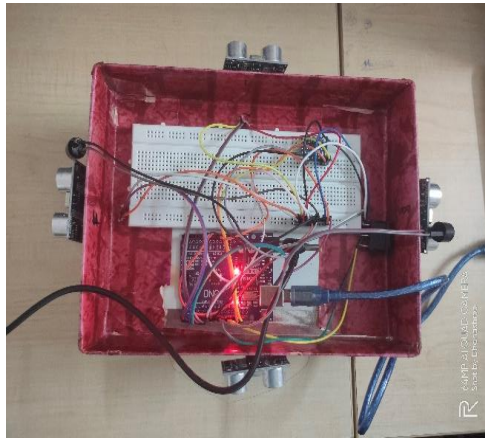
**Figure 3.3 : Interface of Accelerometer(ADXL-345) and Buzzer**

In second module, the interfacing of Accelerometer is done with the help of threshold value which measures the static acceleration in the tilt sensing. It detects the sudden change in the axes of vehicle and alert the driver by buzzer.



**Figure 3.4 : Interface of Ultrasonic Sensor ,  
Accelerometer(ADXL- 345),Buzzerand  
Steering Switch.**

Third module is interfacing of Ultrasonic sensor, Buzzer, Accelerometer(ADXL-345) and Steering Switch is done. Accelerometer(ADXL-345) is used to measures the static acceleration in tilt sensing and to detect the sudden change in the axes of vehicles. The role of machine learning in this system is based on the Bayes Network classifier. Ultrasonic sensor is used to detect the distance between two vehicles and ADXL-345 used x, y and z patterns with threshold value for detecting the rash driving of car. x pattern is used for zig-zag driving, y pattern is used for bumping of car and z pattern is used for round driving. If above patterns will detect in car then the buzzer blow to alert the driver.



**Figure 3.5 : Interface of Four Ultrasonic sensors, Buzzer, Accelerometer(ADXL-345), Steering Switch and Adaptor**

The above diagram shows the interface of four Ultrasonic sensors, Buzzer, Accelerometer(ADXL-345), Steering switch and Adaptor.

#### **IV. OBSERVATION**

Due to rapid increase accident rate, the accident prevention is more necessary. So, a sensor fusion to detect the obstacle using machine learning will be helpful. To prevent the accident this system uses ultrasonic sensor, ADXL-345 which detect the obstacle in all four sides and alert the driver by means of buzzer which will blow when there is an chance of accident and prevent the accident. The main purpose of this system is to save lives of people.

#### **V. CONCLUSION**

The various techniques of accident detection and prevention are discussed such as Ultrasonic Sensor based method, GSM and GPS, VANET, mobile and smart phones. The purpose of this system is to decrease the number of accidents on road. The object is detected by the help of ultrasonic sensor which is interfaced to the Arduino UNO. This system will be helpful to save thousand of lives.

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