Collision Avoidance System in Heavy Traffic and Blind Spot Assist Using Ultrasonic Sensor

Babu Varghese[1], Renju Thomas Jacob[2], Fajas Kamar[3] and Rizwan Ali Saifudeen[4].

School of Electronics Engineering, VIT University, Vellore, India
babualumkan@gmail.com[1],renjujacob_88@yahoo.co.in[2],fajazz@gmail.com[3],rizwanalisaifudeen@gamil.com[4]

ABSTRACT

By this project, the goal is to design a collision avoidance system which is reliable for drivers in heavy traffic where the speed is generally below 20 km/hr. the purpose of the automatic collision system is to keep drivers better informed with the environment surrounding them. The system consist eight different sensing positions front, rear, side and as well as front and rear diagonal positions. Primarily ultrasonic sensors, microcontroller and a set of LEDS are used to implement the design. The blind spot assist will be useful while changing the lanes in highway, it finds presence of vehicle which is in your blind spot and gives alarm. The success of the proposed system can reduce human suffering caused by injury and death. The financial burden will be reducing because maintenance and replacements of parts of vehicle are avoided. Ideally the system should be installed in every automobile on road.

Keywords*: Ultrasonic sensor, Arduino, blind spot, Lane change assist.*

INTRODUCTION

The collision avoidance and blind spot detection plays a key role in drive safety because the presence of the blind spot on both sides of vehicle causes inconvenience to the driver while he changes the lane . The proposed system also avoids the possibility of collision and scratches of the vehicle in heavy traffic where the speed is below 20 km/h. In India about 75% of the vehicle collision is been detected under low speed. Low speed collision in heavy traffic indicates the need of the anti-collision device which is well suited for driving in city premises. The rear end collision contributes more, so the proposed system keeps the driver in alert mode in order to prevent the collision. The proposed system makes use of the ultra sonic sensor for both the collision as well as blind spot detection because of three advantages. 1) The cost is less compared to radar, lidar or cameras and is well suited for automobile application. 2) The distance calculation is very much simpler and does not need any complex computation. 3) Surface measurement of the sensor is large. The ultrasonic sonic sensor can be used to detect the object in drivers blind spot at an absolute speeds around 160km/h. The schematic block diagram of the proposed system is shown below (figure 1). It consists of ultrasonic sensor which senses the object in the preset range, arduino platform which manipulates the data which is received from sensor. Next comes the data presentation part in which it alerts the driver when the vehicle comes in the preset range. Buzzer has been implemented to give the sound warning and LED can be used as light warning

SYSTEM OVERVIEW

A) PRINCIPLE OF SENSING

The Ultrasonic sensor works on the principle of transmitting ultrasonic burst which is well above the human hearing range. It provides an output pulse which gives the measure of time required by the burst to hit and bounce back to the sensor which is termed as echo time pulse. The sensor emits 40 kHz burst which can travel in air at about 1130 feet/second. The time when the trigger pulse is given to the sensor it emits the ultrasonic burst and echo pin is get set. The echo pin resets when the sensor detects the echo of the burst, thus the pulse width of the echo is the measure of twice the distance between the sensor and the object.

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Corresponding Author: Renju Thomas Jacob, Email ID: renjujacob_88@yahoo.co.in

Figure A.1

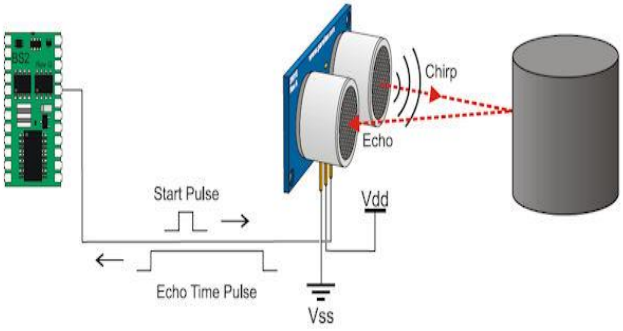

Figure A.2

The distance to the object can be found out by formula given below.

$$D = 0.5 * C * (T1-T0)$$

D = Distance to Object.

C = Speed of Sound.

T0 = Time at which sonic wave is transmitted.

T1 = Time at which sonic wave is received

In dry air that is 0% humidity at 20 °C (68 °F), the speed of sound is 343.2 meters per second (1,126 ft/s). Temperature dependence in velocity of sound in dry air is given by,

$$c = 331.3 \text{ (m/s)} * (1+T/273)^{1/2}$$

The value 331.3 m/s, which represents the speed at 0 °C or 273.15 K. The figure A.1 shows the 4-meter ultrasonic sensor what we have used in our system and figure A.2 demonstrates how it works.

B) COLLISON AVOIDANCE USING ULRASONIC SENSOR

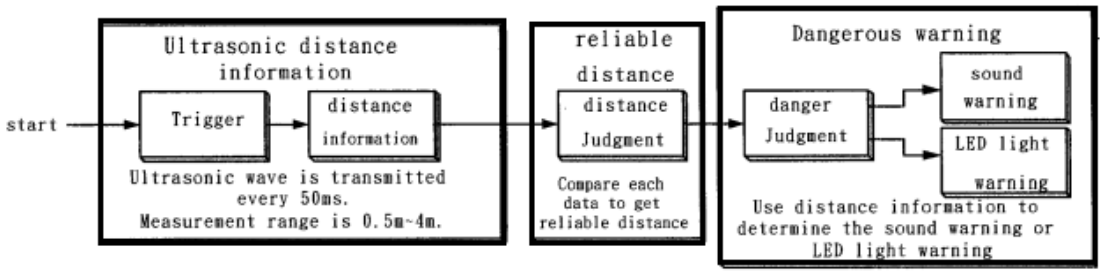

Figure B.1

The figure above showed is for the collision Avoidance system block diagram. It is divided into Three Parts mainly consisting of Ultrasonic distance information, reliable distance judgment and warning system. In Ultrasonic distance information block consists of the trigger followed by distance information unit. The trigger is provided from the Arduino board and the ultrasonic sonic sensor is transmitting sonic burst continuously for every 50ms. The measurement Range is Up to 4m. Reliable distance block is nothing but the judgment of the distance compared with suitable data's. It is followed by the warning block which consist of sound warning for which done with a buzzer and light warning which blinks the LED. The ping sensor is interfaced

with arduino which exactly analyze the data and coming with danger judgment. Arduino is nothing but a physical computing platform with open source based on a microcontroller board.

C) BLIND SPOT

Blind spot in a vehicle can be termed as the area around the vehicle which is not directly observed by the driver while in his control. In other words blind spot is an area that can't be seen by the driver in his mirror while cruising. When moving off the blind behind the driver's left and right side is important. Figure C.1 shows the outline of a host car (which is installed with a blind spot assist) with sensor cones shown and the blind spot is shown with orange color. So here the sensor placements must be in such a way that the cone of the sensor should cover maximum area of blind spot. The logic is so designed that the same sensor can work in high speeds as lane change assist and in heavy traffic at low speeds the range has been reduced to detect collision. Figure C.2 shows a vehicle approaching in to the blind spot of a host vehicle.

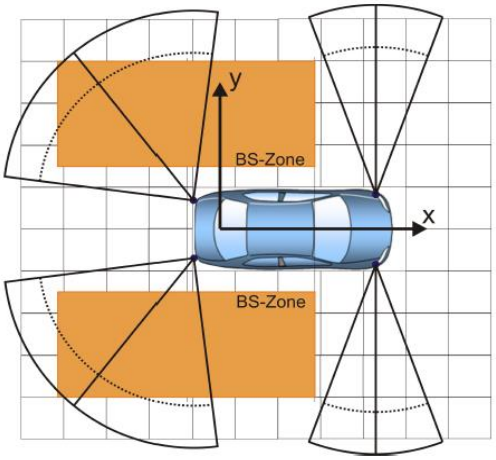

Figure C.1

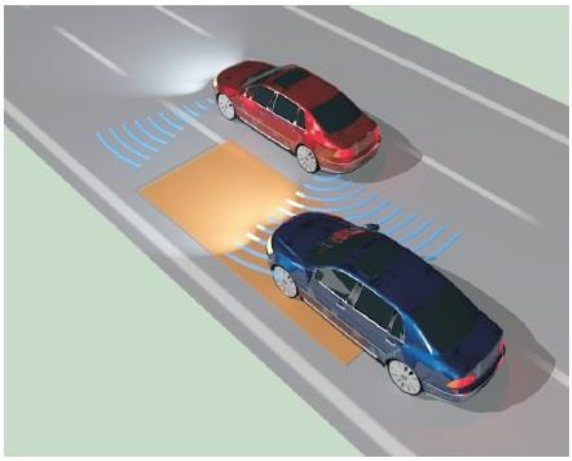

Figure C.2

D) EXPERIMENTAL SETUP AND RESULTS

The Ultrasonic sensor works according to the preset distance. For heavy traffic the range is set to be 10 inches and for the blind spot detection range has to be increased up to 3.5 m which will diagonally cover the blindspot zone, rear and lateral. The setup shown in figure can display "TOO CLOSE" message and will give a buzzer and LED display when approaching vehicle is in the range. The LED can be mounted on the rear view mirror indicating the position of the approaching vehicle.

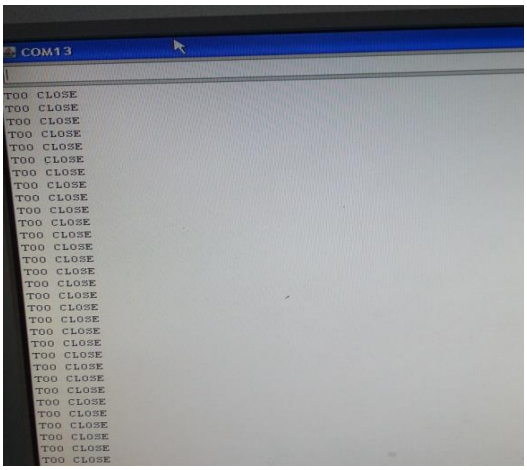

Figure D.1

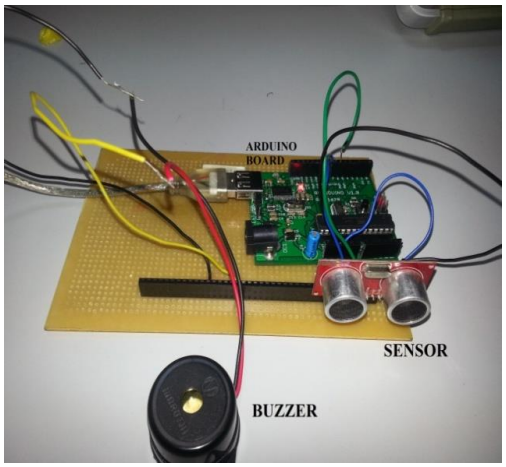

Figure D.2

SENSOR POSITIONING

The position of the sensor varies according to the dimension of the vehicle. Generally for a passenger vehicle we need to use 8 ultrasonic sensors all around the body. In front we place 3 sensors which are within a range of 10 inches to detect proximity in heavy traffic, 1 at the middle of the rear side also set with 10 inches range. The sensors placed at the sides of the rear side has to switch from collision detection to lane change mode, so those 2 sensors are logically controlled with two ranges of 10 inches and 3.5 inches. Along the lateral sides of the vehicle at least one sensor will be required, these sensors also cover blind spot zone so that its range should be switched as said above.

CONCLUSION

The design part and the implementation of the ultrasonic sensor for collision avoidance and blind spot have been developed. Test has been carried out and results shows that the sensor is able to detect the object for both static and dynamic situations. The range of sensor in heavy traffic is set to be 10 inches and in blind spot detection mode it is set to be 3.5 meters. Under the test condition the design could give expected results. As a future expansion the design can be implemented with logic which can control the steering wheel while lane change and automatic applying of braking can be done with collision detection in heavy traffic.

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