Collision Avoidance System

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Abstract— In order to avoid accidents on highway roads, it is essential to maintain safe distance between vehicles which is referred as "Inter-Vehicular Distance". A warning system should be employed inside the vehicle, so that the vehicle could sense the distance between other vehicles by using ultrasonic sensors on all the four sides of the car. This paper presents an ultrasonic automatic braking system for collision avoidance accompanied by comprehensive and suitable breaking depending upon the external conditions. This system consists of ultrasonic sensors which are made up of ultrasonic wave emitter and ultrasonic wave receiver. The ultrasonic wave emitter is provided in all the four directions of the car, producing and emitting ultrasonic waves in a predetermined distance from the car. Ultrasonic wave receiver is also placed besides the ultrasonic receiver, receiving the reflected ultrasonic wave signal from the obstacle. In order to get the distance between vehicle and the obstacle the reflected wave (detection pulse) is measured. A graphical LCD is used to display and alert the driver through an audio module about the incoming distance and threat of an accident. Then arduino is used to control the motor based on detection pulse information, and the motor in turn automatically controls the braking of the car. This paper presents the possible use of an accelerator pedal disengagement mechanism in this system. This solves the problem of safety in case of low visibility in an area.

Key words: Automatic Braking System, Ultrasonic Sensors, Detection Pulse, Arduino Mega, Audio Video Module for Alerting

I. INTRODUCTION

In today's world, wireless communication is increasing day by day because of its many real life applications like Ad-hoc networks, Wi-Fi, Wireless LAN etc. The demand of wireless network is increasing day-after-day because of the limitations of wired network and this in turn leads to reduction in costs. Driving has become an essential activity for most people. The number of vehicles is increasing day by day and so is the number of accidents. Every year due to traffic accidents thousands of people lose their lives, most of which can be prevented about one-half second prior to a collision if a warning is provided to the driver. Due to perception limitations, vehicle drivers cannot react in time to the emergency events, which results in long delay in delivering warning messages and potential automobile crashes since perception limitations are mainly caused due to the line-of-sight limitations of brake lights and the driver's reaction to it .This can be avoided by passing warning messages, control messages that give information about the current status of vehicle (such as current position of location, break, indication, horn, speed,). Vehicles with wireless communication capabilities and different kinds of sensing devices help the drivers to gain real- time information about the conditions of the road thereby allowing them to react on time. In case of warning messages, control messages sent by vehicles involved in an accident enhances traffic safety by helping the approaching drivers to take proper decisions before entering the crash dangerous zone.

II. LITERATURE REVIEW

Lately Inter-Vehicle Communication (IVC) has become an extremely hot topic in network research, opening up new research challenges well beyond those of classical Mobile Ad Hoc Network (MANET) research. The management and control of network connections among vehicles and between vehicles and an existing network infrastructure is the most challenging research fields in the networking domain. In terms of Vehicular ADHOC Network (VANET), Inter-Vehicle Communication(IVC), Car-2-X (C2X), or Vehicle-2-X (V2X), many Vehicular Ad-hoc Networks (VANETs) are wireless communication networks that provide interesting roadside services such as safety of vehicles, traffic congestion, alternate routes, estimated time to destination, and in general improves the efficiency and safety on the road such as Collision Warning, collision avoidance, automatic control are also expected to result in a reduction of traffic accidents. Most conferences and venues have seen an increased research activity related to VANETs. Vehicular networks have been developed to improve the safety, security and efficiency of the transportation systems and enable new mobile applications and services for the traveling public. The communications are controlled by interesting and challenging applications have been visualized and realized.Dedicated Short Range Communication (DSRC) protocol, IEEE 802.15.4, ZIGBEE which is equipped with On-Board Unit (OBU).The ZIGBEE protocol got very good advantages when compared with Bluetooth in terms of power, bandwidth, cost, etc., V2V and V2I applications fall into two categories: Safety-related Information and Infotainment services. Only the security issues of safety-related applications are focused for collision avoidance in this paper since they bring challenging problems, as they are lying at the core of IVAN concept and its a matter of saving lives by preventing traffic accidents. The main characteristic of the IVAN is the absence of infrastructure, such as access point or base stations. The communication between the nodes that they are beyond of the reach of transmission of the radio is made in multi hops through the intermediate nodes contribution.

III. ULTRASONIC SENSOR BASED COLLISION AVOIDANCE

The ultrasonic sensor can be called as a transducer and are capable to send and receive signals. The principal of its operation is similar to radar or sonar which evaluates attributes of a target or an obstacle by interpreting the echoes from radio or sound waves respectively. They generate high frequency sound waves and calculate the echo which is received back by the sensor. The sensor calculates the interval

between the time elapsed between the sent signal and the received echo to determine the distance to the obstacle. Similarly knowing the distance and the time taken we can calculate the velocity of the object.

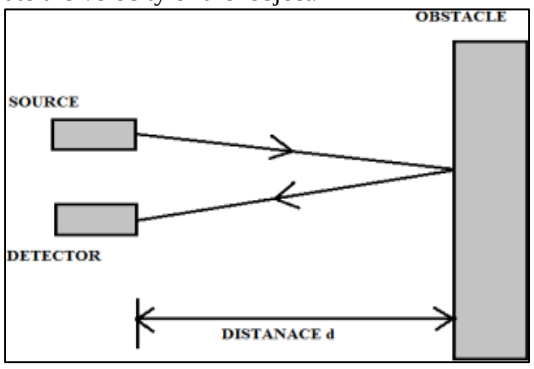

Fig. 1:

The above stated phenomenon takes place because when a sound wave in air hits a solid surface it reflects. So now if we know the speed of sound wave in a particular medium then its easy to calculate the distance. To perform this we must calculate the time taken for a pulse of sound to travel to the object and back again. The distance formula is given by (distance = speed * time). We must divide it by 2 as the distance travelled is double i.e. once while moving towards the object and the other is while the pulse returns after the deflection. Sound with a frequency above 20 kHz are belongs to the ultrasonic range and it isn't audible to the human ear.

The speed of sound in air is 330 m/s, 1500 m/s in water and 5000 m/s in metal. Hence the ultrasonic sensor calculates the distance between the sensor and the obstacle and transmits it to the system. The system after having been given the respective signal takes a corrective measurement as per the need.

IV. BLOCK DIAGRAM

The basic block diagram of collision avoidance system is given below. This system consists of four ultrasonic sensors used to transmit and receive ultrasonic signals. They are used to measure the distance between the two cars based on which the arduino would alert the driver and simultaneously display a warning message.

Further the circuitry would be expanded by using an LCD screen and a WTV020-SD audio module which would be displaying the distance between the two cars and would alert the driver simultaneously of the incoming threat when the situation presents itself. The LCD screen used would be interfaced with the Arduino by means of male and female connectors.

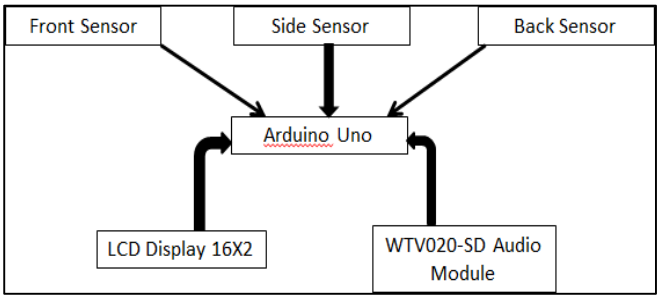

Fig. 2:

V. DESIGN AND IMPLEMENTATION

The working module of the project is so simple that it is easy to understand its working. The heart of the entire processing unit is the arduino which calculates and makes decisions as per the situation. Ultrasonic sensors are used for measuring the distance between the two moving or stationary vehicles. Four such sensors are used and their range is accordingly set so as to measure and alert the distance from of another car from the present car. Different techniques can be used to measure the distance by using ultrasonic sensors. Among them, continuous wave and pulse echo techniques are widely known.

In the continuous wave method, the ultrasonic transmitter generates a continuous output, whose echo would be detected by a separate receiver. In this scenario , accuracy depends on the measurement of the phase shift between the transmitted and the reflected wave. Although better performance can be obtained using pulse echo measurements. Hence the pulse- echo techniques are widely used in commercial systems due to less complexity of the hardware. In this method a short train of pulses is generated, enabling the same transducer to be used as a transmitter and a receiver. The measurement of distance is done using *time of flight* measurement i.e. the time taken by the ultrasonic wave to return to the receiver after being reflected from the object or the obstacle. The distance between the transmitter and the object is determined using the below mentioned equation :-

$D = (t * c) / 2$

Where,

D- Distance between the source and the obstacle c- Ultrasonic wave velocity in air

t- Time interval between pulse emission and echo detection.

Using the above equation its easy to find out the distance between the two cars and if needed the relative velocity between the two cars can be found out and the breaks would be applied automatically depending upon the conditions set to avoid an accident.

Once the arduino processes the information from all the four sensors simultaneously, it sends a command to alert the driver if the other car is in close proximity. The arduino does the above mentioned function by displaying an alert message on a 16*2 LCD screen and at the same time it alerts the driver about the incoming threat through audio warning which is sent through the WTV – 020 audio module. The audio module alerts the driver before a collision to avoid the accident to the last extent possible and also alerts the driver with a different sound for a collision from four different directions. The arduino would have predefined messages for alerting thedrive if incase there's a threat of collision from all the four ends.

Even if the driver fails to break at the correct moment there's an automatic breaking mechanism kept to apply breaks if a particular safety distance has been crossed. The car may be brought to a hold altogether and thereby preventing any chances of forward collision. Along with this the car can be equipped with a camera placed diagonally to cover for the blind spots and display the same to the driver through a suitable software which works real time and has fast connectivity

The mechanism provided is quite robust because of the presence of real time processing under the given situations and its capability to avoid accidents which couldn't be avoided earlier. This method is quite cheap and can be implemented for cars which are no so hi-tech also

VI. RESULTS

The results of the system is given below in the tabular form.

Condition	Output
Ultrasonic Sensor OFF (all 4 directions)	The car would not be able to sense the incoming impact thereby increasing risk for damage and even fatality in case of driver's negligence.
Ultrasonic Sensor ON (all 4 directions)	The Vehicle would be able to sense the distance between the obstacles and also take required action in order to avoid the collision.
WTV Audio Module OFF	The speaker wouldn't be activated to say a predefined command in case there is an incoming eminent threat which is life threatening.
WTV Audio Module ON	The module would alert the driver about the direction in which collision may happen depending upon the distance between the obstacle and the car.
LCD Screen OFF	The driver would not get any warning through the screen placed in front of him about the distance of obstacle or any other moving vehicle
LCD Screen ON	The 16*2 screen would display the distance and velocity of the incoming threat for enabling the driver to take the necessary course of action.

Table 1:

VII. CONCLUSION

In this project, we have implemented the collision avoidance system. The main objective of this project is to alert the driver by delivering the warning messages when the accidents are bound to happen. In order to sense the collision with any obstacle we have used four ultrasonic sensors which determine the distance between the obstacle and vehicle and sends it to the arduino. The arduino processes the information and it is then displayed on the LCD screen and it also converted into audio so that the driver is aware of the message. This is how the collision is avoided using ultrasonic sensors, arduino, audio module, LCD Screen.

Being a prototype, the system cannot identify blind spots. The detection of pedestrians is approximate and optimum and also vehicles coming from lateral directions would not be detected.

However the advantage is that it avoids road accidents by quickly sensing the obstruction and it operates with least efforts of the driver.

REFERENCES

[1] https://www.vsagar.org/how-to-avoid-road- accidents-on-u-turn-in-mountainous-area/ (Referred on: 21st January, 2019)
[2] International journal for research in emerging science and technology, volume-2, issue-2, february- 2015 (Referred on: 9th October, 2018)
[3] http://1000projects.org/a-vehicle-to-vehicle-communication-protocol-for-co-operative-collision-warning.html (Referred on: 14th August, 2018)
[4] https:// www.engineersgarage.com/contribution / accident-prevention-and-security-system-for-automobiles-project (Referred on: 3rd September, 2018)
[5] J. Deeksha et al int. Journal of engineering research and applications issn: 2248-9622, vol. 3, issue 5, Sep-Oct 2013, pp.1564-1568
(Referred on: 26th March, 2019)
[6] Amita Meshram et al Int. Journal of Engineering Research and Applications ISSN : 2248-9622, Vol. 4, Issue 7(Version 3), July 2014, pp.65-67 (Referred on: 18th February, 2019)
[7] https://electrosome.com/hc-sr04-ultrasonic- sensor-pic/ (Referred on: 2nd, October 2018)
[8] http://members.rennlist.com/pbanders/ecu.htm. This link refers to the technical document that contains information about electronic control unit. (Referred on: 8th August, 2018)

