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Vehicle Collision Safety Detection System

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Abstract: ***This project is about vehicle collision safety detection system using an ultrasonic sensor for a car. We use the application of electronic systems embedded in automobile which is expected to minimize the vehicle accident disaster. This project concentrates on developing a model of rear end vehicle collision avoidance system that will detect the distance between two moving vehicles, alert the driver whenever he or she is in danger range using a microcontroller.***

Index Terms: Collision Safety Detection, Safety Distance Calculation, Alarming the Driver, IOT, Vehicle Collision.

I. INTRODUCTION

Invention of automobiles was one of the greatest achievements of mankind in the past and has contributed in many ways to the growth of a nation. However, we cannot ignore the fact that thousands of people lose their life or suffer life changing accidents due to vehicle collisions every year. Nearly 75% of highway traffic accidents are caused by not keeping safety distance between moving cars and The driver's incorrect judgment for braking safety distance is the main reason to cause traffic accident in highway traffic system.

Studies have shown that if the driver is alerted half a second before a potential accident can reduce rear end accidents, road-related accidents and head-on crashes To ensure the driving safety, every country had been studied on automobile anti-collision technology in recent years. The passive safety system played a main role in the past and the active systems so-called advanced driver assistance systems will become more important as a major part in innovations for vehicles. The distance detection and safety distance calculation are the most important technologies we need in advanced driver assistance systems.

Vehicles are an important way of transportation all over the world. There are many cases of road accidents every day in the world. Such accidents create traffic jams on road from hours to days, consequently resulting loss of valuable time. Frequency of road accidents is very high which causes a lot of damage to human life and valuable properties. The number of accidents is very high in hilly and fog affected areas. Commonly many road accidents are caused by collision between vehicles due to the inability of the drivers to gauge the perimeter of their vehicles and other reason is unawareness of nearby vehicles.

A vehicle or car accident is road traffic incident which usually involves one road vehicle being in collision with, either another vehicle, or another road user, or a stationary road side object, this may result in death, injury and/or property damage. Road accidents are the third leading causes of death.

This research will be a attempt alternative solution for this known problem by developing low cost domestic anti-collision warning system model that would be mounted on the existing car models.

Therefore, rather putting aside inbuilt active safety system development to the car manufacturers, the user shall find the ways to solve the problem by developing domestic active safety system model that would be developed later to be fitted to road vehicle This paper introduce an alarming and response system for moving vehicle using ultrasonic ranging device which is a combination of a transmitter, a receiver and a single processing device and a microcontroller. The system calculates the minimum safety distance and alert the driver whenever he or she is in danger range.

II. EXISTING SYSTEM

I. Vehicles warning system are started in 1950s.The first ever

II. Collision detection was Cadillac.it was deemed too costly for manufacture. One of the current vehicle detection collision was AEB systems which will detect the possible collisions with the car in front. It works with sensors which detect the vehicles. a system to retrieve the data from sensors and a braking system which can work autonomously.

III. Pre-collision systems include small radar detectors placed near the front of a car, where the detectors constantly emit high-frequency radar waves. These waves will bounce off the closest objects and return to the sensor. Evaluation systems connected to the sensor measures the time taken for the signal to hit the object and will bounce back. The system uses this information to determine the exact position and speed of the vehicle instantly.

IV. Certain systems provide alarm signal to notify the driver that a collision may happen, while others have pre-crash brake systems that apply additional pressure to the vehicle's braking system to help the driver in slowing down the car and avoiding a potential accident.

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V. Once the airbag control unit determines or detects an accident, it transmits a signal to an inflator system. The inflator is activated to produce an explosion of nitrogen to fill up the airbag. As the airbag fills up, it bursts through the panel in which it was present and enters the space inside the car to provide a cushioning system for the occupant. As a result, the occupant is prevented from being thrown up forward during an accident.

VI. After the crash, the airbag will control unit cuts the fuel supply, unlocks the door and suspends the electrical power supply.

VII. Accidents involving heavy goods vehicles (especially coaches and lorries with trailers) occur all frequently despite calls for responsible behavior, for respect of the loading regulations and the highway code, as well as the obligation for drivers to adapt to their speed, which affects stopping distances, to the traffic and weather conditions (rain, ice, fog, etc.). The prevention of road accidents is extremely important and will be ensured by strict laws, by technical and police controls, ongoing training for drivers (especially those involved in the transport of hazardous substances) and, if need be, by legal and administrative penalties for those responsible.

VIII. It is up to them to limit the resulting damage as much as possible. Passengers should obey the directives of the personnel on board (protective and rescue measures) and behave as they are instructed by the regulations on disaster situations, especially air, rail or maritime disasters.

Defensive driving is the best solution to prevent road accidents and can save a lot of money and time while keeping the roads safe at the same time. Defensive driving can help you navigate most traffic conditions and also help you anticipate any mishaps. Driving in the city is has become increasingly difficult with the number of cars rising with each passing day. Here are the some systems currently to avoid road collision

A. Current Collision Detection Systems

There are a number of vehicle features that could considered as collision avoidance technologies. Some of the most common and promising systems are listed as below:

Forward collision avoidance system – It alerts the driver when the vehicle is getting near to another vehicle in front of it. It employs various sensors such as camera, RADAR or LIDAR to sense the objects or other vehicles in front of the vehicle. A forward collision warning system provided with autonomous braking may reduce the speed of the vehicle thereby mitigating the effect of collision.

Adaptive cruise control - Adaptive cruise control(ACC) maintains the vehicle's pre-set speed. It automatically slows down the vehicle in traffic to maintain a safe gap. Forward mounted sensors keep track of the distance to the vehicle at the front end. The vehicle accelerates to maintain the preset cruise speed as traffic speeds up.

Lane departure warning and prevention system – This system employs cameras to track the position of vehicle within the lane and alert the driver if the vehicle is in danger. Certain systems offer haptic warnings such as seat or steering vibrations and while some others provide audible and/or visual warnings.

Blind spot detection system - The sensor network system monitors the blind spots at the front, side and rear areas of the vehicle. Most of the systems provide visual alerts appearing on and near the side view mirrors upon detecting the blind spot.

An audible alert is activated when the driver signals a turn, and the vehicle is headed towards the blind spot on the turning side. Certain systems also activate the steering controls or brake to maintain the vehicle in its lane.

Park assist and back over prevention system -assists drivers to park and back up their vehicles. Rear object detection systems make use of the sensors and cameras to enable the driver to look for the objects in the rear side of the vehicle while backing up.

Adaptive headlight alert drivers to visualize objects better on dark and curved roads. The headlight pivots in the direction of a moving vehicle to illuminate the road ahead based on the biasis of vehicle's speed and steering wheel movement.

III. METHODOLOGY

The proposed method of vehicle collision safety detection System is mainly composed of distance measurement of front object, calculating safety distance, alarming driver and respond to driver's action

A. Ultrasonic Transmitter

Before transmitting the ultrasonic waves transducer is used to generate the ultrasonic waves. The transducer is given a signal to intermittently produce ultrasonic waves. After that the ultrasonic transmitter sends the waves at a predetermined distance frontward. The maximum range for which the obstacle can be detected depends on the range of ultrasonic sensors used.

B. Distance Measurement using URD

The distance between the sensor and the front object is calculated by

$$s = c \times t / 2$$

Where s is the distance

c is the velocity of sound and tis the time of flight.

C. Safety Distance Calculation

The calculation of safety distance Ds is made by following calculation:

$$Ds = v\,(tpr)+(v^2)/2\,\mu g$$

Where Ds: Minimum safety distance

g: gravity

v: vehicle's current speed

μ: friction factor

tpr: perception-reaction time

System Architecture

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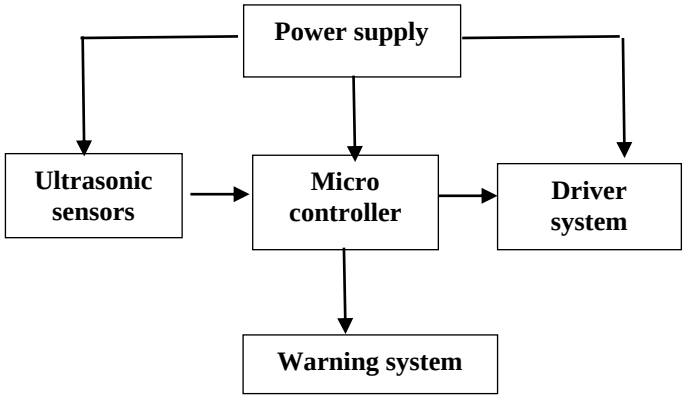

Fig.1 Collision Safety Detection System

Obstacle Sensing Unit

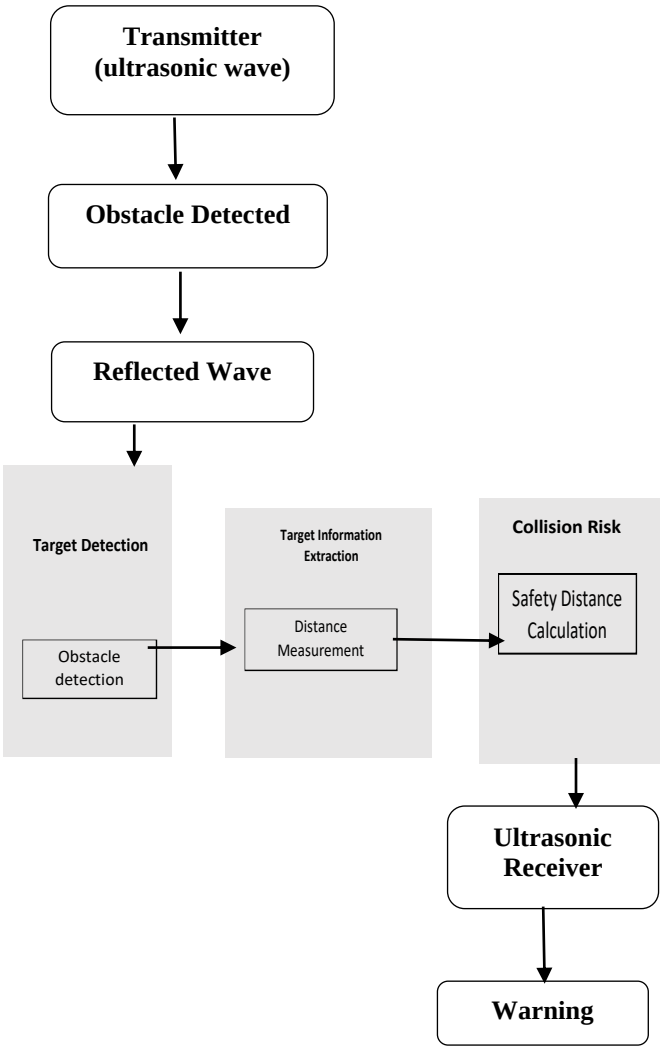

Fig.2 Obstacle Sensing Unit

D. Ultrasonic Receiver

If ultrasonic wave detects the obstacle, it will produce a reflected wave. An ultrasonic receiver is used for receiving the ultrasonic waves reflected from obstacle. The received ultrasonic wave is converted into a reception signal with the help of a transducer. The signal is amplified by an operational amplifier. The amplified signal is compared with the reference signal, to detect components in amplified signal is due to obstacles on the road.

E. Alarming the Driver

When the distance between front object and driving vehicle is less than the minimum safety distance, then a buzzer will alarm the driver indicating the possible collision.

IV. INTRODUCTION TO VARIOUS COMPONENTS USED

A. Ultrasonic Sensor

Ultrasonic Sensor (HC SR-04) module is low cost, high performance sensor and provides stable and high ranging accuracy. It's ranging distance is 2cm to 350cm with 3mm accuracy. This module includes ultrasonic receiver, transmitter and control circuit. The module is low cost, accurate, and easy to interface with a micro-controller. The HC-SR04 range makes it ideally suited for developing object detection and avoidance schemes

B. LCD

Our vehicle monitors are designed to be used for variety of applications that are not limited to automobile use. Universal car LCD monitor are designed to work on 12 volts

C. Microcontroller

D. Present project is designed using 8051 microcontroller in this Project it is proposed to design an embedded system. GPS and GSM modem will also gets activated which are interfaced to the same microcontroller.

E. Accelerometer Sensor

An accelerometer is an electromechanical device it is used to measure acceleration forces. Such forces may be static and Acceleration is the measurement of the change in velocity

V. RESULT & DISCUSSIONS

To evaluate the accuracy of the vehicle tracking and distance measurement, a car right in front of our car is prepared as the tracking target, and the distance is measured by our method and compared to the real distance sampled by a laser sensor. The test is carried out in various situations: driving speed can be low or high, while the distance can be near or far . It can be seen that the error grows notably when the distance is over 40, but the maximum relative error is still under 5%. This is mainly because as the distance increases, feature points become more and more obscure and hard to match with each other, thus the generation of new bounding box is interfered. Fortunately, handling for those faraway vehicles isn't necessarily very urgent, thus errors to this extent are often tolerable. When the distance is near, the accuracy is quite satisfying.

VI. CONCLUSION

The main focus of future is safety and automation of vehicle. Though the vehicles of today are not equipped with this system, through this project we have detected distance between two vehicles and calculated the safety distance, by which warning is given to the driver and taken actions depending upon vehicles reaction by which collision avoidance is achieved successfully using the system.

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Although this project is done using a simple prototype, it can be implemented on actual cars also, as the basic concepts remain the same.

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