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Vehicle Tracking Using Event Data Recorder (IoT) and Collision Avoidance through Auto Emergency Braking

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***Abstract*— In recent days, the occurrence of accident in India is being increased day by day. Where, the count of people who lose their life and get injured in accidents is drastically high in Tamilnadu. This is mainly due to carelessness of people while driving and because of people who do not follow traffic rules. Thereby in order to avoid accidents an Auto Emergency Braking system is fitted inside an automobile along with Ultrasonic sensors and infrared sensors fitted to the front end of the tyre. So that this system will avoid collision occurrence by maintaining a distance say about, 5m and the speed of the automobile gets reduced to the desired rate automatically. It is also helpful in situation to detect any obstacle or when a person is crossing the lane nearby where Auto Emergency Braking system will be applied. This collision avoidance can be possible only at the front end. In case of occurrence of collision at the rear end, then an device called Event Data Recorder which is likely to act as Black Box is placed in a vehicle along with the sensors like accelerometer, contact switch, vibration sensor, steering potentiometer are connected to record the parameters of the vehicle during the time of accident say about 10s before and after the crash and the information at the time of crash will be transmitted via Internet of Things platform and the data's will be stored in a cloud. Hence, the vehicle can be tracked and details can be retrieved when required and will be useful during any investigation purposes.**

***Index Terms*— Auto Emergency Braking (AEB), Event Data Recorder(EDR), Internet of Things(IoT).**

I. INTRODUCTION

Accidents are becoming very frequent and unavoidable in a current scenario. The cause for such accidents varies in reason like over speed, driver's negligence and other causes. In India, every year about 1, 30,000 people lose their life due to accidents. Approximately, of about 4, 00,000 people get injured severely.

In 2009, in India, around 4, 21,600 accidents have been occurred according to the road safety survey. In which 1, 26,896 people have lost their life and 4, 66,600 people have been injured. Whereas in the year 2013, the count of accident has been drastically increased to 4, 43,000. Where the people who lost their life is around 1, 37,423 and people got injured is about 4, 69,900.

Accidents due to 2 wheelers are around 34%, 28% of accidents occur due to car, taxi, tempo, and 11% of accidents occur due to buses and 2% of accidents are due to pedestrians. Therefore it is essential to monitor the vehicles and avoid accident. Therefore, a system monitoring the speed and other desired automobile parameters can be installed in the automobile to warn the driver appropriately and also control if necessary.

An accident avoidance system is an automobile safety system designed to reduce the severity of an accident. Sensors would be needed to alert the car to road or weather conditions to ensure safe traveling speeds.

Some cars come equipped with sensors to determine if an obstacle is near and sounds an audible warning to the driver when it is too close. General Motors has stated that they will begin testing driverless cars by 2015, and Volvo has begun to develop an almost-autonomous 'road train' system for highways which could be integrated in cars by 2020.

Event Data Recorders (EDRs) record a range of vehicle data over a short timeframe before, during and after a triggering threshold and are typically used to record information about road traffic accidents.

The use of AEB can alert the driver to an imminent crash and help them use the maximum braking capacity of the car and apply the brakes independently of the driver if the situation becomes critical. It is important to note that AEB systems are designed to support the driver only in emergency situations and that the driver remains responsible for the vehicle at all times.

II. AUTO EMERGENCY BRAKING (AEB) TECHNOLOGY

Auto Emergency Braking (AEB) is a vehicle safety technology has the potential to prevent a crash or reduce the impact speed of a crash.

AEB systems use sensors, lasers or cameras to monitor for risk and detect potential collisions with other vehicles, pedestrians or hazards. Although AEB systems vary in their functionality, most systems will provide a warning (audible and/ or visual) to the driver.AEB systems will also intervene and the brake the vehicle automatically if the driver does not respond. Some systems will also charge the brakes in order to provide the most efficient braking and prepare the vehicle for collision by pre-tensioning the seatbelts. Crash avoidance systems can be classified into three main categories:

1. Low Speed system – this version targets city driving where crashes often occur at low speeds but can cause debilitating injury such as whiplash injuries. Typically, these systems look for the reflectivity of the vehicles and are not as sensitive to pedestrians or roadside objects.

2. Higher Speed System- this version typically utilizes long range radar to scan further ahead of the vehicle (up to 200 meters) at higher speeds.

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3. Pedestrians-these versions use a camera combined with radar to detect vulnerable road users through their shape and characteristics. The way in which pedestrians move relative to the path of the vehicle is calculated to determine whether they are in danger of being struck.

The effectiveness of AEB has been investigated in a number of studies and a range of effectiveness was found. But the overall trend is a reduced number of crashes for vehicles equipped with AEB. There is limited real world performance data available for AEB at the current time, particularly in Victoria and Australia. Of the real world data available (Schittenhelm, 2013), the results indicate that:

- 53% of all rear end collisions could be mitigated in crash severity
- 35% of rear end crashes could be avoided completely.

In addition, an Australian AEB simulation project estimates that AEB has the potential to reduce fatal crashes by 20-25% and injury crashes by 25-35%.Research utilizing insurance claims data have also found that forward collision avoidance systems, especially those that brake autonomously, showed the biggest claim reductions of 10-14%.

AEB often works with other technologies in the car in order for the vehicle to respond to an emergency situation as efficiently as possible. Emergency Brake Assist specifically works to increase the breaking pressure in order to assist the driver to stop the car as quickly as possible. Emergency Brake Assist does not detect hazards so it relies on the driver to detect the hazard and respond. Many AEB systems will work with Emergency Brake Assist technologies to detect the hazard and apply maximum braking force.

III. EVENT DATA RECORDER TECHNOLOGY

An event data recorder or EDR is a device installed in automobiles to record the information related to vehicle crashes or accidents. In modern diesel trucks, EDR'S are triggered by the engine faults which is sensed electronically (often called faults), or a sudden change in speed. One or more of these situations may occur because of an accident. Information from the EDR is collected after the crash and analyzed to help determine what the automobile were doing before, during and after the crash. The event data recorders are nothing but a simple read-write memory, which is similar to the "black box" found in the flights.

EDR data provides accurate and reliable information on the timing, chronology and actions taken in the pre-crash phase. This provides hard data where there are currently only estimates, and means that accident reconstructions and research can utilize this higher quality information to make better, more robust conclusions. These in turn could be used to support measures to improve road safety as well as enhancing the understanding of the causes of accidents. This is important for improvements to secondary safety, but also for the effective implementation of active safety technologies and protection of vulnerable road users. Use of data from active systems could also inform on positional relationships between road users in the pre-crash phase.

3.1 BACKGROUND

An EDR is a device mounted in a vehicle that will record objective information about a collision that will enable the Police, accident investigators, manufacturers and researchers to understand better the causes of collisions and what may be done to mitigate them. An EDR records only information associated with an event that is, or is suspected to be, a collision. An EDR typically records information about vehicle systems immediately before during and after a collision; the total recording time is typically less than 30 seconds.

An EDR is thus explicitly different to other in-vehicle data recorders such as driver or journey monitoring devices. These latter systems typically record data about the vehicle and its location continuously, typically sending data to a central server via the mobile phone network. Many retrofit systems, particularly in the fleet and insurance markets, include both driver/journey monitoring and EDR functionality.

Many of the standard components of modern vehicles monitor and record information about the vehicle, e.g. for use in the maintenance of the vehicle. Indeed, some of this is already mandated in Europe and elsewhere to facilitate the monitoring of vehicle emissions performance. Other systems that may store information include electronic stability control systems (ESC), engine and transmission electronic control units (ECUs), cruise control module, and deployable restraint system control modules. Some of this information may be of use in accident investigations and there is an extensive literature on the access to, validity of and limitations of the data in these systems, with some companies specializing in the extraction and interpretation of this data for legal cases

Fig. Collision Avoidance

IV. PROPOSED SYSTEM

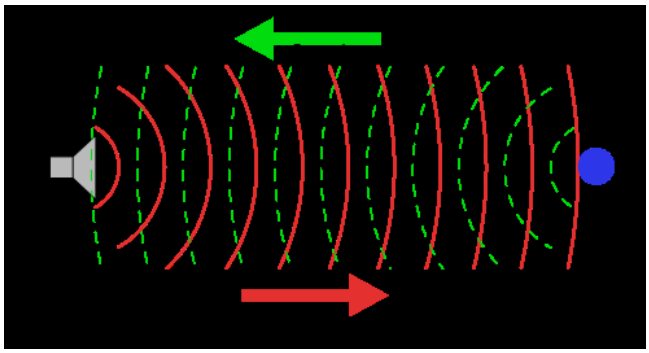
In automobile, the sensors like ultrasonic sensors, infrared sensors are fitted along with the tyre to detect the position of the obstacle.

4.1 ULTRASONIC SENSORS

The last sensor technology to be described in this chapter is the ultrasonic sensor. Polaroid ultrasonic sensors provide the means to determine the vehicle's relative distance from obstacles in the vehicle's path. Ultrasound technology is an inexpensive means to model more complicated laser based radar and microwave technologies that are currently in use around the world in several types of production vehicles.

4.2 TYPES OF SENSORS FOR TARGET DETECTION AND TRACKING

Selecting the right sensor is not a strict process. This is about eliminating all the wrong choices based on a series of question aiming to eliminate first the technology that underlying the sensor and then the product that it doesn't fit to the robot requirements. When we use the word target, we refer in the same time at a small ball, at an object like a chair, or even at a human that stay in front of the robot. To select the best sensor from a variety of products and manufacturers is a hard work especially when you're a beginner and try to build a simple robot. In few words the sensor has to be selected in concordance with your targets size, shape and range. All of these three features have to be on the same line with the specification of the robot. But even so, it is hard to define the best sensor since the performance and precision of this depend on many factors.



4.3 INFRARED SENSOR

An infrared sensor measures the IR light that is transmitted in the environment to find objects by an IR LED. This type of sensor is very popular in navigation for object avoidance, distance measured or line following applications. This sensor is very sensitive to IR lights and Sunlight and this is the main reason that an IR sensor is used with great precision in spaces with low light. On capturing a target in the left range, the left LED connected to the relevant IR LED will illuminate, when a target is captured in right range, the right LED, will illuminate and when a target is captured in the left+ right range, both LED's will illuminate. The rays reflected from the target to the IR receiver, which has a photo transistor. The positions of three IR sensors are perpendicular to a path to follow. A robot provided high illumination light to detect the navigation black line on white background and get a good video quality.

4.4 INTERFACING AND ULTRASONIC SENSORS

The working principle of an ultrasonic sensor is simple and use high-frequency sound waves that are evaluated when the sensor received back the waves. To determine the distance between the robot and object, the sensor measures the elapsed time between sending and receiving the waves shown

Fig. Wave sensor

Apart from these sensors other sensors like contact switch, steering potentiometer, vibration sensor, accelerometer are connected to the vehicle which in turn is connected with controller board say Freedom Development Platform board so that all the sensors fitted in the car is connected to its port. This setup is powered with its power supply with transmitter and receiver which act as an EDR. This setup will be active when accident is about to occur and when crash has occurred the desired parameters like seat belt has buckled or not, speed of the vehicle at the time of crash, whether the brake has been applied or not are transmitted through IoT platform and are stored in cloud. Thereby the data's when required can be retrieved for investigation purposes and so on. As AEB is fitted in the vehicle, it maintains a distance while travelling and thereby ultrasonic sensor and infrared sensor will detect the obstacle and if any obstacle is detected then automatically the speed is reduced and brake is applied. Thereby this avoids collision in front end.

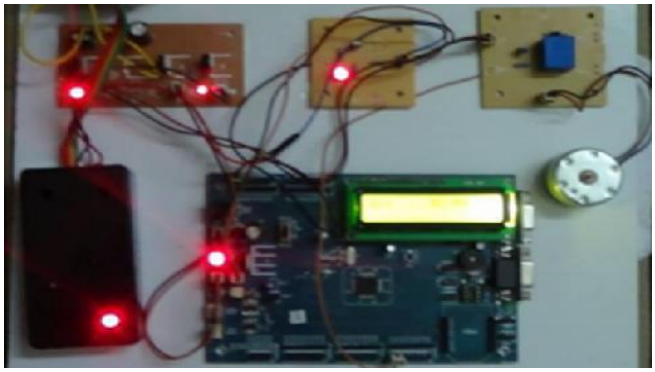


Fig. Hardware Development Board

V. VEHICLE MONITORING

Status monitoring of automobiles has become more important in recent years, especially for the sake of automobile testing. Currently real-time automobile monitoring systems are of more interest to check as many

details as possible by the means of intelligent and automatic fault detection algorithms and online analysis within the heterogeneous environment. However previous works have been used wired measuring devices or short range wireless devices like Bluetooth sensors that makes it hard to implement remote monitoring and apply heterogeneity into the system. Lack of wireless systems and devices which can monitor the parameters of vehicle is obvious in this field. Finding an optimized wireless automobile monitoring system is one of the necessities to reduce the costs and increase efficiency, therefore we try to investigate possibility of using wireless sensor based devices and wireless sensor networks to build up a wireless automobile monitoring system.

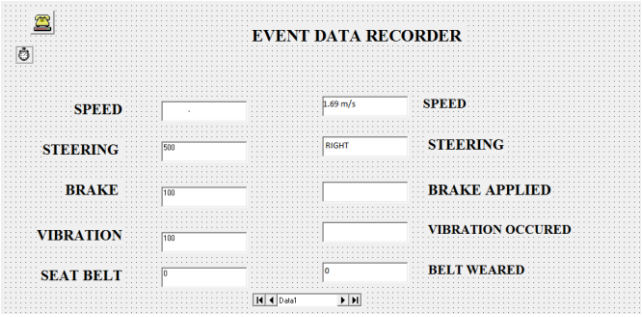


Fig. Output of EDR

VI. CONCLUSION

The project describes the importance of life of people by implementing these technologies in automobiles. This AEB system fitted in vehicle will avoid collision occurrence. The data collected and registered in case of an accident does not simply reflect the technical status of the vehicle (fuel consumption, airbag functionality) and the time of the crash, but they will also register and describe (directly or indirectly) in a dynamic way the driver's behavior (e.g., brake oil pressure at the beginning and end of braking, vehicle including during braking, engine speed, percentage throttle ,use or not of safety belts).It is useful for the manufactures, drivers (as well as other individuals affected by car accidents), owners and insurance companies, could EDR data as evidence in order to check the accuracy of witness statements in cases of litigation. Police and other enforcement authorities in charge of car safety could use the information to complement other sources of information related to a vehicle accident. Insurance companies, to cluster the consumers and offer particular tariffs. Researches, particularly vehicle and road safety sectors could use these data in order to improve the design of road infrastructures.

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