Accident Prevention System through Intelligent Transport System

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Abstract

The number of automobiles in the world increases every year and we have more opportunity to drive. In order to protect drivers and not to damage other cars and pedestrians, research and development of Advanced Safety Vehicles (ASVs) is done to applying advanced technologies to new cars. In this paper, we propose the use of sensor technology for detecting the vehicles with their speed and range. This system not only alerts the driver but controls the vehicle from accident by applying automatic braking in the vehicle and also on the other vehicles with the help of Controller Area Network as wired and Bluetooth Technology as wireless Network.

I. INTRODUCTION

An „ASV" is a vehicle equipped with the safety technology to prevent accidents. It has sensors that can detect possible danger and also exchange information about its speed and location with other cars. We will introduce to you both the current technologies in practical use and some future technologies.

In the current scenario, the world is plagued by accidents which are primarily due to human errors in judgment and hence thousands of lives are lost. These accidents can be avoided if only if there was a mechanism to alert the drivers of approaching danger.

Vehicular Communication Systems are an emerging type of networks in which vehicles and roadside units are the communicating nodes; providing each other with information, such as safety warnings and traffic information. As a cooperative approach, vehicular communication systems can be more effective in avoiding accidents and traffic congestions than if each vehicle tries to solve these problems individually.

Vehicular communications is usually developed as a part of Intelligent Transport Systems (ITS). ITS seeks to achieve safety and productivity through intelligent transportation which integrates communication between mobile and fixed nodes. To this end ITS heavily relies on wired and wireless communications.

The main motivation for vehicular communication systems is safety and eliminating the excessive cost of traffic collisions. According to World Health Organizations (WHO), road accidents annually cause approximately 1.2 million deaths worldwide; one fourth of all deaths caused by injury. Also about 50 million persons are injured in traffic accidents.

If preventive measures are not taken road death is likely to become the third-leading cause of death in 2020 from ninth place in 1990. However the deaths caused by car crashes are in principle avoidable. US Department of Transport states that 21,000 of the annual 43,000 road accident deaths in the US are caused by roadway departures and intersection-related incidents. This number can be significantly lowered by deploying local warning systems through vehicular communications. Departing vehicles can inform other vehicles that they intend to depart the highway and arriving cars at intersections can send warning messages to other cars traversing that intersection. Studies show that in Western Europe a mere 5 km/h decrease in average vehicle speeds could result in 25% decrease in deaths. Policing speed limits will be notably easier and more efficient using communication technologies.

Although the main advantage of vehicular networks is safety improvements, there are several other benefits. Vehicular networks can help in avoiding congestion and finding better routes by processing real time data. This in return saves both time and fuel and has significant economic advantages.

II. ACCIDENT PREVENTION SENSOR SYSTEM

As road safety technology evolves so too does the possibility that we might one day view regular car crashes to be a tragic aspect of the past. This is not to say that car accidents will be wiped out all together, rather that their frequency and seriousness will be minimized to such an extent as to make them a statistical rarity. There have recently been a number of promising technological innovations which point the way to the car crash prevention measures of the future. One of these mooted technological innovations is the Sensory Detector. The sensory detector would work by determining just how close a car is to a vehicle in front and adjusting the speed of it to a level which would prevent the possibility of a road accident.

A. Sensor system for driving control

This is a device which helps drivers to avoid accidents by detecting the presence of nearby vehicles, motorcycles and people and by controlling the driving speed and distance to other vehicles.

B. Warning system for mechanical problems

This is the device that gives a warning before mechanical failure or accident occurs by watching vehicle‟s conditions.

C. The blind area warning system

This is a device which detects the surrounding area while the car is turning right or left, or backing up, and gives a warning to drivers if necessary. This system can prevent accidents involving nearby objects.

ABS - This is an anti-lock braking system for the prevention of accidents caused by skidding.

D. Warning (avoidance) system for driver's danger

This system detects a driver‟s drowsiness and the influence of alcohol from his/her movements and gives a warning with bell. For further danger, it will stop the automobile automatically or the system will drive the car.

E. Seat belts, Airbags and Easy-to-use vehicles

This enhances the performance of seat belts and airbags to mitigate accidents. The research to reduce the load for drivers by improving operability or visualization of meters is also done.

F. Pedestrian injury mitigation system

Research in underway into airbags for pedestrian protection, which can detect and operate in the instance of pedestrian collision. Research is also being done into the structure and form of vehicles to protect pedestrians.

G. Shock absorption system

This is important about the prevention of serious accidents by analyzing a mechanism to stop vehicles sliding under a large truck or overturning during accidents.

H. Automatic mayday system and Automatic fire extinguisher

This is being carried out automatic notification to the police and fire station, and also automatic fire extinguishing when an accident occurs.

III. VEHICULAR COMMUNICATION

Vehicular communications is mainly motivated by the desire to implement Intelligent Transport Systems (ITS) because of their key benefits in safety and traveling ease. Several ITS institutions operate around the world to bring ITS concepts to real world. In the United States one of the main players is U.S. Department of Transportation (US DoT). The federal DoT promotes ITS through investment in potentially high payoff initiatives. One of these major initiatives, Vehicle Infrastructure Integration (VII), seeks to increase safety by providing vehicle to vehicle and vehicle to roadside units communications through Dedicated Short Range Communications (DSRC).

Two categories of draft standards provide outlines for vehicular networks. These standards constitute a category of IEEE standards for a special mode of operation of IEEE 802.11 for vehicular networks called Wireless Access in Vehicular Environments (WAVE). 802.11p is an extension to 802.11 Wireless LAN medium access layer (MAC) and physical layer (PHY) specification. As of November 2006 Draft 1.3 of this standard is approved. 802.11p aims to provide specifications needed for MAC and PHY layers for specific needs of vehicular networks. IEEE 1609 is a family of standards which deals with issues such as management and security of the network:

V2V (short for vehicle to vehicle) is an automobile technology designed to allow automobiles to "talk" to each other. The systems will use a region of the 5.9 GHz band set aside by the United States Congress in 1999, the unlicensed frequency also used by Wi-Fi.

The current state of these standards is trial-use. Standards divide the channels into two categories: a control channel and service channels as these networks have not yet been implemented, a list of such applications is speculative and apt to change in the future (However safety, which is the main purpose of these networks, will most probably remain the most important applications). Furthermore some of these applications require technologies that are not available now.

A. Vehicle to Vehicle or Vehicle to Roadside Communication

Bluetooth devices are capable of communicating with eight other devices simultaneously. We can monitor and check the speeds of eight neighboring cars simultaneously, thus preventing accidents. Thus if we have two Bluetooth enabled devices in two cars, the devices automatically communicate with each other when they come in the range of up to 100 meters. The Bluetooth radio is a short distance, low power radio operating in the unlicensed spectrum of 2.4 GHz and using a nominal antenna power of 20 dB. The modulation used in Bluetooth is Gaussian frequency shift keying, in which zeros are represented by low frequency and ones are represented by high frequency

When any car comes close together, Bluetooth device sends warning signal to the car. Based on the type of warning signal received, the system sends signal to the brake control system to slow down the speed of the car.

B. Sensor-Controller-Actuators Communication

CAN was originally designed for automotive networks, where many small sensors need to report small values frequently. CAN is a multi-master network, so each node may send its data at any time. Collision gets resolved by priority. The message with the lowest message identifier wins the arbitration process and gets through.

The Overhead per message includes an 11-bit message identifier and a 15-bit CRC. A message can contain 50% overhead or more and makes CAN very secure and reliable; especially CRC is confirmed by all nodes. If a single node reports a CRC error, all other nodes discard the message and it automatically gets re-transmitted. The typical physical medium is a twisted pair of wires and the maximum network length depends on the network speed chosen. At 1Mbps the maximum length is about 40m/120Ft. Longer distances are achievable at lower speeds.

IV. AUTOMATIC BRAKING SYSTEM

The automatic brake system is the next generation braking system for controlling the speed of the car. On receiving the control signal from the traveling car, the computer inside the car manipulates the signal and gives control signal to the braking system.

The controller constantly monitors the distance between each of these cars and when it senses that the car is getting too close it moves the hydraulic valves to increase the pressure on the braking circuit, effectively increasing the braking force on the wheels. If the distance between two vehicles is within the 100m the Bluetooth devices get enabled and if the distance comes closer within 10m the automatic braking system takes the control.

A. Electronic Wedge Brake

For each wheel, the electronic wedge brake has a control unit (see diagram above) consisting of a brake pad, a mechanical transfer system, two electric motors for precision control, and sensors to measure movements and forces. Around 100 times a second, a total of four sensors measure wheel rotation and therefore the speed of the vehicle, the forces on the brake and the position of the wedge. Whenever the driver presses the brake pedal, the system transmits the force electromechanically to the wheels, which are electronically networked with one another. Depending on the sensor readings and the braking signal coming from the driver, the two electric motors move the brake pad over a series of rollers along a slanted surface—the actual wedge. The position of the rollers on the inclined surface determines the pressure point of the brake pad. When the pad presses against the disk, the latter is immediately braked. As soon as a high braking moment is generated by increasingly powerful frictional forces, the electric motors either hold the brake pad in position or move it back over the roller bearing and into an optimum position. The distances involved are a matter of micrometers, and the response times are measured in milliseconds. The vehicle‟s onboard 12-V network is perfectly suited to driving the electric motors.

EWB only requires one tenth of the actuating energy required by today‟s hydraulic braking systems. What‟s more, it also responds substantially quicker. Given this significantly enhanced efficiency, the EWB will also have smaller dimensions and therefore reduce total vehicle weight. At the same time, there will no longer be any need for brake lines, a power brake unit or a brake fluid reservoir, which will free up a volume of around 22 l in the engine compartment and thereby give vehicle designers added scope. Using the EWB system, it would be possible to brake a trailer more quickly and in a more controlled way. In principle, any wheeled vehicle can be braked using this new system, including high-speed trains, which are currently equipped with maintenance-intensive and therefore expensive brakes.

B. Anti –Lock Braking System

A typical ABS includes a central electronic control unit (ECU), four wheel speed sensors, and at least two hydraulic valves within the brake hydraulics. The ECU constantly monitors the rotational speed of each wheel; if it detects a wheel rotating significantly slower than the others, a condition indicative of impending wheel lock, it actuates the valves to reduce hydraulic pressure to the brake at the affected wheel, thus reducing the braking force on that wheel; the wheel then turns faster. Conversely, if the ECU detects a wheel turning significantly faster than the others, brake hydraulic pressure to the wheel is increased so the braking force is reapplied, slowing down the wheel. This process is repeated continuously and can be detected by the driver via brake pedal pulsation. Some anti-lock systems can apply or release braking pressure 16 times per second.

There are four main components to an ABS: speed sensors, valves, a pump, and a controller. The controller monitors the speed sensors at all times. It is looking for decelerations in the wheel that are out of the ordinary. Right before wheel locks up, it will experience a rapid deceleration. If left unchecked, the wheel would stop much more quickly than any car could. It might take a car five seconds to stop from 60 mph (96.6 km/h) under ideal conditions, but a wheel that locks up could stop spinning in less than a second. The ABS controller knows that such a rapid deceleration is impossible, so it reduces the pressure to that brake until it sees acceleration, then it increases the pressure until it sees the deceleration again. It can do this very quickly, before the tire can actually significantly change speed. The result is that the tire slows down at the same rate as the car, with the brakes keeping the tires very near the point at which they will start to lock up. This gives the system maximum braking power. When the ABS system is in operation the driver will feel a pulsing in the brake pedal; this comes from the rapid opening and closing of the valves. This pulsing also tells the driver that the ABS has been triggered. Some ABS systems can cycle up to 16 times per second.

V. CONCLUSION

Automated highway is not yet realizable but nevertheless is an important application. In these highways the vehicles are able to cruise without help of their drivers. We need the system on the roads to lead cars safely with devices and antennas to send that receive information and signals about the condition of traffic and roads. Recently, useful automotive navigation systems have been evolving. In the future, they may direct us to the shortest way to our destination by avoiding traffic congestion and accidents. This is done by cooperation between vehicles. For example each vehicle knows the speed and direction of travel of its neighboring vehicles through communication with them.

The status is updated frequently; therefore each vehicle can predict the future up to some necessary time and is able to make appropriate decisions in appropriate time. Because automated highways are not limited by human response time, much higher speeds with very low accidents will be possible.

REFERENCES

[1] Car-to-Car Communication Consortium, "C2C-CC Manifesto, Version 1.1," August 2007,

[2] http://www.car-to-car.org.

[3] "Vehicle Infrastructure Integration (VII)," http://www.its.dot.gov/vii/

[4] http://en.wikipedia.org/wiki/Vehicular Communication Systems

[5] http://en.wikipedia.org/wiki/Anti-lock_braking_system.

[6] http://electronicsbus.com/steer-by-wire-electronic-steering-control-system-design-steering-sensors-actuators-intelligent-vehicles/

[7] http://www.youclaim.co.uk/\Anti-car crash technological innovations.htm

[8] http://www.transport-pf.or.jp/english/riku/11_mirai.html

[9] Vehicle-To-Vehicle And Road-Side Sensor Communication For Enhanced Road Safety - Andreas Festag, Alban Hessler, Roberto Baldessari,Long Le, Wenhui Zhang, Dirk Westhoff

[10] www.tpapers.blogspot.com/ accident prevention using wireless communication