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Intelligent Transport System Implementation on VANET Using Visible Light Communication (LIFI)

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Abstract: *To day Automotive Electronics sector is becoming more in demand due to its increasing technologies. CAN protocol is basically used in automobile industries for communication in Vehicular ad hoc networks. The proposed system presents the development and implementation of digital driving and automatic breaking system for avoid rear-end collision of vehicle. MEMS accelerometer sensor is used to measure static and dynamic acceleration due to moving of the vehicle. Free scale ARM microcontroller unit interfacing with MEMS and visible light communication is to support to rear-end vehicle communication and array of LED is shown that intensity level of breaking system to take decision and y control the motion of the following vehicle automatically . The CAN protocol activate the buzzer and passive safety mechanism to the driver.*
Keywords: *VANET, MEMS, Visible Light Communication, Inter Vehicle distance, rear-end collision.*

I. Introduction

Now a day's accidents occur due to mistakes done by the drivers, an intelligent system needs to be developing to overcome these mistakes. Most of the intelligent transport system has monitoring the system functions such as antilock brakes, speed sensor, vehicle position and other automated system are present in the sports and other luxury cars only, but these cars are not affordable to everyone. So a system needs to be developed which can be implemented in every car. A collision avoidance system is a system of sensors that is placed within a car to warn its driver of any dangers that may lie ahead on the road. Some of the dangers that these sensors can pick up on include how close the car is to other cars surrounding to it, how much its speed needs to be reduced while going around a curve, and how close the car is to going of the road.

The system uses sensors that send and receive signals from thinks like other cars, obstacles in the road, traffic signals and the central database are placed within the car and tell it of any traffic precautions. A situation that provides a good example of how the system works is when a driver is about to change lanes, and there is a car in his blind spot.

II. Related Works

Reducing accidents with intelligent embedded system is one of the recent developments in automotive electronics. A mechanism that not only evaluates the braking intensity of the car but also actively notifies the following cars an active intelligent diagnostic system on the car that alerts, warns and assists the driver in efficient driving and the technician with diagnosis among other available data. To detect collision avoidance in an emerging vehicular safety application the concept of CCA this is implemented by Medium Access control and the routing layer. Mobile ad hoc networks are not directly applicable for CCA [1]. By using Flooding algorithm safety broadcasting of the message can be done but a large number of vehicles in topmost hour the flooding leads to packet collision during the transmission [2].

Based on requirements of modern vehicle control area network (CAN) architecture implemented in order to reduce point to point wiring harness in vehicle automation, this describes CAN bus based network over traditional point to point schemes will offer increased flexibility and expandability for future technology insertions.

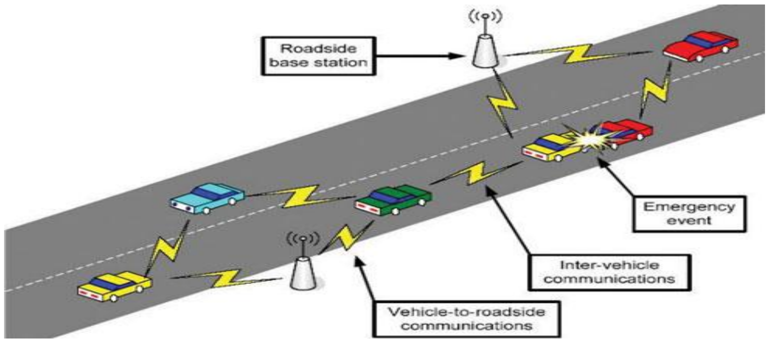

Fig: Inter Vehicle Communication.

This describes system which uses sensors to measure various parameters of the car like speed, distance from other car, presence of alcohol in car and accidental change of lane and sends a warning signal to the driver, by using the bump sensor accident is detected and SMS is send immediately GSM [3]. Architecture is developed for this paper is organized as follows; chapter III explains the proposed architecture and chapter IV explains the Digital Drive system. Chapter V explains the Collision Avoidance System and chapter VI analysis the overall statistics of the system and concludes.

III. System Architecture

The proposed architecture is organized in two parts namely as Digital drive system and Collision avoidance system, where these both units do the vehicle collision and as well senses the temperature in the vehicle, weather the driver is in the drunken state and lane direction of the vehicle. This is carried out by the individual sensors in the system. The block diagram shows the overall integration of Digital drive and Collision avoidance system,

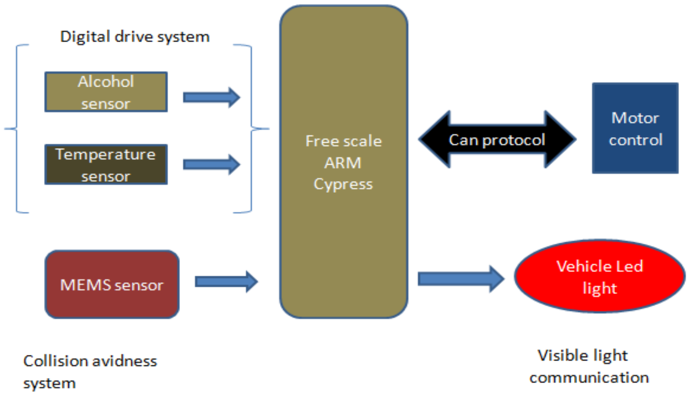

Fig: System Architecture.

In the proposed system alcohol sensor sense the drunken state of the driver weather the driver is drunk the system doesn't allow starting the engine, and the temperature sensor sense the operating temperature at the vehicle. The lane sensor detects the correct path of the vehicle. These all controls are control LED by the ARM processor with the CAN bus controlling network, the MEMS access the motion of the vehicle in three dimensional axis acceleration sensor. User could get acceleration value of X, Y and Z axis, and it is widely used in shock, slope and moving detection. Output sensitivity could be select by simply set simply set voltage level on two jumper pins. The slope of the response has to be calculated dynamically on real time by programming the microcontroller unit. It can be inferred from the plots that for the given vehicle brake system.

Information carried out from the MEMS accelerator is used for the automatic braking of the both front and rear vehicles in the network. Thus the distant between the vehicles is calculated by the speed and braking intensity of the front vehicle. The following diagram shows the vehicle distance calculation,

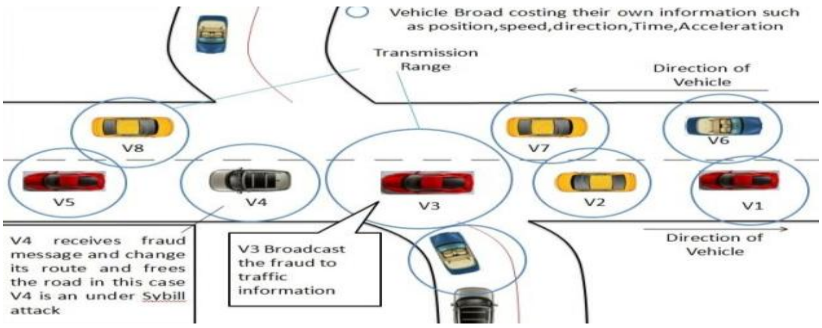

Fig: Inter Vehicle Distance Calculation.

The distance calculated between the vehicles reduce intensity of the brake when an obstacle is infront of the vehicle which should reduce the speed of the rear vehicle, the following vehicle speed is reduced by transfering the control information to the rear vehicle by the LIFI Communication through the rear braking LED placed back of the front vehicle. Thus the communication between these two is carried out rapiedly by the intensity of the light from the LED. After the information passing the vehicle can under contol with out collide to the front vehicle.

IV. Digital Drive system

An intelligent transport system consists of digital drive system and collision avoidance system. The digital drive system contains Alcohol sensor, Temperature sensor, speed sensor, lane and bump sensor.

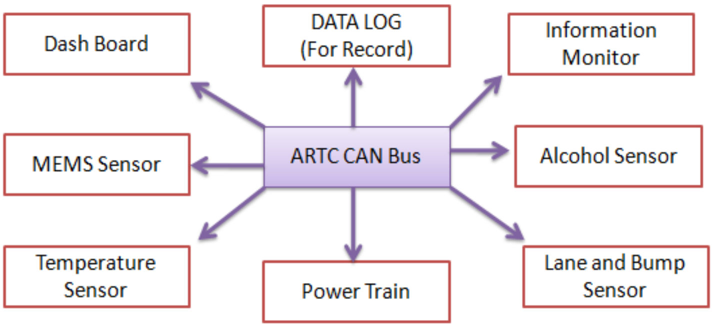

Fig: Digital Drive System Architecture.

The block diagram shows the digital system using the CAN bus, in this system MEMS is mounted on the front and backside of the car for measuring the distance between the two cars and if the distance is lesser the accident warning signal will be given to the driver on the LCD display. The alcohol sensor will sense whether the driver is drunk and it will not allow starting the car. The speed sensor will monitor the speed of the car and if found high then warning will be given to the driver by the alarm. The bump sensor detects accident then a message is send to the hospital and police station about location of the accident.

V. Collision Avoidance System

The collision Avoidance systems is constructed based on the inter vehicle distance between one to another vehicle. The distance between the inter vehicles is calculated by means of the MEMS sensor by sensing the position of the vehicle in the three dimension, hence the sensed parameter control the movement of the rear vehicle braking system. The communications between the vehicles are carried out by the visible light communication over a light source.

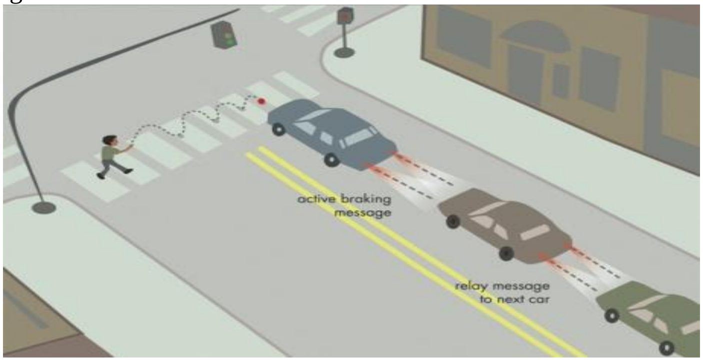

Fig: Collision Avoidance system.

The control signal coming out from the front vehicle is received by the LED of the vehicle which gives faster communication to respond the system to avoid the collision much better than the others. The main thing in the collision avoidance system is to sense the motion acceleration of the front vehicle to the obstacles and how it responds to the system for avoid collision of the vehicles.

VI. Statistical analysis

The work proposes an intelligent embedded system that assists the driver in avoiding a rear end collision with its on board diagnostics. It is a mechanism that monitors the braking intensity of vehicle and depending upon its intensity alerts the other vehicles that are immediately following. The device on the following vehicle immediately is activated to take decisions to avoid the impending collision. An accelerometer interfaced to ARM Cypress Soc microcontroller is a part of the transmitter devices that calculates the rate of deceleration and notifies the device on following vehicle by displaying it on the rear LED arrays and transmitting messages through IR communication. The receiver device is responsible to decode the message and follow a control algorithm based on many other parameters to either decelerate or stop the vehicle notifying the driver immediately. The system also hosts an on board Diagnostic system over CAN protocol that assists the driver and the repair technician during servicing, thus reducing the debugging effort and facilitating easy.

The road condition analysis for unconditional road to the conditional road can be obtained from the MEMS acceleration of the vehicle which can evaluates the inter vehicle communication for the collision avoidance to the rear vehicle through visible light communication. The following shows the statistical analysis of the conditional and an unconditional road for the control signal from the controller.

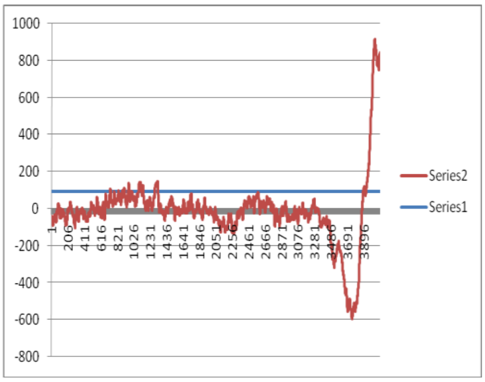

Fig: MEMS signal from unconditional road.

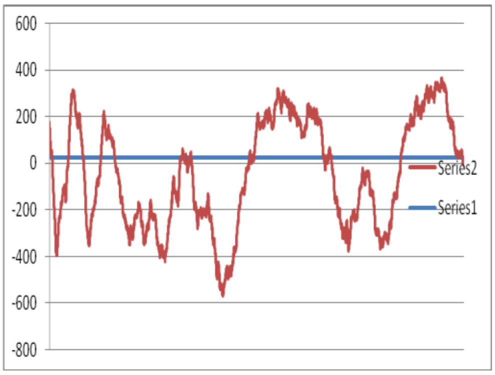

Fig: MEMS signal from normal conditional road.

VII. Conclusion

The deployment of inter vehicular communication networks is rapidly increasing. This paper has advantages over the other existing system in terms of response time and independency on external infrastructure. It is also cheap in terms of cost and reliable when tested in actual environment. The system does not intend to notify other running vehicles except the ones that are following it or is in the Lambert Ian line of sight of the array of IR transmitter lined in the rear bumper. Hence it effectively helps in reducing the accidents due to human errors by alerting the driver in advance. . Also the work has been carried out to avoid the collision, Secure Warning Collision Avoidance through visible light communication is proposed. Our Simulations result shows that the acceleration signal from the MEMS accelerator for the conditional and unconditional roads of the highway and will improve the collision avoidance of the nearby vehicles.

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