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Road Adaptive Overtake Assistant System based on Dedicated Short Range Communication

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ABSTRACT: Dedicated Short Range Communication (DSRC) is an emerging technology that allows vehicles to communicate with each other. The rear-end collision warning system based on DSRC has its unique advantages. This paper consists of three units such as the control unit, monitoring unit, and vehicle units which are based on a wireless network. The ARM CORTEX M3 microcontroller is used for controlling all the operations. It can be implemented in five cases such as Forward hazard warning, Traffic light timing display, Intersection collision warning, Road speed limit warning and Emergency vehicle warning.

KEYWORDS: Dedicated Short Range Communication (DSRC), IEEE 802.15.4.

I.INTRODUCTION

A statistical report points out that rear end collisions are most common in traffic accidents and are the cause of most traffic injuries. The major cause for accidents is due to rear end collisions, driver distraction and following the vehicle too closely. RADAR and LIDAR systems are adopted as the ranging sensor to detect the rear end of a vehicle in front of the equipped car. LIDAR based systems does not work robustly on bad weather. This can cause complications on twisting paths. DSRC is dedicated to the communication to enable vehicles to exchange their movement information and track each other's trajectory. The quality of the wireless communication through DSRC, which is not affected by adverse weather or illumination, ensures the applicability of the system. In addition, DSRC-based technology can achieve long-distance perception between vehicles. This is important due to the fact that, in some cases, warnings should be issued with hundreds of meters of headway distance to keep safety and attain a comfortable drive. Dedicated short-range communication (DSRC) has been used in prototyped vehicles to test vehicle-to vehicle communication for collision avoidance. However there is little study on how collision avoidance software should behave to mitigate accident collisions.

The warning strategies for collision avoidance are constrained by the timing of events such as DSRC communication latency, detection range, road condition, and driver reaction and deceleration rate. With these events, we define two collision avoidance timings: critical time to avoid collision and preferred time to avoid collision, and they dictate the design of software-based collision avoidance systems. In this paper, we use information from a prototyped DSRC-based collision detection system, and we take into account different timing factors that affect collision avoidance, factors such as driver reaction time, braking time and road conditions. With this information, we study how they can be used in a collision avoidance warning system, employing a DSRC device that could detect surrounding vehicles for computing vehicle trajectories. The results of this study illustrate the critical timing zones when advanced warnings must be given to effectively avoid collision in different accident scenarios. From these critical timing zones, we have devised collision detection and mitigation strategies for developing on-board computer software. There has been no study on how such variations affect the strategies and the design of an early warning system and such is the purpose of this paper. The DSRC device uses a bandwidth around the 5.9GHz range and it is based on the proposed IEEE 802.11p standard (IEEE Task Group p). The National Highway Traffic Safety Administration has commissioned a study in

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2006 to assess the effectiveness of such technology on road safety (U.S. Department of Transportation, 2006b). In this study, DSRC tests were performed to evaluate the safety benefits.

II. RELATED WORKS

This paper is focused on the inter-vehicular communication (IVC).IVC applications can be categorized in three main groups. Cooperative assistance systems focus on coordinate the vehicles in critical points like junctions with no traffic lights [1]. This work focuses on preventing rear-end collisions among vehicles by V2V communications and the design consists of a distributed warning protocol and a location-based back off scheme to further reduce the number of warning messages [2]. In this paper, information gathered through IVC can help improve the road traffic safety and efficiency. On the other hand, moving vehicles equipped with communication devices form exactly an instance of long envisioned mobile ad hoc networks [3]. The vast majority of rear-end collisions occur at speeds up to 30 km/h, mostly in city traffic. A common cause of these crashes is driver distraction. A rear-end collision might lead to soft-tissue neck injuries for the occupants in both vehicles involved, as well as material damages [4]. Driver assistance systems heavily rely on remote sensing for road traffic situation perception. The concept of advanced vehicle navigation extends the driver's visual horizon to an electronic horizon with a much larger range. The ability to combine dynamic data (such as vehicle data) and map data (such as the roadway geometry from a vehicle navigation system), provides the means for a driver assistance system to generate a "clear" picture of the current traffic scene[5].

III. EXISTING SYSTEM

In the existing system with the help of GPS and electronic control unit (ECU) data, vehicles are able to get their own motion data such as position and speed. Communication is available between those vehicles equipped with DSRC modules within each other's radio range. In this way, vehicular ad hoc networks (VANETs) are formed. A subject vehicle (SV) will be able to get a lead vehicle (LV)'s data of position, speed, etc. With both SV's and LV's position data, (measured headway distance) *M*hd can be calculated. *M*hd and velocity of both SV and LV are the input to the rear-end collision warning model and corresponding warnings will be the output: Early warning is issued to activate the human–machine interface (HMI) to remind the driver to decelerate, and emergency warning is triggered to launch the automatic control systems (ACSs) to brake.

In a Vehicular Ad Hoc Network (VANET), the wireless Collision Avoidance (CA) system issues warnings to drivers before they reach a potentially dangerous zone on the road. This paper proposes an analytical model for evaluating the performance of emergency messaging via wireless CA systems. First, we utilize the dichotomized headway model, the braking model, and Greenberg's logarithmic model to generate vehicular mobility traces for analysis. Second, we derive the probability of a rear-end collision between two vehicles that travel in the same direction when a sudden event occurs. Third, we quantify the probability of vehicles failing to receive the emergency message. Numerical results from the model show that the number of car crashes per accident is much higher when a wireless CA system is not used. We also find it interesting that the number of car crashes is not directly proportional to the vehicle density when the vehicular mobility traces follow the speed-density relationship offered by Greenberg's logarithmic model. By integrating flow theory into VANET analysis, our model provides useful insights for future intelligent transportation.

DRAWBACKS

Slightly poor performance in an intersection scenario. Another study has found probability of successful message reception is around 90% at 300m and drops off with longer distance.

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IV. PROPOSED SYSTEM

Car-2-x communication is an emerging technology that allows vehicles to communicate with each other. The exchange of real-time data among vehicles between vehicles and roadside units. Proposed system consists of three units such as control unit, monitoring unit and Vehicle units. This entire unit control by ARM cortex M3 controller with I2C and SPI. With this DSRC, helps to improve Road safety, Traffic efficiency, Traffic congestion control.

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A) BLOCK DIAGRAM

The proposed system consists of these units.

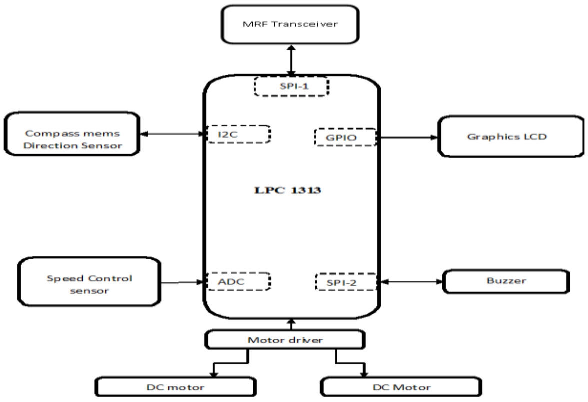

Fig .1 Control and monitoring unit

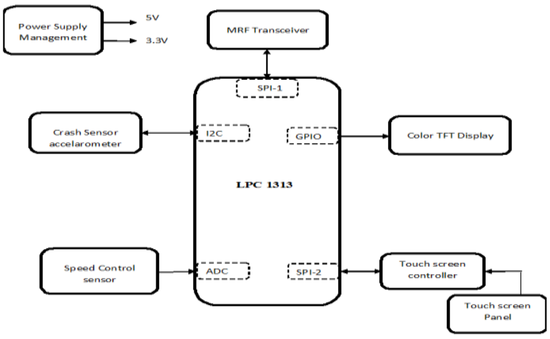

Fig.2 vehicle unit

Fig.1 and Fig.2 are the basic building blocks of the project. Both the units are kept in different places.

Forward hazard warning

If a vehicle detects an incident such as emergency braking, accident, it adds this information to its periodically broadcasted Cooperative Awareness Message which is sent to all vehicles in the close vicinity. Other cars or motorcycles receives the information and decide either to warn the driver if the hazardous location is on the route in front or just to broadcast the information to warn other vehicles.

Traffic light timing display

The vehicle approaches the traffic light that is currently red. Based on the received traffic light phase schedule, at which the vehicle would reach the traffic light at the beginning of the next green phase. This information is presented to the driver who can avoid the unnecessary stop. If the vehicle is somehow needed to stop, then the traffic light would automatically switches off the car engine and later switch ON the ignition once it shows green.

Intersection collision warning

While the motorcycle is riding on the main road, a car is approaching the intersection from the right-hand side. Due to a view obstruction, the car driver is overlooking the approaching motorcycle. When driving onto the intersection, the car driver receives a warning of the approaching motorcycle. The rider also receives a warning on its HMI.

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Road speed limit warning

The road speed limit warning application allows connected vehicles to receive information that it is approaching a road along with the recommended speed for the curve. This capability allows the vehicle to provide a warning to the driver regarding the road and its recommended speed.

B) PROPOSED SYSTEM DESCRIPTION

Power management system provides 3.3V to LPC1313 and required voltage .Microcontroller used is 32-bit ARM Cortex-M3 microcontroller that is LPC1313. MRF transceiver is a wireless network protocol IEEE 802.15.4(miwi) used to communicate between all the three units. A colour touch screen TFT display with QVGA resolution is used to select a desired application. Graphics LCD is used to show the vehicle status and other info to the driver. MEMS Compass is used to find the direction of the moving vehicle according to the rotation of the DC motor. MEMS Accelerometer (LPC 302 DL) is used to sense accident situation by sensing the vibration of the vehicle. Vehicle Speed Control Sensor is used to increase or decrease the speed of the vehicle Buzzer: It is used to provide warning sound to the driver DC Motor: It is used to emulate a running vehicle driven by a motor driver circuitry. Motor driver (L293 DNE) provides high noise immunity inputs. Battery is used to power all the electronics and motors in the project.

V. RESULT AND DISCUSSION

PROTEUS 8 is the software used for the simulation.LPC Xpresso's IDE is the compiler used for compilation.LPC-LINK JTAG/SWD DEBUGGER is used for the debugging options. The software consists of an enhanced, Eclipse-based IDE, a GNU C compiler, linker, libraries, and an enhanced GDB debugger. The hardware consists of the LPCXpresso development board which has an LPC-Link debug interface and an NXP LPC ARM-based microcontroller target. LPCXpresso is an end-to-end solution enabling embedded engineers to develop their applications from initial evaluation to final production. LPCXpresso is based on Eclipse with many LPC specific enhancements. It also features the latest version of the industry standard GNU tool chain with a proprietary optimized C library providing professional quality tools at low cost. The LPCXpresso IDE can build an executable of any size with full code optimization and it supports a download limit of 128 kB after registration. LPCXpresso supports the full embedded product design cycle by moving beyond chip evaluation boards and supporting development on external target boards. The LPCXpresso Integrated Development Environment (IDE) provides a C programming environment with syntax-coloring, source formatting, function folding, online and offline integrated help, extensive project management automation.

Simulation result:

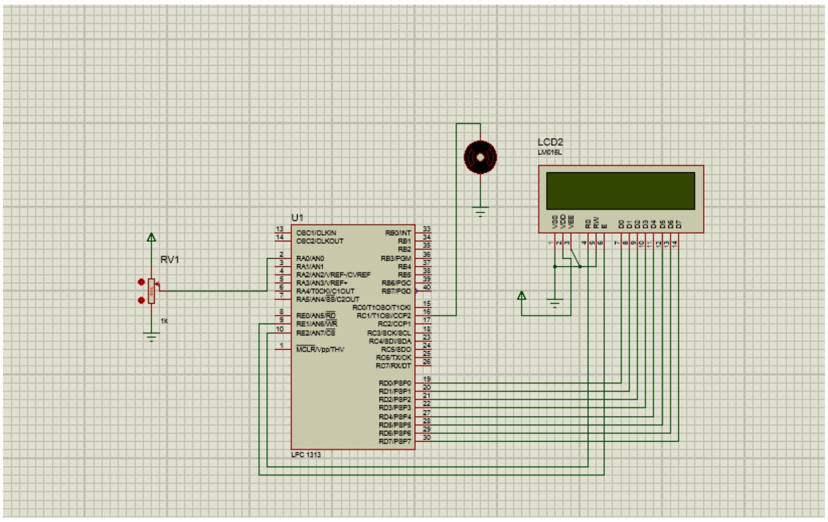

Fig.3 simulation result

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Fig .3 shows the implementation of speed control designed in proteus environment.LCD is used to display the speed to the user.

Result under normal condition:

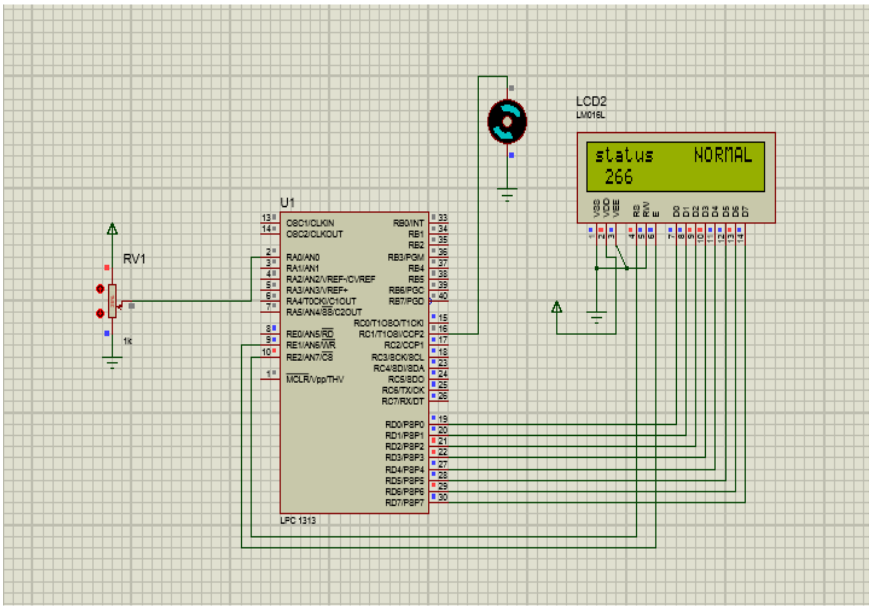

Fig.4 simulation under normal condition.

Fig .4 shows the implementation of speed control designed in proteus environment under normal condition.

Result under abnormal conditon:

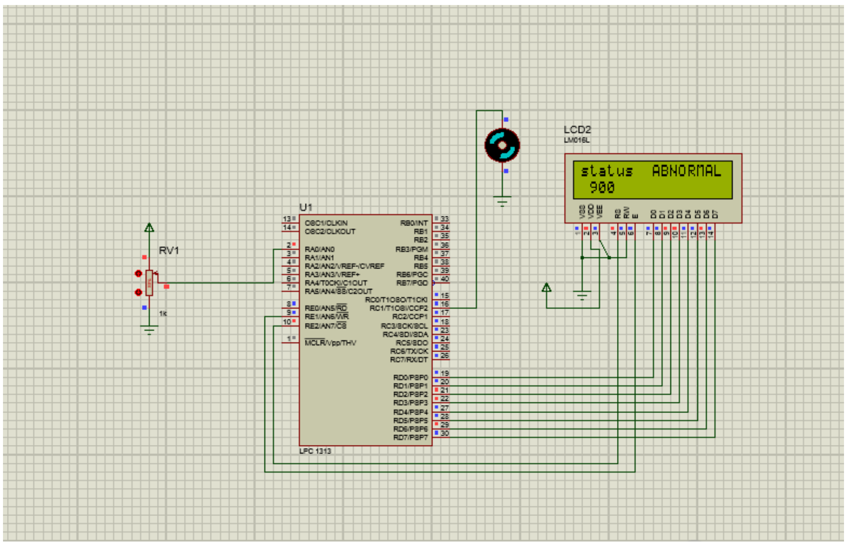

Fig 5. simulation result under abnormal condition

Fig.5 shows the implementation of speed control designed in proteus environment under abnormal condition.LCD is used to display the warning message.

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VI.CONCLUSION

The road adaptive over take assistance system based on the DSRC which make use of wireless technology. The proposed approach can achieve the best performance, leading to more efficient use of wireless bandwidth. Adopting this in vehicular networks can both avoid transmissions of emergency messages, wasting bandwidth due to unnecessary rebroadcasts and prevent emergency messages from transmission collisions caused by serious packet contention. This system helps the driver to avoid rear-end collisions in low speeds.

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