V2V SYSTEM CONGESTION CONTROL VALIDATION AND PERFORMANCE USING CAN COMMUNICATION AND TRACKING OF VEHICLE

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AIM:

This project aims in designing a system which helps in monitoring and controlling multi-regions using CAN (Controller Area Network) protocol. This system helps in achieving communication between multiple devices.

PURPOSE:

The main objective of this project is to provide CAN communication based vehicle security for automobiles, this system also avoid rear end collision using sensors and wireless communication.

ABSTRACT:

This paper proposes a vehicle-to-vehicle communication protocol for cooperative collision warning. Emerging wireless technologies for vehicle-to-vehicle (V2V) and vehicleto-roadside (V2R) communications such as CAN [1] are promising to dramatically reduce the number of fatal roadway accidents by providing early warnings. One major technical challenge addressed in this paper is to achieve low-latency in delivering emergency warnings in various road situations. Based on a careful analysis of application requirements, we design an effective protocol, comprising congestion control policies, service differentiation mechanisms and methods for emergency warning dissemination. Simulation results demonstrate that the proposed protocol achieves low latency in delivering emergency warnings and efficient bandwidth usage in stressful road scenario

INTRODUCTION

Major U.S., European, and Japanese automakers such as General Motors, Volkswagen, and Toyota have recently either equipped some of their production vehicles with Dedicated Short Range Communications (DSRC) systems or plan to do so [1]–[3]. The U.S. Department of Transportation (USDOT) issued in January 2017 a Notice for Proposed Rule-Making (NPRM) with the eventual aim of mandating the deployment of Vehicle-to-Vehicle (V2V) safety communication based on DSRC on all new light vehicles sold in the United States. The DSRC-based V2V technology is an outcome of nearly 15 years of efforts of the industry, academia, and the government. The DSRC-based V2V system builds atop several Institute of Electrical and Electronics Engineers (IEEE) and Society of Automotive Engineers (SAE) standards towards connected vehicles technology for safety and crash avoidance applications Such safety applications are based on V2V safety communication that includes broadcast of vehicle status information through Basic Safety Messages (BSMs). The BSMs include core state information such as Global Navigation Satellite System (GNSS) location, speed, acceleration, brake status, and path history [4] [5], with communication ranges of 400-500 meters, or more. In particular, such V2V systems use the SAE J2945/1 standard [6] that is based on several IEEE and SAE standards: • The Medium Access Control (MAC) and Physical Layer (PHY) protocol follow the IEEE 802.11p standard. The Federal Communications Commission (FCC) has dedicated 75 MHz of spectrum in the 5.9 GHz band for communication between vehicles (V2V) and between vehicles and roadside infrastructure (V2I). • The BSMs follow the Wireless Access in Vehicular Environments (WAVE) Short Message (WSM) using the WAVE Short Message Protocol (WSMP) as defined in the IEEE 1609.3 standard. • The BSM security is based upon compliance to the security certification as per the IEEE 1609.2 standard. It includes digital signatures along with security certificates or certificate digests to validate the sender's BSMs. • The WAVE Provider Service ID (PSID) of the BSMs is defined as per the IEEE 1609.12 standard and is used to distinguish between DSRC messages. • The message data dictionary, content and format of a BSM is as per the SAE J2735 standard. The J2945/1 V2V standard, published in 2016, provides a set of minimum performance requirements (MPR) for V2V communication to support safety applications for crash warning and avoidance [7]. In particular, detailed performance requirements are specified to ensure the accuracy of GNSS position, speed, heading, acceleration, and yaw rate among other factors with respect to ground truth. In a high traffic environment, where there is a high number of vehicles (transmitters), the channel suffers congestion due to rising interference and channel contention [8]. When it comes to channel capacity, [9] presented some fundamental limits especially as a wireless network scales. The conventional approach to handle interference in the IEEE 802.11p standard is to use Carrier-Sense Multiple Access with Collision Avoidance (CSMA/CA) as the medium access protocol [10]. In CSMA/CA, when a node (or vehicle) has a packet to transmit it first listens to the channel. If the channel is deemed idle or unoccupied, it transmit the packet. Otherwise, the node waits for a random back-off time before transmitting the packet. While this mechanism reduces the chances of packet collisions, it does not avoid it entirely. In large and dense V2V networks, the performance of safety applications may therefore unnecessarily suffer if all vehicles send their BSMs at the same high transmission rate and transmit power. The consequent high packet losses affect V2V situational awareness and make it difficult to predict a vehicle's movement or recognize an imminent crash in a timely manner. Hence, mitigating the channel congestion has been widely studied to address the challenge of scalability and to make the safety applications robust. The authors in [11] have shown that communication and safety performance degrades significantly in a congested environment without a congestion control mechanism. For example, the authors have reported about 70% Packet Error Ratio (PER) with 360 transmitting nodes at a fixed 10 Hz transmission rate and 20 dBm transmit power. In [12], a congestion control algorithm is proposed that adapts the message rate of a vehicle according its motion dynamics so that neighboring vehicles can accurately track it. Additionally, the transmit power is adapted to maintain the channel load at a target level. In [13], a distributed transmit power control method is proposed, which reduces the power of safety message transmissions during congestion in order to control the load placed on the DSRC channel. In [14], a message rate control based approach is proposed to adapt the BSM transmission rate (frequency) based on a binary comparison between measured channel load and a target threshold. Binary message rate control is also the subject of [11], in which the authors propose using an Additive Increase Multiplicative Decrease (AIMD) message rate update mechanism for DSRC vehicular safety communication. They present results from prototype radio tests and computer simulations that illustrate effective message rate control for hundreds of emulated or simulated vehicles. The authors in [15] present simulation of two popular rate algorithms (ONOE and AARF) and compare the performance with different metrics. In [16], the authors propose an algorithm to minimize the average system information age in a congested environment. Through the simulations, they also show that simple contention window size adaptations (i.e. increasing or decreasing the window size) are unsuitable for reducing the information age. The authors in [13], propose a distributed transmit power control method which helps reduce BSM load and thus reserves bandwidth for emergency messages with higher priorities. All these factors and considerations have been merged in the SAE J2945/1 standard which provides a congestion control (CC) protocol that adapts the transmit power and rate control of V2V BSM transmissions in order to achieve satisfactory safety performance. The CC protocol executes distributedly on each DSRC-equipped On-board Equipment (OBE) installed in a vehicle and adapts its radiated (transmit) power and the Inter-Transmit Time (ITT) based on the channel congestion levels the OBE experiences locally. The underlying algorithm is designed to be opportunistic to ensure channel utilization remains below the saturation level while V2V safety applications can have a good performance

LITERATURE REVIEW

K. A. Hafeez, L. Zhao, B. Ma, and J. W. Mark, "Performance analysis and enhancement of the dsrc for vanet's safety applications," IEEE Transactions on Vehicular Technology, vol. 62, no. 7, pp. 3069–3083, 2013 An analytical model for the reliability of a dedicated short-range communication (DSRC) control channel (CCH) to handle safety applications in vehicular ad hoc networks (VANETs) is proposed. Specifically, the model enables the determination of the probability of receiving status and safety messages from all vehicles within a transmitter's range and vehicles up to a certain distance, respectively. The proposed model is built based on a new mobility model that takes into account the vehicle's follow-on safety rule to derive accurately the relationship between the average vehicle speed and density. Moreover, the model takes into consideration 1) the impact of mobility on the density of vehicles around the transmitter, 2) the impact of the transmitter's and receiver's speeds on the system reliability, 3) the impact of channel fading by modeling the communication range as a random variable, and 4) the hidden terminal problem and transmission collisions from neighboring vehicles. It is shown that the current specifications of the DSRC may lead to severe performance degradation in dense and high-mobility conditions. Therefore, an adaptive algorithm is introduced to increase system reliability in terms of the probability of successful reception of the packet and the delay of emergency messages in a harsh vehicular environment. The proposed model and the enhancement algorithm are validated by simulation using realistic vehicular traces. T HE RESEARCH and application development in vehicular ad hoc networks (VANETs) have been driven by dedicated short-range communication (DSRC) technology or IEEE 802.11p [1], which is designed to help drivers travel more safely and reduce the number of fatalities due to road accidents. The IEEE 802.11p medium access control (MAC) uses carrier sense multiple access with collision avoidance and some concepts from the enhanced distributed channel access (EDCA) [2]. In this technology, there are four access classes (ACs) with different arbitration interframe space numbers (AIFSNs) to insure less waiting time for high-priority packets, as listed in Table I. The DSRC is licensed at 5.9 GHz with a 75-MHz spectrum, which is divided into seven 10-MHz channels and a 5-MHz guard band. The control channel (CCH) will be used for safety applications, whereas the other six channels, called service channels (SCHs), will be used for infotainment or commercial applications to make this technology more cost effective. Vehicles will synchronize the switching between the CCH and one or more of the SCHs; hence, safety-related messages would not be missed or lost. The synchronization interval (SI) contains a CCH interval (CCI), followed by a SCH interval [3]. Increasing the CCI will enhance the reliability of safety applications and challenge the coexistence of both safety and nonsafety applications on the DSRC. The VANET is a self-organizing network that works on both intervehicle communication (IVC) and vehicle-toinfrastructure communication. In this paper, IVC is taken into consideration, where vehicles will be equipped with sensors and Global Positioning Systems to collect information about their position, speed, acceleration, and direction to be broadcasted to all vehicles within their range. These status messages should be periodically broadcasted in every CCI. In IEEE 802.11p, vehicles will not send any acknowledgement for the broadcasted packets. Therefore, the transmitter cannot detect the failure of the packet reception; hence, the transmitter will not retransmit it. This is a serious problem in collision warning applications where all vehicles behind the accident have to receive the warning message successfully in a short time to avoid chain collisions. This problem motivates us to propose an analytical model for assessing the DSRC reliability and delay, taking into account the multipath fading channel in VANETs, vehicles' high mobility, hidden terminal problems, and transmission collisions. More specifically, the probability of successfully receiving the status messages from all vehicles around the tagged vehicle, the probability of receiving the safety (or emergency) messages from all vehicles up to a certain distance behind the accident scene, and the delay for that safety messages to reach their intended recipients will be studied, assuming unsaturated conditions. The proposed model is built based on a new mobility model that takes into account the vehicle's follow-on safety rule to derive accurately the relationship between vehicle's speed and network density. It is shown that the current specifications of the DSRC may lead to severe performance degradation in dense and highmobility conditions. Therefore, a new adaptive and mobilitybased algorithm (AMBA) is introduced to increase the system reliability in terms of the probability of successful reception of packets and the time delay of emergency messages in a harsh vehicular environment The

MAC protocol of IEEE 802.11p [1] is based on the distributed coordination function of IEEE 802.11, which has been investigated extensively in the literature, analytically, and by simulations. Simulation-based analysis of the IEEE 802.11p shows that, as the network density increases, the system latency increases, and the packet successful reception rate decreases [5]–[10]. To ensure a successful reception of emergency messages, Torrent-Moreno et al. [7] and Vaneenennaam et al. [8] introduced an algorithm to control the load of periodic status messages. The channel access delay of the DSRC has been analyzed in [9] and compared with a self-organizing timedivision multiple-access scheme, which has been proven more suitable for VANETs' real-time applications. In [10], Wang and Hassan proposed a framework for sharing the DSRC between vehicular safety and nonsafety applications. By assuming uniform distribution of vehicles on the road, their simulations show that nonsafety applications may have to be severely restricted, such that safety applications are not compromised, particularly in high-density networks. Many analytical models have been proposed to study the DSRC or, in general, the IEEE 802.11 MAC protocol. Although DSRC is based on IEEE 802.11 and EDCA, the unicast analytical models for IEEE 802.11 [11] and EDCA [12], [13] cannot be used for broadcast communication mode in IEEE 802.11p because no acknowledgment is communicated. Therefore, the transmitter cannot detect a collision from a successful transmission. In [14], a 1-D Markov chain has been used to calculate the delay and the reception rate in VANETs without including the delay in each stage due to a busy channel. Eichler [15] analyzed the DSRC based on the average delay for each AC without taking into account the back-off delay. An analytical model that accounts for the mutual influence among nodes in a multichannel environment and the broadcast message frequency has been proposed in [16]. In this model, Campolo et al. assumed the static distribution of vehicles on the road with no hidden terminals. Moreover, they did not take into account how the vehicle speed affects the network density; hence, there is a need to throttle the message transmission frequency to increase the successful reception rate. In [17], an analytical model for the performance of delivering vehicular safety messages is proposed, without taking into account the mobility of vehicles. This model considers only the neighborhood of a single roadside unit operating in a nonsaturation traffic regime. A 2-D Markov chain is used in [18] to model the impact of the differentiated AIFS on a stationary vehicular scenario in an urban intersection. They assume a fixed number of vehicles within the range of the transmitter and have not included vehicle mobility in their model. In [19] and [20], Ma and Chen and Ma and Wu studied the saturation performance of the broadcast scheme in VANETs, taking into account the consecutive freeze situation of the back-off counter. They assume saturation conditions, i.e., stationary distribution without considering the impact of vehicle mobility on the system performance. In [21], an analytical model for delivering safety messages within IVC is derived. They assume a perfect channel access and have not accounted for the hidden terminal problem, collision probability, and vehicle mobility. Hassan et al. [22] studied the performance of IEEE 802.11p based on the delay of status packets by modeling each vehicle as an M/G/1 queue with an infinite buffer, without taking vehicle mobility into consideration. In [23], Fallah et al. analyzed the effect of different sets of data rates and communication ranges on the performance of the DSRC safety applications. They derive the probability of successful reception without taking the busy channel probability in each back-off stage. They introduced a power control algorithm based only on the average channel occupancy to change only the used communication range. As the channel occupancy increases, they decrease the communication range to maintain an acceptable channel capacity. We will compare their algorithm and the one we have proposed in the analysis and simulation sections. The connectivity in VANETs has been studied in [24]–[26] based on the assumption that vehicles have a uniform stationary distribution without including VANET mobility. By assuming that vehicle positions are known by either simulation or observation, Jim and Recker in [27] presented an analytical model for VANETs. A mobility model has been derived in [28], considering the arrival of vehicles to a service area as a Poisson distribution. Abuelela et al. [29] derived the probability of the end-to-end connectivity between clusters of vehicles distributed uniformly on the road. They introduce a new opportunistic packet-relaying protocol that switches between data muling and local routing with the help of vehicles on the other direction. In contrast to our mobility model, all of these models do not consider how the speed of transmitters and receivers affect the connectivity and the packet reception rates. The mobility model is a crucial part in analyzing and testing VANET applications. Modeling vehicle mobility is quite challenging since the movement of each vehicle is constrained by many factors such as road topology, movements of neighbor vehicles, information on the messaging signs along the road, and driver's reactions to these factors. In [30], a set of movement changes is introduced, such as changing lanes, slowing down, or even changing routes, to allow a micromobility behavior control. In [31], Sommer and Dressler argued that coupling more than one simulator is an important step toward a realistic VANET mobility model. Therefore, we built our simulations by coupling the mobility model (MOVE) [32] with the microtraffic simulator Simulation of Urban MObility (SUMO) [33], to produce realistic vehicle movement traces for the network simulator ns-2 [34]. we propose an analytical model for the analysis of broadcast services in the DSRC protocol, taking into account the high dynamics of vehicles, the hidden terminal problem, collision probability, and nonsaturation conditions. We also derive the delay for emergency messages to reach their intended recipients. The new analysis is based on a new mobility model that takes into account the vehicle's follow-on safety rule to derive accurately the relationship between the vehicles' density and their speeds. The new mobility model considers how the speeds of transmitters and receivers affect the connectivity and the packet reception rates. It also has the capacity to handle the sudden increase in vehicles' density (from jam, accident, or other events) to keep safe distance between vehicles. The packet reception rate is derived, taking into account the interdistance between the transmitter and all potential receivers and their speeds. The proposed model uses a Markov chain approach, which includes the probability of a busy channel in each state, to derive the probability of transmitting status packets and their delay. An adaptive and mobility-aware algorithm is introduced to enhance the performance of VANETs. Simulation results show that the proposed model is quite accurate, and the proposed algorithm enhances the DSRC performance compared with other algorithms in the literature

Rostami, B. Cheng, G. Bansal, K. Sjoberg, M. Gruteser, and J. B. ¨ Kenney, "Stability challenges and enhancements for vehicular channel congestion control approaches," IEEE Transactions on Intelligent Transportation Systems, vol. 17, no. 10, pp. 2935–2948, 2016. Channel congestion is one of the major challenges for IEEE 802.11p-based vehicular networks. Unless controlled, congestion increases with vehicle density, leading to high packet loss and degraded safety application performance. We study two classes of congestion control algorithms, i.e., reactive state-based and linear adaptive. In this paper, the reactive state-based approach is represented by the decentralized congestion control framework defined in the European Telecommunications Standards Institute. The linear adaptive approach is represented by the LInear MEssage Rate Integrated Control (LIMERIC) algorithm. Both approaches control safety message transmissions as a function of channel load [i.e., channel busy percentage (CBP)]. A reactive state-based approach uses CBP directly, defining an appropriate transmission behavior for each CBP value, e.g., via a table lookup. By contrast, a linear adaptive approach identifies the transmission behavior that drives CBP toward a target channel load. Little is known about the relative performance of these approaches and any existing comparison is limited by incomplete implementations or stability anomalies. To address this, this paper makes three main contributions. First, we study and compare the two aforementioned approaches in terms of channel stability and show that the reactive state-based approach can be subject to major oscillation. Second, we identify the root causes and introduce stable reactive algorithms. Finally, we compare the performance of the stable reactive approach with the linear adaptive approach and the legacy IEEE 802.11p. It is shown that the linear adaptive approach still achieves a higher message throughput for any given vehicle density for the defined performance metrics COOPERATIVE intelligent transport system (C-ITS) technology enables a wide variety of vehicular ad hoc networking applications, including collision avoidance, road hazard awareness, and route guidance. Based on the Medium Access Control (MAC) and Physical Layer (PHY) protocols specified in the IEEE 802.11p standard [1], C-ITS is moving rapidly towards deployment in Europe and other regions. Twelve members of the Car-2-Car Communications Consortium (C2C-CC) have mutually pledged to begin equipping their vehicles with C-ITS by the end of 2015 [2]. In the US, where the technology is known as Dedicated Short Range Communication (DSRC), the Department of Transportation has published an Advance Notice of Proposed Rulemaking with an intention to require this equipment in new cars within a few years [3]. While most aspects of the communication system have been finalized and standardized (i.e., in IEEE 1609 WG [4], [5]), one remaining aspect in need of further study is channel congestion control [6]. With a typical communication range of hundreds of meters, a C-ITS device may share a 10 MHz channel with hundreds or even a few thousand other devices. The Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA) MAC protocol used in C-ITS is optimized for low-to-moderate channel loads. [7] illustrates that for higher density of vehicles, IEEE 802.11p shows a behavior similar to ALOHA. With increasing channel load due to high density of vehicles, the channel becomes saturated, the probability of overlapping transmissions (i.e., packet collisions) increases considerably, and the aggregate channel throughput falls off after reaching a plateau [8], [9]. While in general a C-ITS channel may support a variety of applications, congestion in the 5.9 GHz spectrum is likely to be associated with a high volume of vehicle safety messages. These are Cooperative Awareness Messages (CAMs) [10] in Europe and Basic Safety Messages (BSMs) [11] in the US. Congestion reduces the rate at which these safety messages are successfully communicated to neighbors, and the resulting reduced awareness harms the C-ITS safety mission. Broadcast channel congestion has previously been investigated in the context of Mobile Ad Hoc Networks (MANET) [12], but the car-2-car communication settings differs. Previous studies on MANETs, such as [13], focus on techniques to control congestion arising due to re-broadcasting in multi-hop protocols. These techniques do not apply when congestion arises due to frequent broadcast in a single-hop communication setting, which we discuss in this paper. In addition, known congestion control techniques such as Internet flow control do not adequately address this issue due to the unique characteristics of the vehicular networking environment. These include broadcast transmissions, one hop communication, and a shared wireless channel. Therefore, researchers have proposed several algorithms [14]–[16] for the vehicular network environment that are considered in the ETSI standardization process. The effectiveness of these algorithms have largely been evaluated individually and there are few comparative studies available that evaluate the algorithms under common assumptions and scenarios [17], [18]. To the best of our knowledge, however, no prior work has considered a complete implementation of DCC with mandatory CAM generation rate control in the facilities layer or proposed DCC versions that do not suffer from stability issues. Since these protocols are serious contenders for standardization, a thorough understanding of their performance and stability is particularly important With increasing demands for a shared resource, such as a wireless channel, control mechanisms become a requirement to prevent poor service. Perhaps best known in this domain is the extensive work on Internet congestion control algorithms (e.g., [20]–[22]). While there is some overlap between Internet congestion control and vehicular network channel congestion control issues, existing congestion control algorithms are not suitable for delay sensitive, reliable single hop communications over wireless networks and rely on acknowledgment feedback which is unavailable in vehicular network broadcast messaging. Instead, vehicular network congestion control algorithms can exploit richer direct measurements of the congestion level than a TCP agent in an Internet environment. With this precise feedback, it becomes beneficial to use more fine-grained control algorithms, as shown for example in a comparison [23] of a binary adaptive control algorithms (e.g., AIMD algorithm as used in TCP) with more fine-grained linear adaptive control algorithms such as LIMERIC [15]. There are some other efforts to solve the congestion control problem for MANETs by focusing on rate-based flow control and broadcast application’s characteristics [24], [25], but still the main assumption of these works is the wireless networks with re-broadcast requirement, mostly for the routing phase. The current vision for vehicular safety messages, however, assumes an environment with only single-hop broadcast communication [26]. The safety applications considered here do not require messages to be re-broadcast or flooded through the network. Existing MAC standards, such as IEEE 802.11p, cannot maintain optimal throughput while the number of wireless devices increases, unless they rely on a higher layer control mechanism. [27] shows how adaptive congestion control can outperform legacy IEEE 802.11p and motivates the use of a channel congestion control mechanism on top of the legacy IEEE 802.11p MAC layer. To date, several proposals have been presented to conquer the wireless channel congestion problem. In [28], the authors use both power and rate control to reach asymptotically optimal performance. [29] also proposes another adaptive scheme to solve the channel congestion issue. The authors use both rate and power control to overcome this issue, but manipulate the transmission power only once the message rate is already reduced to the minimum defined in the protocol. [30] introduces a new adaptive approach that controls channel congestion while it tries to meet minimum application requirements for multihop information dissemination. This paper's focus, however, is on transmission rate control (TRC) approaches, since some previous works, such as [31], concluded that message rate is the most effective control parameter in terms of reachability. Hence, we focus on TRC technique, which we will detail in the next section. Few comparative evaluations of congestion control algorithms exist. [32] compares the Linear Memoryless Range Control (LMRC) and the Gradient Descent Range Control (GDRC) congestion control algorithms. The authors observed that when local channel load measurement is used, LMRC suffers instability. They concluded that a global CBP measurement can improve stability of adaptive congestion control. The focus, however, is on a different approach, where the control parameter is the transmission power with a fixed message rate. Another work, [33] compares European DCC with Selforganizing Time Division Multiple Access (SoTDMA) in terms of awareness and emergency coverage range, focusing on the effect of simultaneous transmissions. The bottom line of the work is that DCC provides slightly better performance, but the work does not provide the resource management analysis to explain why the results are such as they are. These studies do not compare algorithms that are serious candidates for standardization. Several studies have reported instability for the DCC algorithm. [34] conducts a simulation experiment to show that fewer number of control parameters could lead to a better performance of DCC. It has chosen PHY data rate as the control parameter of a simpler DCC algorithm. While the results show that DCC with just PHY data rate as the control parameter works better than the DCC, the authors did not explain why playing with one control parameter leads to such a better performance or why the resulting loss of range due to PHY rate increases is tolerable. [18] identifies an oscillation problem in the DCC approach. The authors of this work conclude that this oscillatory behavior is due to frequent state changes in DCC's Finite State Machine (FSM), however, the study does not appear to implement the recently approved CAM generation rules required by ETSI in [10]. Similar results have also been presented by [31], albeit also without the CAM generation rules. Additionally, the authors also compare the impact of different DCC control parameters in terms of reachability and stability. They emphasize the transmission rate control as the most important control parameter in terms of reachability. [17] compares the awareness level of WAVE with European DCC approach. One of the observations is again channel load oscillation due to frequent state changes. This study also does not implement the CAM algorithm

EXISTING:

In existing system only CAN based communication using in automobiles for vehicle internal communication ,but there is no separate system to provide security to avoid accidents like rear end collision.

PROPOSED:

In proposed system we implemented sensors and RF based data transmission to the nearer vehicles while driving time. So that this system can detect the front vehicle sudden obstacle conditions using ultrasonic sensor and send signal to the can controller using microcontroller unit. Then microcontroller control the front vehicle ignition and following vehicle ignition automatically through RF wireless communication.

BLOCK DIAGRAM:

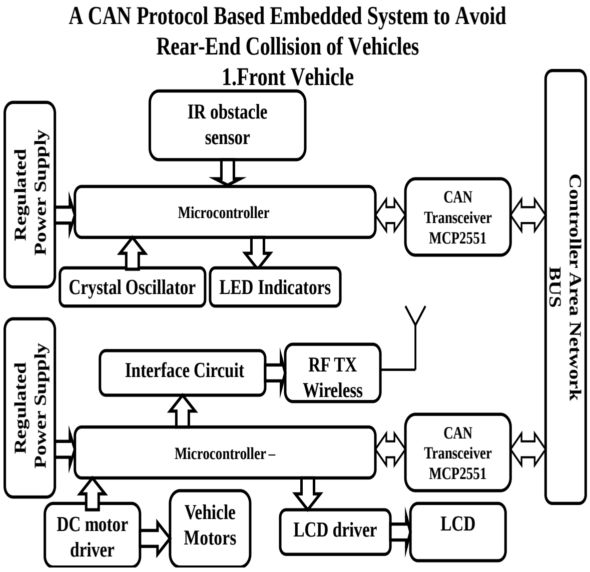

FIG 1: Block diagram of CAN based real time implementation in automobile

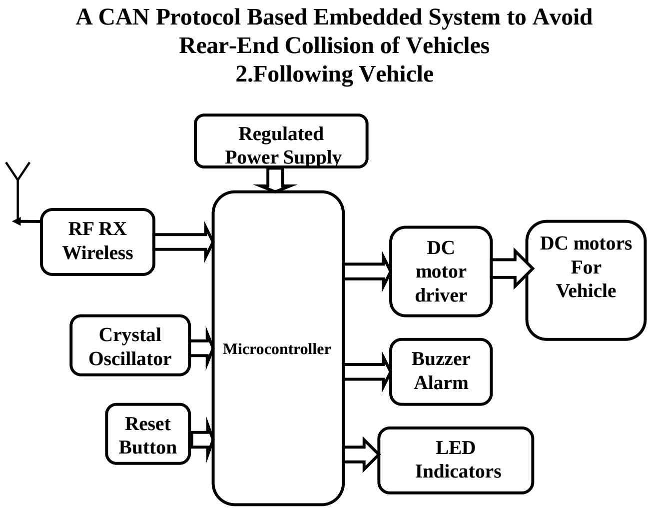

FIG 2: Block diagram of CAN based real time implementation in automobile

A vehicle can become an abnormal vehicle (AV) due to its own mechanical failure or due to unexpected road hazards. A vehicle can also become an AV by reacting to other AVs nearby. Once an AV resumes it regular movement, the vehicle is said no longer an AV and it returns back to the normal state. In general, the abnormal behavior of a vehicle can be detected using various sensors within the vehicle. Exactly how normal and abnormal status of vehicles are detected is beyond the scope of this paper. We assume that a vehicle controller can automatically monitor the vehicle dynamics and activate the collision warning communication module when it enters an abnormal state. A vehicle that receives the EWMs can verify the relevancy to the emergency event based on its relative motion to the AV, and give audio or visual warnings/advice to the driver. Each message used in VCWC protocol is intended for a group of receivers, and the group of intended receivers changes fast due to high mobility of vehicles, which necessitate the message transmissions using broadcast instead of unicast. To ensure reliable delivery of emergency warnings over unreliable wireless channel, EWMs need to be repeatedly transmitted. Conventionally, to achieve network stability, congestion control has been used to adjust the transmission rate based on the channel feedback. If a packet successful goes through, transmission rate is increased; while the rate is decreased if a packet gets lost. Unlike conventional congestion control, here, there is no channel feedback available for the rate adjustment of EWMs due to the broadcast nature of EWM transmissions. Instead, we identify more application-specific properties to help EWM congestion control, which consists of the EWM transmission rate adjustment algorithm and the state transition mechanism for AVs. While congestion control policies are the focus of this paper, the proposed VCWC protocol also includes emergency warning dissemination methodsthat make use of both natural response of human drivers and EWM message forwarding, and a message differentiation mechanism that enables cooperative vehicular collision warning application to share a common channel with other non-safety related applications. Without loss of continuity, the latter two components are largely skipped due to space limitation, however, details for them can be found in

CONCLUSIONS We have presented field test results on DSRC-based V2V system in a congestion environment, which complied with the SAE J2945/1 standard for V2V minimum performance requirements. Our tests provide vehicle-level validation for the congestion control protocol and also demonstrate that the GNSS position of a vehicle can be tracked to within 1.5m of ground truth position even with ITTs of 600 ms. Our results demonstrate the readiness of DSRC-based V2V systems for active safety and crash avoidance

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