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INTER VEHICLE WIRELESS COMMUNICATION SYSTEM

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ABSTRACT

In this paper we presented wireless communication between two or more number of vehicles. Wireless communication can also be used within safety, efficiency and infotainmentareas by using the IEEE- and ASTM-adopted Dedicated Short Range Communication (DSRC) standard. The paper first gives an overview of automotive applications relying on wireless communications, with particular focus on telemetric. Along with a description of the DSRC architecture, we introduce the concept of CCA and its implementation requirements in the context of a vehicle to-vehicle wireless network, primarily at the Medium Access Control (MAC) and the routing layer. An overview is then provided to establish that the MAC and routing protocols from traditional Mobile Ad Hoc networks are not directly applicable for CCA and similar safety-critical applications.

KEYWORDS: DSRC,MAC,WLAN.

INTRODUCTION

Road and traffic safety can be improved if drivers have the ability to see further down the road and know if a collision has occurred, or if they are approaching a traffic jam. This can become possible if drivers and vehicles communicate with each other and with roadside base stations. If traffic information was provided to drivers, police, and other authorities, the roads would be safer and traveling on them would become more efficient. Researchers are greatly interested to develop vehicular communication and networking technology in two realistic ways vehicle to vehicle (V2V) in ad hoc mode and vehicle to infrastructure (V2I) with fixed nodes along the road.

We use Bluetooth, infrared ,R.F, zigbee or IEEE 802.11for wireless connection between two vehicles. Wireless networking based on IEEE802.11 technology has recently become popular and broadly available at low-cost for home networking and free Wi-Fi or commercial hotspots. The DSRC starting idea was to equip vehicular network nodes with off-the-shelf wireless technology such as IEEE802.11a. It is possible for communicating vehicles to use both infrared and radio waves. VHF and microwaves are a type of broadcast communication while infrared and millimeter waves are a type of directional communication. For instance, 75 MHz is allotted in the 5.9 GHz band for dedicated short range communication (DSRC). It is possible to use Bluetooth, which operates in the 2.4 GHz industry, science, and medicine (ISM) band, to set up the communication between two vehicles. It is reliable up to a speed of 80 km/h and range of 80 m. However, it can take up to 3 seconds to establish the communication. Also, since Bluetooth requires a master and slave setup, the master could potentially refuse a communication request. In addition, the master may already be communicating with another slave,which would lower the possible communication rate.

This section summarizes MAC protocol specifics as they apply within IVC. Performance measurements are reviewed, and several new concepts are presented.ad-hoc network between vehicles is better suited for vehicle communications than centralized service. The centralized architecture is not very efficient since information has to go from one vehicle to a central base station and then back to another vehicle. Wireless connectivity between moving vehicles can be provided by existing 802.11 compliant devices. Data rates of up to 54 Mbps can be achieved with 802.11a hardware. This type of communication can be made affordable if the unlicensed ISM bands are used. Compared to indoor Wireless Local Area Network (WLAN) uses, vehicular traffic scenarios have greater challenges. These are caused by the varying driving speeds, traffic patterns, and driving environments. Performance measurements by an 802.11b-based WLAN in vehicular scenarios have been made.

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Two vehicles with IEEE 802.11b WLAN cards, and laptops running Linux were used for the tests. Omni-directional antennae were mounted on the top of the cars to increase the range of connectivity. The cars also had GPS devices to allow their location and velocity to be tracked. One of the laptops is set up as the sender of streaming User Datagram Protocol (UDP) packets, while the other is set up as the receiver. Each of the wireless cards are set up to operate in broadcast ad-hoc mode. This mode disables MAC retransmissions. The sender generates random bits in the UDP packets. Every second the GPS devices provide latitude, longitude, speed, and bearing. Signal quality information is logged at the receiver via the wireless MAC software utilities. The bit reception rate at the receiver, or throughput, is determined by the number of packets received every second. The number of lost packets and signal to noise ratio (SNR), or link quality, are also noted at the receiver. These performance parameters are measured while the separation and relative velocity between the two vehicles is varied. To measure the connectivity of the vehicles, tests were performed with the vehicles following andCrossingeach other. The 802.11b WLAN performance worsened with difficult communication scenarios. For instance, the link quality (or SNR) degraded with increasing distance. A sub- urban environment, with 40 mph speed limits and containing a few building structures and roadside tree groups, showed the best link quality. The vehicles stopped at traffic lights in this environment, but not frequently. Urban environments had speed limits up to 25 mph and contained roadside building constructions. The traffic scenario was a rush hour traffic jam. The vehicles stopped often at traffic lights and in jams. These were the worst conditions for inter vehicle communication. The link quality of the freeway environment (open area with little roadside vegetation and speed limits of 65 mph) lies in between the sub-urban and urban. The freeway-crossing test, surprisingly, showed an increase in link quality until the vehicles were separated by 500 meters, and then it began to decrease .

COOPERATIVE COLLISION AVOIDANCE

The mechanism of CCA is explained using a three-car highway platoon example, as shown in Fig.1 In the example, all cars are assumed to cruise initially at a steady speed of 72 mph (32m/s), and with an intercar spacing (or headway) of 1 s (32 m). Figure 2b illustrates the platoondynamics after the front car (car 0) initiates an emergency deceleration (at 4 m/s2) as a result ofan emergency event. As shown in the figure, the driver in car 1 starts to decelerate when he seesthe tail brake light of car 0, and the driver in car 2 does so when he sees the brake light of car 1.With an assumed driver's reaction time of 1.5 s, car 0 gets hit by car 1 at a distance of 120m, and subsequently, car 1 is hit by car 2. The conclusion from this example is that if drivers react only on visual information, all three cars in the platoon end up in a chain collision.For the same platoon, the effects of CCA with wireless communication are illustrated in Fig.1. In this case, upon meeting the emergency event, car 0 starts sending wireless collision warning messages (W-CWM) to all cars behind it. As shown in Fig.1, these messages are forwarded in a multihop manner in order to ensure a complete coverage within the platoon. Upon reception of a W-CWM, a driver reacts by decelerating, even if the brake light on the car ahead is not already lit. As shown in Fig.1, car 1 still collides with car 0. However, car 2 can avoid a collision if it receives the W-CWM with sufficiently small delivery latency. For instance, as shown by the solid line for car 2, with a delivery latency of 0.1s from car 0 to car 2, car 2 manages to stop without a collision at a distance of 115 m from the site of the emergency event. However, for a delivery latency of 0.4 s car 2 cannot avoid the collision as the driver is not given enough time to start decelerating well in advance. Two conclusions can be made form the above scenario. First, using a high-speed wireless communication network, it is possible to design CCA systems that can improve highway safety by avoiding chain collisions.

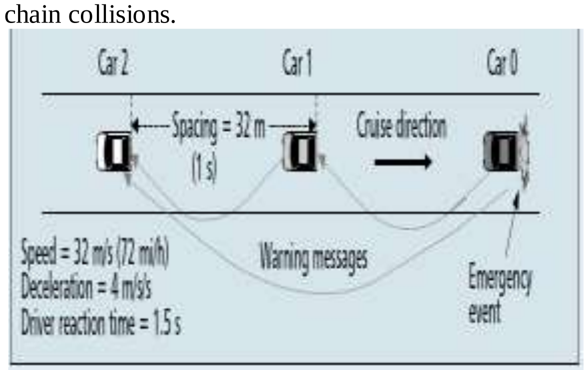

Figure no.1

MEDIUM ACCESS CONTROL (MAC) IN INTER-VEHICLE COMMUNICATION

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presented. An ad-hoc network between vehicles is better suited for vehicle communications than centralized service. The centralized architecture is not very efficient since information has to go from one vehicle to a central base station and then back to another vehicle. Wireless connectivity between moving vehicles can be provided by existing 802.11 compliant devices. Data rates of up to 54 Mbps can be achieved with 802.11a hardware. This type of communication can be made affordable if the unlicensed ISM bands are used. Compared to indoor Wireless Local Area Network (WLAN) uses, vehicular traffic scenarios have greater challenges. These are caused by the varying driving speeds, traffic patterns, and driving environments. Performance measurements by an 802.11b-based WLAN in vehicular scenarios have been made. Two vehicles with IEEE 802.11b WLAN cards, and laptops running Linux were used for the tests. Omni-directional antennae were mounted on the top of the cars to increase the range of connectivity. The cars also had GPS devices to allow their location and velocity to be tracked. One of the laptops is set up as the sender of streaming User Datagram Protocol (UDP) packets, while the other is set up as the receiver. Each of the wireless cards are set up to operate in broadcast ad-hoc mode. This mode disables MAC retransmissions. The sender generates random bits in the UDP packets. Every second the GPS devices provide latitude, longitude, speed, and bearing. Signal quality information is logged at the receiver via the wireless MAC software utilities. The bit reception rate at the receiver, or throughput, is determined by the number of packets received every second. The number of lost packets and signal to noise ratio (SNR), or link quality, are also noted at the receiver. These performance parameters are measured while the separation and relative velocity between the two vehicles is varied. To measure the connectivity of the vehicles, tests were performed with the vehicles following and crossing each other. The 802.11b WLAN performance worsened with difficult communication scenarios. For instance, the link quality (or SNR) degraded with increasing distance. A sub- urban environment, with 40 mph speed limits and containing a few building structures and roadside tree groups, showed the best link quality. The vehicles stopped at traffic lights in this environment, but not frequently. Urban environments had speed limits up to 25 mph and contained roadside building constructions. The traffic scenario was a rush hour traffic jam. The vehicles stopped often at traffic lights and in jams. These were the worst conditions for inter-vehicle communication. The link quality of the freeway environment (open area with little roadside vegetation and speed limits of 65 mph) lies in between the sub-urban and urban. The freeway-crossing test, surprisingly, showed an increase in link quality until the vehicles were separated by 500 meters, and then it began to decrease.The throughput also decreased as the distance increased. In the freeway-crossing case, however, the throughput initially increased with distance before starting to fall. In the sub-urban case, the throughput fell as the velocities of the vehicles increased. Increasing the packet size from 256 to 1024 bytes appeared to increasethe throughput for urban scenarios. It also helped in the freeway-crossing case, when the vehicles wereseparated by smaller distances. At larger separations a smaller packet size was better. The connectivity wasmaintained while the vehicles were separated by up to 1000 meters. The connectivity appeared to be betterwith a smaller packet size.

WIRELESS AUTOMOTIVE COMMUNICATIONS

In this section three Personal Area Network (PAN) standards for in-vehicle communications are presented: Bluetooth (IEEE 802.15.1) ,Zig Bee (IEEE 802.15.4) , and Ultra Wide Band (UWB/IEEE 802.15.3a). Also, one Wireless Local AreaNetwork (WLAN) for inter-vehicle communications is presented: Wi-Fi (IEEE 802.11a/b/g) . All these technologies are possible candidates for wireless real-time control systems found in automotive systems. Important issues not discussed in this paper are safety and security. In general, concerning safety, a wireless link is more sensitive to interference compared with a wired one. Also, from a security perspective, the wireless medium makes the system reachable from outside, possibly subject to intrusion. Moreover, it is still an open issue whether wireless networks introduce health risks for the driver of the vehicle.

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Bluetooth

Bluetooth (IEEE 802.15.1) [1, 5] currently provides network speeds of up to 3 Mbps. Originally devised for PAN deployment for low-cost, low-power, short-range wireless ad hoc interconnection, Bluetooth technology has fast become very appealing also for the automotive environment, as a potential automotive wireless networking technology. In response to interest by the automotive industry, in December 1999 the Bluetooth Special Interest Group (SIG) formed the Car Working Group. The Hands-Free profile was the first of several application level specifications from the Car Working Group. Using the new Hands-Free profile, products that implement the Bluetooth specification can facilitate automatic establishment of a connection between the car's hands-free system (typically part of its audio system) and a mobile phone. Bluetooth wireless products incorporating these new enhancements enable a seamless, virtually automatic interface between the car and wireless products. Today, Bluetooth allows hands-free use of a mobile phone either through the car's audio system or wireless headsets, resulting in better sound and control, and a safe solution to legislation banning mobile phone use while driving.

ZigBee

ZigBee (IEEE 802.15.4) [8, 5] is a new low-cost and low-power wireless PAN standard, intended to meet the needs of sensors and control devices. Typical ZigBee applications do not require high bandwidth, but do impose severe requirements on latency and energy consumption. Despite the number of low data rates proprietary systems designed to fulfil the above mentioned requirements, there were no standards that met them. Moreover, the usage of such legacy systems raised significant interoperability problems which ZigBee technology solves, providing a standardized base set of solutions for sensor and control systems. The Zig- Bee Alliance (with over 120 company members) ratified the first ZigBee specification for wireless data communications in December 2004. ZigBee provides network speed of up to 250 Kbps, and is expected to be largely used in home and building automation (e.g., for fire detection, security and access monitoring, heating, lighting and environment control), and in industrial process monitoring and control systems (e.g., for use in monitoring and control of industrial processes and equipments,especially in hazardous environments inaccessible to normal wired systems).

UWB

UWB (IEEE 802.15.3a), or Ultra Wide Band , is a potential competitor to the IEEE 802.11 standards. However, UWB is more intended for home multimedia networking, whereas 802.11 networks targets data networking, not only in home environments, but also in public and enterprise environments. Looking at the wireless PAN market, currently dominated by Bluetooth, UWB offers a solution with much higher bandwidth. Network speeds offered by UWB are in theory several hundreds of Mbps, although initially speeds of up to 100 Mbps are more likely

Wi-Fi

Wi-Fi (*wireless fidelity*) is the general term for any type of IEEE 802.11 network . Examples of 802.11 networks are the 802.11a (up to 54 Mbps), 802.11b (up to 11 Mbps), and 802.11g (up to 54 Mbps). These networks are used as WLANs. . The three 802.11 standards differ for the offered bandwidth, coverage, security support and, therefore, the kind of applications supported. 802.11a is better suited for multimedia voice, video and large-image applications in densely populated user environments.

Standard	Bluetooth	ZigBee	UWB	Wi-Fi
Freq. band	2.4 Ghz& 2.5 Ghz (ver 1.2)	2.4 Ghz	3.1-10.6 Ghz	2.4 Ghz (b/g) & 5 Ghz (a)
Network	P2P	mesh	P2P	P2P
Maximum network speed	1 Mbps (ver 1.0) • 3 Mbps (ver 1.2) • 12 Mbps (ver 2.0)	250 Kbps	50-100 Mbps	54 Mbps (802.11a) • 11 Mbps (802.11b) • 54 Mbps (802.11g)
Network Range	Up to 100 meters	Up to 70 meters	Up to 20 meters	Up to 100 meters

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CONCLUSION

Securing vehicular communication (VC) systems is complex endeavor, with multiple facets and subject to several unique constraints. We have systematically analyzed the problem at hand, identifying pertinent threats and models for adversaries. We considered general security requirements, and mapped those to specific VC applications. Based on a set of design principles, aiming at a practical system that can be readily adopted towards deployment, we designed a comprehensive solution, a security architecture for VC systems. We focused on identity and credentials management, security for a variety of communication protocols, and privacy enhancing mechanisms .Next we has to use GPS system for finding a proper path .

REFERENCES

[1]. X. Yang *et al.*, "A Vehicle-to-Vehicle CommunicationProtocol for Cooperative Collision Warning," *Proc. 1stAnnual Int'l. Conf. Mobile and Ubiquitous Syst: Networkingand Services*, 2004.

[2]. Bluetooth Special Interest Group (SIG). Bluetooth CoreSpecification. Version 2.0 + EDR, November 2004.

[3]. Q. Xu, R. Sengupta, and D. Jiang, "Design and Analysisof Highway Safety Communication Protocol in 5.9 GHzDedicated Short-Range Communication Spectrum,"*Proc. IEEE VTC*, vol. 57, no. 4, 2003, pp. 2451–55.

[4]. ASTM E2213-03, "Standard Specification for Telecommunicationsand Information Exchange Between Roadsideand Vehicle Systems — 5 GHz Band DedicatedShort Range Communications (DSRC) Medium AccessControl (MAC) and Physical Layer (PHY) Specifications,"*ASTM Int'l.*, July 2003.

[5]. J. Zhu and S. Roy, "MAC for Dedicated Short RangeCommunications in Intelligent Transport Systems," *IEEECommun. Mag.*, vol. 41, no. 12, 2003.

[6]. A. O. Tickoo and B. Sikdar, "Queuing Analysis and Delay

[7]. IEEE 802.15, Working Group for Wireless Personal AreaNetworks (WPANs). http://www.ieee802.org/15/.

[8]. NOW: Network on Wheels. http://www.network-onwheels.de/.

[9]. Ultrawidebandplanet.com.http://www.ultrawidebandplanet.com/.

[10]. ZigBee Alliance. http://www.zigbee.org/.