
Smart Car with Security Camera for Road Accidence Monitoring

Poonsak Sirichai*a*, Somkuan Kaviya, Yusaku Fujii and Preecha P.Yupapind

a, bInnovative Communication Program, Krirk University, Bangkok 10220, Thailand

cGunma University, Kiryu, Japan

dKing Mongkut’s Institute of Technology Ladkrabang, Bangkok 10520, Thailand

Elsevier use only: Received 15 November 2010; revised 15 December 2010; accepted 20 December 2010

Abstract

This research proposes the concept of security and prevention of road accidence using close circuit television (CCTV) monitoring system in conjunction with the vehicular ad hoc networks (VANET), which is integrated by a 3G or 4G cellular wireless networks. By using the CCTV cameras installed in taxi (car), the image is converted to wireless signal and transmitted via the radio system, in which the communication between cars and taxi call centre can be provided. Moreover, the security of image can be protected by using the signal encryption technique, in which the secret key is available only by authorized person, where finally the required image can be viewed when the crime is occurred. This is the security concept with the privacy violation and protection.

© 2010 Published by Elsevier Ltd.

Keywords: innovative communication; surveillance wireless network; privacy protection; CCTV; VANET;

1. Introduction

Communication technology has been involved in human life for years, especially, when the mobile telephone technology has become an important part of human life, for instance, telephone communication, live news, internet and television, etc. To date, the mobile telephone technology development remains, in which the use of mobile telephone incorporating a short range network (Ad Hoc Network) is open to the world [1, 2], which is available for many applications such as transportation [3], office network, tourism, conference [4], etc. However, there are many more applications can also be involved, where one of them is the use for ad hoc network for security purpose.

In this work, we propose the technique that uses ad hoc net work installed in cars which is able to form the transportation security by using the ad hoc net work, which is called vehicular ad hoc network (VANET), in which the required function of this work is that the transportation security is formed by using the VANET system. The taken images are recorded and linked by the VANET which can be used for transportation security and broadcasting. Moreover, to make the system available for privacy protection, the transmitted images can be
encrypted by secret code, which is available for only authorized person. The security with privacy violation concept is proposed, in which the large demand of the concept and system will be seen in the near future.

2. VANET System Architecture

Fig. 1 shows an overview of in-vehicle network architecture and out-vehicle network architecture, in which the automobile in an in-vehicle network adopts four vehicle bus protocol is appliance, using CAN (Controller Area Network), LIN (Local Interconnect Network), MOST (Media Oriented Systems Transport) and Flex Ray. However, this protocol cannot communicate with each other. Therefore, the OSEK operating system is designed as the standard software using the various ECUs (Electronic Control Units). In the out-vehicle network, the OBU (On Board Unit) in the automobile can communicate with the infrastructure node via the Internet. The remote home service and remote vehicular service providers provide the particular service to an automotive user. The in-vehicle and out-vehicle network architectures are discussed in details and founded in references [5].

This vehicular network and the on-board PC architecture consider that all the intelligent sensors, actuators and other control units inside the vehicle are implemented by the capable microcontrollers, where in this case, the protocol is implemented and formed the network. By using the networking, it would be enable them to exchange data among themselves, while also allowing any device to transmit data to/from the external network, or be accessed from it to provide features such as remote diagnostics, monitoring, data collection and remote firmware upgrade [6]. This architecture makes various hardware and software changes to the vehicle network in order to make this network via the internet. The remote firmware upgrade feature of the nodes requires the most changes, in which the discussed architecture requires the modules to have flash memory for coding, and an on-module or on-chip (built into the micro-controller unit (MCU), flash programming voltage generator. The firmware nodes have a specially developed boot loader core in the non-volatile memory of the MCU, thus enabling access to the MCU via the bus through the port of the MCU to reprogram the flash memory is required.

This new feature is essential for simply debugging and reprogramming, in which the long distance (remotely area) can be linked via the internet [7]. Moreover, the used nodes should also be able to operate with the wakeup mode, in which the nodes would consume the minimum amount of battery power when the vehicle is not moved (stopped). To perform a diagnosis task, the system is being able to wake up remotely. To reduce the cost and size, and to minimize the technology obsolescence, an on-board computer generally does not have very high storage and processing capacity. Additionally, this computer mostly acts as a client depending on the remote server on the internet, and therefore does not require very high performance [8].

Fig. 1 Communications system for VANET
The service system is as shown in Fig. 2 which is available to search, download and install service applications that can be operated on a user terminal in an open telemetric environment. The system has incorporated the telemetric gateway in the service providers including the wireless optimized TCP, the wireless optimized HTTP, the SMS gateway, pushed module and framework, as illustrated in Fig. 3. Such a system has three main components: gateway, framework and world telemetric protocol: (i) Gateway: it allows developers to write a telemetric server application that can be operated irrespective of the gateway of the mobile network, (ii) Framework: developers can write applications, without knowing about the details of integrating the related servers distributed in networks, by utilizing APIs supported by the framework, and (iii) World Telemetric Protocol (WTP) defines a protocol to exchange messages between a telemetric terminal in a vehicle and a telemetric service center, in which the telemetric service developers and service providers can develop and provide telemetric services that do not depend on devices and service carriers [9].

Fig. 2 shows a car communication system connected to the internet

Fig. 3 shows a car wireless communication via the internet

The GPRS technology is employed to locate the global satellite network, wireless VANET and mobile networks, in which mobile wireless allows receive - send the exact video and sound information that is encoded as secrets and
the information used in the investigation as evidence in court [10]. The development of this new system is the CCTV is a small resolution sufficient installed in taxi and public transport by the hidden camera inside a taxi meter and the various public transport. In operation, when the driver press the meter, the camera system with CCTV can start when the engine start and send the video data via GPRS to the control center. Each car will have a different GPRS code which is stored in the system, the information must be coded. The serious investigation can be seen by the authorized person who knows the security code can access to the required data (image), where finally, the information such as location of car, vehicle registration number can be known via the GPRS signal. However, if there is a problem that is affected to the passengers, then they can check and ask for the offender [11].

In case of the driver is caused any problem, he/she can send the alarm notification to the control center, in which the control center staff can notify the police to catch the criminals, or to extract a solution for the problem of unsafe events to track the vehicle from the GPRS signals [12]. Fig. 4 is composed of all relevant elements of a proactive service listed in the above three statements. This service dynamically links a car, as shown in Fig. 4, advertising an image from the local telemetric system. To select an image that may be offered by many cars in the location, the user agent needs to perform a selection according to the context information, including the speed of the car and the direction, thus filtering out cars that are far away or come from the opposite direction. The system architecture is based on the 3G technologies. The concept of a service is essential to the system and gives the system various advantages [13].

3. Road Accident Security

The use of VANET for road accident security and monitoring concept is described as the following details: (i) Create VANET communication is system to communicate that near-term niche communicate, (ii) the 3G communication system to send data to a control center and is recorded, (iii) use GPRS notify coordinates of the vehicle to be used in monitoring or assistance, (iv) taxis and public transport can be alert and monitor the safety center using the data obtained from the system.

In application, the vehicle communication with each other via the station nodes can also be possible. By using the recorded data (image), the useful investigation is used as evidence in legal situation which is easy to decide to pay the damage cost for insurance business. We have shown that the vehicular networks will contribute to safer and more efficient roads in the future by providing timely information to drivers and concerned authorities is the innovative communication. For the public buses, the situation such as rioting, robbery, hijack, hostage, the police can be able to watch inside the car at all times for easy access to solve the situation. Finally, in case of stolen car, the
bike network can be formed via 3G nodes and to know the stolen car position from GPRS, in which the searching and recovery can be realized.

4. Conclusions

The main objective of this proposal is safety and comfortable transportation, in which the easy, accurate, effective and simple communication between vehicles on dynamic mobility is required. Effective measures such as communication media between vehicles can be constructed as well methods to track the automotive vehicles, which is also preferred to use and form the defining safety measures in vehicles, streaming communication between vehicles, infotainment and telemetric. Vehicular networks are expected to implement variety of wireless technologies such as cellular and satellite.

References