Design of Safety Alarm Model Using in Vehicle Ad-hoc Networks and Beacon

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ABSTRACT

Vehicle moving at high speed environment, in order to prevent traffic accidents, it is necessary to secure the speed ratio safety distance of the vehicle. In this paper, by using the VANETs communication to ensure the safety distance between vehicles, the driver is to design a safe distance warning system that can help to ensure the safety distance.

KEYWORDS

VANETs(Vehicle Ad-hoc Networks), V2P(Vehicle to Pedestrian)

1 INTRODUCTION

VANETs (Vehicle Ad-hoc Networks) research has been actively carried the system for practical use and research policies for is this is displayed. In the most important research, policy of VANETs is safety and efficiency. Moreover, the most serious issue among them is safety of vehicles, and safety of pedestrians. For safety of Pedestrian side, it will have some possible of guarantee for driver's safety driving caused by wrong recognition or detection. [1, 2] In addition, safety of driver's side, it deployed that they not keep the safety distance in vehicle to vehicle. To solve this problem, we need to network technology of vehicle-to-vehicle communication. VANETs defines two communication function. First, V2V (Vehicle-to-Vehicle) defines Predicts the status of the situation and the surrounding environment around the vehicle via V2V communications, it informs it to the driver, thereby, has the capability to be able to induce a safe driving. [3, 5] Second technique V2I (Vehicle to Infrastructure), it that will offer infrastructure and information and communication using the RSU of information and Internet information to the driver, such as a vehicle of RSU (Road Side Unit) it has a function that can. [4,5] Predicts the status of the peripheral vehicle condition and the surrounding environment via a V2V and V2I communication as described above, it is possible feature that can induce safe driving to inform the driver of this. [3,4,5]. In particular, a method using direct communication by utilizing the device around the smart device and the vehicle information on the surrounding environment based on V2I technology, auxiliary capable of increasing the driver's vehicle safety from the periphery of the danger it is possible to become a technique. However, the current VANETs is V2V, V2I communication method, the safety messages between the vehicle and the vehicle, such as a left turn assist with the movement of the auxiliary. Intersection is composed of mainly receive the form, keep track of the position data of the pedestrian safe operation of the accident from the pedestrian model is insufficient which may be it may be difficult. Therefore, in order to obtain information on pedestrians, V2I communication technology capable of transmitting and receiving between the vehicle and the pedestrian are required.

Basically pedestrian, and carrying the smart devices and smart phones, these devices are based on the position and personal data of the

pedestrian as a device that may generate BLE, the vehicle and pedestrian it can be used for communication between. In addition, the vehicle is so moving at high speed, it require a high-speed transfer can communicate. [6,7] However, the communication between the senseless vehicle and pedestrians, when receiving sending unwanted pedestrian information from the traveling direction of the vehicle, on the driver is driving, causing traffic accidents there is a possibility. Accordingly, the communication between the vehicle and the pedestrian, it sent the pedestrian information in a fluid environment suitable for the situation of the vehicle, a communication method to enhance safety.

Therefore, in this paper, detects the risk of a pedestrian around the vehicle, communication between vehicles to ensure safe operation, the 802.11p based communication, by utilizing the BLE communication between the vehicle and the pedestrian provides a scheme capable of notifying the detection of the risk. The proposed method provides two major services. Provide the first eye, setting model of fluid dangerous areas for safe operation of pedestrian safety and driver. Using the model as described above, the safe driving is required areas fluidly proposed, using a set of real-time and localized areas, and we want to further enhance the safety. The second provides an algorithm model for risk detection settings that can be distinguished detecting a vehicle that require dangerous pedestrian the surrounding environment. This is to eliminate the most of the unwanted pedestrian information from the vehicle, we propose a model for the alarm to be able to induce the safe driving to the driver to determine the dangerous information for the driver.

2 RELATED WORKS

VANETs is started from the communication model, it has been actively carried out in the research and commercial sectors of the multiple applications. Commercialization of V2V among them is progressing greatly. The purpose of V2V mean a communication between a V2V the vehicle and the vehicle is meant to improve safety between vehicles, communications and application models will help to be able to induce the safe driving to the driver to. [5] As one example, the country Highway Traffic Safety Administration under the umbrella of the United States Department of Transportation (National Highway Traffic Safety Administration) is, it is possible to know through a report called "Vehicle-to-Vehicle Communications Readiness of V2V Technology for Application". [8] V2V evaluates a technology that can improve the safety of road and the driver, using a scenario, define a number of applications, and explains the necessity and importance of V2V. First, we explain the safety application model that can be used at the intersection called Intersection Movement Assist (IMA). IMA is, there may occur a collision at an intersection when the driver enters the intersection, to determine the risk through a V2V communication. If it is determination that there is a danger to the driver, it is a model for a warning to the driver. Second Left Turn Assist (LTA) is, when the vehicle of the driver is trying to turn left, without the vehicle is stopped on the opposite side of the lane to try to turn left, danger that the approach to the driver of the vehicle it is a model for the left turn warning to the driver to determine the sex. Third, Emergency Electronic Brake Light (EEBL) is near and the driver of the vehicle, if the car in front of their own was suddenly braked by sudden braking, and a warning to the driver, the driver also immediately brake a model that allows the. Model as described above, was defined as an application model that can be used when the weather is poor fog or heavy rain, fell. However, such safety scenarios through V2V communications, with only drawbacks surrounding environment, especially communication scenario with a pedestrian safety and danger has not been set is performed in the communication of the vehicle and the vehicle in. Not only has defined the application

model that defines the communication called Pedestrian to Vehicle (P2V) PRW (Pedestrian in Roadway Warning), through what kind of communication with the accurate communication definition, pedestrian and vehicle technology to solve the problem of risk and safety between the have the disadvantage that could not have been accurately presented. [9]
Therefore, the communication between the vehicle and the pedestrian is set, you must define the service and application model.

2.1 GPS

Global Positioning System (GPS) radio waves in the satellite to send the GPS radio waves from the receiver means the technology to understand the position of the terminal. Current Location Services devices required, such as the majority of users of smart devices and vehicle navigation terminal, GPS module is mounted, the user can receive the provision of various location-based services. [10,11] The high error rate of GPS, due to technical and other GPS models through error correction of the position estimation range of users, can reduce the error rate, activation of location-based services is underway . [12]
In particular, the same as the smart devices, services and peripheral eateries that provide us with the current position location information to understand in order to find the destination to the user, provides medical facilities, such as equipment search, user experience there is a give service. In addition, search the user's location to emergency patients, there is a safety services, such as a lost child search. However, in the location-based services, research is insufficient for the service of real-time emergency information. The position can be information service in real time via a GPS, utilizing this, if the user is risk in localized range occurs, the service of service model that this can be addressed is insufficient. Thus, by utilizing the hazard alarm services in local range of the user's current position, it is necessary to service model that can give the user risks low.

3 PROPOSED MODEL

Set of danger zone, after the driver of the vehicle has recognized the pedestrian, there is no traffic accident between a pedestrian and a vehicle at this time to the organizing of the car, that the vehicle is stopped It means an area that can. The definition of the concept of the danger zone is the same as the following figure 1. Smart device of pedestrian broadcasts regularly risk message. If auto smart device has received transmits a risk message from the pedestrian, calculates the distance of the pedestrian and the vehicle by utilizing the information of the message. And if the risk of a pedestrian has been determined, after setting the danger zone, so as to induce the vehicle stopped or safe driving through the alarm to the driver. At this time, hazardous area may be defined a distance to hazard zone by using two variables. First, it is the stopping distance of vehicle has occurred is pedestrian and traffic accidents. Then, it is possible to pedestrian travel distance of the pedestrian looking to when moving to the front of the vehicle, and obtains a common width of the pedestrian, defining the danger zone between the vehicle and the pedestrian.
Smart device of the driver is there is a matter that should be considered prior to the setting of the danger zone. First, when the driver of the vehicle has received a danger alarm via a smart device, the distance communication time with the driver during the reaction time of stopping the car, and the car along the total stop time of receiving the alarm , shorter than the distance between the vehicle and the pedestrian. In order to save the stopping distance, we must look at the definition of the stopping distance of the existing defined vehicle. Description of the stopping distance, the following figure is the same as 1.

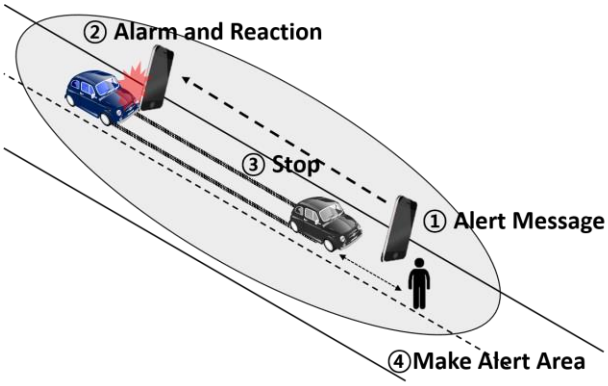

Figure 1. Alarm pedestrian model

Stopping distance is classified in braking distance, a total of two types and Princes Street. First, Hazardous and Princes Street or the pedestrian appeared in the roadway, when the driver discovered the danger, the driver decided to stop, it means the time to start the brake operation after the time of the foot on the accelerator. And, the braking distance and brake operation is started, the vehicle means that intends first live the distance to stop completely. Distance Place this kind of distance, but the stopping *distance* of the vehicle.

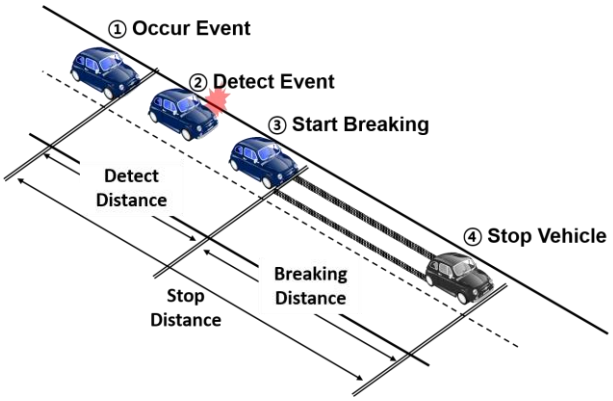

Figure 2. Mssd model

Equation (1) is Stopping distance of the vehicle determines the speed ratio stopping distance of the vehicle using a mssd used in conventional (Minimum Stopping Sight Distance). t is reaction time if it were a driver, f is the friction coefficient of the vehicle, V is the speed of the vehicle.

$$\text{mssd} = \frac{V}{3.6t} = \frac{V^2}{254f} \tag{1}$$

And we have to calculate the pedestrian moving distance. Figure. 2. Is shown that pedestrian moving distance for safety alarm service.

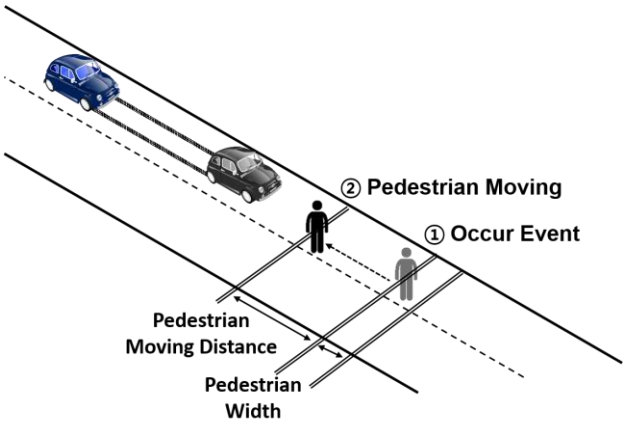

Figure 3. Pedestrian moving distance model

$$Pm = \left(\frac{mssd}{\frac{V}{3600}} * 1.8 \right) + 1 \tag{2}$$

$$admssd = mssd + Pm \tag{3}$$

The vehicle is in an environment moving at high speed, it is possible to attach a sensor capable of measuring the distance from the vehicle to ensure a safety distance. However, the measuring method as described above, it can be implemented through the algorithm and the communication method capable of correcting the error rate for relative measurements. Not only, using the pedestrian which is fixedly arranged for measuring the distance between the vehicle in a manner as described above, it is necessary to measure the safety distance between vehicles. This movement information of the vehicle via a device capable VANETs communication, and transmitted to the pedestrian, the pedestrian is to transfer a safe distance information between

the measured vehicle re vehicle, the safety driving of the driver It must be able to be derived. Therefore, in this paper, using the VANETs in a way to teach a safe distance in a high-speed environment, define how to transfer a safe distance information of the vehicle. Thus, after being transmitted the information of the rear of the vehicle and the vehicle ahead. Through a VANETs communication method using a pedestrian V2P, alarm a safe distance to the driver by using a safe distance algorithm model. In this paper, is a safe distance between the vehicle when the front of the vehicle was a sudden braking, to define the stopping distance of a rear-end collision accident the rear of the vehicle is to recognize this will not happen with the safety distance. Figure 4. The suggested safety distance of alarm model of the next.

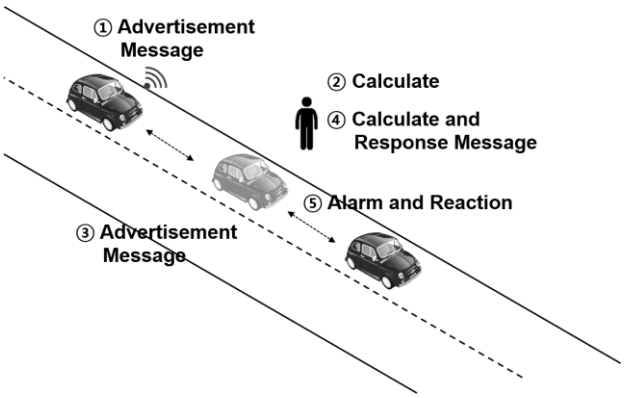

Figure 4. Alarm model of safety distance

First, the front of the vehicle (the black car) to send the car of Advertisement Message in a pedestrian. In this case, Advertisement Message transmits the information on the lane of the road that is the speed and the current arrangement of the current vehicle as a message. Then, the pedestrian is utilizing the speed of the vehicle ahead is predicted by calculating the distance between the rear vehicle to be accessed in the future. When the rear of the vehicle (gray car) transmits a car Advertisement Message pedestrian, the pedestrian can compare the information of the speed information and the forward vehicle behind the vehicle is approaching, and a safe distance is ensured it is determined that the. And it sends the Response Message to the rear of the vehicle. Rear vehicle receives the Response Message, and transmits the alarm information to the driver, is induced to be able to secure a safety distance.

Then, it must seek distance error along the communication Delay between the vehicle and the pedestrian. Communication delay determines the overall delay of the communications using 802.11p being used in the current VANETs communication standards. Formula is represented by following (4).

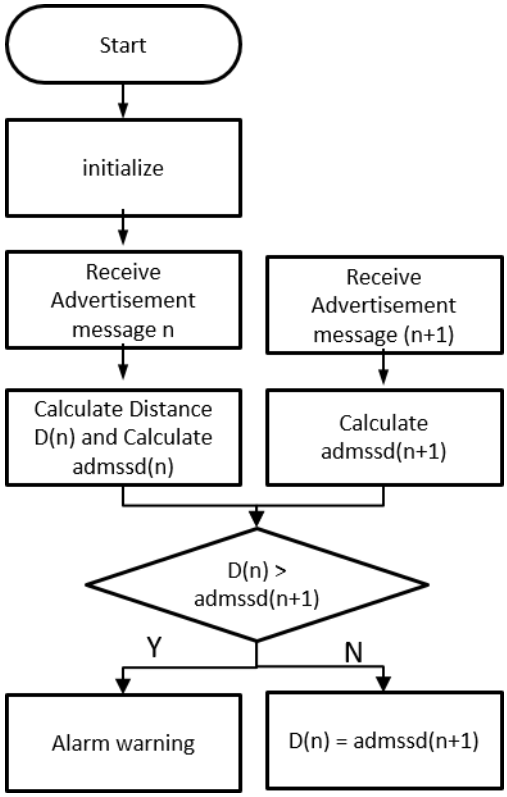

Figure 5. Safety distance algorithm

T_{trans} the Transmission delay time of 802.11p, T_{pro} the Propagation delay time, T_{que} is Queueing delay time and T_{com}, means Computation Time to calculate the information of Advertisement Message.

$$T_{delay} = (T_{trans} + T_{pro} + T_{que}) + T_{com} \quad (4)$$

It is possible to determine the distance of the preceding vehicle and the rear vehicle by

utilizing. Formula is as follows (5). V_{width} refers to the width of the vehicle.

$$\therefore D_{total} + admssd + 2(T_{delay} * V) + V_{width} \quad (5)$$

To send an alarm to be able to forward vehicle induces safe driving to the driver by comparing the D_{total} distance and the rear vehicle past the pedestrian with the distance D_{total} obtained above. At this time, a safe distance algorithm, following Figure 5.

4 CONCLUSION

In this paper, in order to induce a safe driving to the driver, to design a safe distance notification model between the vehicle, it was presented. Using the model and algorithms presented.

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