A Collision Predicting Mechanism for Automobiles

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Abstract

Road accidents have become a major tragedy in the world and significant number of lives lost every day due to vehicle accidents. There are researches on road safety and some applications were developed to avoid collisions by warning the driver. Most of the applications use Radar signals to detect abnormal movements or emergency events of the vehicles and other applications use GPS and vehicular communication techniques to share warning messages. Common human drivers suffer from perception limitations on roadway emergency events and responding to emergency warnings are delayed because humans have a Psychological Refractory Period (PRP) that limits the ability to respond to stimuli which are presented in close temporal proximity. Studies have shown that about 60% of roadway collisions could be avoided if the driver was provided with a warning at least one-half a second prior to a collision. All the related work focus on detecting an abnormal situation in a roadway or emergency movement of a vehicle and after that it generates warning messages and propagate them. This project has developed a new approach of predicting such emergency movements of the vehicles before it happens and warn the driver to avoid taking a sudden movement or be aware of an emergency event from a surrounding vehicle.

As the methodology of the project, real time road traffic was observed from 24 observation points. Each point was observed by five observers to record relative speed, relative acceleration and deceleration through naked eye view by comparing each vehicle to a base vehicle. This data was analyzed to develop the message passing approach, the model of driver decision in both straight and curved road segments and other algorithms. A test bed was implemented using single board computers, GPS adapters and WiFi adapters to communicate with each other as a vehicular network to test the algorithms.

As the findings of the project, a general model of vehicle positioning on a straight road segment which provides minimum connections via a vehicular network was concluded to pass messages which are having local parameters of a vehicle, namely GPS location and speed. The proposed model can be used to construct vehicular communication network for sharing information to predict possible collisions in single lane roads. Further, it is more efficient because it creates only four connections with surrounding vehicles and generates less network traffic. Therefor message delay and the processing time for propagating messages are reduced.

The next finding of the project was the general model of driver decision in a road to be used as the criteria of predicting vehicle movements by analyzing real time speeds and locations of surrounding vehicles before they take the action.

According to the findings of the project it can be concluded that instead of road safety applications which detect and inform the collisions, it is possible to develop applications to predict and warn about the collisions before they happen. For that purpose, it is necessary to use a well-functioning vehicular network to pass parameters and each vehicle can process them to predict collision possibilities. The proposed method makes vehicles intelligent enough to inform the drivers about the surrounding vehicle movements and predict collision situations to avoid vehicle accidents. This model was developed for four vehicles that drive towards one direction and it can be applied to most situations having two or more vehicles. Indicating surrounding vehicle movements will be an advantage for the drivers to avoid collisions when visibility is poor, when there are blind spots, or when the driver is not paying enough attentions to the surrounding. Thus, the mechanism presented in this paper is efficient and adequate to predict possible vehicle collisions in single lane roads to ensure safe traveling.

Keywords: Collision prediction; GPS; Vehicular network

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User Behaviour Observation and Analysis Through IoT

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Abstract

Researchers have developed a multitude of theories, possible applications and usages of Internet of Things (IoT). Yet, only a very few of these proposed systems have ever been implemented and tested on a real-life situation. Wireless devices such as smartphones/tablets and other wearables as well as embedded short-range wireless devices are found in every imaginable place from shoes, cars to buildings. These devices have become an integral part of everyday life at a personal and commercial level. These devices maybe sensors to monitor various conditions to improve or provide insight into the functionality of the embedded system, be it human or machine while other devices may also provide easy access to functions in various equipment from heating, ventilation and air conditioning systems to door locks. These devices are capable of communicating with each other without human intervention. The Machine-to-Machine (M2M) connections are expected to grow over 2 billion by 2018 at a 43% annual growth rate. The accessibility of IoT devices through Internet, enable a multitude of new services such as e-Health, connected consumers, city automation and smart grid. These are the essential building blocks of IoT.

The telecom carriers in the telecommunications industry also face economic issues as the revenue generated by traditional services such as voice is declining. As an innovative future direction, M2M is identified as a promising revenue-generating service. Telecom carriers may need to establish new networks to accommodate the influx of user devices and their interactions while identifying new business opportunities. However, the majority of IoT devices may not have the capability to directly connect to the Internet due to their limitations in battery capacity, processing power, wireless radio range and standardization issues.

This work provides an insight into an IoT architecture test bed and its further analytical possibilities. The usability of the IoT architecture is supported by data gathered at a real-life experiment conducted during an exhibition. The visitors to the exhibition were handed an IoT device that transmitted a periodic Bluetooth Low Energy (BLE) signal (BLE tag). The visitors entered the exhibition area, stopped at some exhibit for a random time period to receive

explanation, randomly moved to another exhibit or moved around the area and left the vicinity at their own will. At each exhibit a smartphone was set up to receive and record the BLE tag messages as a location-aware M2M gateway. The smartphones deployed at the exhibition area sent the information collected from the BLE tags to a central database server for recording. The experiment used 12 smartphones as M2M gateways.

The analysis of the recorded data yields some interesting results of the exhibition itself such as the most popular exhibition item. When multiple smartphones receive the same signal from a single BLE tag, it was considered that the particular BLE tag is connected with the smartphone receiving the strongest signal. The signal strength can be measured by the Received Signal Strength Indicator (RSSI) of the BLE tag periodic advertisement packet. Using this methodology, it was possible to order the smartphones according to the number of maximum RSSI value BLE tags associated with it throughout the exhibition time period from 9 AM to 5 PM. The exhibit associated with the smartphone that has the highest number of maximum RSSI BLE tags can be considered as the most popular exhibit. Similarly 2nd and 3rd popular exhibits can also be identified. Further analysis also provide an insight into the participant behaviour at the exhibition such as the average time spent at each exhibit and the entire exhibition, the order of exhibits visited and the most crowded time of the day at the exhibition as well. These results show the importance and vast analytical possibilities for the corporate sector as well as the benefits for the end users.

Keywords: Bluetooth smart network; IoT architecture & communication; IoT test bed; Internet of Things