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Research paper

Smart Infotainment System for Vehicular Network

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Abstract

On fast moving life, time management has become an important factor. Objective of this paper is to implement features of high range vehicles even in middle range vehicles through few performance metric improvements. The parametric and non-parametric analysis is applied to evaluate vibration modes. In a Vehicular Ad hoc Network (VANET), vehicles communicate with each other through Dedicated Short-Range Communication (DSRC) wireless devices. Equipped with hundreds of smart sensors, vehicles can detect their own parameters (such as braking, lane changes, and acceleration) and road conditions (such as icy roads and weather conditions).Vehicular ad hoc networks, the spontaneous creation of a wireless network for data exchanges, are used for clustering data. Quantitative data analysis is carried out for decision making.

Keywords: *Vehicle to vehicle communication, road surface monitoring, emergency message alert, weather prediction, data analysis.*

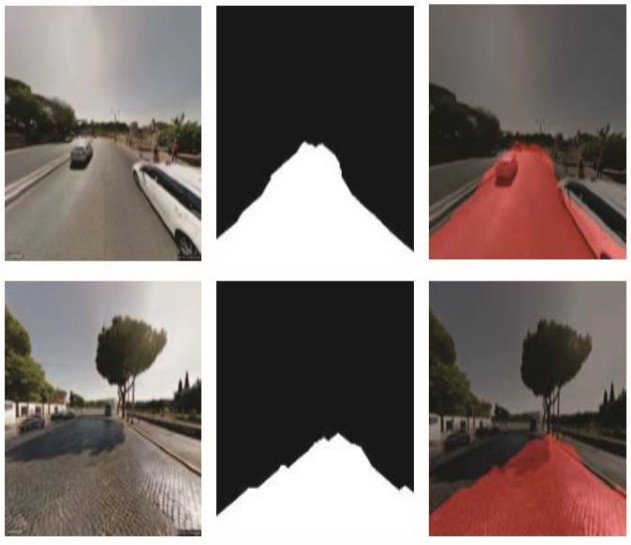
1. Introduction

1.1. Vehicle to Vehicle Communication

V2V communication opens the door to lot of innovation in the infotainment system of the car. It's a radio-based network which enables exchange of burst of data between vehicles, as well as between vehicles and traffic infrastructure with frequent updates. For example, the driver can see the past the next bend in the road to the bend after and even farther in prior using the smart system. Thus the driver could adjust his/her driving behaviour and avoid dangerous situations. This will make the driving more efficiently. The vehicle thus sees hazards before they are perceived by the driver, and warns the driver and other road users in good time.
Networks in which vehicles and roadside units are acting as communicating nodes, providing each other with information, such as safety warnings and traffic information in termed as V2V Communication. They can be effective in avoiding accidents and traffic predictions/congestions. Both types of nodes are Dedicated Short-Range Communication (DSRC) devices. DSRC works in 5.9 GHz band with band width of 75 MHz and approximate range of 1000 m. Vehicular communications is usually developed as a part of Intelligent Transportation System (ITS).

2. Road Surface Monitoring

The system is for operating during every-day operation continuously monitoring the vehicles and to support decision making. Towards the construction of such a monitoring system, this model will serve as a reference for evaluating the conditions of road surface. The reference model is constructed based on specific circumstances where the road surface is known and undamaged, the road is straight, the vehicle speed is constant, the vertical dynamics of the vehicle is excited by well specified test obstacles placed on the road. Preliminary results can be found by non-parametric and parametric spectral analysis applied to evaluate vibration modes in terms of ride comfort. Unstructured roads have more irregular shapes and contain unclear edges.
Through this analysis vehicle can predict the road condition in advance and shall re-route itself if necessary. Also, V2V network shall through sharing this data can enable the system to suggest more than two routes to a destination with different test cases that suits different driver's interest.
One shall prefer smooth road even during the heavy traffic and some may prefer free flowing traffic irrespective of the road conditions. These cases shall be addresses through an smart V2V network system.



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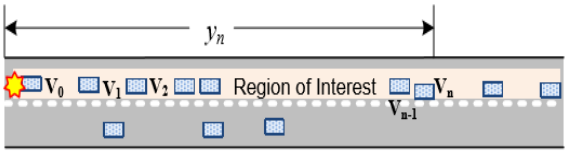
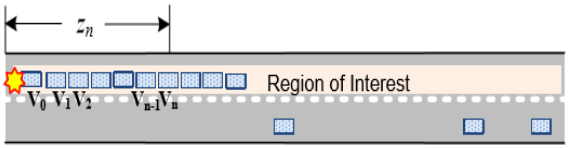
3. Emergency Message Alert

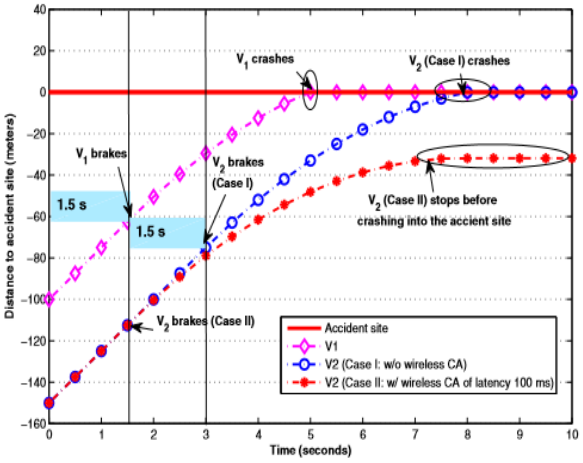
In a Vehicular Ad Hoc Network (VANET) issues warning to driver before they reach a potentially dangerous zone on the road is the ultimate task. This is performed by registered mobile number been connected to the smart vehicle. Once if any collision occurs, message is sent to the registered mobile numbers (5No's) and nearby smart network at a minimal time. Traffic and delay in the path can be known priory and the alternatives can be made through V2V networks. The feature results in less consumption of time and reduced traffic over the particular area as shown in fig (a) and (b). This also enables easy path for quick access of ambulance and other emergency. The vibration sensor placed at the suitable position in the vehicle also enables to monitor the road conditions as discussed earlier.



(a) An accident occurs and V_0 generates an emergency message



(b) Vehicle V_n safely stops behind vehicle V_{n-1}



4. Weather Prediction

Weather monitoring plays an important role in day to day life. Weather is a state of atmosphere at a given place and time. Weather monitoring involves determining factors of weather like temperature, humidity, dew point, wind velocity (speed and direction), luminosity, solar radiation, barometric pressure and so on. It is important to collect information of temporal dynamics of weather changes. There are many solutions available for weather monitoring. In particular, weather parameter information is required for people to enjoy their travelling to any place of interest. If the monitoring station is situated at a far away location, then wired communication is not feasible. Vehicle to Vehicle Communication data is more effective and accurate than the data from satellite like Google weather prediction, as the updation of the data will be delayed. Here in this scenario, the environmental conditions/fluctuations are acquired through a group of sensors and the data is computed through edge computing techniques and is shared between vehicles. Thus the data received through this V2V network of high accuracy and highly reliable. The figure 4.1 shows the data acquired through the weather monitoring system through the V2V network.

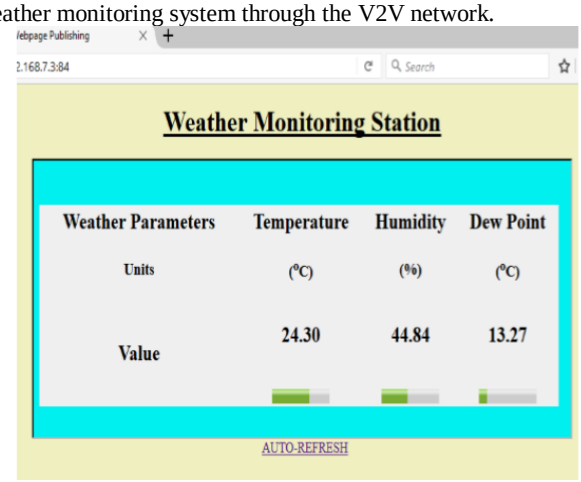


Figure 4.1: Weather monitoring system

5. Data Analysis

Data analysis on the sensor acquired burst is the essential tool for achieving the effective driving and improving the road safety. It is a process of inspecting, selecting, transforming/converting and mapping data with the goal of deriving useful information, suggesting solutions and in supporting decision-making. Predictive analytics focuses on application of statistical models for predictive forecasting. Data-informed decision-making (DIDM) gives reference to the collection and analysis of data to guide decisions that are required. The data for analysis is collected by Vehicle to Vehicle Communication; the data is stored in cloud or server. The process is carried out in the cloud and the decision is made. Decision is sent to the requesting vehicle. The analyzed data will be more effective and trust worthy.

6. Conclusion

Safety applications are always paramount to significantly reduce the number of accidents, the main focus of which is to avoid accidents from happening in the first place. For example, Traffic View and Street Smart inform drivers through vehicular communications of the traffic conditions in their close proximity and farther down the road. Vehicle platooning is another way to improve road safety. The emergency delay occurs in all the places due to lack of information provided to the respected persons, this can be solved to a great extent with the Alert message system. The facilities exist only in highly economic cars like Tesla in India. Our system enables implementing this V2V communication in all sort of vehicles from low range to middle range vehicles. In the next years, vehicles will be equipped with multi interface cards,[9] as well as sensors, both on board and externally. With an increasing number of vehicles equipped with on-board wireless devices (*e.g.*, UMTS, IEEE 802.11*p*, Bluetooth, etc.) and sensors (*e.g.*, radar, ladar, etc.), efficient transport and management applications are focusing on optimizing flows of vehicles by reducing the travel time ad avoiding any traffic congestions. As an instance, the on-board vehicle radar could be used to sense traffic congestions and automatically slow the vehicle. In other accident warning systems, sensors are used to determine that a crash occurred if air bags were deployed; this information is then relayed via V2V or V2I within the vehicular network.[10]

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