Life Time Enhancement of Wireless Sensor Network for Vanet

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ABSTRACT - In cities, the number of vehicles continuously increase faster than the available traffic systems, congestion is difficult and it became even worse in case of car accidents. This problem affects the modern society, including economic development, traffic accidents and health damage. This paper proposes the implementation of On Board Unit (OBU) in the Vehicular Ad Hoc Network (VANET) for highways and realizes vehicle to vehicle communication (V2V). The Crowdsensing based system was designed for traffic management in Internet of vehicle (IoV) interactions for different sources to sense and report occurred events. A trust model is proposed to evaluate the trustworthiness of vehicles. The cluster-based traffic management scheme to collect event report and upload messages co-operatively. This project present the delay sensitive routing algorithm for event propagation based on store carry and forward transmission mode in IoV system.

Index terms- On Board Unit (OBU), VANET, IoV, Crowd sensing, trust model, cluster based, delay sensitive routing, store carry and forward.

I.INTRODUCTION

Internet of Things (IoT) has drawn a great attention in both research fields and industries over the past few years, e.g., laptops, TVs. As a research of IoT, internet of vehicle (IoV) has evolved as a new platform based on Vehicular Ad hoc Network (VANET). VANET are a subtype of Mobile Ad hoc Network (MANET), they integrate the wireless network into the vehicles and establish the Ad hoc network between vehicles and roadside units(RSU). TMS concerns the planning, controlling and purchasing of transport service to physically move vehicles. TMS collects the information such as vehicles, traffic lights, and roadside sensors. The collected information are send to the traffic management center (TMC) concentrated in a cloud in or in a data center.

Within TMS, one building block is VANET, which provides the data exchange between vehicles, RSU and TMC. In VANET, vehicles are mobile node which has on board unit (OBU). OBU has embedded sensors, processing units and wireless interface in which vehicle can communicate among themselves to create Ad hoc network. To support such communication, VANET depends on Dedicated Short Range Communication (DSRC). DSRC can be used to connect vehicle to infrastructure (V2I) and vehicle to vehicle (V2V).

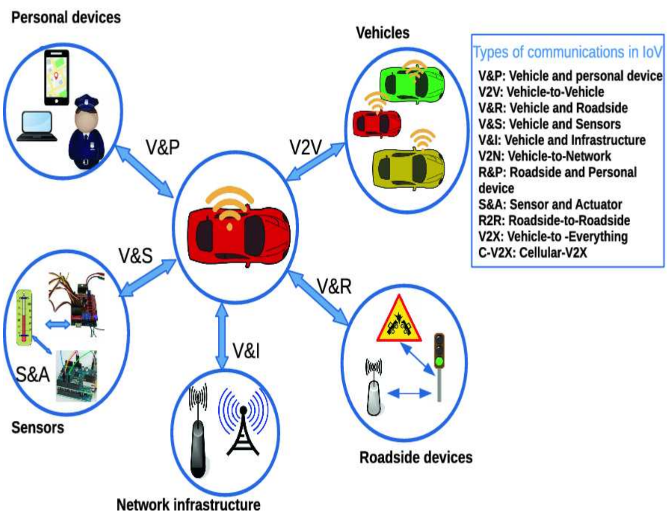


Fig .1:Types of communication in IoV

TMS supports five types of communication, i.e., Vehicle to Vehicle (V2V), Vehicle to Road Side Unit (V2R), Vehicle to Infrastructure (V2I), Vehicle to Personal devices (V2P) and Vehicle to Sensor (V2S). V2V, V2S and V2P communication architectures enable vehicles to communicate with each other directly based on MANET. RSU, base stations and other infrastructure can provide network access for vehicles.

The on board unit (OBU) consist of central control module, wireless communication module, GPS module and human-machine interface module. Central control module includes serial port information processing, data transceiver, memory and judgement and decision making. GPS module includes location, speed and acceleration. If a collision thread is detected, a warning information will be send to the neighbors immediately. On the other hand, if the driver discovers the obstacles, he/she can press the warning buttons on the touch screen of the OBU. Then the OBU will send the warning message to the next vehicle.

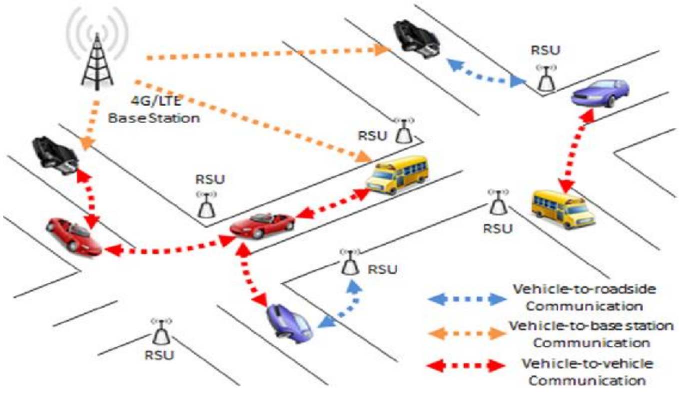


Fig.2: TMS communications

The communication between vehicle to roadside unit is **Dedicated Short Range Communication** (Wi-Fi, Bluetooth etc.,), the protocol used in vehicle to vehicle is IEEE 802.11p i.e. WAVE (wireless access in vehicular environment) short message protocol (WSMP), the protocol used in vehicle to infrastructure is Long term evolution (LTE) 802.11 (MAC) protocol.

II. BLOCK DIAGRAM

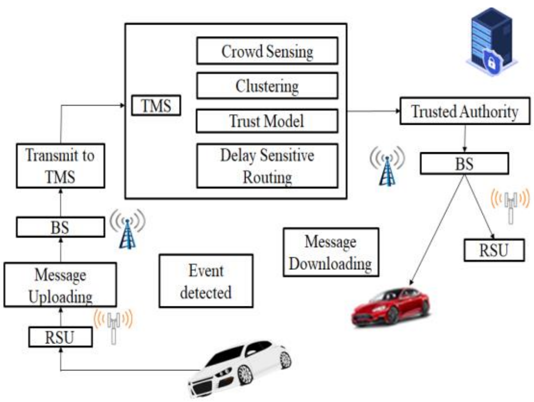


Fig.3: Crowd sensing based IoV

SYSTEM COMPONENTS

Fig.3: illustrates the system model of Crowdsensing-based IoVs. Five major parts are Vehicle, Road side unit (RSU), Base station (BS), Traffic management server (TMS) and Trusted authority (TA).The detail description of these parts are as follows:

1. Vehicle: Vehicles travelling on highways are equipped with On Board Unit (OBU) for wireless communications. Wi-Fi, Bluetooth technologies can be influenced for V2V communication. Vehicles can directly exchange data and multimedia via wireless communication to neighbouring vehicles.

2. RSU: The RSUs, stationary units are fixed on the roadside for every hundreds of meter with the ability of wireless communication are connected to the control centre via ethernet, acting as a routers to upload messages generated by the vehicles to the TMS. In addition, we consider that an RSU can acquire locations of neighbouring RSUs

3. BS: The base station maintains the communication between the network and the mobile users through a radio link. Wireless access services for vehicles are provided by Long Term Evolution(LTE) cellular networks

4. TMS: TMS collects the information such as vehicles, traffic lights and roadside sensors. The collected information are sent to the traffic management centre concentrated in a cloud. When TMS receives a message for a vehicle, message truthfulness will be validated. Then, TMS will inform the officers in the traffic management department to solve the problems mentioned in the validated messages.

5. TA: It is a fully trusted server in IoV systems. When vehicles enters into the network, it gets its initial credit by registering to TA. Besides, TA is considered to have a powerful ability to keep the security and privacy of users information.

Our main contribution can be summarized as follows:

- We design a crowdsensing based system model for traffic management in IoVs to specify the components and interactions among different elements to sense and report occurred events.
- A Cluster-based traffic management scheme is used to collect event reports and upload messages cooperatively to the TMS which reduces the response time and communication overhead.
- Trust model is a principle element which is used to create a trustful environment to improve the security in vehicular networks. Two methods are included in Trust model, Bayes trust is proposed to compute local trust and Vehicle rank is presented to compute global trust.
- We present a Delay sensitive routing algorithm for event propagation based on the store-carry-and-forward transmission mode in IoV system.

III. CROWDSENSING BASED IoV

Crowdsensing, sometimes referred to as mobile crowdsensing, is a technique where a large group of sensing and computing (such as smartphones, wearables) collectively share data and extract information to measure, map, analyse, estimate or infer any processes of common interest. Crowdsensing belongs to three main types: environmental (such as monitoring), infrastructure (such as locating potholes) and social (such as tracking exercise data within a community). It has natural connections with IoV systems by stimulating large-scale individuals to participate in order to make an improvement on effectiveness and feasibility. Crowdsensing is leveraged to deploy roadside Aps in vehicular networks.

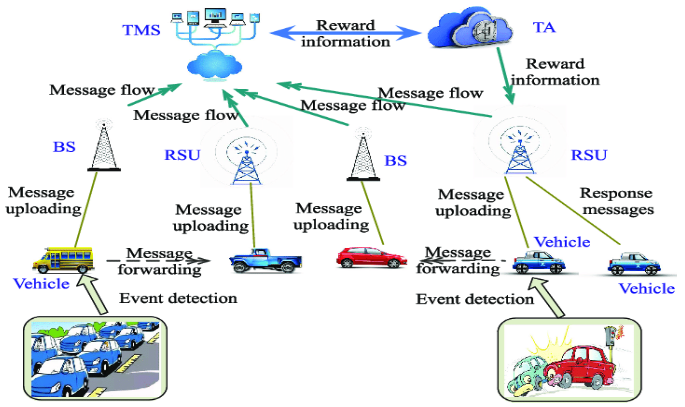


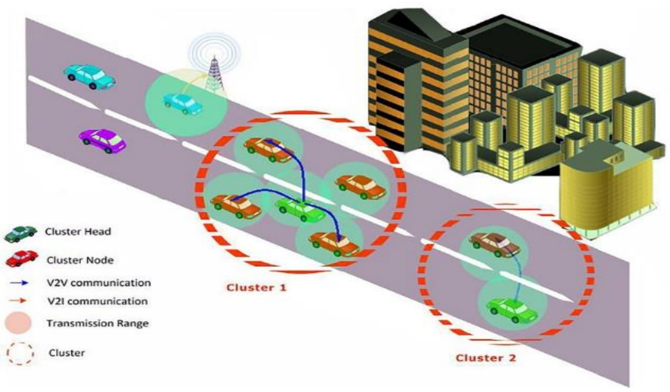
Fig4: System model of crowdsensing

Fig4 is designed for traffic management to specify the components and interactions among different participants to sense and report the occurred events. In order to reduce the delay for message uploading and message accuracy, crowdsensing based algorithm is used. It is utilized for message collection to improve the accuracy of reported message.

- Two methods are applicable for a vehicle to upload messages toward TMS: one is uploading messages through RSUs directly; the other is utilizing cellular networks through BSs.
- If the first method is chosen, uploading messages to TMS is free.
- When TMS receives message, its accuracy will be validated, e.g. the time, location and description of the recorded event.

IV. CLUSTERING BASED IoV

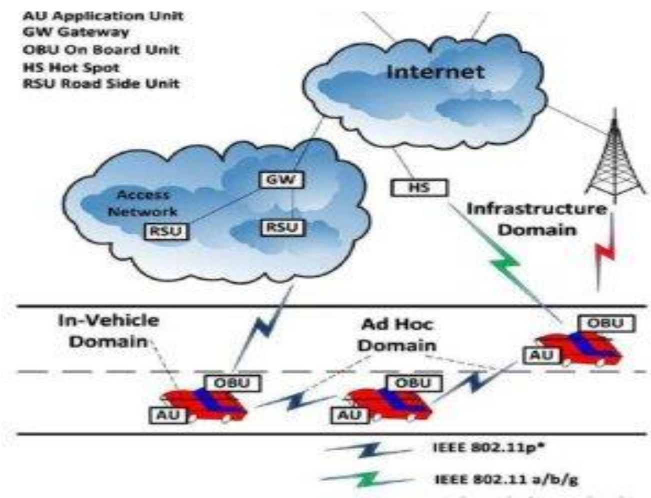
In order to improve routing efficiency and reduce the communication overhead by the crowdsensing method, we aggregate vehicles into several groups. Clustering is a mechanism of grouping of vehicles based upon some predefined metrics such as density, geographical locations of the vehicles. We propose a We propose a cluster-based traffic management scheme to collect event reports and upload messages cooperatively, which largely shortens the response time of traffic management server and reduces the communication overhead. It is the process whereby a group of nodes is organized to form a sub-network on the road which makes the network more robust and scalable.



- This scheme is used to collect event report and upload messages cooperatively, which largely shortens the response time of the TMS and reduce the communication overhead.
- To reduce the communication cost, cluster based message is integrated in message collection process.
- It decides whether to upload it via BS or RSU.
- If BS is chosen, the message transmission delay is almost negligible while the transmission cost is high.
- If RSU is chosen, transmission cost is less

V. WORKING

Vehicles travelling on highways are all equipped with On Board unit (OBU). The RSUs, stationary units are fixed on the roadside every hundreds of meters, are connected to the control centre via ethernet. Generally speaking, the control centre can collect information like the geometry of a coming cross, electronic map and existence of obstacles. Then the control centre send the information to the OBU equipped vehicles via RSU in that vehicles utilize a variety of wireless technologies to communicate with devices. Dedicated Short Range Communication (DSRC) is currently consider as the most promising wireless standard that can be used to connect vehicle to infrastructure and vehicle-to-vehicle. In DSRC network there are two basic units: Roadside Unit (RSU) and On-Board Unit (OBU). The OBU is typically, a network device fixed on a roaming vehicle and connected to the DSRC wireless network. The system is divided into four parts including Central control module, Wireless communication module, GPS module and Human machine interface module.

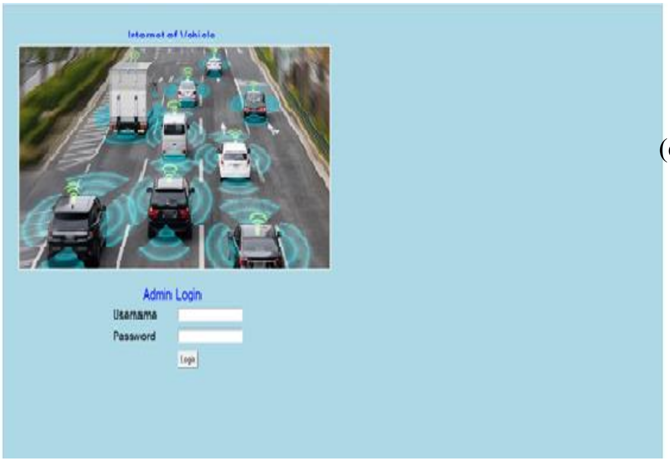


- In Central control module includes serial port information processing, data transceiver and decision making.
- Wireless communication module enable information exchange among the vehicle nodes equipped with On board-unit. These OBU exchange their data among other vehicle nodes or OBU.
- In GPS module it receives the signals, recorded, encoded and filtered in this module Then the messages are transmitted by the GPS are recovered. Finally, location and velocity of GPS equipped vehicles can be calculated.
- On one side, each OBU-equipped vehicle broadcasts its basic information several times per second, which is got from GPS module, including location, speed.
- At the same time, the vehicle also receives the "safety messages" from OBU-equipped neighbours. The receiving vehicle then use the messages to compute the path of its neighbour, and decides whether there is a collision threat.
- If a collision threat is detected, the warning information will be sent to neighbours immediately.
- On other side, when the driver discovers a hazard (example., obstacles), he/she can press the warning buttons on the touch screen of the OBU.
- The OBU will send the warning to neighbour vehicles.
- The OBU will take action to warn the driver immediately after discovering a collision threat or receiving a warning.

VI. APPLICATION

- Active road safety applications
- Collision warning: Intersection, Risk, Head on, Rear end, Co-operative forward, Pre-crash
- Warning on: Overtaking vehicle, Wrong way driving, Stationary vehicle, Traffic condition, Signal violation, Control Loss, Emergency vehicle proximity, etc.
- Lane change assistance
- Emergency electronic brake lights
- Hazardous location notification
- Co-operative merging assistance
- Message types for safety apps: time-triggered position messages and event-driven hazard warnings
- Traffic efficiency and management applications
- Speed management and Co-operative navigation
- Infotainment applications
- Co-operative local services
- Global Internet services

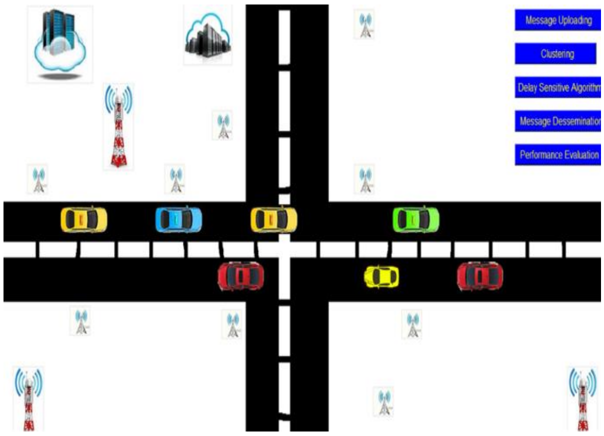
VII. RESULT



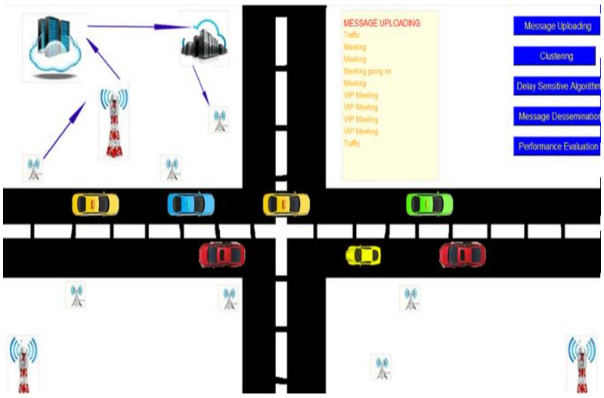
(a) Registration of vehicle

(e)

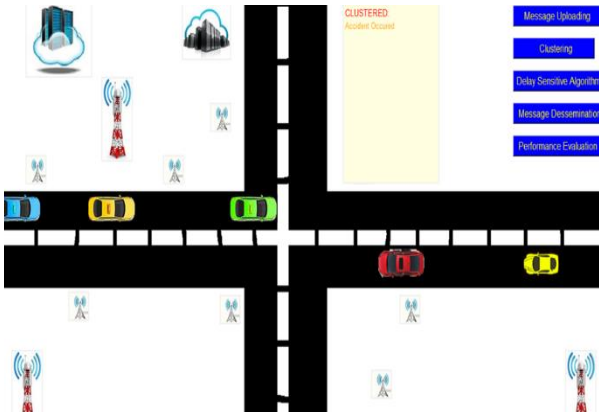
(b) VANET



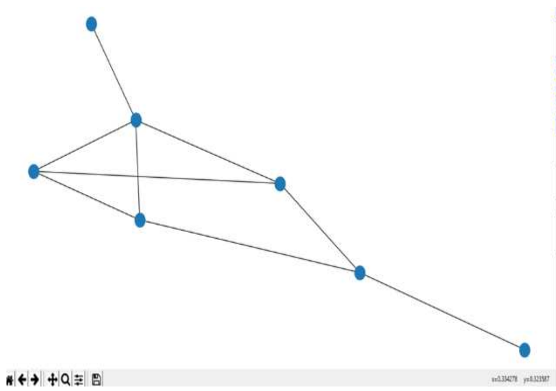
(c) Overall message output



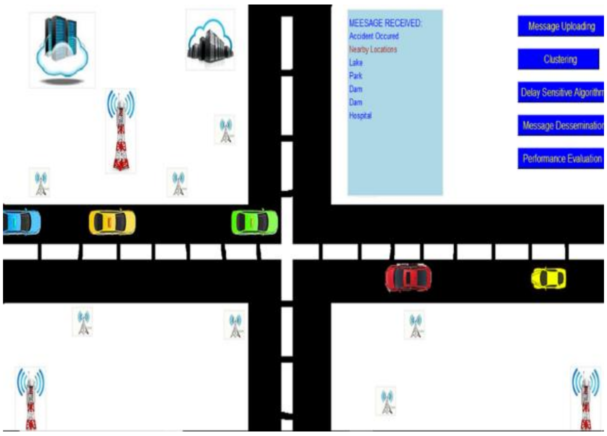
(d) Message uploading



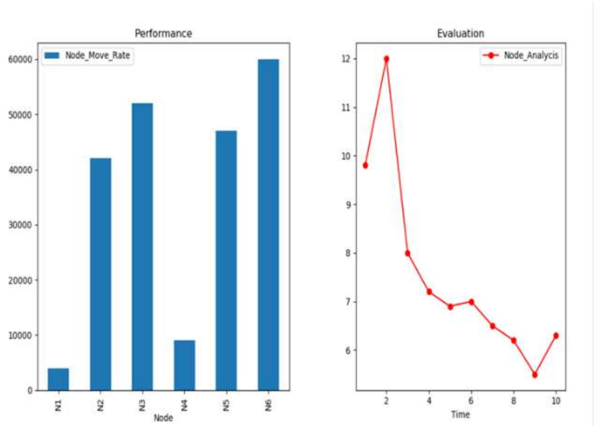
(e) Clustering



(f) Delay sensitive algorithm



(g) Message disseminator



(h) Performance evaluation

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