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A Review on Safety Mechanisms in Vehicular Ad hoc Network

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Abstract - Major goal of the Vehicular Ad-Hoc Network (VANET) is to improve road safety and driving comfort. VANET cannot guarantee timely detection of dangerous road conditions. For addressing such problem, we proposes a new scenario using VANET, with Roadside Sensor Unit (RSU) connected to base stations(BS), every vehicles on the road can communicate to server via base station. The sensor nodes along the roadside, senses road conditions, and deliver information about dangerous conditions of roads to vehicles via RSU and BS and the same message is broadcasted to other vehicles by V2V and V2I communication. All such broadcasted messages are real or fake message is check through Position-based routing security algorithm, which provides security to emergency messages and checks whether alteration of any parameter is done or not by any malicious nodes. The proposed system notifies about the accidents and suggests new route to other vehicles to avoid traffic congestion.

Keyword - *Vehicular Ad hoc Network (VANET), V2V, V2I and V2V and RSU communication, data mining, PBR.*

1. Introduction

Vehicular Ad Hoc Networks (VANETs) have received increasing attention from the research and industrial communities recently. Many valuable applications, such as entertainments, Congestion Control, and accident avoidance, have been envisioned or planned in VANETs.

Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) are two major types of communications in VANET. VANET allow vehicles to connect to roadside units (RSUs), which are fixed infrastructure that are equipped with powerful computing devices and installed at different locations in a city. They can connect with each other via a wired network and with passing by vehicles through wireless communications. Each vehicle is equipped with an On Board Unit (OBU), through which they can transmit messages and data packets to the destination using V2V communication or transmit to a Roadside Unit (RSU) using V2I, will be possible directly when in range, or across multiple hops. Such hybrid design is very important to realize various types of applications. As we know large numbers of automobile accidents are caused due to driver fatigue, to address this problem we are proposing a real-time vision-based detection system, which uses V2V communication. And V2I communication .where for Infrastructure communication we design traffic related scenario using VANET architecture, Roadside Unit (RSU), sensors nodes, Base Station(BS) as shown in figure 1which also includes server, which receives messages from BS, RSU, and also from vehicles. Server broadcast the messages receives from BS and RSU to emergency services station in case of accidents and help.

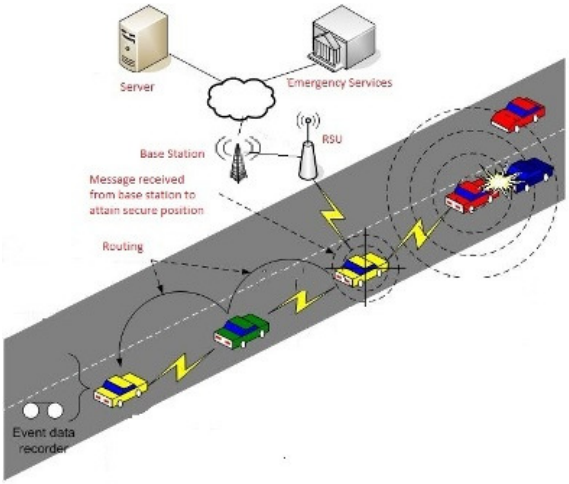

Fig.1 System Architecture for proposed system

The objective of this paper is to apply security routing algorithm to the emergency messages broadcasted by the vehicles during accidents. The Emergency services (ambulance) are allowed to pass first on the road, in between other vehicles at time of traffic in the proposed network, so that the services station did not get fake alert messages from any kind of vehicles. The emergency services station will receives messages of accident from server and base station of the proposed network.

The remaining paper is organized as follows: Section II describes the previous work. Section III presents the proposed work. Section IV describes the expected outcome of the proposed system. Lastly section V presents the conclusion.

2. Previous Work

M fogue, et. al. [1], author has proposed a system architecture which detects road accidents through vehicular networks automatically and also shows the estimation of road accidents on base of severity through data mining and process of knowledge interferences. They have made a research and develop a prototype through which they have shown that it takes noticeable less time needed for alert messages through vehicles at the time of accidents due to which emergency services were reached to accident spot within less time as compare to previous ways and time require to reach for rescue purpose. The drawback for this proposed system is that they have not designed any module for traffic congestion; the proposed system focuses more on providing safety for road accidents and notification about them. The designed system does not describe anything about the security algorithm, for providing security to the alert messages broadcasted by the vehicles at the time of emergency for rescue purposes.

F. Martinez, et. al. [2], author proposes an architecture for rescue operation in current periods, they proposed new architecture using vehicular network for vehicular communication and also shows that through new system rescue time needed for road accidents is less, as compared to present scenario, they have also shown how emergency services and road safety will evolve with the proposed system with the help of vehicular communication and road transportation. The major drawback for this system, does not notify about the automatic notification for road accidents, for safe driving comfort, they have also not proposed any module for any kind of traffic congestions and also not work for secure routing of messages in vehicular communication.

Fan Li, et. al. [3], author discuss the research challenge of routing in VANETs and presents the survey using recent routing protocols, and shows the mobility models for VANET. The paper provide ubiquitous connectivity while on the road to mobile users, who are otherwise connected to the outside world through other networks at home or at the work place. This paper describe about the possible different kind of architecture for VANET, for safer vehicular communication. They have discussed about various kind of routing protocols which can be used for VANET and research challenges for the same. They have described about the model for vehicle mobility while travelling on road. They have concluded that the performance of a routing protocol in VANETs depends heavily on the mobility model, the driving environment, the vehicular density, and many other facts. The major drawback is that they have not discussed anything about secure routing protocol which can use for VANETs.

A. Thangavelu, et. al. [4], authors has proposed a system VETRAC for vehicle tracking, in which driver driving the vehicle or any other persons can monitor the location of any other travelling vehicle. The designed system used WiFi IEEE 802.11 b/g for getting a current and exact location of the vehicle, for providing effective and simple communication. The advantage of this project is that it provides navigation function anywhere at any time using Wi-Fi wireless connection. The major drawback is for security of VETRAC, which has not been implemented in current setup.

A. Buchenscheit, et. al. [5], authors discuss about use of radio communication to warn other vehicles and to preempt traffic lights, according to situations. The designed system reduces the risk of accidents and save time of responding help of emergency services. They have given a scenario for emergency vehicle warning system which makes full use of inter-vehicle communication, via using traffic lights mechanisms so that such vehicles will reach at spotted location faster. They have designed a module via which drivers can interact to rescue people via video analysis, and ask for emergency response trips can pose a significant danger to traffic safety, this can be consider as dangerous because any one can contact any time to help center, for which they have not used any security algorithm for safer routing based communication

Charles Harsch, et. al. [7], author addresses the problem :they provide a scheme that secures geographic position-based routing, which is often used for Vehicular communication. Moreover, author focuses on the scheme to integrate security mechanisms of data packets delivered from warned vehicles to server for help at the time of emergency. They have presented a solution to secure a position-based routing protocol for wireless multi-hop communication in vehicular ad hoc networks. They bring up with solution which combines digital signatures/certificates, plausibility checks, and rate limitation. Author focuses more on security routing algorithm, but have not develop any module which broadcast any kind of alert messages when accidents occurs, for high traffic congestion problem and change of route if in case of traffic jam, this can be considered as major drawback.

3. Proposed Work

VANET describes about vehicular networking, how vehicles interact with each other on road side at the time of travelling. The proposed systems detect the accidents on road side of different vehicles; checks whether the broadcasted message of the vehicles for emergency help

via security algorithm – Position-based routing (PBR). PBR supports geographic unicast broadcasting, it assumes that every node knows its geographic position, for e.g.- via IEEE (802.11) standard and maintains the location table with id and geographic position. Thus if any vehicles tries to broadcast fake emergency message about accidents or about traffic jam, then such vehicles is trace through its location and routing algorithm then such vehicles are not allowed to further broadcast any message, it won't be allowed to access the network and communicate to RSU or V2V or V2I.

In the present work, the proposed scenario will perform the data mining-for extracting the information of the accidents such as, location where accidents was occurred, vehicle type, model of vehicle, reason of accidents, etc. to show the result graphically in simulation based software for severity estimation of accidents, using Bayesian method.

Bayesian method-for accident severity estimation and various routing protocols to route the information gathered from vehicles on board sensor units, road side sensor to base station to server and to entire network.

The proposed system provides the facility to send alerts/warnings messages and broadcast the alert messages to server, data receiving from the base station and also to nearby vehicles in network zones for possible collisions avoidance, detection through the system.

A. *Position- based routing algorithm*

Position-based routing provides multi-hop communication in a wireless ad hoc network. It assumes that every node knows its geographic position, e.g. by GPS, and maintains a location table with ID and geographic positions of other nodes as soft state. PBR supports *geographic unicast* (GeoUnicast), *topologically-scoped broadcast* (TSB, flooding from source to nodes in n-hop neighborhood), *geographically-scoped broadcast* (GeoBroadcast, packet transport from source to all nodes in a geographic area) and *geographically-scoped anycast* (same as GeoBroadcast, but to one of the nodes in the area).

PBR defines packet headers with fields for node ID, position and timestamp for a source, sender, and destination.

Basically, PBR comprises three core components: beaconing, a location service, and forwarding.

Beaconing: Nodes periodically broadcast short packets with their ID and current geographic position.

Location Service: When a node needs to know the position of another node currently not available in its location table, it issues a *location query* message with the sought node ID, sequence number and hop limit.

Forwarding schemes: if a forwarder has more recent (up-to-date) information in its location table about a given estimations, it updates on-the-fly the destination position and timestamp values in the packet header.

PBR packet performs following such functions:-

- One way communication.
  - Broadcasts.
- Location table with ID and positions of nodes.
  - Beaconing.
  - Location service.
  - Forwarding.
- Location is plausible.
  - Actual position is hard to obtain.
- Two levels of encryption:
  - End-to-end (Source ID, Position, data, etc).
  - Hop-by-hop (Sender ID, Position, TTL).
- Packets have a freshness range.
  - TTL.
  - Timestamps can apply timeout.
- On reception of a packet, a forwarding node:
  - Verifies both the source and sender signatures.
  - Updates the mutable field values and generates a new sender signature.
  - Replaces the old signature with the new one.
  - Re-forwards the packet.
- The destination node verifies both the sender and source signatures.

A PBR scheme is depicted in figure 2.

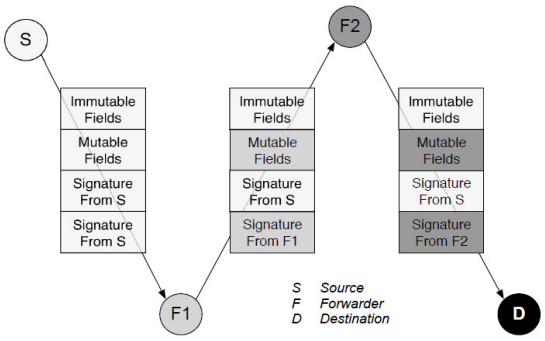

Fig.2 Position Based routing

B. *Bayesian method for accidents severity estimation*

Bayesian method: Bayesian method shows the probability using a set of random variables and then shows the dependency relationships between them. This method develops the model by using the information store in the parameters which consist of data, and model developed is designed on the basis of data distribution technique such as observing data, previously. The variables used for probability represent the model of

directed acyclic graph, for obtaining qualitative knowledge. It generates accurate enough predictions about the accidents so that severity of accidents is estimated and results are shown graphically.

Bayesian method performs following tasks:-

1. Designs a probability model using different sets of data.
2. Decide distribution of data on priory and then quantifies the unknown data values for development of models using different set of parameters and data, which are observed previously.
3. Observe the data, and construct the likelihood functions based on the data and the probability model.
4. Summarize important features for the probability distribution.

In the Figure 3, the flow of the proposed system is explained.

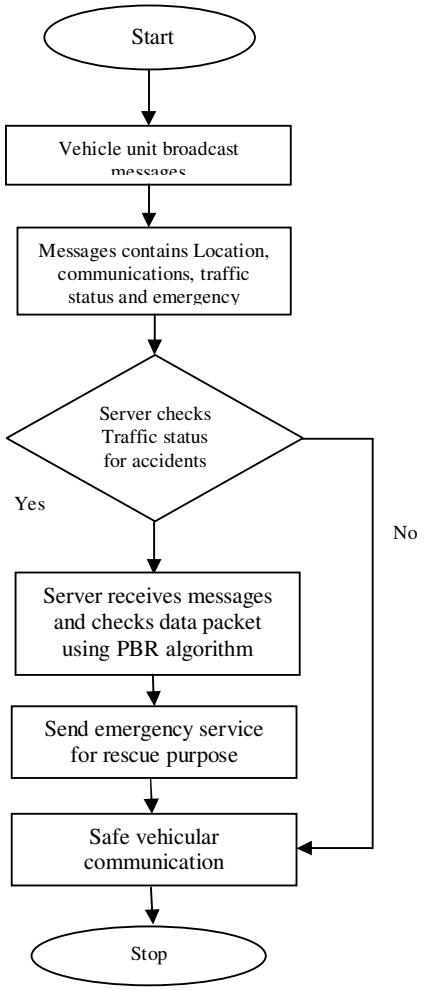

Fig.3 System Flow Diagram

When the system is started; vehicles start communicating to each other, and broadcast the messages. There location id, traffic status and notifications for accidents - emergency messages everything is within the data packets exchanged between vehicles and RSU. If in case of accidents detected on any route from RSU and sensor nodes then vehicle unit will broadcast the message for emergency help. Server will receives such messages from BS to RSU via vehicles met with accidents. PBR security algorithm checks whether the data packets delivered from RSU is in proper format or not. Server sends the message to emergency service station for help at proper location id for rescue purpose. However, if an accident is not occurred then V2V and V2I communication occurs via proposed system, and no further process will be carried out

4. Expected Outcome

From the idea of the proposed system we are clear with these outcomes. They are discussed below.

1) Improve the reliability and efficiency of the current rescue system for preventions of the accidents.
2) Design and implementation of a system for automatic accident notification and assistance based on V2V and V2I communications.
3) Reduce the time congestion for rescue operations and alert messages.

5. Conclusion

In proposed system framework, the system designs a VANET based architecture for providing driving safety while travelling to vehicles on roads, for this purpose several sensors nodes (SNs) were used for better communication between V2V and V2I and V2RSU. In the proposed system the main work was to detect an road side accidents, for which immediate help is required. These help is provided through emergency services vehicle, to make sure that no fake message is not broadcasted by any vehicles, security algorithm is used – PBR (position based routing). Several sensors were arrange in such a way that they will monitor respected data from environment and detect the accident. 802.11(IEEE) Sensor will give the geographical location of moving car, thus all this information will combine together and system will send this information to emergency medical numbers.

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