International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 04 Issue: 03 | Mar -2020 ISSN: 2582-3930

A Secure Efficient Data Collection Algorithm Based on Self-Adaptive Sensing Model in Mobile Internet of Vehicles

[1]Ariyanatchi. M, [2]Mohamed Rafi. M, [3]Balasubramanian. N

[1]Final year MCA, Mohamed Sathak Engineering College, Kilakarai

[2]Professor, Dept of MCA, Mohamed Sathak Engineering College, Kilakarai

[3]Associate Professor, Dept of MCA, Mohamed Sathak Engineering College, Kilakarai

Abstract- In research on data collection using wireless mobile vehicle network emphasizes the reliable delivery of information. The Internet of Things is energetic the progress of conventional Vehicle Ad-hoc Networks into the Internet of Vehicles (IoV). IoV promises huge commercial interest and research value, there by attracting a large number of companies and researchers. A vehicle will be a sensor platform, engrossing information from the environment, from other vehicles, from the driver and using it for safe navigation, pollution control, and traffic management. Such as large balance of deployment, collection algorithm is proposed for mobile vehicle network surroundings. An adaptive sensing model is designed to establish vehicular data collected works. The vehicular sensing node in group can regulate network sensing chain according to sensing distance threshold with surrounding nodes. It will dynamically choose a combination of network sensing chains on basis of remaining energy and location characteristics of surrounding nodes. The replication and experiments show that the vehicular node can realize secure and real-time data collection. Moreover, the planned algorithm is superior in vehicular network life cycle, power consumption and reliability of data collection by comparing to other algorithms.Finally, the challenges ahead for realizing IoV are discussed and future aspects of IoV are envisioned.

Keywords:Sensing Distance Threshold;Vehicular Adhoc Networks; Wireless Vehicle Networks; Data Collection Protocols; Network Sensing Chain; Self-Adaptive Sensing;

1. INTRODUCTION

A network domain is an administrative grouping of multiple private computer network or hosts within the same infrastructure. Domains can be identified using a domain name; domains which need to be accessible from the public Internet can be assigned a globally single name within the Domain Name System (DNS).A domain controller is a server that automates the logins, user groups, and architecture of a domain, rather than manually coding this information on each host in the domain. It is common practice, but not required, to have the domain controller act as a DNS server.That is, it would assign names to hosts in the network based on their IP addresses.A network is a collection of computers, servers, mainframes, network devices, peripherals, or other devices connected to one another to allow the sharing of data.Mobile wireless vehicle network attracts more attentions in recent years. In real applications, such as sensor nodes placed on wild animals, exhaust of a running car, mobility is inevitable problem to be considered. Mobility has brought new challenges to intelligent vehicle network. Since vehicular nodes always move fast routing for WSN data transmission may be easy to lose stability and security. Consequently, how to cope with rapid change of dynamic topology and improve to be addressed in wireless vehicle network. Mobile wireless vehicle network is composed of vehicle nodes with wireless communication equipment, which is an important part of modern Intelligent Transport System (ITS). Mobile IoV has realized direct connection between different vehicles. It is a special self-organized mobile sensor network, which can be applied in real-time monitoring, driving assistance, and vehicle control and scheduling, vehicle entertainment and other value-added services. IoV is evolving from Vehicular Adhoc Networks (VANETs) to achieve the vision of 'from Smartphone to smart car' In real applications, it will face the issues, such as limited bandwidth of wireless channel, multi-hops and computation complexity. A huge growth in number of on-road vehicles has been predicted by renowned organizations.

2. RELATED WORKS

Recently, prospective investigation addressing emerging and future challenges for IoVs has become a heated area of research. In addition, Internet security group in University of Southern California has analyzed the security of IoV and conducted researches on secure communication and routing protocol. Currently, monarch group in RICE University has also launched the project of Ad hoc city. The goal of this project is to compose a backbone network by using all buses in the city. The network is connected with surrounding base station. Finally, the connection between mobile wireless IoVs will be realized by short-distance wireless communication. Current researches on data collection in vehicle network tend to concentrate on mobile network model of vehicles and MAC routing protocol. According to features of vehicle network, the MAC and routing protocols are designed and optimized for VANET environment. We evaluate in vehicle network from two aspects. On one hand, many solutions have been proposed to solve problems of data collection of mobile nodes. For example, the computation model, which uses vehicle to vehicle communications to dynamically forecast accident risk in traffic flow, is rarely reported in study of vehicular movement model. A mixed mode of TDMA and CSMA/CA is used in to devise multi-channel MAC protocol. Although multichannel parallel transmission has improved data transmission rate, high-speed movement of nodes in vehicle network still affect its performance. On basis of the car-following model with the minimum safe distance, the scheme in has fully used real message and proposed a more reliable model for dynamical computation. These schemes have good stability but are not real-time. In this case, cross-layer design should be realized by considering MAC protocol and high-layer data forwarding strategy. A high effectual data collection algorithm in mobile vehicle network based on self-adaptive sensing model is planned named ACMAP algorithm. The algorithm is suitable for data collection in mobile vehicle network. Since routing between vehicles is responsible by vehicle node, there are fewer sensing messages for data packet switching in algorithm implementation. Consequently, our scheme improves reliability of data collection but incurs no extra communication overhead. Finally, I compare our scheme to other similar schemes. The results show that our scheme is superior in power overhead and reliability.

3. SELF-ADAPTIVE SENSING MODEL

Each vehicle sends a secure message in a synchronous slot. In this case, all vehicles will send secure message at the same time. Owning to CSMA mechanism at data link layer, each vehicle will randomly choose a back off window from competition windows. When the back off time of a vehicle decreases to zero, channel will be checked. If the channel is empty, it will be the time for real-time data collection. If both the time of vehicles decreases to zero and the channel is empty, getting and delivering of data packets will be realized at the same time. Collision of many data packets will be occurred in channel, causing contents of data packet be damaged.

The vehicles are consecutively numbered from V1 to Vn. At the time t0, we assume the vehicle Va collides with roadblock or vehicle ahead. The accident vehicle immediately triggers an urgent warning and broadcasts to the following vehicles rapidly. A vehicle V_b receives the warning and applies emergency brake with the maximum deceleration. Supposing the speed of V_j is greater than that of Vj-1 in front. There is a latency tress between the accident vehicle V_a triggering a warning and a follow-up vehicle applying emergency brake. The latency tress includes wireless transmission latency between vehicles and response delay try after the driver realizing the warning. Simply, we assume that the driver always applies emergency brake after realizing an accident without considering the state of front vehicles. Meanwhile, we consider all vehicles have the same maximum deceleration Amax.

$$\mathbf{V_{ij}(t) = V_{ij} + a_j(t)} \quad \mathbf{(1)}$$

$$\mathbf{V_{ij}(t) = V_{ij} + a_j(t) - a_{max}} \quad \mathbf{(2)}$$

To introduce a Minimum Safe Distance (MSD) to compute the collision probability P of subsequent vehicle with front vehicle under an emergency situation. The minimum safe

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 04 Issue: 03 | Mar -2020 ISSN: 2582-3930

driving distance is the minimum distance between two vehicles towards the same direction in order to prevent from collision when the subsequent vehicle receives the warning and applies emergency brake. Road-Side Unit (RSU) could calculate the MSD in real time according to the latest motion state of two neighboring vehicles Vj and Vj-1.

$$P_r = 1/E\,(P_r)\,\exp\,[-\,P_r\,/E\,(P_r)] \quad (3)$$

Firstly, I ensure data collection in mobile wireless vehicle network to be reliable. On this basis, the transmission distance of message between two vehicles is required to be no less than a thresholdλ.λ Is a reliable distance parameter in mobile wireless vehicle network. It according to reliability of data collection. Known from formula the probability of safe distance between two vehicles is greater than $p_s(d)$ when data is successfully transmitted. The safe distance of wireless signal for data sender is denoted by S_a. a_j denotes the acceleration speed at the moment of t_j. The sensitive distance of data is calculated by formula.

5. DATA GATHERING ALGORITHM

To established self-adaptive sensing model in above section. In this section, we need to design data distribution mechanism in vehicle network. For example, in a synchronization slot or during the rush hour, if the secure information of all vehicles cannot completely send within specific time, the vehicle will switch to other channels to complete the task. Consequently, we will demonstrate from three aspects of vehicle network, data grouping, data collection and path selection respectively. In grouping stage in mobile vehicle network, as shown in we need to group nodes and select sensing nodes. The basic idea is that the mobile vehicle node selects the closest fixed vehicle nodes and inserts it into safe group according to the distance between itself to surrounding fixed vehicle nodes. Fixed vehicle nodes select sensing nodes according to remaining energy of nodes in group and the distance to itself. Meanwhile, the TDMA slot is divided. Suppose there are k nodes in network, respectively S1, S2, and Sk. In this case, k vehicle nodes with one-way awareness will be generated surrounding these k nodes. Firstly, we need to make all the mobile vehicle nodes Mi (i=k+1, k+2… k point Sj respectively. Common vehicle nodes are not equipped with locating device such as GPS, so they cannot perceive position information. In order to calculate the distance Dij (t) between a node Mi and its fixed neighboring node Sj, a transmission channel for broadcasting is required. Let all sensing nodes Sj (j=1, 2… k) send a broadcasting information Staticnode_Msg including its ID and timestamp to surrounding nodes. Since all nodes are time synchronization and use wireless communication, they can calculate Dij (t) by monitoring message at time t1 and the message is received at the time t2.

$$Dij\,(t) = Radio\ velocity * |\,t2 - t1\,|$$

Mobile wireless vehicle nodes Mi towards the same direction are possible to receive Staticnode_Msg from fixed node Sj. After Mi receiving message, the sensing distance between Mi and the surrounding fixed node can be calculated by formula., its ID, remaining energy and the self-adaptive sensing distance to Sj, is then sent to S_j. This proposed method can be implemented in four steps.

Step 1: All Fixed vehicles node send message Staticnode_Msg to surrounding nodes.

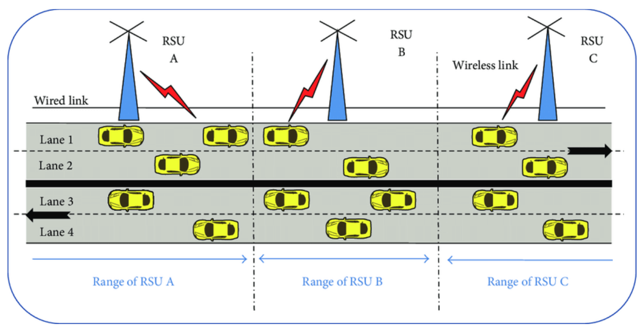

Fig 4.1 Wireless Sensing Vehicles

Step 2: Mobile vehicle node Mi receives message Staticnode_Msg and calculates the distance. It will send message Mobile node_ Msg to the closest sensing node. So far, all mobile vehicle nodes can find their sensing as the main reference point, other common nodes are classified into one group. There are two fixed nodes S1, S2j and multiple mobile nodes M1, M2…M6 m3, it receives the message Staticnode_Msg with to S1, S2 can be calculated, respectively, d3. Since the shortest distance d3, then the main reference point of mobile node M3 is S2. Accordingly, other the mobile nodes, which use fixed node S2 as main reference, point, include M3, M4, M5, and M 6. These nodes are within a group. Similarly, S2, S3, S4 have formed into another group. The procedure can be used to reduce computation complexity.

Step 3: All mobile nodes receive message Clusters from fixed nodes. If its ID is equal to Cid, it will be sensing node. Its state is changed to "B". If the common node sequence of the message contains its ID, the current mobile node is a member of the group. Its state is changed to "G". The ID of group head and its TDMA time slot are recorded. Therefore, the time slot at data transmission stage.

5. CHALLENGES AND ISSUES IOV

Interoperability of Networks Architecture:

There is a great need for enhanced communications protocols and algorithms which might be able to facilitate and tohandle the mobility management in the Internet of Vehicles domain. As it can be noticed, until now, it might be difficult to make an efficient and interoperable implementation which might satisfy all the IoV constraints and requirements needed for the IoV deployment.

Intelligent Routing and Path Planning:

As VANETs present a high mobility and frequent topology changes, efficient IoV architecture must highly consider the predictive next position as main features in their communication's layer decision.

Sensors & Artificial Intelligence:

Vehicle continuously interacts with its environment through a certain number of sensors data. These data sensed from different sensors need to be fused before being used in making vehicles 'decision. Currently, the artificial intelligence is great core technologies that is used in this field and needs to be well tested in different real scenario before vehicle passengers can confidently use full self-driving cars.

Real Time Massive Data Processing:

A good combination of parallel and sequential data processing is needed in scenarios where only parallel data processing is not sufficient. A parallel data acquisition, data processing and big data analytics is needed and is essential in IoV.

6. ASSOCIATIONS AND EXPERIMENTS

The performance of routing protocol in mobile vehicle network is simulated on basis of urban street model. The metrics such as delivery rate of data packet, link delay and energy consumption are evaluated. We have designed the simulation environment based on ACMAP algorithm. The proposed protocol is compared to TDMA in and STDMA. These metrics are analyzed in this section. The communication radius of wireless vehicle node is 10m and transmission rate of data channel is 500kbps. To perform 500 experiments on 20 virtual mobile vehicle nodes and 3 sensing vehicle nodes with STDMA, TDMA and ACMAP. Since selection of sensing node in ACMAP algorithm depends on grouping information of fixed vehicle nodes, the number of generated sensing nodes in each round is 20. The mobile vehicle node selects and establishes sensing network link according to the distance to sensing node.

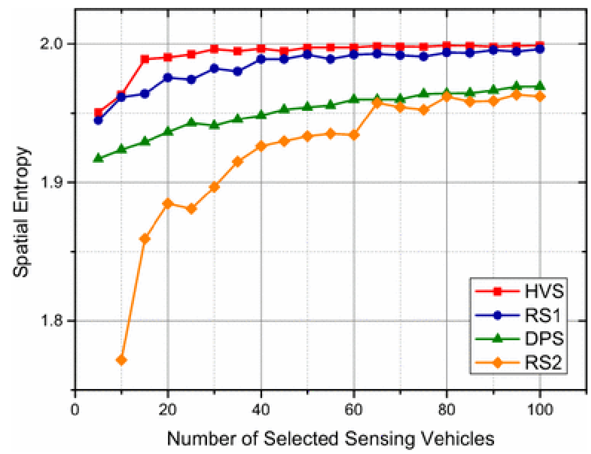

Fig 6.1 ACMAP Performance

7. CONCLUSION AND PREDICTION

Mobility of mobile vehicle nodes will affect data collection in vehicle network. By considering this issue, we propose a data collection algorithm based on self-adaptive sensing model. The algorithm adopts sensing threshold distance probability to get information of neighboring nodes, such as average remaining energy. The vehicle nodes can be awakening in each network monitoring period with a probability. The stability and consistency of node connectivity is ensured in procedure of establishing data link. In this case, energy consumption of sensing nodes and monitoring time of idle node are reduced. The method can effectively select quality of receiving nodes and reduce the time for data transmission and competition. Fatherly, energy consumption is decreased and network life time is prolonged. We have concretely analyzed our algorithm and proved its good performance in terms of energy consumption through lots of theoretical analysis and simulations. Our research is only suitable for mobile wireless vehicle network since some other problems such as synchronization of data collection are not considered.However, it is still facing many challenges and disuses such as commercialization, growing-traffic causalities like accidents, safety issues, efficiency, pollution, etc. It is predicted and also evident that IoV components will produce big data in high speeds and many IoV applications are real time, highly sensitive to latency and require fast big data processing and reliable fast feedbacks.

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