PERFORMANCE ANALYSIS OF MULTIPLE ACCESS TECHNIQUES FOR DATA TRANSMISSION IN VANET

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ABSTRACT

Data Collection in Vehicular Networks plays a major role in the data delivery area. The main objective of data delivery schemes falls into three main functionalities such as lifetime improvements, network stability maintenance and data security. The proposed model guarantees in Internet of vehicles (IoV), to perform the successful data transmission with error-free communication strategies. In this system, using Dynamic Source Routing Protocols to perform the successful communication between source and destination ends. In this work we are comparing life cycle of TDMA, STDMA and Self Adaptive sensing model. The attack detection strategies such as Malicious Node detection scheme has been included. If the neighbor node reply to the request within the particular point-of-time, that node is considered as a next-node for further precedence otherwise mark that as malicious node and this kind of sensing the node is called Self-Adaptive Sensing.

INDEX TERMS: *Self-AdaptiveSensing, Wireless vehicle Network, Data packet.*

I. INTRODUCTION

In recent years Mobile wireless vehicle network attracts more attentions. Mobility is inevitable problem to be considered in real time applications such as sensor nodes placed on wild animals, exhaust of a running car. 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 [1]. Consequently, how to cope with rapid change of dynamic topology and improve efficiency of data dissemination are urgent issues to be addressed in wireless vehicle network.

A mobile ad hoc network (MANET) is a continuously self-conjuring, infrastructure-less network of mobile devices connected wirelessly. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently [1]. Each must forward track unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route track [1]. Such kind of networks may operate by themselves or may be connected to the larger Internet. They may contain one or multiple and different transceivers between nodes. This results in a highly dynamic, autonomous topology.

Figure 1: MANET an Overview

Vehicular Ad Hoc Networks (VANETs) are created by applying the principles of mobile ad hoc networks (MANETs) [1].The spontaneous creation of a wireless network for data exchange to the domain of vehicles. They are a key component of intelligent transportation systems (ITS). While, in the early 2000s, VANETs were seen as a mere one-to-one application of MANET principles, they have since then developed into a field of research in their own right. By 2015, the term VANET became mostly synonymous with the more generic term inter-vehicle communication (IVC), although the focus remains on the aspect of spontaneous networking, much less on the use of infrastructure like Road Side Units (RSUs) or cellular networks [2].

VANETs support a wide range of applications from simple one hop information dissemination of, e.g., cooperative awareness messages (CAMs) to multi-hop dissemination of messages over vast distances [2]. Most of the concerns of interest to mobile ad hoc networks (MANETs) are of interest in VANETs. Rather than moving at random, vehicles tend to move in an organized fashion. The interactions with roadside equipment can likewise be characterized fairly accurately [2]. And finally, most vehicles are restricted in their range of motion, for example by being constrained to follow a paved highway.

Some of the examples of VANET include electronic brake lights, which allow a driver to react to vehicles braking even though they might be obscured [2]. Platooning, which allows vehicles to closely follow a leading vehicle by wirelessly receiving acceleration and steering information, thus forming electronically coupled "road trains" [2] . Track information systems, which use VANET communication to provide up-to-the minute obstacle reports to a vehicle's satellite navigation system.

The structure of this report is at first we have brief introduction followed by problem definition and the comes our main part which is self adaptive sensing model and then system architecture design followed by simulation and conclusions.

II. PROBLEM DEFINITION

Existing research on data collection using wireless mobile vehicle network emphasizes the reliable delivery of information [3]. There are other performance requirements such as life cycle of nodes, stability and security which are not set as primary design objectives. This adds to the inferiority of data collection ability of vehicular nodes in real application environment. By considering the features of nodes in wireless IoV, such as large scales of deployment, volatility and low time delay, an efficient data collection algorithm is proposed for mobile vehicle network environment [4]. An adaptive sensing model is designed to establish vehicular data collection protocol. The protocol adopts group management in model communication. The vehicular sensing node in group can adjust network sensing chain according to sensing distance threshold with surrounding nodes. Depending on the remaining energy and location characteristics of surrounding nodes it will dynamically choose a combination of network sensing chains [4]. In addition, secure data collection between sensing nodes is undertaken as well. It can be represented that vehicular node can realize secure and real-time data collection. Moreover, the proposed algorithm is superior in vehicular network life cycle, power consumption and reliability of data collection by comparing to other algorithms [5].

The major aim of the project is to compare Self Adaptive Sensing Model Algorithm with other algorithms and can prolong lifetime of vehicle network by comparing to STDMA and TDMA protocol [5]. In STDMA, sensing nodes require more energy to form sensing group and record information of each member node. However, in ACMAP algorithm, mobile vehicle nodes are responsible for collecting sensing information and sending the fused information to fixed node. Other tasks such as selection of sensing nodes, TDMA time slots partition, are finished by fixed nodes which have more energy [6]. Therefore, energy consumption can be reduced, prolonging network lifetime.

The increase of speed leads to lots of packet loss. In our algorithm, data forwarding is taken by fixed nodes. It reduces extra overhead caused by the topology of mobile nodes and avoids the uncertainty brought by the fact that mobile nodes are responsible for routing [6]. Data transmission success rate is improved by comparing to STDMA.

III. SELF-ADAPTIVE SENSING MODEL

In self-adaptive sensing model, each node with message searches for possible path nodes to copy its message. Hence, possible path nodes of a node are considered [7]. Using NSS, each node having message selects its path nodes to provide a sufficient level of end-to-end latency while examining its transmission effort. Here, it derives the CSS measure to permit CR-Networks nodes to decide which licensed channels should be used. The aim of CSS is to maximize spectrum utilization with minimum interference to primary system [7]. Assume that there are M licensed channels with different bandwidth values and y denotes the bandwidth of channel c. Each CR-Networks node is also assumed to periodically sense a set of M licensed channels. Mi denotes the set including Ids of licensed channels that are periodically sensed by node i. suppose that channel c is periodically sensed by node iin each slot and channel c is idle during the time interval x called channel idle duration [7]. Here, it use the product of channel bandwidth y and the channel idle duration x, tc= xy, as a metric to examine the channel idleness. Furthermore, failures in the sensing of primary users are assumed to cause the collisions among the transmissions of primary users and CR-Networks nodes [8].

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 [9]. Three aspects of vehicle networks are data grouping, data collection and path selection.

The basic idea is that according to the distance between itself to surrounding fixed vehicle nodes, the mobile vehicle node selects the closest fixed vehicle nodes and inserts it into safe group [9]. Fixed vehicle nodes selects 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 S_1, S_2, S_k. In this case, k vehicle nodes with one-way awareness will be generated surrounding these k nodes [9]. Firstly, need to make all the mobile vehicle nodes M_i(i=k+1,k+2,, k+m)in network and a closest reference point S_j respectively [9]. Common vehicle nodes are not equipped with locating device such as GPS, so they cannot perceive position information.

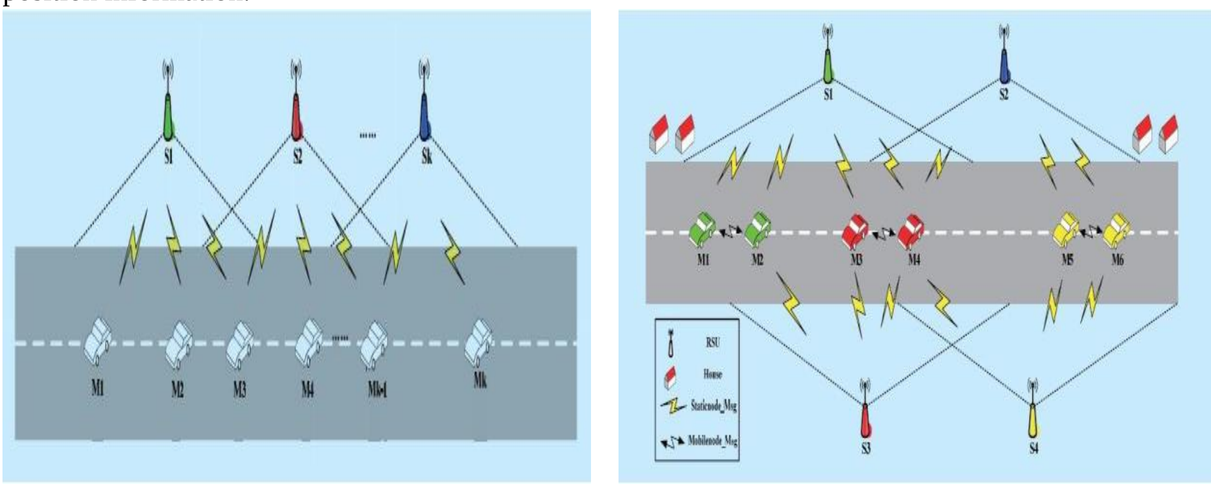

Figure 2 Data distribution of single node in vehicle network

Mobile wireless vehicle nodes M_i towards the same direction are possible to receive Static-node Msg from fixed node S_j. After M_i receiving message, the sensing distance between M_i and the surrounding fixed node can be calculated by equation. Among the surrounding nodes, the node S_j with the minimum sensing distance will be selected as the main reference point [10]. The message Mobile node Msg, including ID of main reference point, its ID, remaining energy and the self-adaptive sensing distance to S_j, is then sent to S_j. This proposed method can be implemented in four steps.

Step 1: All fixed vehicle nodes send message Static node Msg to surrounding nodes [10].

Step 2: Mobile vehicle node M_i receives message Static node Msg and calculates the distance. It will send message Mobilenode Msg to the closest sensing node. So far, all mobile vehicle nodes can and their sensing nodes. After selecting a fixed vehicle node S_j as the main reference point, other common nodes are classified into one group. There are two fixed nodes S_1,S_{2j} and multiple mobile nodes M_1, M_2,M_6 in the figure. For the node m3, it receives the message Static node Msg with timestamp from two fixed nodes [8]. The distance to S_1, S_2 can be calculated, respectively, d_3. Since the shortest distance d_3, then the main reference point of mobile node M_3 is S_2. Accordingly, other nodes can also and their main reference points.The mobile nodes, which use fixed node S_2 as main reference point, include M_3, M_4, M_5, and M_6 [8]. These nodes are within a group. Similarly, the nodes surrounding fixed nodes S_1; S_2; S_3; S_4 have formed into another group. t_{ij} can be used to reduce computation complexity [11]. It represents the latency between fixed node i and mobile node j. In addition, if two distances between mobile node and fixed node are the same, the fixed node with high remaining energy Er will be selected into the group [11].

Step 3: Each vehicle node will compare to mobile sensing node. Then we select the parameter of sensing grade, divide TDMA time slot and broadcast message Cluster Msg .To keep the time synchronization, requires Step 1 and Step 2 to finish with in Tn. The time of whole grouping procedure is denoted by Tc [11] .

Step 4: All mobile nodes receive message Cluster Msg from fixed nodes. If its ID is equal to Cid, it will be sensing node [11]. 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 node can send data to specific group head at its time slot at data transmission stage [11].

IV. SYSTEM ARCHITECTURE DESIGN

There are 54 nodes in the network. Assume s source point and destination point. The main aim is to sent packets to the destination [12]. After knowing the path for source and destination, calculate the shortest path. After the transmission range are identified send the packets to the neighbor nodes. The neighbor node which has the maximum strength will consider the packet and sent to destination. Then, check whether the neighbor node strength is poor or good. If it is poor, check for an alternate and again repeat the steps. If it is good, encrypt the data packet and then forward the packets [12]. Finally, packet reach the destination and the packet is decrypted. Hence the process has been completed with successful transmission.

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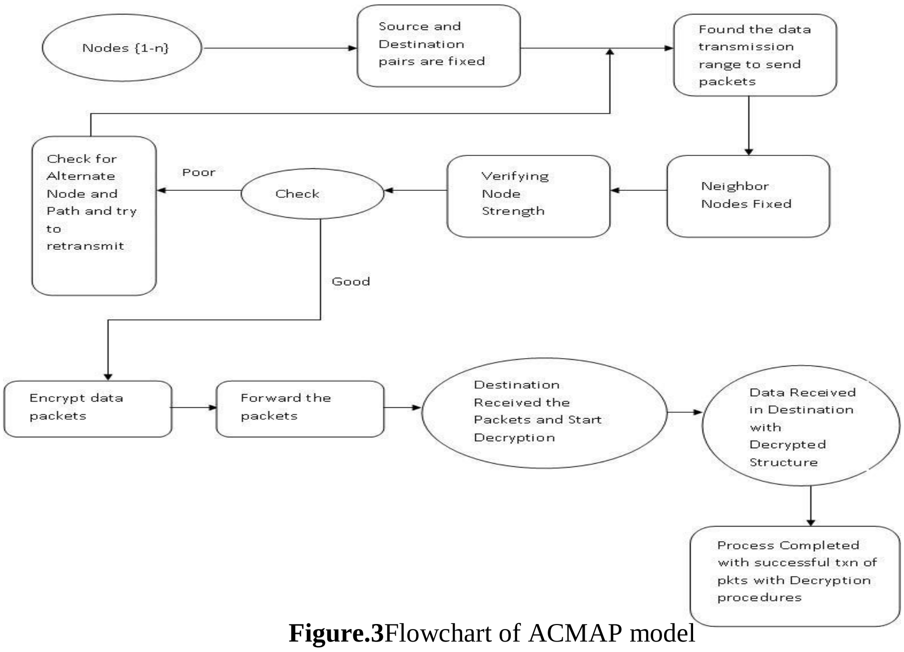

Figure.3 Flowchart of ACMAP model

V. SIMULATIONS RESULTS

The Mobile wireless vehicle network is composed of vehicle nodes with wireless communication equipment, which is an important part of modern Intelligent Transport System. In simulation, the environment of mobile wireless vehicle network is set as follows. All of the mobile vehicle nodes are distributed within an area A of 1500*1500 m^2. Fixed vehicle node sink is located within the boundary [13]. The communication radius of vehicle node is 10m and transmission rate of data channel is 500 Kbps Initial energy of vehicle node is set to 10 J. To make the hop count large enough in data transmission and make it convenient to evaluate effects on network performance, we suppose the mobile sensing nodes are distributed within the area of 10 m. Four sink nodes which have no collision in data transmission are generated at each time [13]. Simulation will stop when the sensing node sink have received 1000 data messages. Totally there are 54 nodes. These 54 nodes are fixed nodes and based on the connection that is being provided some nodes act as mobile nodes. Initially, need to group the nodes and assign a source and should send the data packet to each neighbor node and should wait for the route response. If route response is not received within the threshold delay, then that node is considered as a malicious node.Then the next neighbor node is chosen [13]. The main advantage of ACMAP algorithm is that, it can perform multicasting that is it can send the data packet to different locations from a single source.

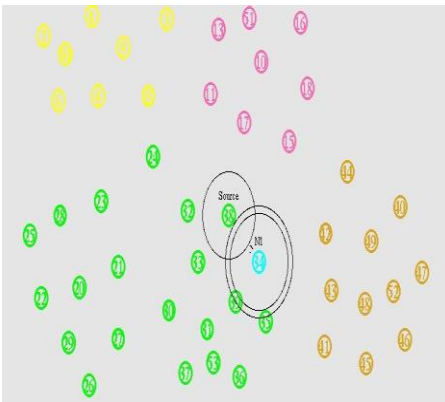

Figure 4: Simulated Results

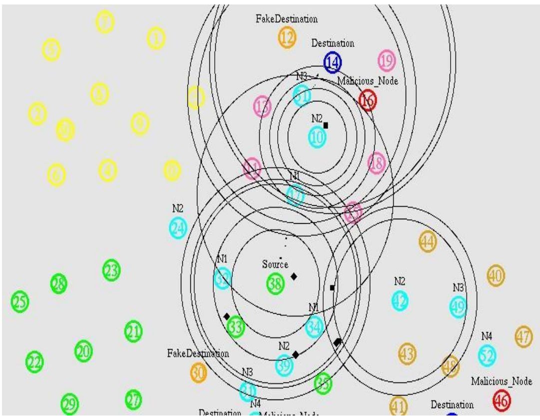

Figure 5: Node 14 acts as next destination without packet loss

The simulation results show creation of nodes, then how the communication is starting from source and it passes through each node [14]. There will different destinations as it is multicasting. Similarly the packet reaches the different destinations. Meanwhile, it checks the malicious node, if the route response is not received within the certain response time, it is considered as Malicious node.

The performance of routing protocol in mobile vehicle network is simulated on basis of urban street model. Life Cycle in data collection of mobile vehicle nodes is compares with TDMA, STDMA and ACMAP [15].

Comparison with different algorithms is performed and is represented by using a graphical representation. Comparison of lifecycle in data collection for mobile vehicle nodes is plotted with TDMA, STDMA and ACMAP algorithm with x axis as number of rounds and y axis as number of vehicle nodes [15].In ACMAP algorithm, all nodes communicate within the range of d0. In this case, energy consumption problem in data transmission can be addressed.

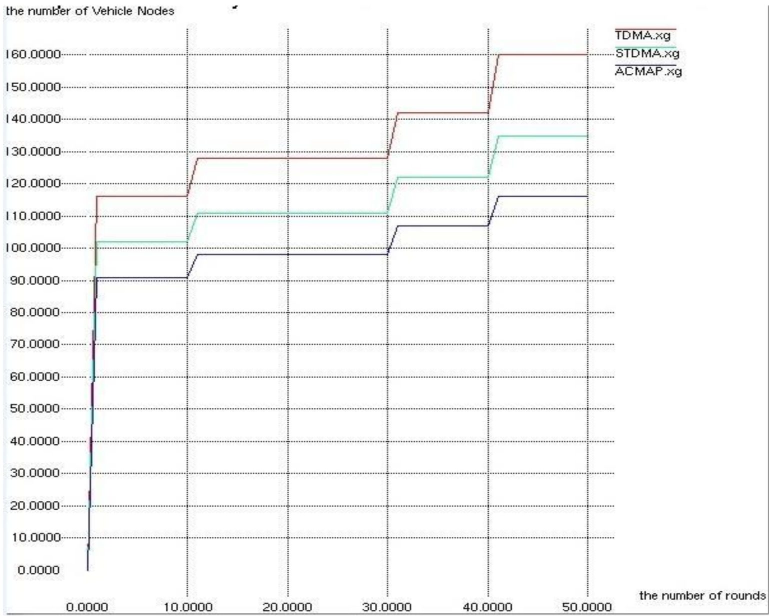

Figure 6: Comparison of lifecycle in data collection

Data forwarding in vehicle network are realized by awareness, which saves much energy by comparing to one way communication [16]. However, since STDMA protocol does not consider relationship between energy attenuation and communication distance in data transmission, energy of node is easy to use up in short time. In STDMA, sensing nodes require more energy to form sensing group and record information of each member node [17]. However, in ACMAP algorithm, mobile vehicle nodes are responsible for collecting sensing information and sendingthe fused information to fixed node. Other tasks such as selection of sensing nodes, TDMA time slots partition, are finished by fixed nodes which have more energy. Therefore, energy consumption can be reduced, prolonging network lifetime.

VI. CONCLUSION

ThusMobility of mobile vehicle nodes will affect data collection in vehicle network. This can be overcome by considering 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 awaken in each network monitoring period with a probability. The stability and consistency of node connectivity is ensured in procedure of establishing data link. The method can effectively select quality of receiving nodes and reduce the time for data transmission and competition. Network life time is prolonged. The aim is to analyze the algorithm and prove its good performance in terms of energy consumption through lot of theoretic analysis and simulations. This is suitable for mobile wireless vehicle network. In future, more comparisons will be performed to prove the energy consumption is reduced and synchronization into data collection will also be performed.

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