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A Secure of Stable Vanet Architecture Model in Wireless Sensor Network

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Abstract: **Vehicular ad hoc network (VANET) is known as an essential factor of smart Transportation systems. The key benefit of VANET communication is noticed in dynamic protection systems, which objective to enhance security of travellers by exchanging caution messages between automobiles. Other applications and personal services are also allowed in order to lower the cost and to promote VANET exploitation. To effectively set up VANET, security is one of the main challenges that must be tackled. Another important concern is scalability is a serious issue for a network designer how to maintain stable communication and services in VANET. Extremely dynamic environment of VANETs seems it difficult.**

Every one spends 10 to 40% time in vehicles a day that's why it is necessary to be updated with knowledge in vehicle. Vehicle ad hoc network (VANET) is a technology that establishes communication among vehicles through road side infrastructure. We have proposed an automated faith management scheme for VANETs that uses machine learning to categorize nodes as malicious. Clustering is one solution for the scalability problem. Here we also proposed an stable vehicular clustering based on weighted clustering algorithm (SVWCA) cluster maintained scheme which can handle the stability of the vehicular network.

Keywords: **Vehicular ad hoc network (VANET), wireless sensor network, clustering.**

1. INTRODUCTION

Vehicular Ad-Hoc Networks (VANET) are becoming an important technology for concerning latest computer world. It can be help to get better the driving skill both in terms of security and effectiveness. Figure 1 describes VANET, when multi-hop communication is apply VANET allow a automobile to radio communicate through other automobiles which are away of transmission range. It as well enables vehicles to correspond with roadside unit. VANET will to be expected be a crucial part of upcoming Intelligent Transportation Systems (ITS).

Presently, ITS relies greatly on communications deployment. Electromagnetic sensors are set into road outside; traffic cameras are set up at major junction; and Radio Frequency Identification (RFID) readers are organize at main road doorways. A usual method for gathering and give out traffic information is as follows. First, traffic sample are collected by road side sensors and send to local transportation center. After statistics handing, traffic information can then be distributes to a user's communication unit via cellular networks. This is an costly and ineffective mode of distribute location-based information, mainly when the information of concern is just a hardly hundred meters from the user's location. Because of its limited communication ability, VANET might modify this paradigm, generating and disseminating Information very simple.

The develop and execution of Vehicular Ad Hoc Networks (VANETs) stay representing an key research challenge, which, if resolved, could show the way to the development of the after that key breakthrough

After the Internet and cellular network technologies. Vehicles could participate the role of an allowing structure for a number of vastly used apps (e.g., disaster warning systems, traffic information control and prevention systems, climate and weather conditions observing, etc.), as well as enjoying ones (e.g., online entertainments, ad and promotion, etc.). In addition, every vehicle, associates in a peer-to-peer approach, can enhance the bandwidth resources that are currently available, as well offering connectivity to novel geographical regions. It shows importance of research on VANETs has

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proliferated for the duration of these two decades, dealing with all most important different phases that engage their devise: communication protocol layers, applications, and mobility/channel models.

The enough short quantity of vehicles allows with communication lines that maintain VANET-based networking has so distant prevented the run of any extensive trial, thus primarily to a proliferation of simulative and logical studies. Simulations, in particular, have been applied to check how function and protocols can perform when implemented on a huge amount of vehicles, while determined to resemble as closely as probable the actions and the situation that each solo car would face in real word. So, complete simulative models have been devising to replicate the expected movements of cars on lanes, in addition to the behaviour of wireless lines in vehicular background. In essence, the common ground of the great majority of the research that has been carried out in the space of vehicular-based networking and applications is that of finding ways of testing apps and protocols while reproducing, as closely as possible in simulation, the situation that would be found by a real VANET.

2. RELATED WORK

In the last decade ad-hoc networking is a very attractive topic among researchers. Numerous articles have been published with new solution proposals, extensions and improvements to existing methods and algorithm, theoretical analysis of the problems involved, simulation results etc. Let it be wired or wireless, focused on stationary, mobile, sensor or vehicular ad-hoc network, they all profited from it. Clustering has been already extensively researched in the past. One of the most frequently mentioned clustering algorithms, MOBIC [3], focused on mobile ad-hoc networks was published in 2001 but his roots are even a few year solder. Due to the fact that mobile and sensor ad-hoc networks gained research popularity a few years before vehicular adhoc networks (VANETs) a lot more articles with topic on clustering have been published from those specific fields. Consequently different surveys and overviews have already been written with the intention to give a brief overview and present this research field in mobile and sensor ad-hoc networks Clustering is a process of grouping nodes (mobile devices, sensors, vehicles etc.) in geographical vicinity together according to some rules. These rules differ from one algorithm to another and are the key factor to build stable clusters. Clusters are a sort of virtual groups that have been formed by a clustering algorithm. Each cluster has at least one cluster head (CH) that is selected or elected by other cluster nodes (CN). Usually each CN can be elected to a CH but in some algorithms different type of nodes have better prepositions to become one. For example, CN with additional 3G network connectivity can be better suited for CH than their non-3G neighbours. Some algorithms also define other types of nodes, e.g. cluster relays etc. Cluster size varies from one cluster to another and is mostly dependant on the transmission range of the wireless communication device that a node uses. But some clustering algorithms also implement other filters that prevent some nodes to join a cluster. One of the most frequently used is the movement direction filter – a CN does not join a cluster whose CH moves in its opposite direction.

Due to radio signal propagation laws the ideal and intuitively most natural cluster is represented as a circle with CH in the centre and CN around it as shown in Fig. 1. Each CN can communicate directly with its CH and two different CNs can communicate with each other either directly or, in the worst case, via their CH. Such clusters are named 1-hop clusters as every two nodes can communicate in 1 hop or less with each other. But 1-hop is chosen only for simplicity reasons – solutions, although rare, exists that use more than 1 hop and those clusters are named n-hop clusters. Cluster stability is an important goal that clustering algorithms try to achieve and is considered as a measure of performance of a clustering algorithm. Stability is important for the upper and lower communication layers whose performances can improve noticeably with the help of clusters. It allows spatial reuse of resources simplifies routing and makes the network appear more stable in the view of each CN. Cluster stability can be defined in different ways but most frequently used are the number of CH changes and number of a CN changing its CH. By carefully selecting the CH and nodes that form a particular cluster their stability can be dramatically improved.

3. FUNDAMENTAL THEORY

3.1. Design Factor:

There are many factors to consider when designing a VANET. Will the network be vehicle-to-vehicle only, or could roadside units be used for communication? What forms of communication will be available? Which vehicular systems will be employed in the network? These and many other aspects will require analysis when determining the features and capabilities of a VANET.

3.1.1 .Vehicle-to-roadside communication:

New technologies that will allow vehicles to communicate with roadside units are in progress. The IEEE 802.11 working group continues to actively develop draft amendment 802.11p [21] in order to provide support for Intelligent Transportation System (ITS) applications. In the existing infrastructure and ad-hoc modes of the IEEE 802.11 wireless standard, the time required to authenticate and associate with a basic service set (BSS) is too long to be employed by VANETs. The 802.11p standard will provide wireless devices with the ability to perform the short-duration exchanges necessary to communicate between a high-velocity vehicle and a stationary roadside unit. This mode of operation, called WAVE (wireless access in vehicle environments) will operate in a 5.9 GHz band and support the Dedicated Short Range Communications (DSRC) standard [22] sponsored by the US Department of Transportation. These standards will support systems that communicate from vehicle-to-roadside, vehicle-to-vehicle, or both.

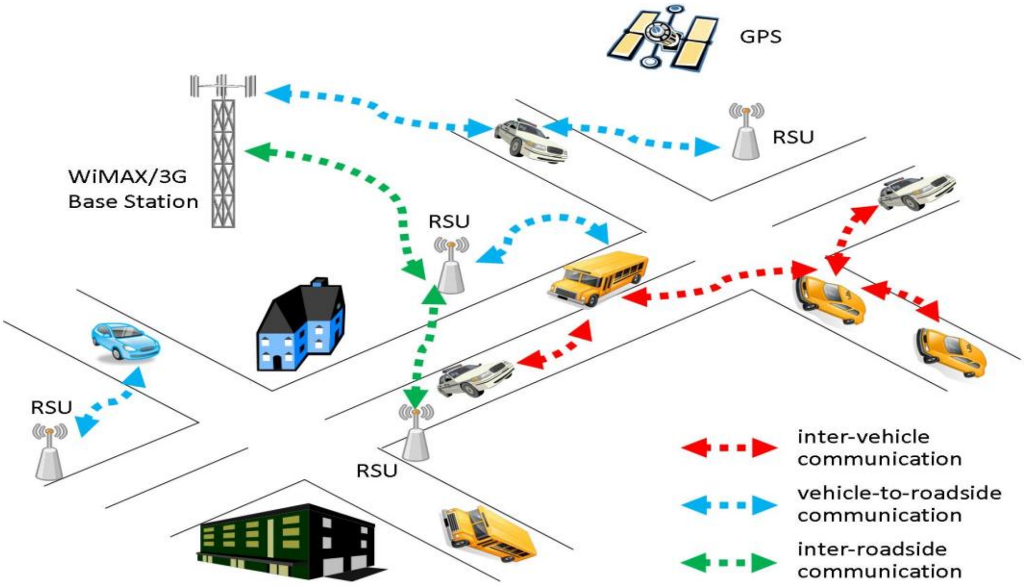

Fig. Vehicle-to-roadside communication

3.1.2. Vehicle-to-vehicle communication:

Installing fixed infrastructure on roads incurs great expense, so vehicle-to-vehicle (V2V) communication will be necessary to extend the effective range of networked vehicles. VANETs require features not provided by cellular network based systems, such as low data transport times for emergency warnings and robustness due to the network's decentralized structure. In an emergency situation, cellular base stations are often overwhelmed with calls, but distributed communications have the potential for load balancing traffic to avoid network congestion.

3.1.3. Communication paradigms:

Like other kinds of networks, different communication paradigms can be supported in VANETs. Unicast communication provides the ability for one node to communicate with a target node in the network. The target node may be in a precise known location or an approximate location within a specified range [23]. While unicast is a useful mode of communication in VANETs, many applications will require dissemination of messages to many different nodes in the network. Multicast communication allows messages to be sent to multiple destinations using the most efficient route possible. For instance, when a traffic jam occurs at a particular location on a roadway, it would be valuable to send messages to vehicles that are approaching that point so that they can take alternate routes. Sending a multicast message that reaches vehicles not affected by the traffic jam would waste valuable network bandwidth. Instead, it is desirable to only target affected vehicles, whose positions can be determined by analyzing a road map. If each vehicle is equipped with knowledge of its own global coordinates, then a specialized form of multicast communication called geocast is possible. In geo casting, a message is sent to all of the nodes in a particular geographic position, usually relative to the source of the message. A similar form of communication is anycast, where a node sends a message to any destination node in a group of nodes. Any cast provides a data acquisition feature that is the intuitive inverse of geo casting, where a

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node sends a message to a certain geographic area to request data from any node found there, called geographical any cast. Geographic any casting has the ability to provide ``distributed floating car data" [24]. Another communication paradigm called scan operates like a sonar echo, sending a message that traverses a certain region once [23]. Much research [25] has focused on providing these various multicast services in VANETs. This paper primarily focuses on routing protocols that deliver unicast services.

3.1.4. Environmental constraints:

VANETs operate in a very different environment than most computing applications. The high velocities at which vehicles move will sometimes reduce the amount of time available for message exchanges. Protocols will need to take advantage of vehicles moving in the same direction at relatively similar speeds to maintain connections for longer periods of time [26]. Protocols must operate well in both city roads and highways. City streets pose a unique set of geographic constraints as buildings between streets often form obstacles for radio signals that must be routed around. Road characteristics, such as traffic signals and stop signs will affect the flow of traffic in urban areas, breaking any reliable streams of similar-velocity vehicles that may be found on highways. On highways, low vehicle density must be considered. Traffic density, often measured in the number of vehicles per unit distance, has a large influence on road capacity and vehicle velocity. In low traffic densities, vehicles tend to move at faster rates, but as traffic density increases, vehicles slow down. Very high traffic density (in the case of a serious road block, for example) also causes both relative speed and distance between vehicles to become stable

4. PROPOSED APPROACH

4.1. Proposed Architecture of system:

Vehicular ad hoc network (VANET) is known as an essential factor of smart Transportation systems. The key benefit of VANET communication is noticed in dynamic protection systems, which objective to enhance security of travelers by exchanging caution messages between automobiles. Other applications and personal services are also allowed in order to lower the cost and to promote VANET exploitation. To effectively set up VANET, security is one of the main challenges that must be tackled. Another important concern is scalability is a serious issue for a network designer how to maintain stable communication and services in VANET. Extremely dynamic environment of VANETs seems it difficult. This paper proposed a more secure and stable cluster scheme for VANETs that uses drop ratio to categorize nodes as malicious. Here also proposed an entropy-based WCA (EWCA) cluster maintained scheme which can handle the stability of the vehicular network.

4.2. Module Description:

We present the proposed Secure and stable vehicular clustering based on weighted clustering algorithm (SVWCA).First part of proposed work describe security mechanism for malicious node detection in VANET to secure transmission. Second section gives detail about stable clustering method as SVWCA algorithm.

The proposed method has been divided into two parts .In the first part the clusters were formed and in the second part the detection of malicious node is done. We have extended the WCA algorithm by adding one more parameter LET by which the stable cluster formed for a long time. The detailed description of each part is discussed below

4.2.1 The new stable vehicular clustering based on weighted clustering algorithm (SVWCA):

Algorithm is divided in to two phase in phase-I the clustering formation taken place and in the phase-II we use LET for stable clustering.

Phase-I: Clustering Formation:

For effective cluster formation and remain cluster stable during frequently change topology in highway, this paper proposed new SVWCA more reliable algorithm. In clustering techniques, clusters should be formed in such manner that it not be very large or very small. In a very large cluster, traffic of transmitted information from members to their cluster-head is increased so cluster-head have lost of overheads, and then the cluster-head could not deliver messages on efficient time limit. If cluster formation is very small clusters may not be stable and changed frequently in network because the re-affiliation of network rose. In new SVWCA, this work use two other techniques to cluster creation and cluster maintain.

This paper proposes disbelieve value for check bevies value for any node, among number of neighbors based on dynamic transmission range and direction of vehicles in weighted clustering. In addition, we use the entropy model proposed in [39]. In order to select a trustier node as a cluster-head, we consider the disbelieve value (Td) in SVWCA. The disbelieve value (Td) for vehicle V represents authentication value of behavior for vehicle V when it forwards messages. Each vehicle maintains two lists: one white list and one black list. The white list of vehicle V, represented by WLV, includes the list of neighbors of vehicle V that their Td values are lower than the threshold values. Note that value of sis equal for all vehicles inside the convinced certificate authentication (CA) in VANET. The black list of vehicle V, represented by BLV, consists of neighbors of vehicle V that their Td values are higher than the threshold values. The black list BLV is the copy of the main black list created by the relevant CA. Each CA broadcasts its main black list periodically to all cluster-heads which are placed inside its region and then each cluster-head broadcasts the main black list to the vehicles located inside its cluster.

Firstly, each vehicle announces itself as a cluster-head by putting its own address and ID in a beacon to be broadcast. After receiving beacons from its neighbors, each vehicle has complete information from its current neighbors, and it can make decision whether to change its current cluster status or not. For this purpose, vehicles execute SVWCA in order to select their cluster-heads. The SVWCA algorithm has following steps to choose its required parameters as:

Step 1: Determining the neighborhood list for vehicles

Step 2: Determining the vehicles priority based on their disbelieve values

Step 3: Determining the direction of vehicles

Phase-II: Stable Clustering Using Mobility prediction:

The mobility of nodes coupled with the transient nature of wireless media often results in a highly dynamic network topology. Due to mobility some nodes will detach from the current cluster and attach itself to some other cluster. The process of joining a new cluster is known as re-affiliation. If the re-affiliation fails, the whole network will recall the cluster head selection routine. One disadvantage of WCA is high re-affiliation frequency. High frequency of re-affiliation will increase the communication overhead.

One way to predict the mobility of nodes is using the Link Expiration Time [40]. The impact of mobility prediction schemes on the stability of the clusters obtained using a mobility-aware clustering framework. Compute the Link Expiration Time (LET) to predict the duration of a wireless link between two nodes in the network. The approach assumes that the direction and speed of motion of the mobile nodes does not change during the prediction interval.

4.2.2 Link Expiration Time (LET):

The Link Expiration Time (LET) is a simple prediction scheme that determines the duration of a wireless link between two mobile nodes. Dynamic clustering in ad hoc networks has also been extensively studied in the literature. Several distributed clustering algorithms for MANETs have been proposed. While some schemes try to balance the energy consumption for mobile nodes, others aim to minimize the clustering-related maintenance costs. Combined metrics based clustering schemes take a number of metrics into account for cluster configuration.

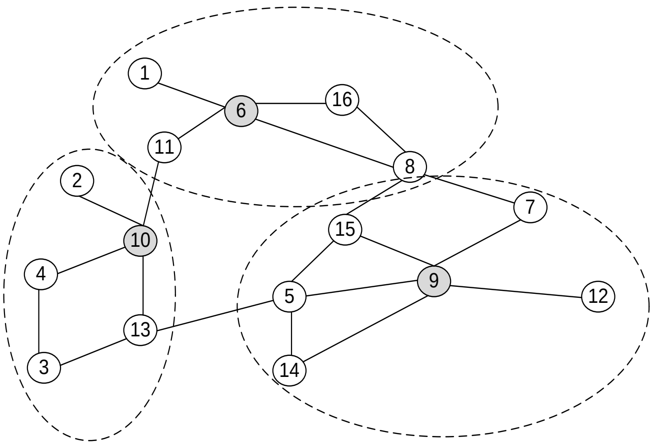

Fig.4.1.Clustering Example

The Weighted Clustering Algorithm (WCA) [8] is one such scheme, where four parameters are considered for the cluster head selection procedure, which are representative of the degree, the sum of the distances to other nodes in its radio distance, mobility, and battery power of the mobile nodes. Here we propose an enhanced WCA which can enhance the stability of the network. Such a scheme can be tuned flexibly the parameters to suit to different scenarios. To calculate the duration of link between two mobile nodes, we assume that their location, speed and direction of movement remain constant

Here let:

- Location of node i and node j at time t be given by (xi ,yi) and (xj ,yj).
- Vi and Vj be the speeds,
- θi and θj be the directions of the nodes i and j respectively.
- If the transmission range of the nodes is r, then the link expiration time Dt is given by the formula given below

Where

$$a = v_i cos\theta_i - v_j cos\theta_j$$

$$b = x_i - x_j$$

$$a = v_i sin\theta_i - v_j sin\theta_j$$

$$b = y_i - y_j$$

The LET gives an upper bound on the estimate of the residence time of a node in a cluster. In the proposed clustering framework, when LET-based prediction is used, a node is allowed to join a cluster only if the predicted LET of the link between the node and the cluster head is greater than the cluster's admission criteria Tj

For every node N that detach from current cluster we check whether the node is a Cluster Head (or) Cluster member.

1. If it is a Cluster Head then call for cluster head selection within the particular cluster and form a new cluster.

2. If it is a Cluster member then calculate Link Expiration Time with Cluster Head of each cluster and the node that re-affiliates must be within transmission range of cluster head where transmission range is fixed.

Check whether LET is greater than threshold value (Tj), Here Tj is average of all LET, and if it is greater than the Node is eligible to join the particular cluster which shares greater LET.

5. FUTURE WORK

One are of research involving the algorithm is in parameter optimization .Parameter selection was discussed parameters were tuned to highways scenario; however, it is clear that parameter are very dependent on the specific network topology and mobility. Future research can be done to optimize mobility characteristics. The proposed algorithm lays the natural ground work for the cluster selection scheme. The cluster stability, reasonable overhead, and robustness to error, make an approve an excellent fit for a cluster head selection based on LET. Thus another future research direction is the implementation of cluster bases MAC or routing scheme, which works in concordance with algorithm. A new cluster-based MAC scheme, or modified existing MAC scheme, can be designed to work in unison with the algorithm, and provide the true throughput and delay characteristics of algorithm. Together, a cluster-based MAC scheme and algorithm can solve many of critical issue facing VANET networking today.

6. CONCLUSION

Every day motor vehicle accidents cause unnecessary loss of life. The economic and societal ramifications of motor vehicle accidents and traffic congestion are of global concern. Research and development in Intelligent Transportation Systems (ITS) has been making great headway into the future safety and ease of our roads. The induction of the DSRC standard, has laid the groundwork for vehicle-to-vehicle and vehicle-to-roadside communication. Vehicular networks will incite countless applications, among them: reduction of traffic congestion, collision prevention, and traffic management.

Vehicle Ad hoc Networks (VANETs) exhibit many challenges for networking and communication. VANETs are prone to a highly dynamic network topology, packet congestion, and the hidden terminal problem. All of these challenges can be alleviated by a clustered network. Many cluster-based MAC and routing schemes have been suggested for VANETs, although this research is lacking a stable VANET clustering algorithm. To achieve stable clusters in a highly mobile network, such as VANETs, mobility must be considered during both cluster head election and cluster maintenance.

VANET is a capable wireless communication technology for improving highway protection and information services. This paper has estimated two different algorithms appropriate for VANET in highway road. First, algorithm have proposed VWCA as a new vehicular clustering algorithm based on the WCA technique in two part first one for formation of cluster and second for maintain of cluster properly for less overheads.

VWCA make use of disbelieve value in the weighted sum operation. The disbelieve value has been obtained from this work next proposed monitoring malicious vehicle (MMV) algorithm. Using disbelieve value, vehicles that have lower disbelieve value than their neighbors are selected as cluster-heads. Therefore, cluster-heads are more reliable vehicles than other vehicles in the network using their PDR value.

In future works developing algorithms for a city scenario based on the techniques proposed here for highways and introducing a new security algorithm based on key distribution and the proposed clustering algorithm.

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