Available online at www.scholarsresearchlibrary.com

Scholars Research Library

Scholars Research Library

European Journal of Applied Engineering and Scientific Research, 2015, 4 (2):28-34
(http://scholarsresearchlibrary.com/archive.html)

ISSN: 2278 – 0041
CODEN(USA): EJAEAJ)

An efficient automatic secure traffic lights systems for VANETs

Mortaza Abbaszadeh*, Zohreh Hassanpour_Barazandeh and Saeed Saeedvand

Department of Computer Engineering, Ilkhchi Branch, Islamic Azad University, Ilkhchi, Iran

---

ABSTRACT

VANET[1] is composed of RSU[2] and vehicles distributing secure or insecure messages. VANETS allow finding independent moving vehicles in the road by distributing traffic information and road conditions. In this paper (ASTS[3]), a method has been proposed, and in this method, k-meansalgorithm is used for clustering vehicles, and Dijkstra's Algorithm is used to find the shortest route. It can be performed in three main phases. The first phase is declaring road conditions in terms of weather phenomena and traffic restrictions. The second phase is tracing passing vehicle and data collection.The third phase is declaring sudden stopping of vehicles.

Keywords: cluster symmetric key, Vanet, Dijkstra's Algorithm, k-means algorithm

---

INTRODUCTION

Nowadays, with regard to expansion of the cities and increasing population, one of the problems is to find a solution to decrease the route length and urban travelling time span. In this regard, analyzing the network in information systems or computing the shortcut route can be useful. Vanet [1]is a developing technology, and it can be used to solve the problem of urban population traffic. Vanets are real samples for application program of the network. Vanet network can provide vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication by using radio waves. Vehicles can communicate autonomously, and they create a wireless non-structured network. The mean difference of vanet networks with other networks is that there are no central sink massages and it controls the network. The network is composed of a series of vehicles that are mobile, and they are not fixed. Also, they do not play the role of a router or access point. In fact, Vanet networks are a special kind of MANET networks[2]whose nodes are vehicles. Each vehicle can detect the surrounding vehicles. They form a network by connecting to the network, and they communicate. Then, this vehicle creates another network with new surrounding vehicles. The basis of Vanet networks is that they are non-structured, and DSRC[4] and 802-11p standards are used [3]. Hence, these networks can make topology changes. Since they do not have any computing problems in terms of sources and energy consumption, they are flexible. There are two kinds of data in Vanet involving information sensitive to secure messages, and information that are not sensitive to delay, and their immediate delivering is not compulsory such as traffic information or weather information. There is much sensitivity in terms of distributing secure information due to their direct relation with human body. Therefore, distributing appropriate information on time has an important role in vehicle networks. Secure information involves various messages such as warning after the

[1]Vehicular Ad-HocNetworks
[2]Road-Side Unit
[3] An Efficient Automatic Secure Traffic Lights Systems for VANET
[4] Dedicated Short Range Communication

accident, warning dangers of the road and etc. Information propagation includes different protocols to transfer information, and it depends on the user and message content. In this paper, it has been tried to reach the shortest route by using Dijkstra's Algorithm[4].

Kishore Birders and his colleagues [5]added security to CDRIV protocol [6]in traffic light system in terms of higher security of vehicles. In this research, CDRIV protocol has been used on the basis of reducing traffic information aggregation and controlling traffic signal in traffic lights system. They added security to related protocol, and called it the secure adaptive traffic lights systems (SATS) for Vanets [7]. In order to produce the key in this protocol, cluster symmetric key [8] has been taken into account. This key has been obtained from RSU [9] located in the side of intersections. In the results of this research, the number of moving vehicles from the beginning to the end of interaction has been considering. Also, 41vehicles wish start time of car transmission (0.443) and ending time of car transmission (0.446) have been considered. Also, it has been performed by using security protocol of the system (SATS) and on the basis of the same conditions without considering the system security and the member of vehicle, but different transmission ending time less than 0.446 has been considered. In the presented study, some important issues and factors have not been taken into account. The cluster vehicle updates the information of vehicle density such as the connection of vehicles to the cluster or a cluster formed on the basis of vehicles direction before the intersection. Another problem of this protocol is take of adequate security in this protocol especially when another vehicle outgoes head cluster vehicle in the intersection.

This paper has been organized as follows. In section 2, sensors in vanet network has been presented. In section 3, Dijkstra's algorithm has been explained. In section 4, clustering and the way of detecting cluster head have been described. The presented method and the protocol have been explained in section 5. Finally, conclusion is presented.

2. Sensors in Vanet network

The most important part of vanet is sensors used in various parts of vehicle. It reports the vehicle position and external environment to the driver and controller, and applies the driver rules or information received from other vehicles (Figure1).

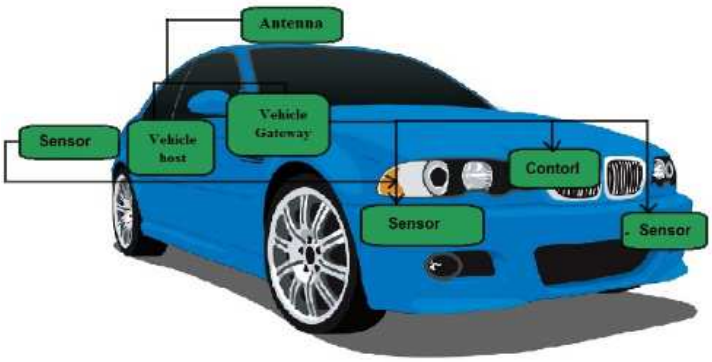

Figure 1: components of vanet network components

The advantages of new traffic lights systems controlled by vanet technology is improving the traffic, minimizing delay of vehicles in intersections, reducing the length of vehicles queue in intersections, and reducing fuel consumption.

Since traffic is changing, and it is unpredictable, it's necessary to control traffic changes during the day to present an appropriate reply to the user and to report reducing or increasing the traffic to the user when they face with new situations of traffic. Therefore, in these cases, it's not possible to determine the best route by using the algorithm of the static shortest route due to changing travelling time.

3.Dijkstra's Algorithm
The method of tree structure has been used in Dijkstra's Algorithm.it is a greedy algorithm as well as graph traversal algorithm. This algorithm solves the problem of the shortest route from source unit for weighed graphs that don't have a negative edge or weight. Finally, it disturbs the shortest route from the source to all graphs. This algorithm considered an optimal choice in each step. All heads are propagated, and the nearest one is continues by using the same method [4].

3-1. Routingalgorithms
In analyzing the optimal route in the network of dynamic transformation, it necessary to consider time of passing from the edge is related to the properties in terms of length and width of the route as well as the traffic in a special time.The related information of properties are available, but there is no proper criteria to demonstrate the traffic. Since traffic conditions are changing on the basis of time, central system is required to present a suitable response to the users so that traffic changes are considered, and increasing or decreasing traffic is reported to the users when they face with new traffic conditions.

The shorten rote is usually one of the application problems in transportation [10]. With regard to developing these systems, various algorithms have been presented for optimal routing by considering parameters, characteristics and the structure of the network. Since there are various routing issues in terms of graph structure and parameters, there is no optimal algorithm for routing problems. In other words, a special algorithm can have the best results for a problem. Routing algorithms are classified into two main groups [11]involving.

1) **Matrix algorithms**: They find the shortest route between the pairs of heads in the network by repeating the operations. In these algorithms, the network is considered as a matrix [12](The algorithm of Floyd, WashitaJohnson).

2) **The algorithm of tree structure**: They find the shortest route from the head to other heads. In these algorithms, a tree is created from the shortest route with the branches that are branched from the source [13] (Dijkstra's Algorithm, Bellmanford).

4. Clustering
Clustering in vanet is a method used for optimal distribution, overload reduction as well as delay reduction of message delivery. Dynamic clustering removes the concept of fixed base completely. In fact, dynamic clustering is a technique used to constitute a group of moving vehicles that do not have any relation and physical connection. In clustering, it has been attempted to classify data into clusters. In this case, the similarity between data of each cluster maximizes, while the similarity between of various clusters minimizes.

A cluster moves physically in the road. Vehicles are determined according to the speed and their proximity to head cluster, and they become the member of the cluster or leave it [15].Much research has been carried out in terms of clustering and keeping the cluster, and this shows its importance and application in vanet network. The protocol of MAC[1][16]called DBM-MAC has been presented, and it is a method to support the communication in geographical part and in highway scenarios in terms of various applications. DBM-MAC involves a design of distributed clustering and a mechanism of rapid distribution of information. In this design, three important parameters have been taken into account to select the members, and they affect the rate and amount of delay in message delivering.

We consider vanet network based on vehicle-to- vehicle architecture and moving vehicles in a highway scenario. All vehicles are equipped to GPS and a vanet sender/ receiver.Cluster- based architecture is composed of various clusters.Vehicles move in a common path, and they become the member of a cluster in neighborhood (In distance of about 1 km) on the basis of clustering algorithms.

A cluster expands in two or four road lines. Clusters are rectangular. The length of vehicle is very important in vehicular network, and it is certainly larger than lines width. The important advantage of different mobile clusters is that head cluster and the cluster itself moves along with other vehicles in spite of the fact that vehicles move. This issue guarantees that, although vehicles have high speed due to the architecture of mobile clusters, a stable cluster is created, and adjacent vehicles remain next to each other (Figure 2).

[1]**Media access control**

A sample of forming dynamic cluster is that, as long as a vehicle enters a new intersection or highway, it searchers the cluster by distributing a general message of membership request. If no reception message is received in predicted time, the mentioned vehicle initiates forming the cluster by general distribution of a hello message in its neighborhood. Then, vehicles of the neighbor distribute the related information through backward mutation. The information involves relation speed, neighborhood degree and the relative position [17].

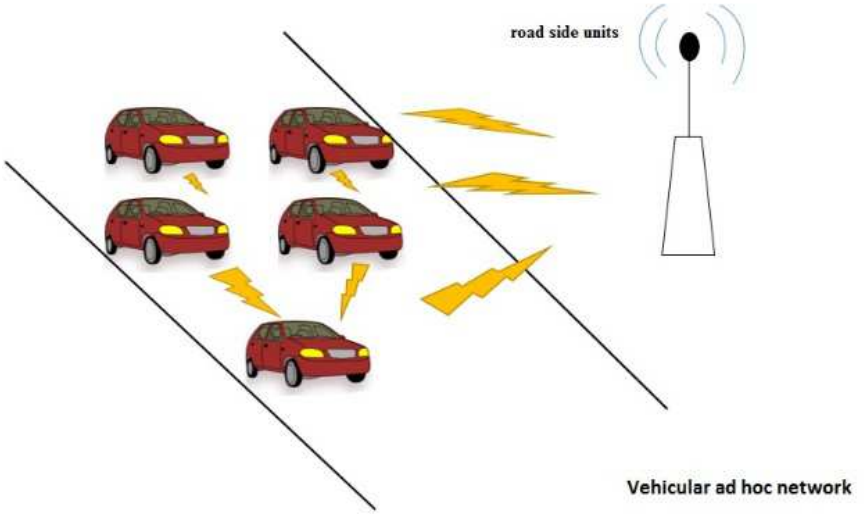

Figure 2) vehicular ad hoc network

4-1. Clustering on the basis of K-means algorithm

This method is one of the best clustering methods, and it is considered as the methods of flat clustering and exclusive clustering. Clustering and head cluster selection are performed in considered route by considering the number of vehicles. In K-means algorithm, each cluster is displayed by the average of that object's cluster. The procedures of k-means algorithm are as follows [14]:

1) At first, selecting random point of k among initial samples is performed in the center of clusters.
2) Each point is dedicated to the nearest center.
3) Computing of the center is performed by using cluster members.
4) Return to step 2 until no changes occur in the center of clusters.

5.The proposed method

Our proposed method (ASTS) is a developed algorithm by SATS and CDRIVE, and it is performed by adding the properties of clustering security and routing optimization. When there is more than one clustering, the vehicle entering the considered path informs the RSU by sending a hello message, and it determines the position of vehicle available clustering positions according to vehicle GPS. Also, it directs the vehicle to the nearest clustering. The tasks proposed in this research are considered in three phases.

The first phases: declaring the road situation in terms of weather phenomena and traffic restrictions.

The road situation is declared in terms of weather phenomena and traffic restrictions by RSU units, vehicles monitoring or aerology equipment's.RSU has relation with meteorological organization in the roads. Communication data is transferred in general information packages. Speed reduction resulting from weather phenomena is declared to all head cluster vehicles through OBU and RSU. Freezing, flood and the slippery of the road surface must be detectable by the vehicle sensors.

The second phase: Tracing passing vehicles and data collection traffic data in collected to manage road transportation as follows.

1) RSU sends general information packages to all vehicles (Head cluster) involving information.
2) If a vehicle receives a message (Involving speed, Direction and Address) from RSU, it declares its own distance with other vehicles by using equipment or sensors of distance determination, and then transfers it to RSU.

3) The packaged information is placed in RSU, and it is transferred to control center in special conditions such as bad weather conditions, freezing and etc.

The third phase: Declaring sudden stopping of the vehicles
In terms of declaring vehicles sudden stopping, the considered vehicle must immediately inform the near vehicles and its own cluster placed in a determined distance. Here, the considered vehicle stops without declaring it to RSU due to heaving all vehicle and stopping all of them. Also, it's not necessary to inform RSU due to changes according in a special range. They stop by applying detection automatic system of sudden brakes, and it is declared through vehicular monitoring.

5-1. Hypothesis
It is supposed that each vehicle is equipped to GPS and monitoring or digital maps to determine the situation. Also, the information related to message is declared to central station by using road side equipment so that covered are events are predicted. RSUs have relations with GPS and digital maps. Each vehicle is equipped to a TPD[1] device by using OBU [2]so that computing and encryption are performed among vehicles.

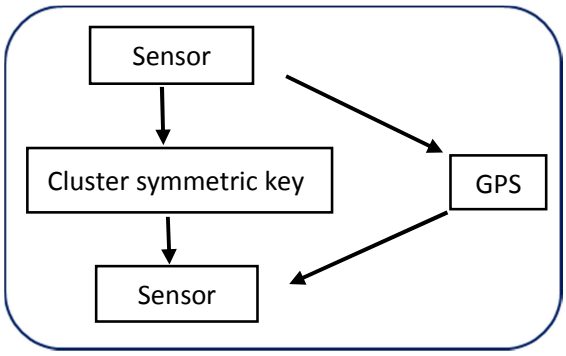

Figure 3) Nodes vehicles

5-2. Security requirements of the algorithm
1) Vehicle authentication: Joining the vehicle to the cluster must be confirmed. The vehicle that has joined a cluster must belong to the same direction.
2) Private messages: the connection between RSU and vehicle to obtain symmetric cluster key must private.
3) Message authentication: The accept message of joining by the head cluster vehicle to compute vehicles mass estimation must match with information estimation.
4) Keeping privacy of the vehicle: when the vehicle joins the head cluster, the main ID of vehicle and other personal information must not be manifested.
5) Invalid source: Sending message to the vehicle must be according to legal requirements.

5-3.Protocol description
In this paper, we consider Vanet network located in the urban environment. This network involves vehicle-to-vehicle or vehicle-to-infrastructure communication. All vehicles are equipped to a vanet sender recover. The network is composed for N set of nodes. There are RSU units for road side in this network. Road side infrastructures are determined in predetermined locations on the basis of urban classifications.

In network clustering, the system model is as follows. Vehicles move on a common path through using k-means algorithm and cluster- based architecture. They become the member of a cluster in neighborhood, and the clusters expand in the road (figure 4). In vehicular network, the length of cluster is very important, and it is usually larger than the road width. In figure 4, it is supposed that the white space, small circles and small squares are respectively considered as the road, vehicle and k common point in the algorithm. The initial clusters are usually selected from initial vehicles randomly. Therefore, the clusters obtained from clusters can be different in two independent k-

[1]**Tamper_ proof device**
[2]**on-board unit**

means clustering.In spite of the fact that the clusters are mobile, and the speed of vehicles is high, a stable topology is created, and adjacent vehicles remain next to each other.

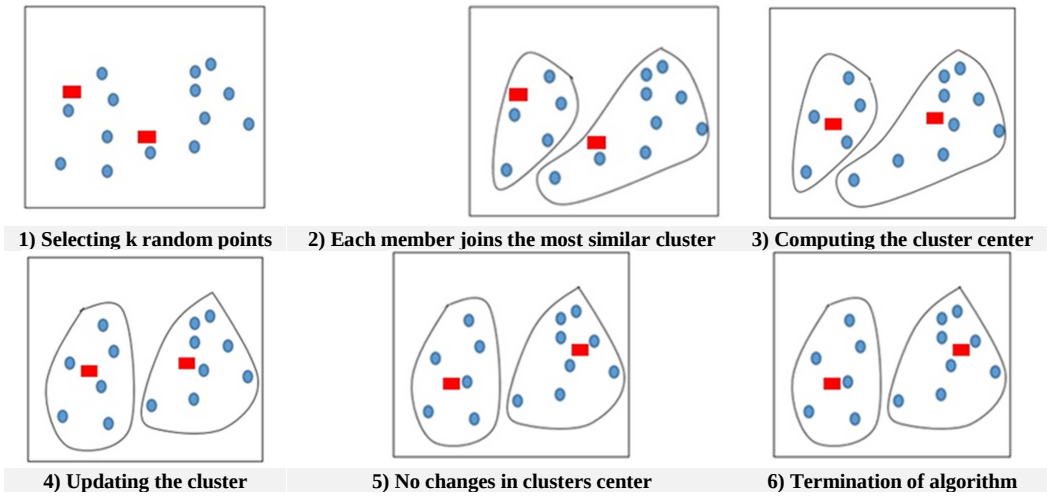

Figure4) the process of K-means algorithm

Each RSU forms a fixed cluster in its transferring range by using k-means algorithm. In this design, joining the vehicle to the cluster must be confirmed by the head cluster so that mass is appropriately estimated. Also, time of trip must be less during cluster formation. Here, neighborhood condition is directly to the range of transferring and receiving nodes. DSRC is used as the interface of communication channels. Dijkstra's Algorithm presents the shortest path in which the vehicle can reach the considered past quickly. The shortest path is obtained by moving in all routs, and it is tried to perform it optimally.

Protocol is performed in four steps:
1) Symmetric cluster key of the vehicles s obtained from RSUs that are near to intersection.
2) k-means algorithm has been used to create the head and head cluster.
3) Symmetric cluster key has been used to join the vehicle to the cluster.
4) Information transferring by the head cluster vehicle to control unit and traffic signal in intersections are obtained by using general key (PKC) [18](figure 5).

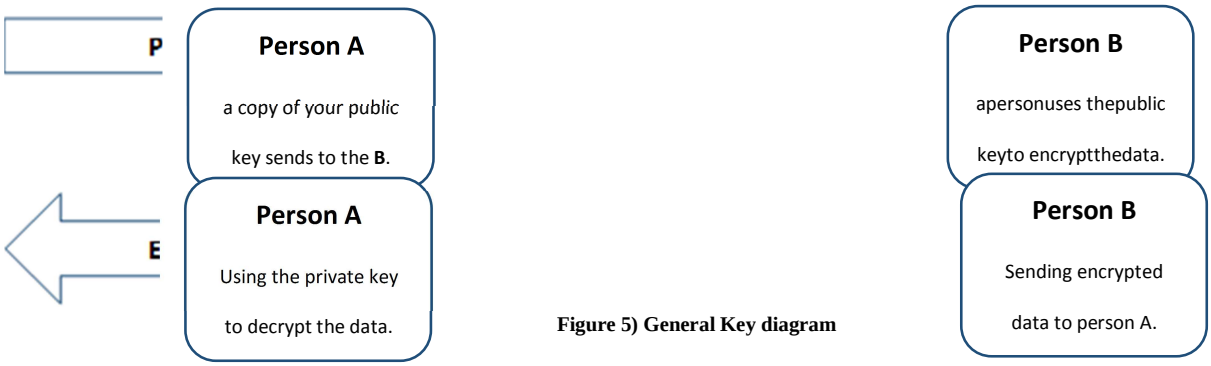

Figure 5) General Key diagram

5-4. Vehicle

The vehicles entering RSU range are clustered by using k-means algorithm on the basis of available information of vehicles (speed, direction and address). Usually, initial clusters center are randomly selected from initial vehicles. Here, the number of clusters that have been previously formed is clear, and head cluster (middle node of the cluster) is determined by k-means algorithm.

5-5. RSU task

1) Authentication of vehicles properties joining to the cluster

2) Route clustering
3) The connection with other RSUs
4) The connection with cluster head
5) The connection with the control center
5-1) meteorological organization
5-2) monitoring center

CONCLUSION

As it has been said, many problems of the road can be solved by providing appropriate information for drivers in a suitable time. Vanet networks provide the required vehicular communication, and they reduce traveling time and events considerably. The main purpose of vanet networks is their connection with vehicles that lack any central sink. This network is composed of mobile network nodes that do not have any fixed location. In the proposed method, k-means algorithm has been used for suitable clustering, and routing has been performed quicker by applying Dijkstra's Algorithm. The vehicles communications is possible due to connection of RSU with vehicles and other bases such as aerology, traffic organization and etc. The Purpose is to reach an optimal method for suitable clustering in vanet network, and access the shortest route in the roads and cities.

Three phases have been proposed in this method. The first phase is declaring the road conditions in terms of weather and traffic restrictions. The second phase is tracing passing vehicle and data collection, and the third phase is declaring sudden stopping of vehicles.

REFERENCES

[1] F. L. Yu Wang, "Vehicular Ad Hoc Networks," *Computer Communications and Networks*, no. Vehicular Ad Hoc Networks, pp. 503-525, **2009**.
[2] Y. M. Abbas Jamalipour, "Intermittently Connected Mobile Ad Hoc Networks," in *Intermittently Connected Mobile Ad Hoc Networks*, Springer New York, **2011**, pp. 1-6.
[3] J. B. Kenney, "Dedicated Short-Range," *IEEE and SAE Standards for Wireless Access in Vehicular*, vol. 99, no. 7, pp. 1162-1182, **2011**.
[4] M. C. F. Saul I. Gass, "Dijkstra's Algorithm," Springer US, **2013**, p. 428.
[5] R. M. P. M. M. M. P. Kishore Biradar, "Secure Adaptive Traffic Lights System for VANETs," in *Intelligent Computing, Networking, and Informatics*, Springer India, **2013**, pp. 843-883.
[6] N. B. M. M. J. L. Maslekar, "C-DRIVE," *IFIP International Conference on New Technologies*, pp. 1-5, **2011**.
[7] R. M. P. M. M. M. P. Kishore Biradar, "Secure Adaptive Traffic Lights System for VANETs," in *Intelligent Computing, Networking, and Informatics*, Springer India, **2013**, pp. 873-883.
[8] R. M. P. M. M. M. P. Kishore Biradar, "Secure Adaptive Traffic Lights System for VANETs," in *Intelligent Computing, Networking, and Informatics*, Springer India, **2013**, pp. 873-883.
[9] Q. L. Yanwen Wu, "Scheduling Algorithm for Vehicle to Road-Side Data Distribution," in *High Performance Networking, Computing, Communication Systems, and Mathematical Foundations*, Springer Berlin Heidelberg, **2010**, pp. 22-30.
[10] j. saberian, "Improve the performance of routing algorithms in an urban networks," pp. 2-4.
[11] A. Preygel, ""Path finding: A Comparison of algorithms," *Management Science*, **1999**.
[12] P. C. Fischer, "Efficient procedures for using matrix algorithms," in *Automata, Languages and Programming*, Springer Berlin Heidelberg, **1974**, pp. 413-427.
[13] P. Festa, "Shortest Path Tree Algorithms," Springer US, **2009**, pp. 3507-3519.
[14] O. W. werner Dubitzky, "K-means," *Encyclopedla of Systems Blology*, no. K-means, pp. p-1072, **2013**.
[15] Saman.kamali, "Clustering in automotive networks," *The 8th Symposium on Advances in Science and Technology*, p. 2.
[16] J. Z. Nirwan Ansari, "Media Access Control," in *Media Access Control and Resource Allocation*, Springer New York, **2013**, pp. 3-28.
[17] Saman.kamali, "Clustering in automotive networks," *The 8th Symposium on Advances in Science and Technology*, p. 4.
[18] "public key," *Computer Science and Communications Dictionary*, p. 1366, **2009**.