An Advanced Bayesian approach in Vehicular ad-hoc Network using Content-Centric Technique and LAR

Sehrash Rafiq[1], Sahil Verma[2], Kavita[3]

[1]Student, M.Tech, EMGOI, Ambhala
[2]Assitant Professor, Dept. Of CSE, E-Max Group of Institutes, Ambhala
[3]Assitant Professor, Dept. Of CSE, E-Max Group of Institutes, Ambhala

Abstract: **Problem of traffic congestion in VANET is an important problem which has drawn the attention of researchers all in the region of the world. This paper proffer a novel position based routing protocol with the idea of baseline and distance minimization using EKF-based content centric approach. The protocol has been implemented successfully for a vehicular adhoc network applied. The vehicular movement used a new concept of communication using minimization of distance from base line. The base line was drawn from source to destination node. Position, velocity, acceleration and direction are considered. The discussed protocol seems to work quite well and seems to yield encouraging outcomes. The delivery ratio of the packets was increased considerably and the average delay was reduced considerably.**

Keywords: **VANET, Manhattan model, MANET.**

1.   Introduction

Vehicular ad-hoc wireless networks are a mainlystimulating group of mobile ad hoc wireless networks (MANETs) that remain presently appealing the wide spread consideration of exploration in the arena of wireless networking and also motorized manufacturing.The communication in (MANETs) supports an amount of dispersed applicationbetween mobile nodes in infrastructure-free locations. So, itconsidered by reasonably high flexibility, communication in VANET Shows robusttasks than that in further general MANETs. [1]

As an central part of ITS research, the potential accomplishment of VANETs research lies on the expansion of vehicular communication system that allows convenient, steady and cost-effective distribution of data to profit the protection and comfort "on the road". Among several communication applications in VANETs, there is an extensive range of important applications involving traffic safety, traffic observing and unpiloted vehicles applications demand time control communication in Ad-hoc wireless networks. We call these disseminated time restraint applications as real-time communication. As deliberated above, highly dynamic or Vibrant nodes and no centre stationary server will cause the accident on wireless medium in the communication of VANETs.

1.1 Topology and Congestion in VANET

High Dynamic Topology: VANETs have very high dynamic topology .The communication links among node changes offensively speedily. Communication among two nodes residues for terribly less time.As an example if two vehicles

moving off since one an additional through a speed of 25m/sec and if the broadcast range is 250m, formerly the connection can only last exclusively for less than five seconds (250m/ 50ms-1).Consequently, this however enormously dynamic topology is existing in VANET

Frequent disconnected Network: From the above distinguishing we have seen that association between two or additional vehicle residues for five second roughly. To keep up the uninterrupted property vehicles desires another association close without delay. But if failure occurs vehicles will link with Road side Unit. Frequent disconnected network in the main occurs wherever vehicle density is extremely low like country. [2]

Mobility Modelling and Prediction: The above two properties desires the data of positions of vehicles and their movements however this is frequently terribly dealt to expect since vehicle will move unsystematic and it doesn't have a pattern. Consequently quality models node estimate that supported the learning of predefined road route model and vehicle speediness are use.

Communication Surroundings: The movement model extremelydiffers in different locationsince rural area towards urban area, from highways to that of city environment. Hence mobility modelling and vehicle movement estimate and routing algorithm should familiarise to these

changes. Mobility models are very modest for Highways because vehicle movement is one dimensional. But in case of city environment lots of vehicle existent different obstacle like building are present it makes communication application very difficult in VANET.

2. Literature Review

Förster et al.[3] This paper proposed PUCA – a organization whichmake obtainablecompleteprivacyintended forauthentic users, even at the side ofscheming backend providers. The organizationusagesunidentifiedidentifications for confirmationthrough the backend, although disappearing the communication betweenmeans of transportationas well as with RSU unmoved and in conformation with currentcriterions. For deduction of mischievous vehicles from the organization, the author take advantage about a friendly privacy cancellationmechanism which d'nt need resolution of assumed name. Throughsystem, itdetermine that robust and provableconfidentiality security in vehicular networks can be accomplished, whereassatisfyingmutualsafetynecessities, such as Sybil resistance and cancellation.

Toutouh et al. [4].The paper proposed, the usage of smartphones has analyzed, and laptops in vehicle-to-vehicle (V2V)communications whichdescribing a test bed approvedavailable in the city of Malaga. The author analyzed that it involved two dissimilar MAC/PHY terms: the commonly used in IEEE 802.11g also in IEEE 802.11a.So the authorconsidered two dissimilarkinds of testing: the initiallyintended to estimate the strength of wireless signal which is produced by the examine devices, and the secondly, itdedicated on describing the QoS of V2V (vehicle-to vehicle) communications of these procedures.

Wang Yu et al. [5] This paper analyzes the data delivery delay for the persistence of roadside unit (RSU) placement in a vehicular ad hoc network through discontinuous connectivity. A mathematical model is established to describe the connection between the average interruption for delivering road situation information and the placement distance between two neighbour RSUs. The resultant mathematical model deliberates a sparse highway scenario where two neighbour RSUs are positioned at a distance without a straight connection and vehicles are lightly scattered on the road with road situation information randomly created between the two neighbour RSUs. Furthermore, the model take into interpretation the vehicle speed, the vehicle density, the likelihood of ahappening, and the placement distance between two neighbour RSUs.

Wongdeethai et al. [6] The paper analyze about the road traffic collecting procedure to collect information of the road traffic in a Vehicular ad-hoc network on urban roads. The important operation of the protocol is the broadcastingof query whichdirects a query communicationabove cosist of routes which is predefined in the track of the destination position. To collect the information of the road traffic,then the nodes cancontributing in thedistribution of query whichcontain their specificspeed to the query message so that blocking information on dissimilarlocations of road divisions is collected.

Malhi et al.[7]In this paper, it is based on the fuzzy trust expectation model is proposed to successfullycalculate the belief of further vehicles for the protectedrouteestablishment in vehicular ad hoc networks. Then, the results and study of the planned model concluded the ordinary protocols are accessibleby means ofmodels.

David B. Johnson et al.[8]The proposed modeling flexibility for vehicular ad-hoc networks. In this, established on the association of vehicles on actualroadmaps, the accurate model of node indication has been accessible.The ns-2 network simulator will be used in this model. The plannedprocedure is relaythrough the arbitrary Waypoint mobility model. Outcomes show that the model in Random Waypoint mobility isanuprightestimation for put on the faction of vehicles on a lane, but nearby conditions in which new model is wellsuitable.

3. Problem Formulation

The problem in this thesis will utilize the(MMM) Manhattan mobility model for vehicular movement. The Manhattan mobility model imitates the movement configurations of mobile nodes on streets distinct by maps. It is valued in modeling movement of nodes in an urban area or city situations. This model follows grid road topology. The map is distributed into number of vertical andhorizontal roads. Intended forindividuallyroad is allocated into two lanes in each route. In vertical Street nodes move north and south route and horizontal streets nodes interchange in east and west route. The horizontal and vertical street creates several crossing points. The nodes can take turn from crossing point in left, right or go straight route. The model works built on a probabilistic approach for selection of nodes movements. The probability of moving in the same route is 0.5 and the probability of turning left and right is 0.25. The problem of crowd sensing in Vehicular Ad-hoc Network is a most commonly researched problem in current years**.** Many researchers use several machine learning algorithms to solve the problematic of congestion Mobile crowd sensing discusses to a broad range of community sensing paradigms. For instance a distinctprocedure of crowdsourcing, mobile crowd sensing goals to make available a device to includemembers from the commoncommunity to contribute efficiently and effectively and exploit context of use associated sensing data from their mobile devices in resolvingprecisecomplications in associations**.** But lack of actualexplanations to enumerate the connection among participants in crowd sensing encourages us to form a difficult solution for the same. Thus, it could not effectively assign the computing tasks and human based tasks of crowd sensing among individuals in VSNs simultaneously. Hence, one of the problems which have been taken in this paper is about task allocation of crowd sensing in VSNs. The first major phase toward attaining this goal will be to determine the effects of different driving environments on the signal propagation within the vehicular cloud framework. Also location based crowd sensing has been applied by many researchers but there has been very few works in by means of content aware approach. This papertargets to achieve the goal of crowd sensing using not only location but also velocity

and direction of vehicles. The aim is to develop and improved version of Kalman filter to solve the problems of non-linearity in the traditional one. In our problem statement, an expected zone needs to be calculated for the conceivablelocation of the target node. It is a roundabout the target which canholds the predictableposition of the target node.

4.   Proposed Methodology

The paper aims to solve the problem of crowd sensing in VANET using context aware algorithm and Bayesian filters. We will use the usually accepted urban, suburban, and rural wireless communications environment categories.   The content centric approach will be developed using various parameters such as location, velocity and direction. In this thesis, we proposed the Extended Kalman Filterintended for estimating the states for improved crowd sensing.

4.1 Extended Kalman Filter:

One of the main expectations of the Kalman filter is that it is designed to approximate the states of a linear system based on dimensions that are a linear function of the states. Inappropriately, in many of the conditions where we would like to use a Kalman filter, we require a non-linear system model and/or a non-linear measurement equation. In detail, the scheme model is a non-linear function of the states and/or the measurements are non-linear functions of the states. Commonly, the non-linearities don't spread to the system disturbances and measurement noise.

Since of the attractiveness of the Kalman filter, designers have established a set of mathematics to extend Kalman filter theory to conditionswhereverthe system model and/or measurement model are non-linear functions of state. The resultingKalman filter is stated to as the Extended Kalman filter. As we will understand, the Extended Kalman filter uses the non-linear system model for calculating the expected state estimation,$\hat{x}(k + 1|k)$then the non-linear measurement model to form the expected measurement, $\hat{y}(k + 1|k)$.

It relates to the problem which is non-linear in nature both in terms of process dynamics and measurement dynamics. Therefore, ordinary Kalman filtering cannot be realistic here. An Extended Kalman Filter needs to be designed based on Taylor series expansion about a nominal value which is taken as the preceding estimate in this case. The state transition matrix F is given by the Jacobian of the vector function f (x~, w~) about state x~ and the noise scaling matrix τ is given by the Jacobian of the direction function f (x~, w~) about state w~ .

Subsequently the process dynamics are uninterruptedthough the measurements are commonly discrete in nature, a hybrid continuous-discrete EKF model is too developed. The EKF equations of discrete time cannot be used openly and continuous time EKF equations has to be derived. Also, later the measurements are discrete in nature, a hybrid of both is developed and defined below.

An observable, dynamical non-linear system, throughdynamics continuous process and discrete measurement dynamics is defined by,

$$\tilde{x}(t) = f(\tilde{x}(t)) + \tau_c \tilde{w}(t)$$
$$\tilde{y}_k = h(\tilde{x}_k) + \tilde{y}_k$$

wherever x~ $\in \Re n$represents the state vector of the scheme in n-dimensional, f (.) : Dx $\rightarrow \Re n$ is a fixed non-linear representing of system states to system inputs, z~k$\in$Dz$\subset \Re p$prepresents the p-dimensional scheme measurement, h(.) : Dx$\subset \Re n$ $\rightarrow \Re p$ is a nonlinear representing of system conditions to output, τc$\in \Re n$ x w represents the uninterruptedprocedure noise scaling matrix, w~ $\in$Dw$\subset \Re w$represents the w-dimensional noise in random process and ~v $\in$Dv$\subset \Re v$ denotes the measurement noise in v-dimensional random

Take an arbitrary line between S and D , It will keep the IN intermediate node selection within the direct S-D route.
D2 is the minimum distance from this arbitrary line

- It will reduce delay in selection of node.
- It will be selected in such a way it will keep the shortest distance so no chances of getting any longer route or stale route.

4.2 Assumptions:

- Fixed no. Of nodes and road structure is already defined.
- Each node is in authority to preserve a multicast tree in the form of ADJACENT NODE TABLE.(For multicasting) .
- Some of the predefined root nodes would be there.

4.3 Multicast tree

1. Root Nodes: Roadside units for reliable transmission and predefined
2. Leaf Nodes: Adjacent node table maintained as multicast tree.
In the vehicular adhoc network (VANET), the vehicles are connected through vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) communication. Towards vehicle to vehicle (V2V) communication is available to interchange important information between vehicles. To create path among various vehicles many routing protocols had remained proposed which remain of reactive and proactive type. In VANET, reactive routing protocols had significantpresentationwhich usage the dissemination technique for route establishment. The dissemination technique will increase delay in the network and network resource using up will increase at fixed rate. To reduce delay in the network, the technique of multicasting had been proposed. The following are several supposition of the proposed system
1. The network will be arranged with the fixed number of nodes and roads structure already defined

2. Each node are in authority to maintain the table of its neighbouring nodes

3. For multicasting nodes some nodes in the network are predefined as a root nodes.

In the complete network we describe some nodes which are root nodes, beneath these root nodes we will describes the leaf nodes. The leaf node derivesunder which root that will be definitethrough prediction based technique for multicasting. A novel node links the network which comes beneath the root node 1 on the basis of distance and time formulationby means of the predication centredmethod

Let us assume the leaf node changes and originates in the range of root node 2 and then leaf node 1 will link the root node 2. The leaf node will comes beneath which root node it will be definite on the base of distance procedure. The handoff takes place when the threshold distance takes place and the distance will be better than threshold value.On the basis of distance among the nodes, the root nodes are in authority to preserve the tree. In this routing table information about their leaf nodes are stored and the root nodes can maintain. Formerlyask forfor the path to target the root nodes can denote to the stored informations to RSU's. RSU give data about the leaf node for path establishment and the source node interconnects with the RSU. The source node send route appeal packets to only those root nodes, which have right to use to preferred leaf node.

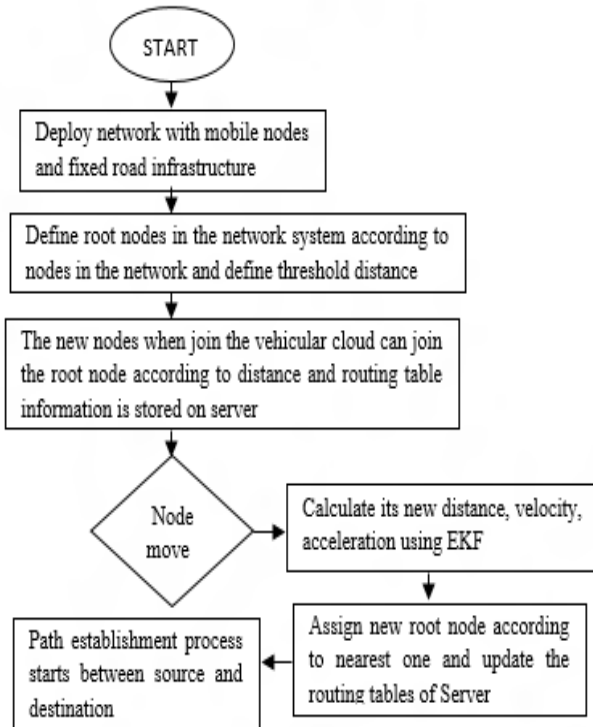**FLOW CHART: Working of node assignment**

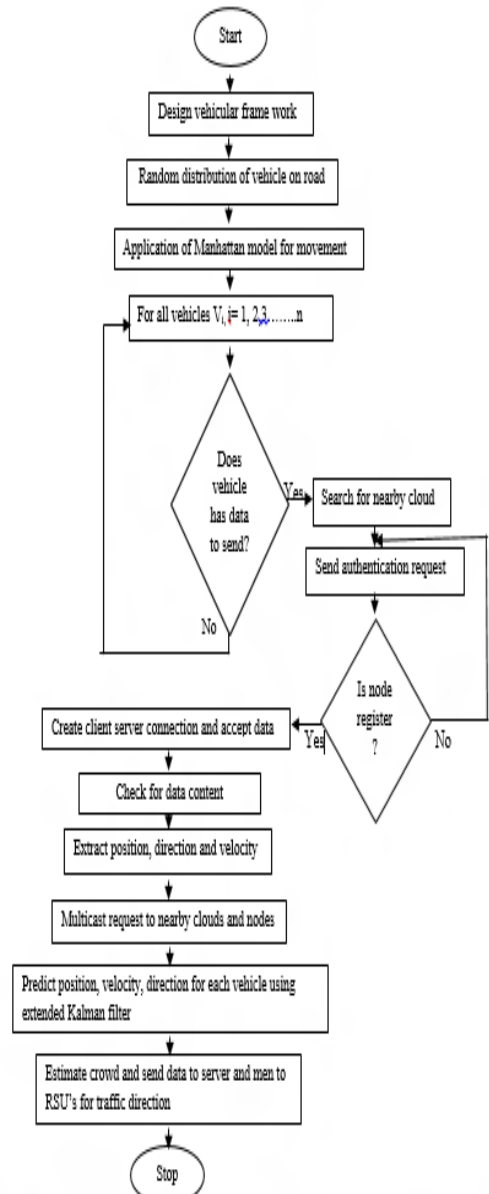Figure 1: Working of Node assignment

4.4 METHODOLOGY

Fig.2: Flowchart of methodology

5.   Results

The proposed technique has been implemented in for a VANET environment with 10 horizontal and vertical roads. 300 vehicles were placed in the roads randomly and they moved according to the Manhattan model. All the simulations were carried out in MATLAB R2013b in a core i5 processor based computer with 8 GB RAM and 500 GB hard disk.
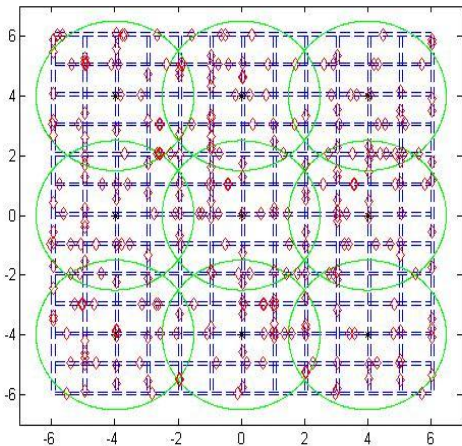
Fig.3:- Representing node distribution and vehicular cloud region

Figure 3 representing the communication between them is represented by green lines. The communication is done according to the proposed algorithm. The minimum distance line is found out and then the vehicles in the vicinity are found out. The vehicles which
have the minimum perpendicular distance to the line are selected for next hopping.
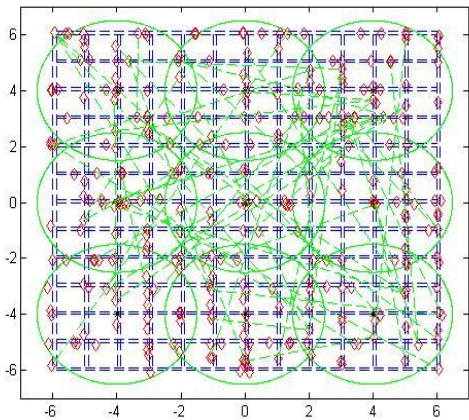

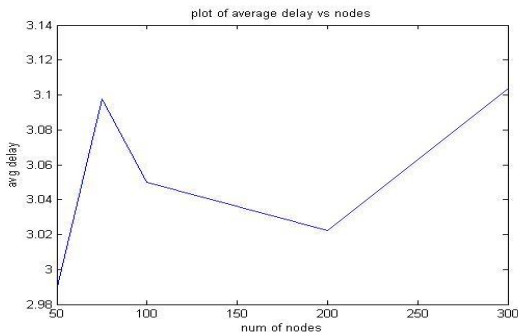Figure 4: Plot of Communication (V2V and I2V)

Fig.5:-Plot of Average Delay versus Each Round.

Figure 5 represents the plot of average delay versus each round. As observed the average delay of our proposed algorithm remains constant more or less around 3. This is a very low value and proves the efficacy of
our algorithm. The communication between them is represented by green lines. The communication is done according to the proposed algorithm. The minimum distance line is found out and then the vehicles in the vicinity are found out. The vehicles which have the minimum perpendicular distance to the line are selected for next hopping.

The packet delivery ratio of our algorithm is plotted against rounds and it is observed for our algorithm that it is very high nearly 87 % in each rounds. The high value of PDR represents that our algorithm performs quite well as compared to the traditional ones and the minor reduction in the average PDR is due to the decreasing energy of various batteries attached to the vehicles. Figure 5 show the plot of average packet delivery ratio vs. number of nodes.
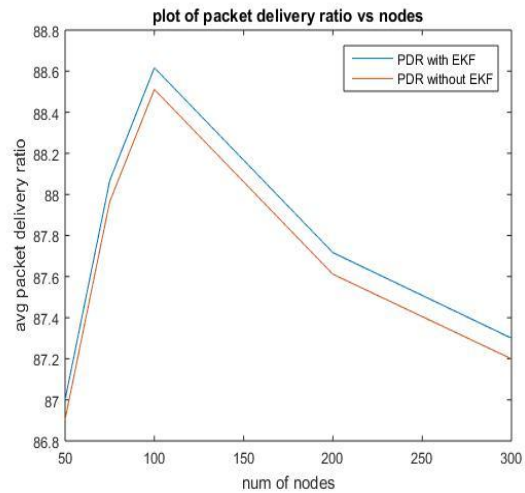

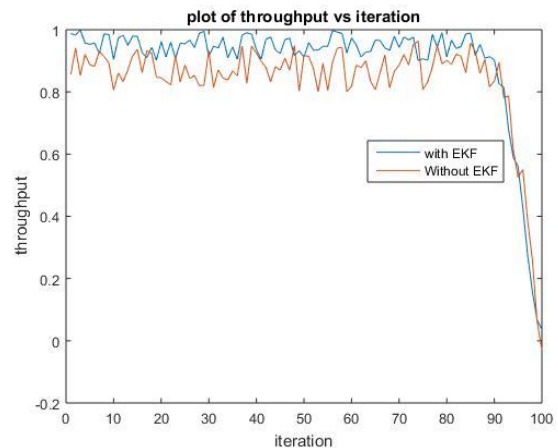
Fig.5: Packet Delivery Ratio vs. Nodes

Fig 6: plot of throughput versus iterations

As observed in figure 6 the throughput in case of our algorithm is better than that of the without EKF and it starts decreasing at a later rate which is desirable.

6.   Conclusion

The paper tries to design a novel location aided routing protocol with the concept of baseline and distance minimization. The protocol has been implemented successfully for a vehicular adhoc network and Manhattan model is applied. The vehicular movement used a new perception of communication using minimization of distance from base line. The base line was drawn since source to destination node. The discussed protocol seems to work quite well and seems to yield encouraging outcomes. The delivery ratio of the packets was increased considerably and significantly reduced the average delay. This shows the efficiency of our algorithm. In future other algorithms can be utilized for the same and our proposed model can be executed for hybrid networks. Also Meta-heuristic algorithms can be utilized for the same and the performance can be compared with our method.

References

[1].   Zeadally, Sherali, Ray Hunt, Yuh-Shyan Chen, Angela Irwin, and Aamir Hassan. "Vehicular ad hoc networks (VANETS): status, results, and challenges." *Telecommunication Systems* 50, no. 4 (2012): 217-241.

[2].   Vishal Kumar, Shailendra Mishra, Narottam Chand. "Applications of VANETs: Present & Future."*Communications and Network*, 2013, 5, 12-15.

[3].   Forster, David, Frank Kargl, and Hans Lohr. "PUCA: A pseudonym scheme with user-controlled anonymity for vehicular ad-hoc networks (VANET)."*Vehicular Networking Conference (VNC), 2014 IEEE*.IEEE, 2014.

[4].   Toutouh, Jamal, and Enrique Alba. "Light commodity devices for building vehicular ad hoc networks: An experimental study." *Ad Hoc Networks* 37 (2016): 499-511.

[5].   Wang, Yu, Jun Zheng, and Nathalie Mitton. "Delivery delay analysis for roadside unit deployment in intermittently connected VANETs." *Global Communications Conference (GLOBECOM), 2014 IEEE*.IEEE, 2014.

[6].   Wongdeethai, Singha, and Peerapon Siripongwutikorn."Collecting road traffic information using vehicular ad hoc networks." *EURASIP Journal on Wireless Communications and Networking* 2016.1 (2016): 1-15.

[7].   Malhi, AvleenKaur, and ShaliniBatra. "Fuzzy-based trust prediction for effective coordination in vehicular ad hoc networks." *International Journal of Communication Systems* (2016).

[8].   Saha, Amit Kumar, and David B. Johnson. "Modeling mobility for vehicular ad-hoc networks." In *Proceedings of the 1st ACM international workshop on Vehicular ad hoc networks*, pp. 91-92. ACM, 2004.

[9].   Keykhaie, Sepehr, SalehYousefi, and Mehdi Dehghan. "Modeling of propagation of road hazard information in sparse vehicular ad hoc networks."*International Journal of Automation and Computing* 12, no. 5 (2015): 518-528.

[10].   Bitam, Salim, AbdelhamidMellouk, and SheraliZeadally. "VANET-cloud: a generic cloud computing model for vehicular Ad Hoc networks." *Wireless Communications, IEEE* 22, no. 1 (2015): 96-102.

[11].   Wang, Neng-Chung, Jong-Shin Chen, Yung-Fa Huang, and Si-Ming Wang. "A Greedy Location-Aided Routing Protocol for Mobile Ad Hoc Networks."In*WSEAS International Conference.Proceedings.Mathematics and Computers in Science and Engineering*, edited by Shengyong Chen, no. 8.World Scientific and Engineering Academy and Society, 2009.

[12].   Das, Sanjoy, and D. K. Lobiyal. "A performance analysis of LAR protocol for vehicular ad hoc networks in city scenarios." *arXiv preprint arXiv:1210.3047*(2012).

[13].   Lochert, Christian, Hannes Hartenstein, Jing Tian, HolgerFussler, Dagmar Hermann, and Martin Mauve. "A routing strategy for vehicular ad hoc networks in city environments." In *Intelligent Vehicles Symposium, 2003.Proceedings. IEEE*, pp. 156-161. IEEE, 2003.

[14].   Panichpapiboon, Sooksan, and WasanPattara-Atikom. "A review of information dissemination protocols for vehicular ad hoc networks."*Communications Surveys & Tutorials, IEEE* 14, no. 3 (2012): 784-798.

[15].   Malhi, AvleenKaur, and ShaliniBatra. "Fuzzy-based trust prediction for effective coordination in vehicular ad hoc networks." *International Journal of Communication Systems* (2016).

[16].   Ros, Francisco J., Pedro M. Ruiz, and Ivan Stojmenovic. "Acknowledgment-based broadcast protocol for reliable and efficient data dissemination in vehicular ad hoc networks." *Mobile Computing, IEEE Transactions on* 11, no. 1 (2012): 33-46.

[17].   Altayeb, Marwa, and ImadMahgoub. "A survey of vehicular ad hoc networks routing protocols." *International Journal of Innovation and Applied Studies* 3, no. 3 (2013): 829-846

[18].   Wang, Qing, SupengLeng, Huirong Fu, and Yan Zhang. "An IEEE 802.11 p-based multichannel MAC scheme with channel coordination for vehicular ad hoc networks." *Intelligent Transportation Systems, IEEE Transactions on*13, no. 2 (2012): 449-458.

[19].   Wasef, Albert, and XueminShen. "EMAP: Expedite message authentication protocol for vehicular ad hoc networks." *Mobile Computing, IEEE Transactions on* 12, no. 1 (2013): 78-89.

[20].   Ding, Ruizhou, Tianyu Wang, Lingyang Song, Zhu Han, and Jianjun Wu. "Roadside-unit caching in vehicular ad hoc networks for efficient popular content delivery." In *Wireless Communications and Networking Conference (WCNC), 2015 IEEE*, pp. 1207-1212. IEEE, 2015.

[21].   Kuhlmorgen, Sebastian, Ignacio Llatser, Andreas Festag, and Gerhard Fettweis. "Performance Evaluation of ETSI GeoNetworking for Vehicular Ad hoc Networks." In *Vehicular Technology Conference (VTC Spring), 2015 IEEE 81st*, pp. 1-6.IEEE, 2015.