© 2016 IJEDR | Volume 4, Issue 2 | ISSN: 2321-9939

An improved content centric extended kalman filter based crowd sensing in vanet using vehicular cloud computing

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Abstract - The design a novel location aided routing protocol with the concept of baseline and distance minimization is presented in this paper. The protocol has been implemented successfully for a vehicular adhoc network and Manhattan model is utilized. 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. The discussed protocol seems to work quite well and seems to yield encouraging results. The packet delivery ratio was increased significantly and the average delay was reduced significantly.

***IndexTerms* - VANET, Manhattan model, MANET.**

I. INTRODUCTION

VANET (Vehicular Ad hoc networks) is a type of Mobile Ad hoc Network (MANET), where every node is a vehicle moving on the road. A node is used as router to send data from one node to another. In VANET mobility of vehicles; structure of the geographical areas since node movement depends on it, timely delivery of messages. In VANET, privacy is important characteristic. It uses two method of communication. One is vehicle to vehicle (V2V) and the other is vehicle to fixed road side equipment (V2R). In both the methods vehicles can communicate to other vehicles or road side unit either directly or through multiple hops. Vehicle to vehicle communication (V2V) has two types of communication: one hop communication and multi hop communication.one hop communication is the communication between the direct vehicle to vehicle. In multi hop communication, the vehicle relies on other vehicles to retransmit.A mobile ad hoc network (MANET) is a dynamically reconfigurable wireless network that does not have a fixed infrastructure. In order to attain efficient routing several protocols has been presented for mobile Adhocnetwork.Vehicular ad hoc wireless networks (VANETs) are a specifically type of mobile ad hoc wireless networks (MANETs) that are popular among various researchers in the field of wireless networking as well as automotive industries. VANET is compared with MANET in terms high mobility. Infrastructure-free environments and higher dynamic network topology cause frequent network partition. Moreover, vehicular ad hoc wireless networks is developed by the constraint of roadways where trees, buildings and other assorted obstacles influence the practical transmission effects as compared to generic open fields.

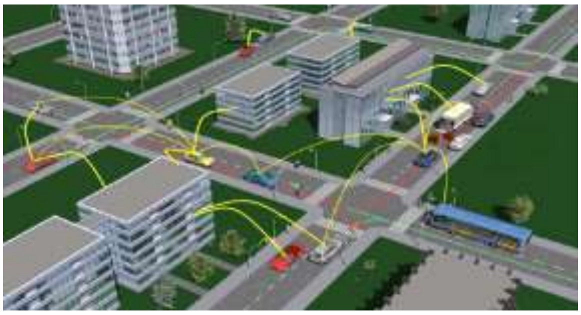


Fig.1. Vehicular Ad Hoc Network

1.1 Congestion in VANET

Traffic on road is big problem today. Multiple hours and tons of fuel is wasted everyday by these vehicles jammed in traffic. This is a fact that, therefore million tons of fuel is going to wasted today due to the increase of traffic intensity. In Technology era all the vehicles themselves have an ability to compile and analyse the traffic data and communicate it to drivers in a layout which will let them to make smart decisions to the avoid congested areas. Communications between these vehicles can be obtained either through vehicle-to-vehicle communications or vehicle-to infrastructure. Vehicular ad-hoc networks are mobile ad-hoc networks that give the communications between adjoining vehicles or nearby fixed equipment [1].Each vehicle records and flow the information such as place and speed or route that information is received from other vehicles in network. Congestion detection is one of the multiple applications of VANETs or it didn't design to be used as means for an automated driving rather as tool to deliver information to driver which will help her/him make decisions to avoid the heavy traffic. Design traffic congestion detection system which will have good influence on budget, the surroundings or society in general letting us to spend less time stuck in the traffic or more time doing any creativity.The Vehicular Ad-hoc Network has been presented in various areas, such as detecting nearest collisions and giving warning signals to aware driver. Since VANET has ability to provides a variety of services. These services are provided by VANET often based on association or among vehicles which are furnished with a relatively motion sensors and GPS units. Awareness of the specific location is vibrant to the every vehicle in VANET so it can provide an accurate data to aristocrats.

II. LITERATURE REVIEW

Neng-Chung Wang et al. [11] presented a greedy location-aided routing protocol for mobile ad hoc networks. In this work, GLAR approach is used in order to improve efficiency of LAR in mobile networks. In this protocol, initially baseline is decided. Thus, it can be easy to find better routing path with this GLAR protocol.**Alberto Gordillo Muñoz et al. [4]** proposed Multicast over vehicle adhoc networks. In this work, several approaches are categorized and compared which provides its merits and demerits to give better result for multicast over vehicle adhoc network. Vehicular networks may improve the safety and efficiency of road travel but there are many challenges that still need to be overcome. **Sanjoy Das et al. [12]** a Performance Analysis of LAR Protocol for Vehicular Ad Hoc Networks. In this paper, performance analysis of Location Aided Routing (LAR) protocol in different city scenarios has been done. The objective is to provide a qualitative analysis of the LAR protocol in different city scenarios in Vehicular Ad hoc Networks. **Lochert, Christian,** [13] A routing strategy for vehicular ad hoc networks in city environments has been presented In this paper we proposed 'geographic source routing' (GSR), which combines position-based routing with top logical knowledge, as a promising routing strategy for vehicular ad hoc networks in city environments. **David B. Johnson**[14] proposed modeling mobility for vehicular ad-hoc networks. In this work, realistic model of node motion based on the movement of vehicles on real street maps has been presented. Our model can be used with the ns-2 network simulator. The proposed algorithm is compare with the Random Waypoint mobility model. Results show that the Random Waypoint mobility model is a good approximation for simulating the motion of vehicles on a road, but there are situations in which our new model is better suited.**Malhi, Avleen Kaur** [15]in this paper, a fuzzy-based trust prediction model is proposed to effectively compute the trust of other vehicles for the secure path formation in vehicular ad hoc networks. The results and analysis of the proposed model over the standard protocols are presented using simulations.

III. PROBLEM FORMULATION

The problem of crowd sensing in Vehicular Ad-hoc Network is a most widely researched problem in recent years. Many researchers use various machine learning algorithms to solve the problem of congestion Mobile crowd sensing refers to a broad range of community sensing paradigms. As a special form of crowdsourcing, mobile crowd sensing aims to provide a mechanism to involve participants from the general public to efficiently and effectively contribute and utilize context-related sensing data from their mobile devices in solving specific problems in collaborations. But lack of effective solutions to quantify the relationship among participants in crowd sensing inspires us to form a formidable solution for the same. Thus, it could not effectively allocate the computing tasks and human based tasks of crowd sensing among individuals in VSNs simultaneously. Therefore, one of the problems which have been taken in this paper is about task allocation of crowd sensing in VSNs. The first major step toward achieving 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 utilized by many researchers but there has been very few works in using 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 computed for the possible position of the destination node. It is a circle around the destination that contains the estimated location of the destination node. The Request Zone is a rectangle with source node S in one corner (Xs, Ys), and the Expected Zone containing destination D in the other opposite comer (Xd,Yd).In this protocol, only those neighbours of source node that are present within the request zone forwards the route request packet further. The source node S should know the location of destination node D(Xd,Yd)at time t0 and average speed v with which D is moving. Every time node S initiates a new route discovery process, it the circular expected zone at time t1 with the radius $R = v(t1 - t0)$ and center at location (Xd,Yd). I and J are neighbours of Source node S. But, only node I forwards the packets received from S to its neighbours, since I is within the request zone. The node J discards the message received from S since J is outside the request zone.

IV. 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 commonly accepted urban, suburban, and rural wireless communications environment categories. On one extreme, we must evaluate the large and small scale fading and other effects that are typical in multi-path dominated urban environments and on the other extreme, signal blockage and other issues that are typical in direct path dominated rural environments. Each environment also has unique traffic density features which must be evaluated if we wish to consider using multi-hop network routing. The second major step toward achieving our primary goal will be to determine the effects of packet size on the overall performance of the wireless network. In general, there is a tradeoff between transmitting many small packets with a relatively large overhead vs. fewer large packets with a relatively small overhead. The network's ability to tolerate and correct errors is directly related to the amount of data that is lost and the ease with which it can be retransmitted. If one large packet is lost, the effect is much more detrimental than it would be if one small packet is lost. On the other hand, the size of the packet header is independent of the size of the packet. As the ratio of packet header size to packet payload size increases, the efficiency of each packet transmission decreases. We will determine the point at which the packet is small enough that the system is still able to exceeded minimum performance thresholds given a dropped packet, but large enough that the ratio of packet payload to packet overhead is sufficiently large for adequate data flow. The content centric approach will be developed using various parameters such as location, velocity and direction. An extended Kalman Filter is proposed in this paper for estimating the states for improved crowd sensing.

One of the main assumptions of the Kalman filter is that it is designed to estimate the states of a linear system based on measurements that are a linear function of the states. Unfortunately, in many of the situations where we would like to use a Kalman filter, we have a non-linear system model and/or a non-linear measurement equation. Specifically, the system model is a non-linear function of the states and/or the measurements are non-linear functions of the states. Usually, the non-linearities don't extend to the system disturbances and measurement noise.

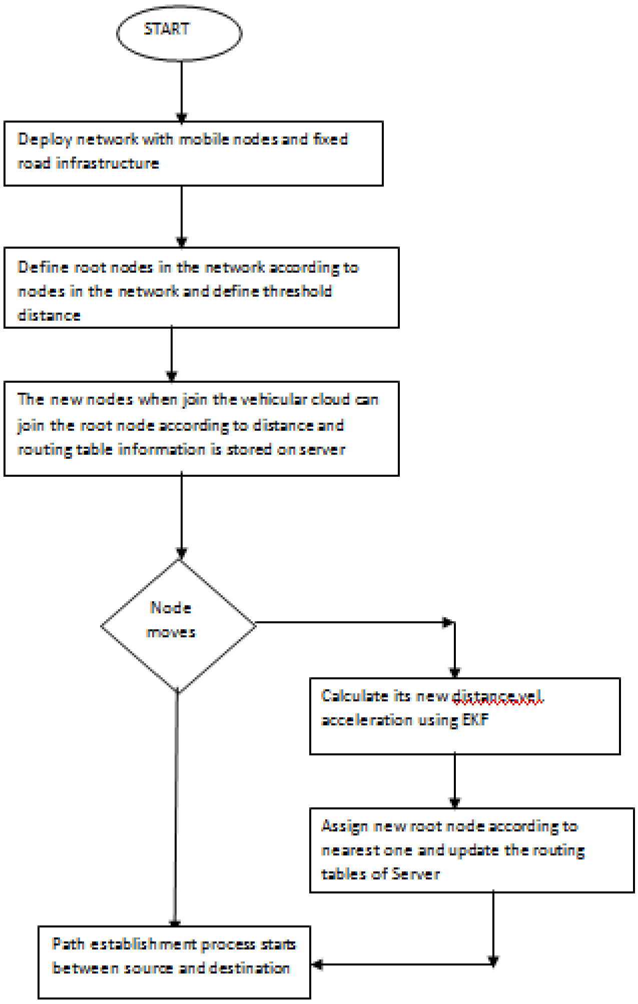


Fig.2: Working of Node assignment

EkF applies to the problem which is non-linear in nature both in terms of process dynamics and measurement dynamics. Hence, ordinary Kalman filtering cannot be applied here. An Extended Kalman Filter needs to be designed based on Taylor series expansion around a nominal value which is taken as the previous 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 vector function f (x~, w~) about state w~ .
Since the process dynamics are continuous while the measurements are usually discrete in nature, a hybrid continuous-discrete EKF model is to developed. The EKF equations of discrete time cannot be used directly and continuous time EKF equations has to be derived. Also, since the measurements are discrete in nature, a hybrid of both is developed and described below.

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

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

where x~ ∈ℜn denotes the n-dimensional state vector of the system, f (.) : Dx→ℜn is a finite non-linear mapping of system states to system inputs, z~k∈Dz⊂ℜp denotes the p-dimensional system measurement, h(.) : Dx⊂ℜn→ℜp is a nonlinear mapping of system states to output, τc∈ℜn x w denotes the continuous process noise scaling matrix, w~ ∈Dw⊂ℜw denotes the w-dimensional random process noise and ~v ∈Dv⊂ℜv denotes the v-dimensional random measurement noise.

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.

Assumptions:

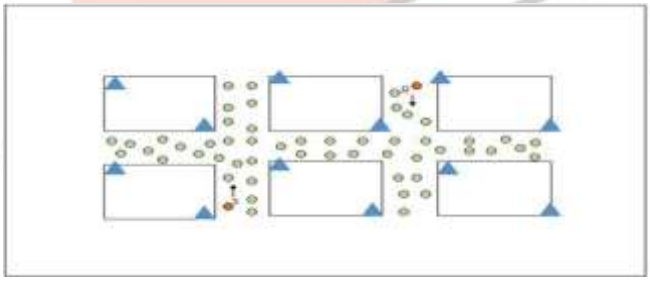
- Fixed no. Of nodes and road structure is already defined.
- Every node is responsible to maintain a multicast tree in the form of ADJACENT NODE TABLE.(For multicasting) .
- Some of the predefined root nodes would be there.

Multicast tree

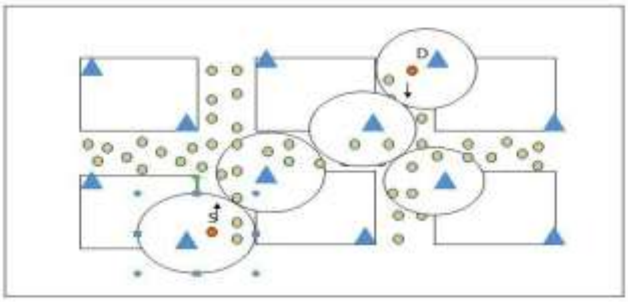
1. Root Nodes: Roadside units for reliable transmission and predefined

2. Leaf Nodes: Adjacent node table maintained as multicast tree.

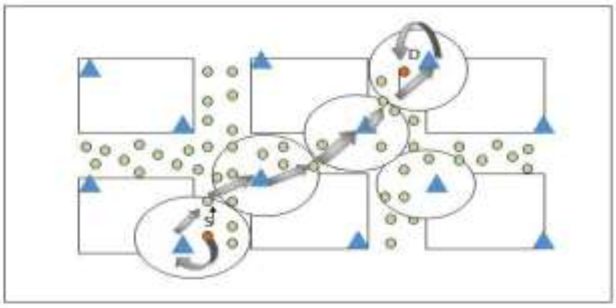
Step 1: root node=infrastructure in diagonal form.



Step 2: Zone formation for multicasting tree.



Step 3 : Gives least delay.



In this step, S sends its message to root node that is Infrastructure and further send it to the farthest vehicle which is moving in the direction of destination and as it over to the new zone and become a part of new tree then it send information to the root node of new tree, Similarly it goes on until it reaches to the Destination and it works on the basis of prediction of the destination with knowledge of direction and position.

MULTICASTING IN VANET

In the vehicular adhoc network, vehicle to vehicle and vehicle to infrastructure communication is available for communication. To vehicle to vehicle communication is available to exchange important information between vehicles. To establish path between various vehicles various routing protocols had been proposed which are of reactive and proactive type . The reactive routing protocols had remarkable performance in VANETS which use the broadcasting technique for path establishment. The broadcasting technique will increase delay in the network and network resource consumption increase at steady rate. To reduce delay in the network, the technique of multicasting had been proposed. The following are various assumptions of the proposed technique

1. The network will be deployed with the fixed number of nodes and roads structure already defined
2. Every node are responsible to maintain the table of its adjacent nodes
3. Some nodes in the network are predefined as root nodes for multicasting nodes

In the proposed technique, in the whole network we define some nodes which are root nodes, under these root nodes we will defines the leaf nodes. The leaf node comes under which root that will be decided by prediction based technique for multicasting

V. 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.

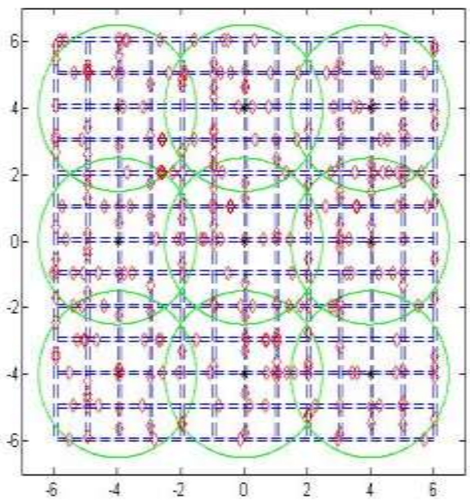


Fig.3 vehicles are placed on roads randomly

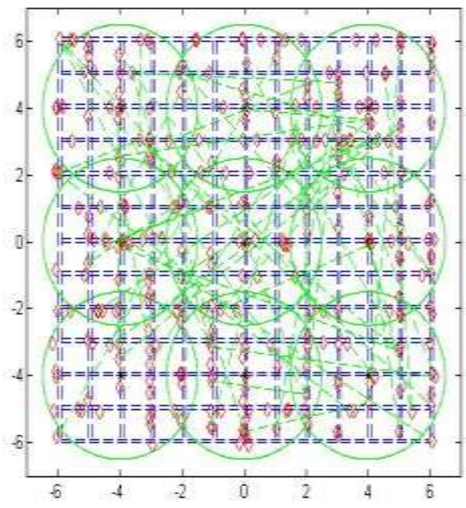


Fig.4: representing the communication

Figure 4` 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.

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 4 show the plot of average packet delivery ratio versus number of nodes.

Fig.5: Plot of Packet Delivery Ratio versus Nodes

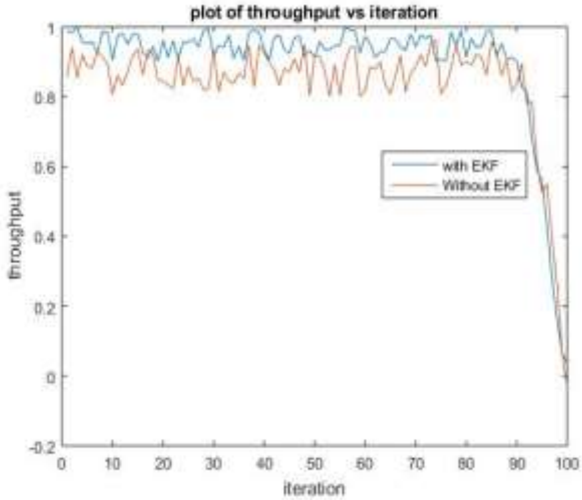


Fig 6: plot of throughput versus iterations

As observed in figure 5 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.

VI. 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 utilized. 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. The discussed protocol seems to work quite well and seems to yield encouraging results. The packet delivery ratio was increased significantly and the average delay was reduced significantly. This shows the efficiency of our algorithm.In future other algorithms can be utilized for the same and our proposed model can be implemented for hybrid networks. Also Meta-heuristic algorithms can be utilized for the same and the performance can be compared with our method.

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