ENHANCEMENT OF EFFICIENT COMMUNICATION IN VEHICULAR AD HOC NETWORK

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ABSTRACT

Communication in wireless mobile ad-hoc networks should be time efficient and resources utilization. We propose an approach to efficient communication which helpful to reduce traffic, accidents, jam, pollution etc. During the routing process it is to divide the vehicular network into clusters. In clustering Cluster Head (CH) & Gateway (GW) node those are responsible for communication with Junction. CH communicates information to GW or another cluster's CH or GW. In this paper we are designed clustering model for efficient communication in VANET.

***Keywords**: Clustering, Junction, City map, Cluster head, Gateway etc.*

1. INTRODUCTION

In wireless network number of vehicles is communicate to other vehicle this special type of wireless networks, known as vehicular ad hoc networks or VANETs [1]. To develop the safety of drivers and provide the comfortable for driving, messages for different reasons require to be sent to vehicles through the inter-vehicle communications and also using fixed infrastructure a new concept junction, those are fixed on road side helpful to maintain the record of traffic and send or forward valuable information to the passing vehicles.

Improvement in wireless technologies [5] has help integrate the capability of wireless networks to vehicles [2] enabling them to communicate without any infrastructure; thus reducing deployment cost. IEEE 802 committee [3] defined standard, IEEE 802.11p [4], for the Wireless Access in Vehicular Environments (WAVE). The Federal Communications Commission (FCC) has allocated 75MHz of bandwidth for short range communications between Vehicle-to-Vehicle communication (V2V) and Vehicle-to-Infrastructure communication (V2I) which operates on 5.9 GHz. Multiple wireless technologies exist such as IEEE 802.11 (Wi-Fi), Bluetooth, WiMax, Satellite Digital Audio Radio Systems (SDARS) and but VANETs use Dedicated Short Range Communication (DSRC) [7] due to its low latency and ability to broadcast messages in multiple directions [5]. The range of DSRC is 1000 meters which is suitable for both V2V and V2I.

DSRC utilizes bandwidth from 5.850 to 5.925 GHz to enhance the productivity and protection of the transportation system [6].

Cluster-based routing technique is a solution to fast & efficient communication. Inside the cluster one node that coordinates the cluster activities is cluster head (CH). Inside the cluster, there are ordinary nodes also that have direct access only to this one cluster head, and cluster head forward information through gateway node. Gateways are nodes that can hear two or more cluster heads those will be different clusters.

Ordinary nodes send the packets to their cluster head that either distributes the packets inside the cluster, or (if the destination is outside the cluster) forwards them to a gateway node to be delivered to the other clusters head. We have made more efficient this concept using junction those are fixed on circle or roadside. Junction gives the exact location of destination node and also provides optimal path for forward the data packet.

2. OVERVIEW OF THE VEHICULAR COMMUNICATION SYSTEM:

2.1 Different type of data communication

Vehicular communication is a process of spreading data or information over distributed wireless networks. Vehicular communication is used to reduce the number of data transmission in communication medium. Basically it is used to reduce the redundant data transmission. But data aggregation approach is unsuitable for the dissemination of safety related data in VANETs. The data communication approaches in VANET network may be classified on the basis of following category:

i) Vehicle to Vehicle Communication

It is challenging task because vehicle always move from one to another location. In vehicle to vehicle data dissemination flooding and relaying approaches are used. In flooding the data is created and received in surrounding area, every node participates in the data dissemination .It goes for delay sensitive application and also very suitable for the sparse network during the low traffic condition. The relay type of data communication in the network, the relay node (vehicle) is selected where relay node (vehicle) forward the data to the next hop and so on. It reduces the congestion and scalable to thick networks, usually preferred for the overcrowded networks.

ii) V2I/I2V communication

It consists of two type's data dissemination- push based and pull based. In push based data dissemination, the data can be efficiently delivered from the moving vehicles or fixed base station (junction) to another vehicle, it is typically used in the traffic situation, e-advertisement. While in pull based data dissemination any vehicle is enabled to query information about specific location or target it is form of request and respond type model. Mainly used in enquiry about the petrol pup, malls and parking non-popular data which user specific.

iii) Cluster based communication

For a better packet delivery ratio(PDR) and to decrease broadcast storms, an information has to be relayed by a least amount of intermediary nodes to the destination .To do so, nodes are organized on a set of cluster in which one node or more gathers data in his cluster and send them after next clusters. This type based solution give less propagation delay and high delivery ratio with bandwidth fairness [8].

iv) Opportunistic communication

Due to clustering in VANET, some work for example, suggest the use of opportunistic diffusion of data in which message are stored in each intermediate node and forwarded to every encountered node till the destination is reached.

v) Geographical communication

When continuously topology change the end to end paths are not constantly present in VANET a geographic dissemination is used in by sending the message to the closest node toward the destination till it reaches. Sometimes geo-casting is also used to deliver message to several nodes in geographical area.

vi) Peer-to peer communication

In P2P solution, the source node stores the data in its storage device and do not send them in the network till another node asks for them. This concept proposed for delay forbearing application.

3. PROPOSED DESIGN

3.1 Basic idea

To illustrate the basic idea of this proposed technique, consider a multilane two way city scenario depicted in figure 1. In this proposed idea, we divide the city into clusters and these clusters are

made according to the number of links with each other & their mobility. The particular area, to which any junction unit can broadcast or forward the information (for that geographical area) or the particular path in the city , forms a cluster, which will cover in next section Cluster Formation and Maintenance. Safety message can be broadcasted within different clusters from junction.

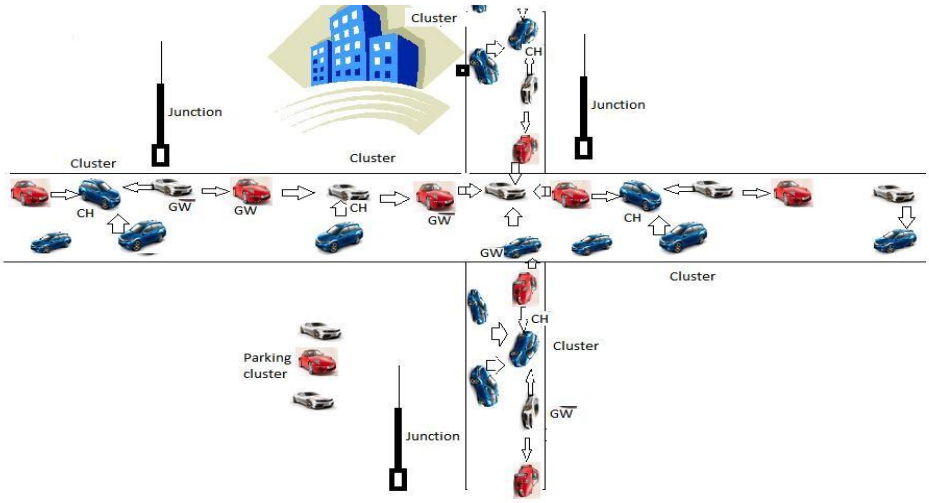

Fig. 1. The proposed architecture

We are considering a scenario where using the junction transmit specific information about traffic. If there is no vehicle in other lane within the same cluster junction forward to long distance vehicles, so we use junction for transmit information timely & accurately. This architecture is for both scenarios, Vehicle to Vehicle (V2V) as well as Vehicle to Infrastructure (V2I).

The basic working of this proposed technique is, assume that vehicle wants to communicate to vehicle as shown in figure 1.

In VANET, basically two nodes are required for the V2V and V2I communication, called as VANET nodes.

Following concept are using for efficient communication:

i) Clustering: The dynamic and dense VANET topology and the harsh VANET environment, produce many challenges for communication and networking. In MANET research these difficulties were overcome by cluster topology. Clustering in VANET reduce the messages

exchanged between individual network nodes and the overhead of information stored within those nodes.

VANET is the dynamic and dense network topology, resulting from the high mobility and high node-density of vehicles [10]. This dynamic topology causes routing difficulties as well as congestion from flooding, and the dense network leads to the hidden terminal problem. A clustered structure can make the network appear smaller and more stable in the view of each node [11], [12]. By clustering the vehicles relative mobility between communicating neighbor nodes will be reduced, similar mobility, the leading to between cluster stability. In addition, the hidden terminal problem can be diminished by clustering

This research does not consider network broadcasts requiring more than one hop in communication. This simplifies the on the whole communication and clustering approach and reduces the overall bookkeeping necessary to maintain the clusters. This approach seeks to obtain optimal results by adding traffic-specific information to the clustering logic.

ii) Vehicle Node: In the VANET V2V communication is the challenging due to their continue movement in the network. We proposed a strategy for how vehicle communicate information through other vehicles & proposed junction which make efficient communication among them. Vehicles communicate through accurate path with the help of junction, clustering, city graph, & cooperation among the vehicles etc.

iii) Junction: Junction fixed on the road side and on circles. Each time when a vehicle passing into the range of junction, cooperate to them and provide location services , shortest path selection, prediction service etc. junction collect the vehicle information like vehicle speed, vehicle position, moving direction etc.

Junction provide the shortest path for vehicles with the help of City map database

In this paper we provide an efficient & safe environment for drivers. We focus in our research, information should be timely reached to destination , Safety applications will monitor the surface of the road , approaching vehicles and feed information that could put the vehicle at risk back to the driver.

4. PROPOSED STRATEGY

4.1 Cluster Establishment

Mobility is the biggest challenge in VANET where Vehicle move or change their position so its big challenge during transmission destination node may be change their location , we can find the solution using proposed strategy:

4.2 Cluster Head (CH) selection

CH selection is the beginning & important task of cluster formation. The node which will have the highest value of weight will be CH.

- **Node weight:** Each node maintains the node mobility with comparison to all neighbor nodes and also finds the number of nodes those are in coverage area.
  Both values find with call function mob() & Reqnode(), X & Y respectively.

  X = Call node mob() Y = Call reqnode()
  Weight = $\alpha.X+\beta.Y$ …… (i)

  Where node mobility X depends on the value of $-1>\alpha<0$.
  Number of requesting node depends on the value of $0>\beta<1$.

4.3 Gateway selection

It is a forwarding node which collect information from CH or Junction & forward to next CH, GW or junction, more than one GW node may be in a cluster , its work as router. Node should lesser mobility than other node can select as GW for that cluster.

4.4 Cluster formation

A lot of vehicles are on the way in city scenario, we make a plan for communicate proper information from source to destination which is helpful for comfort transportation.

4.4.1 Cluster formation algorithm

1. Vehicle node send hello packet to each neighbor node for their availability.
2. Recd ack from different neighbor node.
3. All neighbor nodes maintain information of their neighbors.
4. Call Cluster head selection()
5. Call cluster gateway selection() by CH
6. Periodically repeat step 4 & 5
7. If (CH/GW in the range of junction) then
   [Perform following function on junction]
   {
   Call Location service ()

Call shortest path ()

Call Prediction service ()

}

else Forward to next CH/GW node

4.4.2 Flow chart:

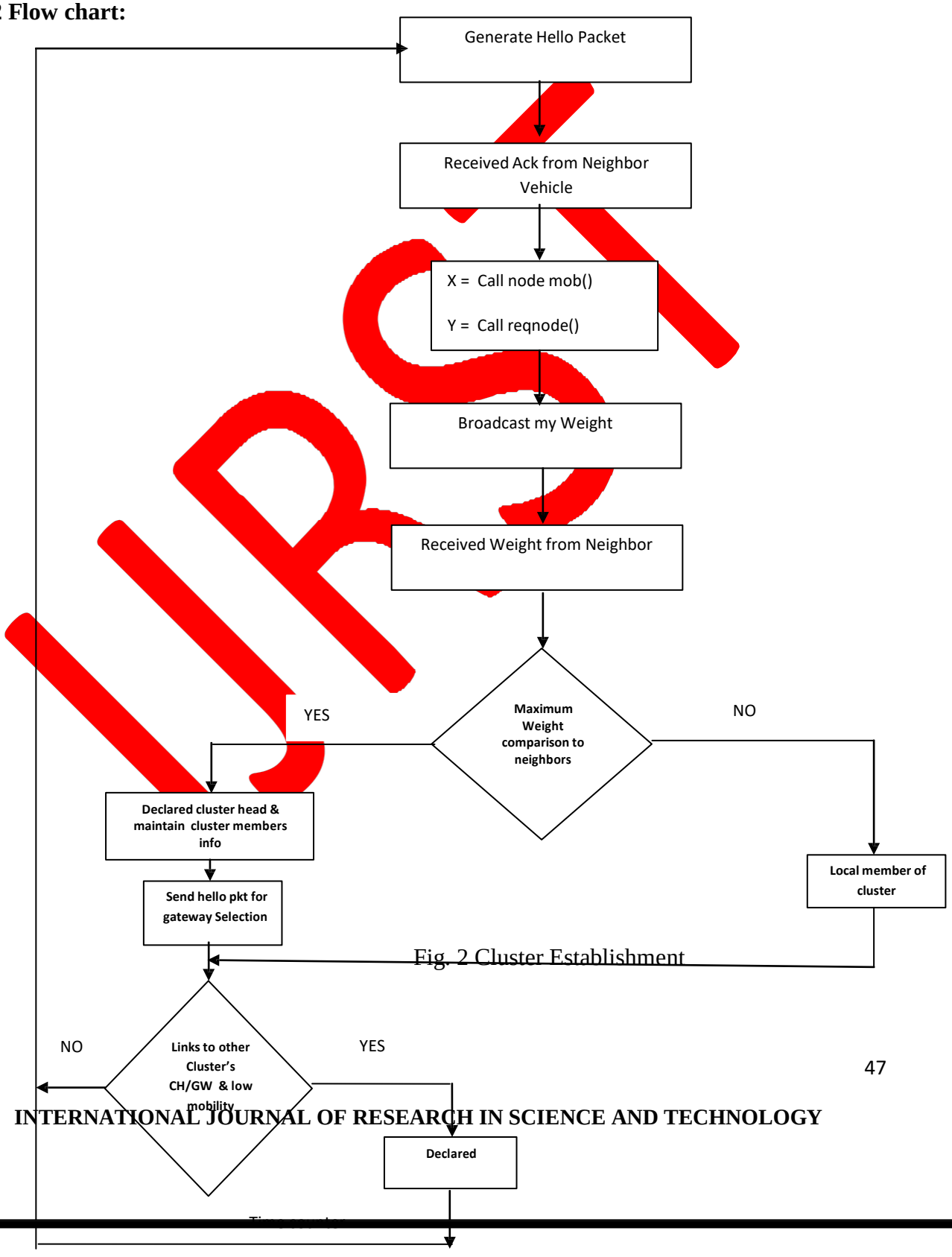

Fig. 2 Cluster Establishment

4.5 Role of junction

It is fixed on the road with a distance. Its role is very important because it finds the position of destination node, prediction service, and shortest path & stores all traffic information.

5. CONCLUSION

In this paper we presented a strategy for V2V & V2J through cluster formation, CH selection, GW selection, we designed a node weight formula for selection of CH. CH select GW node which is forwarding node, junction give response to CH & GW for different services. These services help to efficient communication between the source vehicles to destination vehicle.

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