Implementation of Beaconless Geographic Forwarding Scheme for V2V Communication and Analysis of Opportunistic Routing Schemes and it's Suitability in VANETs

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Abstract:- Among the many routing mechanisms for Vehicular Ad-hoc Networks (VANETs), the recent and the emerging one is Opportunistic Routing (OR) mechanism. It uses the broadcast nature of wireless medium while the traditional routing mechanism does not. The most specific feature in Opportunistic routing are 1) Forwarding nodes will be selected 2) A coordination mechanism will be carried out between the forwarding nodes to deliver the packet to the destination. For wireless high mobility networks like VANETs it is difficult to have a predefined path. So broadcasting the data packet till it reaches the destination would be the solution for it. But in denser areas, due to the broadcast storm the control overhead will be very high which leads to the high energy consumption by the nodes. The intention of this research works is to avoid the energy consumption by the forwarding nodes by implementing a beaconless geographic forwarding scheme. The forwarding nodes are selected based on the distance of it from the destination. In this paper survey of various Opportunistic Routing mechanisms is carried out. NS 2.35 and SUMO is used for simulation.

Keywords: Opportunistic Routing (OR), Vehicular Ad-hoc Networks (VANETS), Broadcast nature.

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I. INTRODUCTION

In wireless, VANET became a main platform of research. Vehicular Ad-hoc Network comprises of denser networks, less denser networks. In these case routing place a major problem, because the information has to route through the high mobility multiple hops. The special feature of wireless medium is the broadcast nature of it which does not used in traditional routing mechanisms. Opportunistic Routing uses the broadcast nature of wireless medium. At each transmission rather than choosing an identified convey candidates, it broadcast to a group of relay nodes. It means, there are 3 steps in Opportunistic Routing

(1) Broadcast data packets to a group of relay nodes
(2) By using Coordination protocol, choose the best relay candidate
(3) Then forward the packet to that selected candidate.

Through any possible link OR can transmit a packet rather than one particular link. It means that OR will have a backup link during transmission and so the transmission failure is reduced. In many research OR shown that it performs traditional routing mechanisms.

II. BACKROUND STUDY

Opportunistic Routing is clearly explained through three major types:

A. *Geographic Opportunistic Routing:*

Geographic OR provides location aware routing. Forwarding nodes are selected based on the position of the nodes and then follows a contention based coordination scheme to select the forwarder. Additional delay is induced in this method because of the Request to send and clear to send packets. The most important achievement by this method is that, it boosted the packet delivery ratio (PDR).

B. *Probabilistic Opportunistic Routing:*

It supports wireless node mobility. In this Opportunistic Routing source will transmit several copies of the packets to any confront nodes, thereby the network will be flooded by redundant several packets. This probabilistic opportunistic routing is emerged mainly for the mobility network like inter-vehicle communication. This protocol states the contests associated with reducing the delay in communication and assure better delivery of traffic.

C. *Cross Layer Opportunistic Routing:*

Cross layer opportunistic routing has two sub-categories. PHY-aware opportunistic routing which make use of signal strength indicator based selection of opportunistic node in noise and limited interference slow fading surrounding. The second one Mac aware Opportunistic Routing. It two fold the efficiency of energy.

III. LITERATURE SURVEY

Sanit Biswas and Robert Mooris proposed Extremely Opportunistic routing (Ex-OR) [1], varies from outdated routing in a way that, using of predetermined paths for transmitting packets is not followed here. To all the nodes in the network, it just broadcast the packet. To reach the destination, a forwarder list is used. Every node checks the available list in the header and forwards after the packet reception. Experimental outputs show that Ex-OR give 2x times the better performance than the traditional routing schemes.

Eric Rozner et al projected Simple Opportunistic Adaptive Routing Protocol [4] SOAR. It is one of the table driven link state routing protocol which gives good outcomes than Ex-OR by effectually exploiting the adaptive forwarding path to avoid facsimile transmissions, timers which is priority based and adaptive rate control. It also increases throughput and fairness with multiple simultaneous flows.

Szymon Jakubczak et al put forward MAC Independent Opportunistic and Encoding protocol (MORE) [5]. It is also one of the mechanism which uses network coding. It cannot create spurious transmission by hearing through in between nodes without checking with each other. That is to the destination, intermediate nodes will forward random linear combination of packets. MORE protocol raises the throughput and co-ordination between the nodes is not necessary in this case.

Z. Zhong, J,Wang et al proposed Opportunistic any-path forwarding (OAPF) scheme [2]. The disadvantage with Ex-OR is that the forwarding nodes may deliver the packets to the low-quality routers for propagation. This protocol makes use of EAX (Expected Any Path) measuring count. In the occurrence of computation of forwarder set, the node assumes that the opportunistic routing is performed by the forwarder also. So this method is recursively perform forwarding packets opportunistically.

Chen-Jung et al proposed ECONOMY [3] which avoids transmission of duplicate packets by passing a token along the path so that relays can able to hear each other. Unacknowledged packet is transmitted when a token arrives with the information of acknowledgement inside the received token.

Yunfeg Lin et al proposed Code OR [6]: It also a coding based OR. Because of the use of small segment sizing to drop-off delay, it is used for real time multimedia applications. The utilization of wireless broadcast medium in this is effective which improves unicast throughput in opportunistic routing. It performs segmented network coding, here the data is partitioned into multiple segments and same segment packets will only be encoded.

Zhong Liang Zhao et al proposed Context Aware OR [7] (CAOR), drop the idea of list of candidates. All the eligible nodes will be take part in the transmission of packets and the node is considered eligible will be based on some metrics such as quality of the link, residual energy and mobility.

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Slide-OR [8] is proposed by Y. Lin, B. Liang et al. In thius the decoding of a packet in one segment is cannot be done by the coded packet from another segment. In slide-OR different overlapping coded packets can be combined for decoding a packet, which in turn raises the throughput.

Dimitrios Koutsonikloas et al proposed Cumulative Coded Acknowledgement scheme (CCACK) [9]. One of the network coding based OR protocol. Less coordination overhead make this networking coding based approach attracted but is shows a degradation in performance in dynamic wireless environments with channel gain levels changing, background traffic to their upstream nodes which gives loss rates with zero overhead.

Xinyu zhang and Bochum Li proposed Optimized Multipath Network coding (OMNC) [10]. Multiple paths were used here to transmit coded packet to destination and between the neighbor nodes the delivery of packets is done using broadcast MAC. Using distributed optimization algorithm, the coding and rate of the broadcast is allocated to transmitters that avoids congestion and increases the advantage of network coding.

Xi Fang, Dejun Yang et al proposed Constrained Opportunistic Routing (CONSORT) [11] makes the choices in selecting an OR for each and every user to improve the total efficient and in a wireless mesh network, no of simultaneous users dependent on load requirements of the node as constraints and it allocates resources to improve the total efficiency.

Kurth et al proposed Transmit diversity cooperative OR (TDICOR) [13] which increases the throughput in wireless multi-hop networks by effectively utilizing the transmit diversity and multiuser. The robustness of data transmission and acknowledgement is increases by sing distributed transmit diversity. Only less bandwidth consumption is a major advantage here.

Z. Wang, Y. Chen et al proposed A novel Co-operative Opportunistic Routing scheme in Mobile Ad-hoc Networks (COREMAN) [14] used proactive source routing protocol. It enables each node to have information in the network at any time about the path to all the other nodes. If the data is transmitted to the destination, the route information carried through the network with the data can be collected by the intermediate routers.

Chansu Yu and Tianning Shen proposed Multi-hop transmission Opportunity (MTOP) [16]. It is a Multi-hop transmission opportunity protocol which permits the frame to get forwarded consequently over a number of hops. It decreases overhead at MAC-layer. It transmit data at a fixed suitable high rate.

M. Zorzi and R. R. Rao proposed Geographic Random Forwarding (GeRaF) [18] transmission scheme based on geographical routing, here relay nodes are active nodes within the exposure area and packet will be received and asses their own priority. Evaluation of the performance is based on simulation and analytical.

IV. Proposed Work

This research work is based on Opportunistic Routing which uses the broadcast nature of wireless medium. At each transmission rather than choosing an identified convey candidates, it broadcast to a group of relay nodes. It means, there are 3 steps in Opportunistic Routing which are Broadcast data packets to a group of relay nodes, by using Coordination protocol, choose the best relay candidate, then forward the packet to that selected candidate. A detailed survey of various Opportunistic routing protocols and its suitability in VANETs is carried out. Also in this paper implementation of beaconless geographic forwarding scheme is done. For wireless networks like V2V communication, it is difficult to have a predefined

ISSN: 2321-8169
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path. Broadcasting of data packets till it reaches the destination will be the solution for is. But control overhead will be very high in denser area due to the broadcast storm. Due to this control overhead, energy consumption by all nodes will be very high. This research uses beaconless geographic approaches which in turn will drop-off the consumption of energy by the nodes in the network. The idea behind that is, source broadcast the data packet and neighbouring nodes which receives them will calculate the distance between it and destination and then the distance between the source and destination. If the distance from the neighbour to destination node is greater than the source to destination distance, it will drop the packet. If it is lesser, it will set the timer based on the distance. The neighbour node or forwarding node will wait till time runs out and then broadcast the data packet along with its location and destination location. This process is carried out till it reaches the destination.

V. ALGORITHM

Source broadcast the data packet
{
If (Dmd>Dsd)
{

node drops the packet received from source
}
else
{
node set a timer based on the distance and forward after timer runs out
}
}
(the above algorithm will be repeated till the packet reaches the destination)

Dmd: Distance between my node (node which receives the packet from the source) & destination.

Dsd: Distance between source & destination.

VI. WORK DONE

Fig. 1 Real Time Road Map

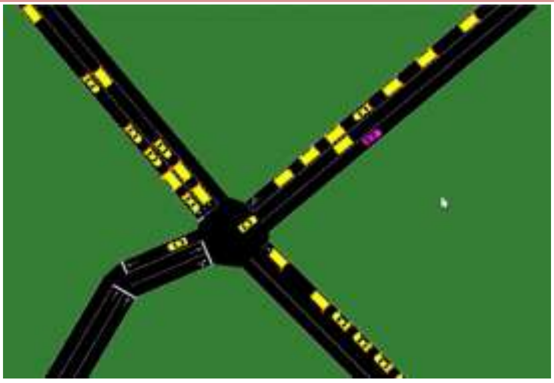

Fig.2 Visualization in SUMO

For VANETs there are many number of simulators. Any wired or wireless communication network can be simulated with the help of network simulators if some outlines of vehicular environment is present. NS 2.29 is used here and a traffic simulator called SUMO – simulation of urban mobility, is used to create real time traffic network.

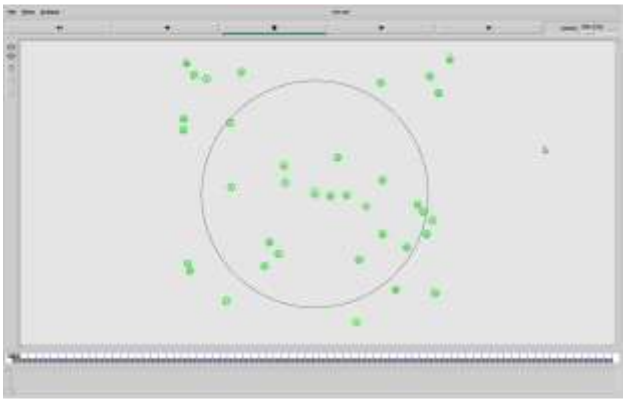

Fig.3 Flooding based Routing

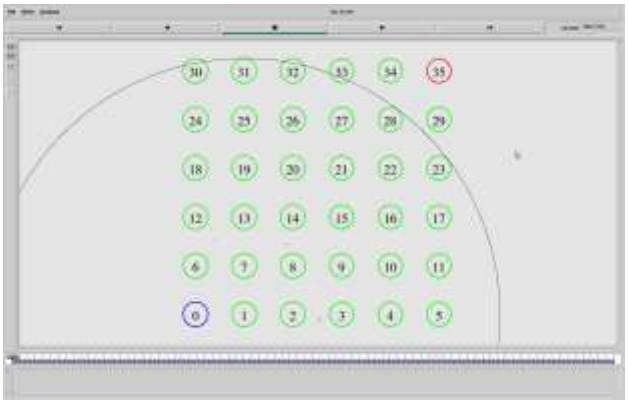

Fig.4 Receiver Based Directional Forwarding

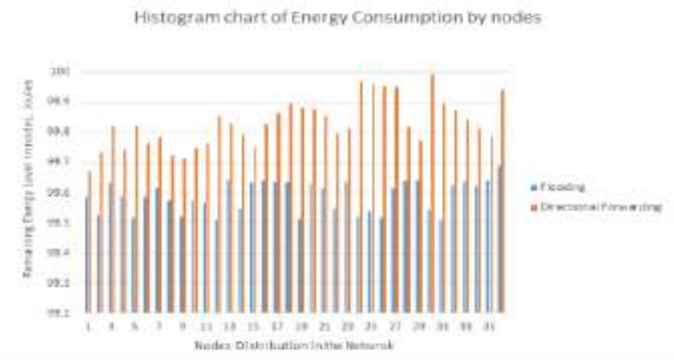

Fig.5 Remaining Energy Level in all nodes

Fig.3 shows the flooding of packets from source to destination, whereas fig.4 shows the directional forwarding (restricted forwarding) from source to the destination. As compared between this, the energy consumption is less in directional forwarding than flooding of packets. Fig. 5 shows the remaining energy in all the nodes.

VII. CONCLISION AND FUTURE SCOPE

In wireless multi-hop networks, Opportunistic Routing is an engaging technique which as some important feature such as overhearing and coordination among the relay nodes in the network. OR works remarkably good in VANETs with higher node density, but broadcast nature will create more control overhead for which Beaconless Geographical forwarding scheme will be a solution to it. In future, we can implement a beaconless geographical Opportunistic Routing scheme for V2V communication which can give better performance

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