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# An Improved Performance of Greedy Perimeter Stateless Routing protocol of Vehicular Adhoc Network in Urban Realistic Scenarios

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## ABSTRACT

Vehicular Ad Hoc Networks (VANETs) or Inter-Vehicle Communication (IVC) is an extension to a popular Mobile Ad Hoc Networks (MANETs) technology. VANET is developed to provide comfort communication between the vehicle while driving. In VANET there is a continuous wireless data transmission occurs either between Road Side Units (RSUs) or On Board Units (OBUs) in the vehicles. To keep the transmission smooth it required a good routing protocol. Right from the inception of VANET technology in 2000s the work done only on basic routing protocol. Mobility model is one of the key parameter while designing the vehicular network. In this paper the Simulation of Urban Mobility (SUMO) and Mobility Model Generator for VANET (MOVE) are used for creating scenarios and traffic. The real time maps are edited in JAVA open street map editor (JOSM) and the simulation is done in NS-2. The performance is evaluated by using the two routing protocol on the basic of packet delivery ratio and end to end delay for Urban scenarios.

**Keywords :** VANET (Vehicular Adhoc Network.) SUMO (Simulation of Urban Mobility), MOVE

## I. INTRODUCTION

Vehicular Ad Hoc Network (VANET) is a fast growing technology in today's world. The fundamental idea behind implementing VANET is to offer information sharing, supportive driving, providing navigation and safety to human life in fast moving vehicles. The communication takes place either between vehicle-to-vehicle (V2V) or between vehicles-to infrastructure (V2I). On Board Unit (OBU) that is fixed on vehicle is responsible for collecting data from various sensors, which gives condition of that vehicle. OBU send this data either to other vehicle or to Road Side Unit (RSU). On the other hand, RSU is a fixed infrastructure situated along the sides of road whose work is to broadcast the information to other vehicles. However, due to high mobility and dynamic topology of VANET discovering and maintaining routes is very challenging task in VANET. To achieve an effective vehicular communication, vehicular network must be available all time in real time. A small delay in sending or receiving of message may lead to devastating results. Due to rapid changing topology, there are numerous technical hitches in designing a Routing Protocol of VANET.[1] Routing is the process of moving packets from a source to a destination and Routing Protocols are the one who decide how those packets are going to move. Routing occurs at Layer3 (network layer) of the OSI reference model via some logical addressing. Routing protocols plays a key role in path discovery so; it becomes important for routing protocol to give effective result in real time.

In this paper, as shown in figure 1 of process flow, we have taken the urban realistic scenario for simulation .The real maps are taken from the open street map for urban realistic scenario. The maps are edited in Java Open Street Map editor (JOSM) to remove the unwanted areas like buildings, rivers etc. after the editing of real maps the output file is given to the SUMO (Simulation of Urban Mobility) for simulating the real traffic scenario of vehicular network. The output of this SUMO is used in network Simulator (NS-2) for the analysis of various QoS parameters.

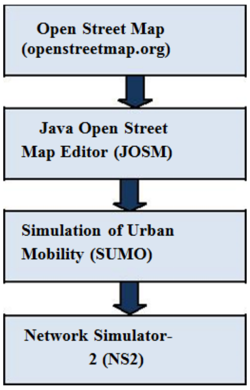


**Figure 1**: Process flow for capturing real time mobility model

## II. METHODS AND MATERIAL

### Introduction to Routing Protocols

VANET Routing protocol has significant role in performance because of sending &receiving packets between sources to destinations. There are number of routing protocols has developed for wireless Adhoc network. VANET routing protocol [1][2]basically classified into two types: Proactive and reactive routing protocols.

In proactive routing protocol, it maintains the route information at all nodes and update the table accordingly. In reactive routing protocol, it maintaining the route information for nodes on demand.

In this paper, the simulation and comparison is performed on the basis of two different routing protocols. [13] GPSR (Greedy Perimeter Stateless Routing) & MGPSR (Modified Greedy Perimeter Stateless Routing) protocols.

### a) GPSR:

Greedy perimeter stateless routing (GPSR) is the best known position based routing protocol for VANETs. GPSR makes greedy forwarding decisions using only information about a router's immediate neighbors in the network topology.

- GPSR consists of two methods for forwarding packets:
  1. Greedy Forwarding
  2. Perimeter Forwarding
- Greedy Forwarding is used to send data to the closest nodes to destination. Perimeter Forwarding is used where Greedy Forwarding fails

1. Greedy Forwarding

- Find neighbors who are the closer to the destination
- Forward the packet to the neighbor closest to the destination

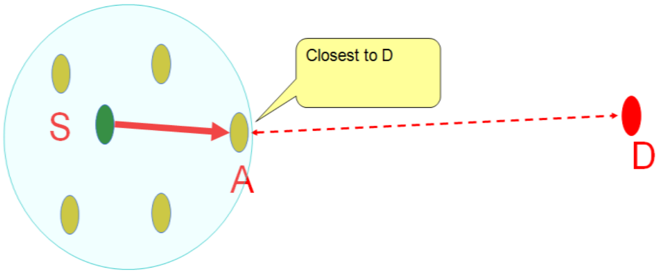


**Figure 2** : Greedy Forwarding Method

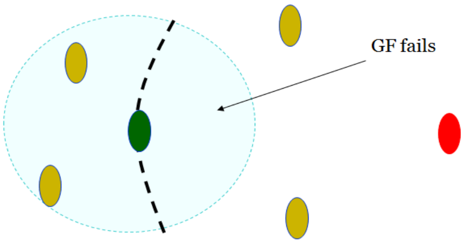


**Figure 3**: Greedy Forwarding does not always work

2. Perimeter Forwarding

- Apply the right-hand rule to traverse the edges of a void
- Pick the next anticlockwise edge

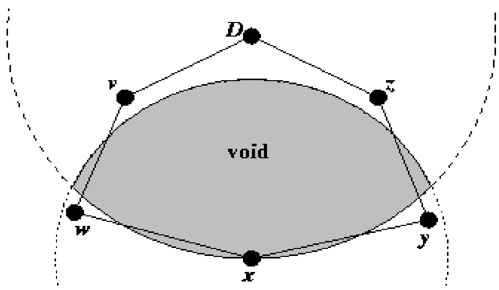


**Figure 3** : Perimeter Forwarding with Void: Right-Hand Rule

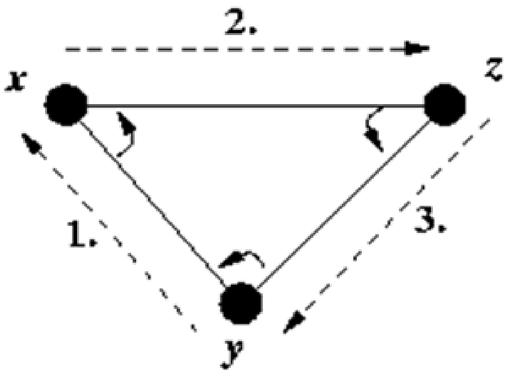


**Figure 4** : Perimeter Forwarding Pick the next anticlockwise edge

**b) MGPSR:**

MGPSR is the extension to the GPSR protocol for computing effective communication among the nodes which substantially increases network lifetime of nodes.

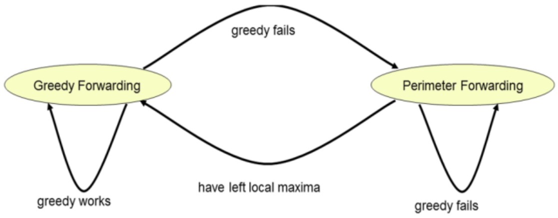


**Figure 5 :** Modified Greedy Perimeter Stateless Routing (MGPSR)

## III. RESULTS AND DISCUSSION

**Simulation In Josm (Java Open Street Map Editor)**

[17] JOSM is a desktop editing application, written in java. It supports loading standalone GPX tracks and GPX track from OSM database as well as loading and editing existing nodes, ways, metadata tags and relations from the OSM.

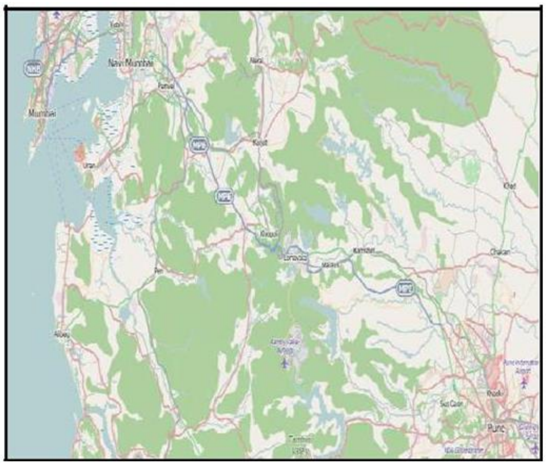

**Figure 6** : Road Map for Vehicles of Urban Based Scenario

The map in Figure 6 is taken from http://openstreetmap.org, which is available free for downloading via their export map feature.

**Figure 7:** Map of Urban Area – City Based Scenario Figure 8: Map of Urban Area – City Based Scenario for road in JOSM

As shown in figure 7 & 8, the downloaded maps are saved in “.osm” file format that can be edited in JOSM and from “map.osm”. In figure 5 the urban area of city based scenario contains buildings, Trees, traffic and other unwanted streets are removed. In Figure 8 all these unwanted parts are edited in JOSM, and only the roads are remain for the traffic simulation. So, that the file size become small and to lessen the unnecessary computation. We can import that file in [16] SUMO and create traffic environment.

## Simulation in Sumo (Simulation of Urban Mobility)

To generate vehicle traffic in [16] SUMO the tools like "net convert”, “poly converts" and "randomTrips.py" are used.

- **Net convert** can imports road networks from different sources (openstretmap.org) and generates road networks that can be used in SUMO. It will identify the Nodes, Junctions, and Signals etc and build the network file that is compatible with SUMO.
- **Poly convert** imports geometrical shapes (polygons - buildings) from different sources & converts them to a representation that visualized in SUMO-GUI.
- **RandomTrips.Py** is used to generate random routes.

From the above steps, we get the SUMO configuration (**medical.sumo.cfg**) file in which we have to give path of both the network file and route file. The configuration file is used to like merge the network file and route file

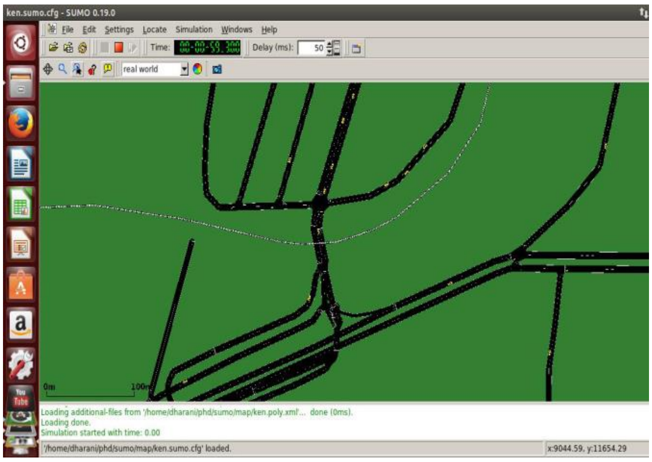

**Figure 9 :** Road network of urban area showing the simulation of vehicles in Sumo (Traffic Simulator for 50ms delay)

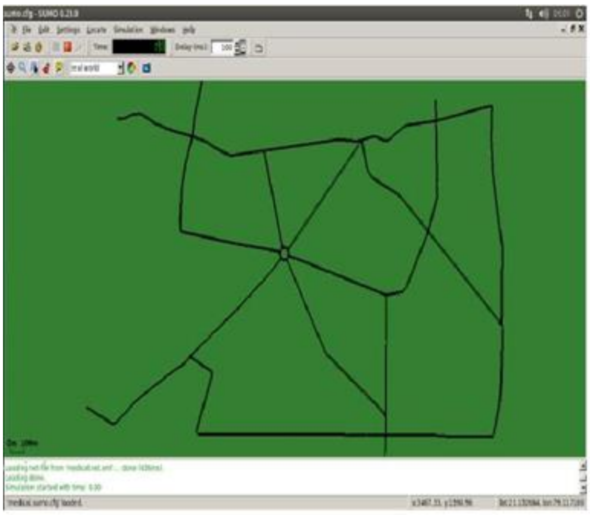

**Figure 10 :** Imported map from JOSM in SUMO

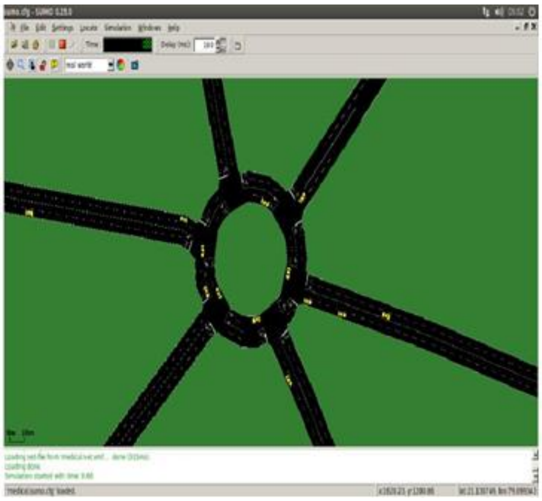

**Figure 11 :** simulation of view of Traffic in SUMO (Traffic Simulator for 100ms delay)

### Simulation & Results

The mobility model of SUMO is given to the network simulator 2 (NS-2) for simulation. We have done the simulation using two different routing protocols for urban realistic scenario. The simulation is done using different number of nodes.

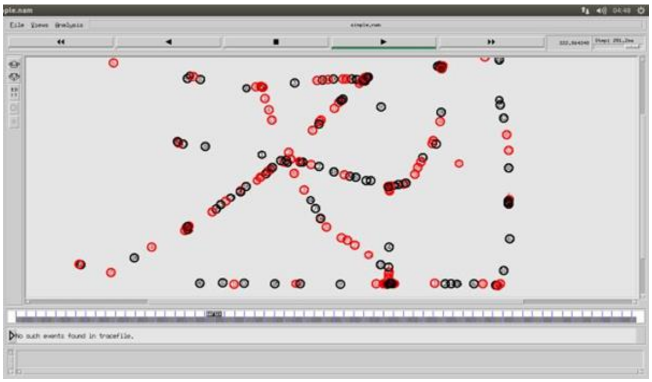

**Figure 12 (a):** Simulation in NS2 for urban realistic scenario for 100 nodes

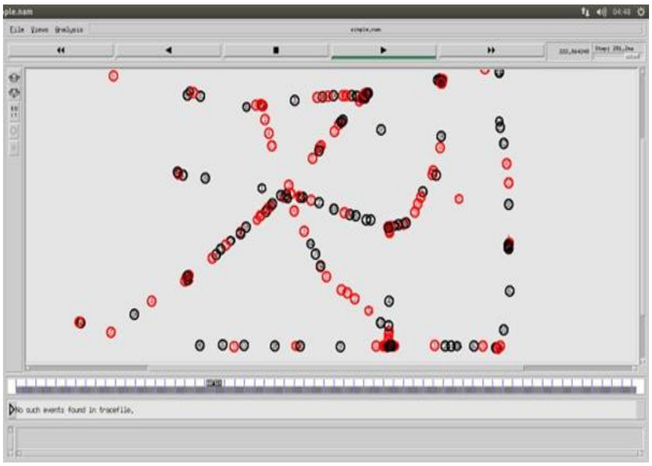

**Figure 12 (b) :** Simulation in NS2 for urban realistic scenario for 120 nodes

In Figure 13, The Packet Delivery Ratio increases with different number of nodes

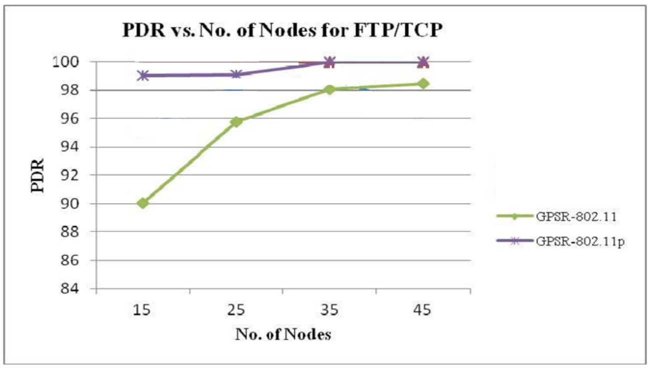


**Figure 13** : Comparison graph of PDR vs Number of Nodes

In Figure 14, The Packet Delivery Ratio increases with different node speed

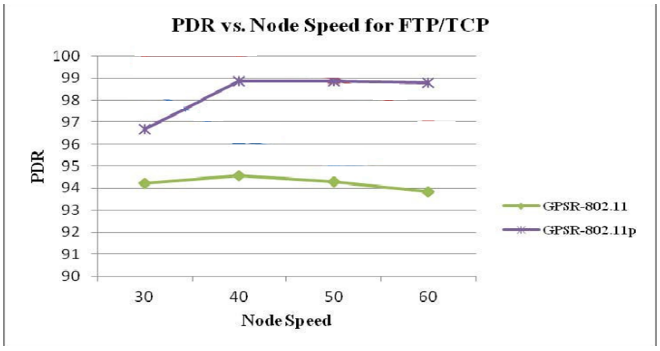


**Figure 14** : Comparison graph of PDR vs Node speed

In Figure 15, the average end to end delay decreases with different number of nodes

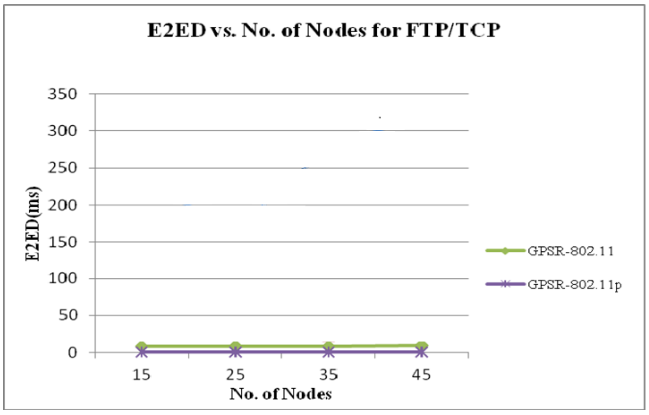


**Figure 15** : Comparison graph of E2ED vs Number of Nodes

In Figure 16, the average end to end delay decreases with different node speed

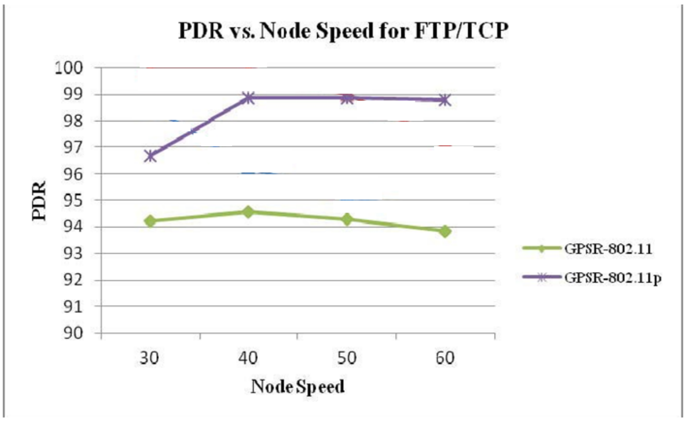


**Figure 16** : Comparison graph of E2ED vs Node speed

## IV.CONCLUSION

The simulation of urban mobility (SUMO) gives the better mobility model after compiling in java Open Street Map editor (JOSM) for urban realistic scenarios. In this paper we simulate the GPSR & MGPSR routing protocol for analyzing the packet delivery ration and end to end delay parameters. As a result Performance of Modified MGPSR gives better results than GPSR for urban realistic scenario. Modified GPSR proposed to get better performance in all conditions and achieve better performance in high packet delivery ratio and less end to end delay which substantially increases network lifetime of vehicular nodes and also increases effective communication among the vehicles.For the future work, the performance can be evaluated on the basis of different Qos parameters like routing overhead throughput, efficiency etc.

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