

Simulation of Urban Mobility (Sumo) For Evaluating QoS Parameters For Vehicular Adhoc Network

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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 throughput for both rural & Urban scenarios.

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

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 rural-highway and urban-city based scenario for simulation .The real maps are taken from the open street map of mumbai-pune express highway for rural scenario and medical square Nagpur for urban city based 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.

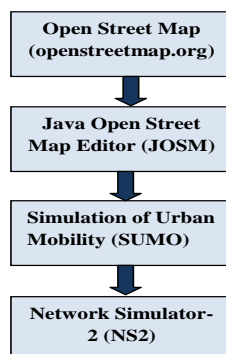


Figure 1: Process flow for capturing real time mobility model

II. Introduction To Routing Protocols

VANET Routing protocol has significant role in performance because of sending & receiving packets between source 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 maintain 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 protocol. [2]AODV(Adhoc on demand distance vector Routing) & AMODV (Adhoc on demand multipath distance vector routing) protocols.

a) AODV:

Adhoc on demand distance vector routing is the reactive routing protocol that uses Adhoc on demand routing to establish a path between source to destination. When Source node S wants to send information to destination node D, the route discovery process based on flooding of RREQ packet .As a node forward route request packet ,it set a reverse path from itself to node S from the neighboring nodes from which it receive the first copy of RREQ. At the end the route discovery process, source node send the information along the path.

b) AMODV:

AMODV is the extension to the AODV protocol for computing multipath paths. The routing entries for each destinations contains hop-to-hop count .All the next hop have same sequence number .for each destinations, a node maintains the advertised hop count. AMODV can be used to find node disjoint or link disjoint routes.

III. Simulation In Josm (Java Open Street Map Editor)

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

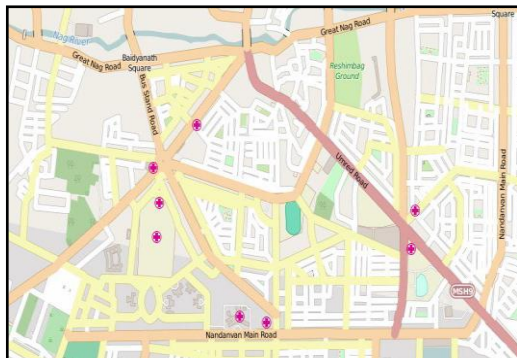


Figure2: Map of Urban Area – City Based Scenario
Expressway

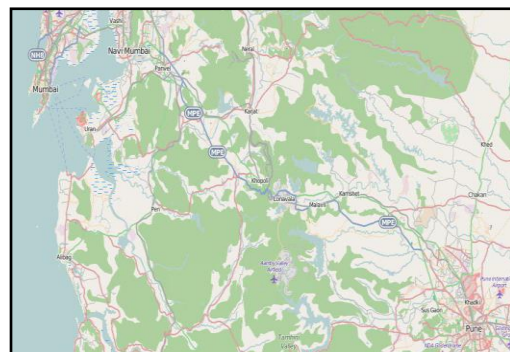


Figure 3: Map of Rural Area :
Expressway

Both the maps in Figure 2 and 3 are taken from <http://openstreetmap.org>, which is available free for downloading via their export map feature.



Figure 4 : Map of Urban Area – City Based Scenario

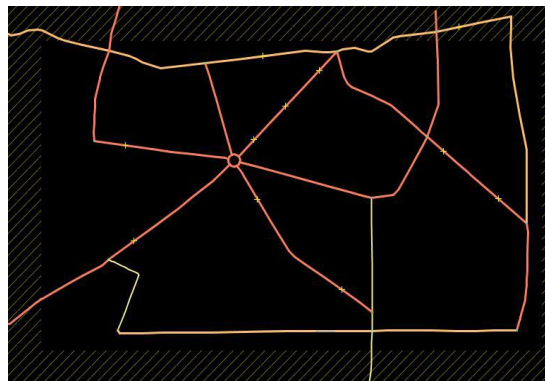


Figure 5: Map of Urban Area – City Based Scenario for road in JOSM

As shown in figure 4 & 5, 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 5 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 [4]SUMO and create traffic environment.

IV. Simulation In Sumo (Simulation Of Urban Mobility)

To generate vehicle traffic in [4]SUMO the tools like "netconvert", "polyconvert" and "randomTrips.py" are used.

- **Netconvert** can imports road networks from different sources (openstreetmap.org) and generates road networks that can be used in SUMO. It will identify the Nodes, Junctions, Signals etc and build the network file which is compatible with SUMO.
- **Polyconvert** 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

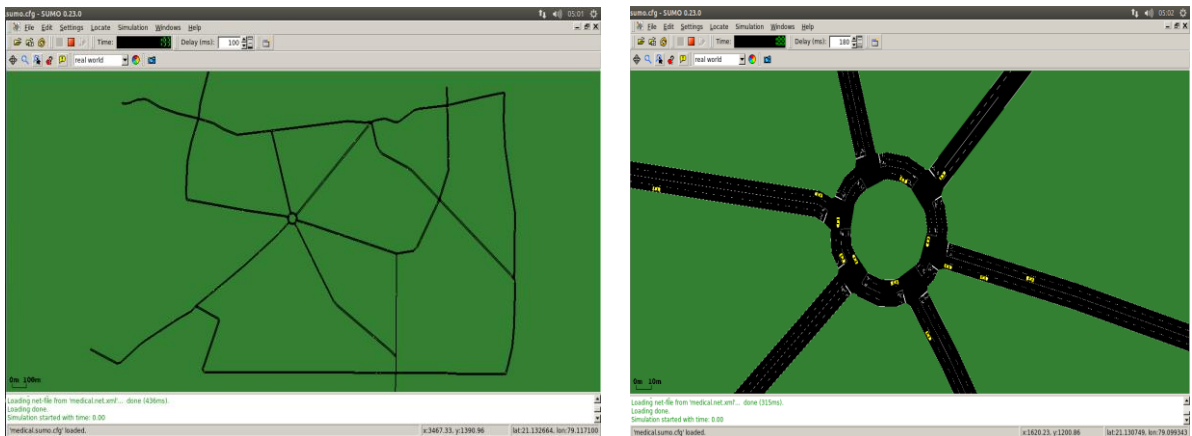


Figure 6 : Imported map from JOSM in SUMO Figure 7 : simulation of view of Traffic in SUMO

V. 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 protocol for urban city based scenario. The simulation is done using the 120 number of nodes.

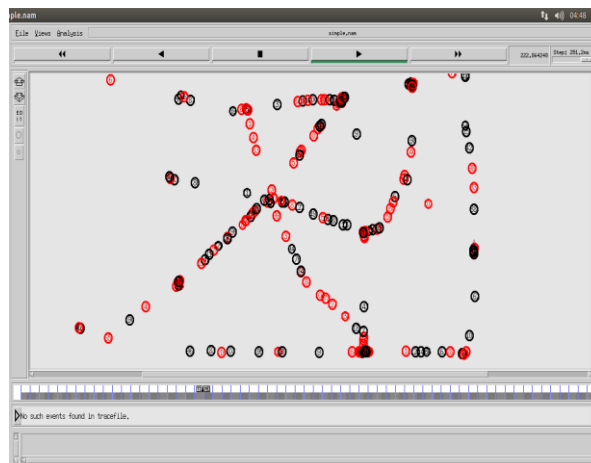


Figure 8 : Simulation in NS2 for urban city based scenario

In Figure 9, the comparison of throughput (kbps) analysis for city based scenario is performed, from the results AMODV is having better throughput than AODV.

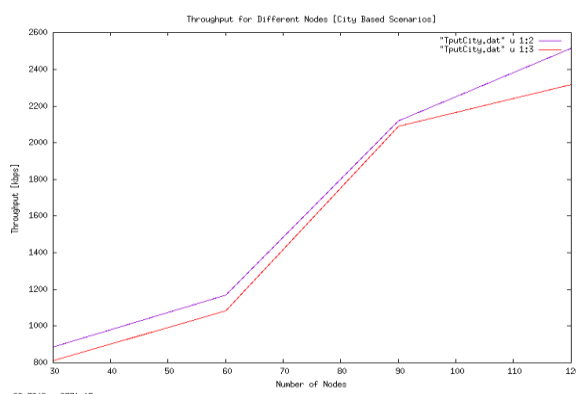


Figure 9 : Comparison graph of throughput for two routing protocols of city based scenario for different nodes.

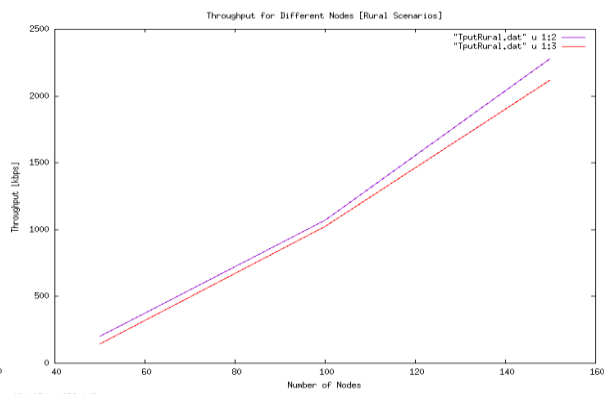


Figure 10: Comparison of throughput for two routing protocols of rural scenario for different nodes.

VI. Conclusion

The simulation of urban mobility (SUMO) gives the better mobility model after compiling in java Open street Map editor (JOSM) for rural as well as urban scenarios. In this paper we simulate the AODV & AMODV routing protocol for analyzing the throughput parameter. As a result Performance of AMODV gives better results than AODV for both urban-city based and rural based scenarios. for the future work, the performance can be evaluated on the basis of different Qos parameters like end to end delay, jitter, routing overhead, efficiency etc.

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