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Implementation of Real Time Traffic Network

[1] **Vibha Oberoi; [2] Praveena Chaturvedi**

[1] Department of Computer Science, Gurukul Kangri Vishwavidyalaya,
Haridwar, Uttarakhand, India

[2] Department of Computer Science, Kanya Gurukul Mahavidhyalaya,
Dehradun, Uttarakhand, India

Abstract— VANET is an ad hoc network which is made up of individual vehicles/nodes that communicate with each other directly and also can communicate with the fixed units i.e. Road Side Unit (RSU). In this paper, a real time traffic simulator and network simulator is used to couple both network and traffic simulator is presented. Realistic movement mobility model based on various road structures (highway, urban, rural) and road scenarios (traffic accidents, congestion) is being developed for a region (Ashtley hall, Dehradun, Uttarakhand).This model generated by Simulation of Urban Mobility (SUMO) can be used itself and can also be integrated with network simulator in order to analyse the performance of different routing protocols so that it can be implemented and can benefit travellers on road.

Keywords— *VANET, SUMO, NS2, Routing and Routing Protocol*

1. Introduction

Advancement in wireless ad-hoc network has led to the development and emergence of an ad-hoc i.e. Vehicular Ad-Hoc Network (VANET) which would provide road safety to the travelers on road, improves the efficiency of traffic, decrease the waiting time on traffic signals and most importantly decrease the number of accidents on road thereby giving comfort to the travelers and drivers on road. VANET has some distinct characteristics such as High mobility, rapidly changing network topology, Unbounded network size, frequent exchange of information and many more which puts this ad hoc network into different class altogether [7][10][11][12]. VANET can be defined as **"It is ad hoc network that provides communication among vehicles and road side infrastructure by using wireless gadgets mounted over the vehicles". S**ystem model of VANETs is equipped with three main components i.e. On Board Unit (OBU), Road Side Unit (RSU) and Application Unit (AU). On Board Unit (OBU) which is a device placed on all the vehicles (nodes) and its main functions is to define the area geographically, message passing, congestion control network and security. The second component i.e. RSU is a small device that is fixed along the road side and connects with the vehicles on roads in order to collect the information which can be stored and shared at the central network. The third component is AU which is in build function of the vehicles (nodes) and its main function is detection of messages received from OBU [9].

There are three types of communication that takes place in VANETs i.e. Vehicle to Vehicle Communication (V2V), Vehicle to Infrastructure communication (V2I) and Infrastructure to Vehicular Communication (I2V) [8].

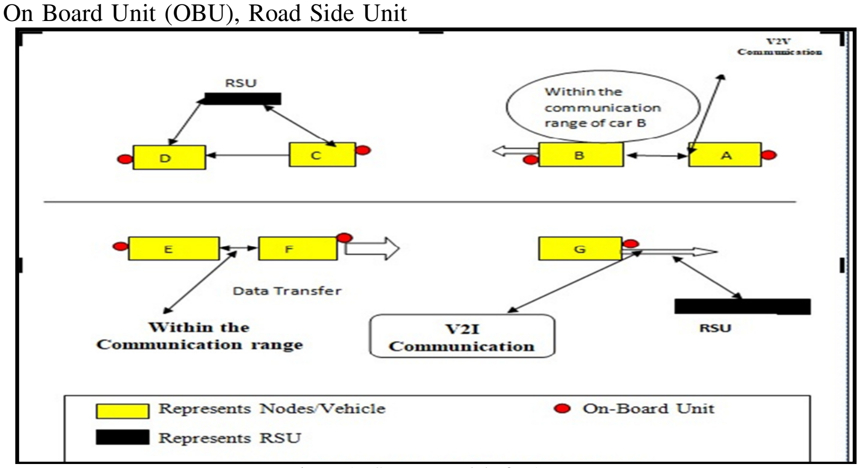

Figure 1 : System Model of VANET

2. Literature Survey

The author [1] has designed a real time traffic of Vishakhapatnam and has analyzed the region on certain parameters. Researchers in [2] and [3] has exported data from Google map and has tried to generate the mobility pattern but source and destination nodes are generated randomly. J. Harri [4] has generated the real time traffic scenario but did not took into consideration some important factors like Minimum and maximum speed of the vehicle, Traffic condition etc.

Researcher [5] has conducted simulation setup under two scenario i.e. B-directionally coupled simulation and offline simulations

3. Tools used

In this setup two simulators have been used i.e. Simulation of Urban Mobility (SUMO) and Network Simulator (NS2).

3.1 Simulation of Urban Mobility (SUMO):

SUMO is a free, portable and open source tool for building up a customized road topology and is also able to import maps of cities of all the world.
The complete suite includes tools for importing road networks, generating routes from different sources, and two versions of the traffic simulation itself, one started from the command line and one including a graphical user interface [6].Supports different types of vehicles It is flexible NS2.

3.2 Network Simulator (NS2):

Network Simulator 2(ns2) is an event based discrete network scenario simulation software for various protocols.NS2has many advantages such as stability, acceptability, extendibility and can support nodes up to 20000.

4. Proposed System

The main aim of this proposal is to import real road network formats of a particular region so that a desired framework can be created by customizing the source code. The block diagram of our proposed has been described in the given figure (Figure-1):

This proposed model will lead to number of advantages. Firstly we can easily extend the network area, in this case we have just analyzed 1086 X 1076 m area. Secondly it can implemented in any kind of vehicles like motorcycle, car, truck, buses or railways. Also support pedestrians which will not only make easy and secure life of drivers on road but will also help pedestrians. Thirdly it is a flexible network so it can lead to best simulation framework in research, academics & industry.

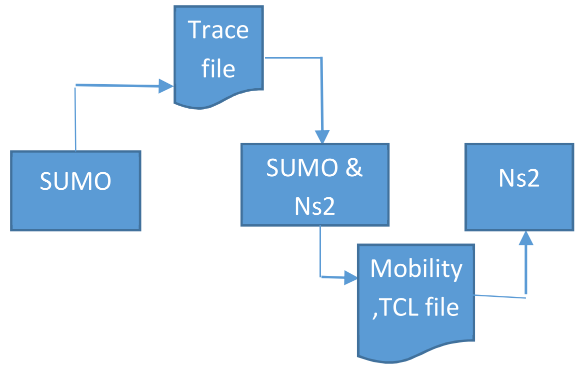

Figure 2: Block Diagram of Proposed System

This simulation network will be very cheap as it does not require any costly equipment's so we can easily test complex problems. The most important benefit would be that it supports many routing protocols so we can analyze the different performance metrics for that region and evaluate which one is best. Analysis can easily be carried out different performance metrics such as throughput, jitter, end to end delay, Normalized Routing Overhead (NRO) and many more.

5. Design

SUMO is used to generate the real time mobility pattern of the nodes (vehicles). A map can be exported and can be processed to generate the trace file. This trace file can exported to the NS2 and analysis can be carried out under the different performance parameters. The simulation setup is clearly defined in the below table:

Table 1: Simulation setup

Operating System	LINUX Mint 64 bit
CPU	Intel® Core™ i3 2.00GHz
RAM	4 GB
NS-2 VERSION	NS-2.35
SUMO VERSION	Sumo-1.1.0
Number of nodes	100
Simulation Area	1086 X 1076
Speed	MIN 10 MAX 100
Data Type	CBR
Data Packet Size	512 bytes
Total Simulation Time	100

6. Implementation & Results

The integration of SUMO and Ns2 simulation majorly comprise of three components i.e. SUMO- Microscopic

Simulator, Ns2-Communication Network Simulator and Conversion tool. Our objectives have been fulfilled by undergoing the below mentioned phases.

Phase 6.1: Real time Traffic Generation

Real Time Generation using SUMO is done by exporting desired location map from OpensStreetMap. Configuration file is created and executed in SUMO environment. The output of the confuration file when exceuted on SUMO Environment will geneted as seen in figure 3:

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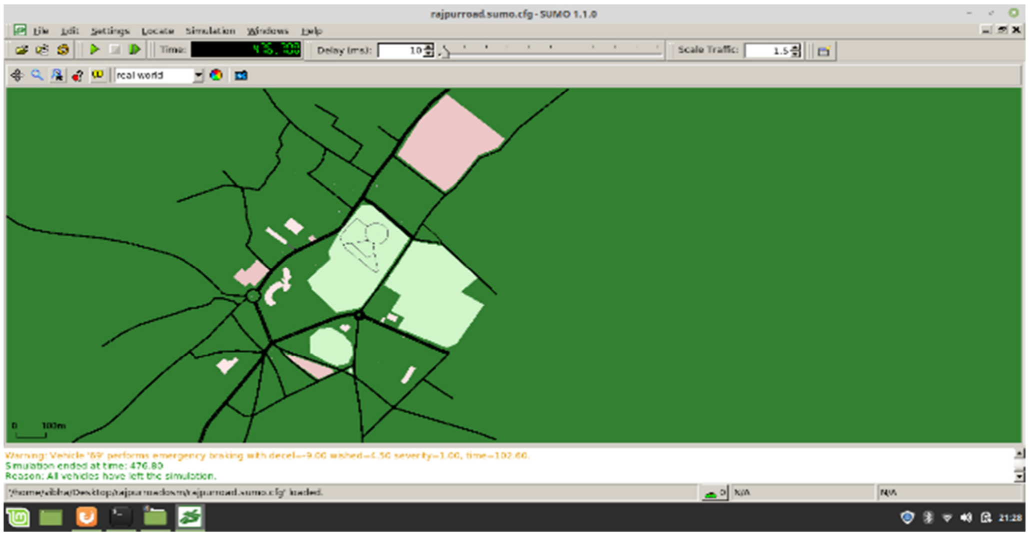

Figure 3: Output of Configuration file in SUMO Environment

Phase 6.2: Integration of SUMO and ns2

The trace file generated from SUMO is integrated with ns2 so that the real time trace file can be analysed over different performance evaluation metrics such as throughput, end to end delivery, jitter, Packet Delivery Ratio (PDR), Normalized routing overhead. Exporting of SUMO trace into ns2 will lead to creation of three TCL files i.e. mobility file, activity file and network file. On execution of TCL file in NS2 environment we will get the result as shown in figure 4.

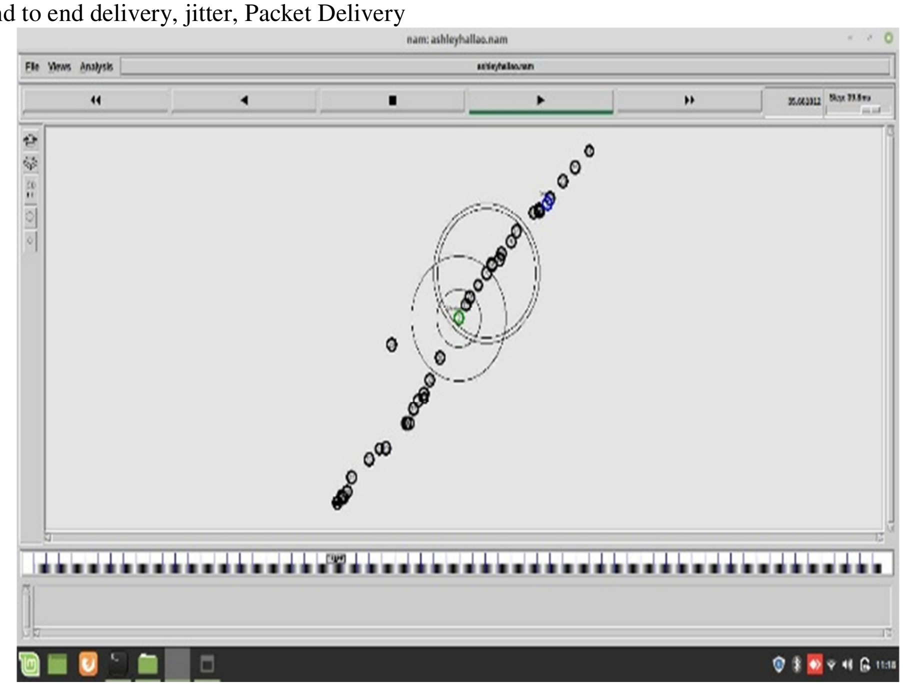

Figure 4: Output of TCL File

The output so generated by SUMO can be used itself. The trace file generated by SUMO is not directly usable for analysis on different parameters by NS2.So, integration of the trace files is done to generate the required three important files i.e. mobility file, activity file and the TCL file. As NS2 requires information about location of the node/ vehicles at different time stamps. This information is generated in mobility file.

7. Conclusion

We have designed a real time network scenario of Ashley hall, Dehradun, Uttarakhand of different nodes/vehicles density which will help us to analyse the performance metrics i.e. throughput, jitter, delay, NRO of VANETs. This real time environment has been implemented in SUMO and integration of SUMO &NS2 is done so that further analysis could be carried out. The main output of this paper is to create a realistic vehicular mobility model.

Our future work would be to find which routing protocol is best for this real time scenario by considering the network performance metrics. Secondly to find the optimal path based on least number of hops metrics.

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