International Journal of Technical Research and Applications e-ISSN: 2320-8163,
www.ijtra.com Volume 4, Issue 2 (March-April, 2016), PP. 163-166

SMART TRAFFIC CONTROLLER USING ADHOC

Rajat Bhatia[1], Vishrut Sharma[2], Kanchan Arora[3]
[1,3] School of Computer Science and Engineering, [2]School of Electronics Engineering,
[1,2,3]VIT University, Vellore,T.N., India-632001
rajat.bhatia@yahoo.com

Abstract— **Road safety has become a main issue for governments and car manufacturers in the last twenty years. For every citizen of metropolitan cities getting struck in long traffic jams has been the major concern of the era. The evolution of wireless technologies has allowed researchers to design communication systems where vehicles can participate in the communication networks. This paper aims at creating a healthy communication network among the vehicles so that every other vehicle on the road can get to know the traffic situation ahead on the lane by communicating with the vehicles ahead so that the driver can take a adequate decision of changing the path or staying on the same path. This system will trigger a message every time it faces over traffic situation on the road. This situation will be judged by the traffic simulators on the traffic lights. And the message will be forwarded by a decentralized type of wireless network called ad hoc network generated by taking cars as nodes. The system will be useful in preventing the never ending and annoying traffic jams on roads and will save the precious time of the people.**

Index terms- **Vehicular ad hoc networks (VANETs), Mobile Ad hoc NETworks (MANETs), Vehicle-to-Vehicle (V2V), Vehicle-to-Infrastructure (V2I), TCP, UDP, NS2.**

I. INTRODUCTION

The paper revolves around the wireless technologies of the network cycle and the concern of protecting its citizens through it. Vehicular ad hoc networks (VANETs) are attracting a growing attention due to the promising important applications, from road safety to traffic control and entertainment for passengers. Smart cities would like to plan how to minimize their transportation problems due to the increasing population that produces congested roads. VANETs aim at helping to alleviate this issue improving vehicles mobility, increasing road safety and also seeking to have more sustainable cities. At the beginning of the development of vehicular technologies, the main goal was to have more efficient and safer roads. Nowadays, thanks to the huge development of wireless technologies and their application in vehicles, it is possible to use Intelligent Transportation System (ITS) that will change our way to drive, improve road safety, and help emergency services. VANETs may soon allow vehicles to easily communicate among themselves and also with fixed infrastructure. This will not only improve road safety, but also raise new commercial opportunities such as infotainment for passengers. Car accident prevention, safer roads, pollution and congestion reduction are some of the goals of VANETs. The deployment of an efficient system to manage warning messages in VANETs has important benefits, from the perspective of both road operators and drivers. Efficient traffic alerts and updated information about traffic incidents will reduce traffic jams, increase road safety and improve the driving in the city.

II. LITERATURE SURVEY

Vehicular Ad hoc NETworks (VANETs) belong to a subcategory of traditional Mobile Ad hoc NETworks (MANETs). The main feature of VANETs is that mobile nodes are vehicles endowed with sophisticated “on-board” equipments, traveling on constrained paths (i.e. roads and lanes), and communicating each other for message exchange via Vehicle-to-Vehicle (V2V) communication protocols, as well as between vehicles and fixed road-side Access Points (i.e., wireless and cellular network infrastructure), in case of Vehicle-to-Infrastructure (V2I) Communications. Future networked vehicles represent the future convergence of computers, communications infrastructure, and automobiles. There is a strong need to enable vehicular communication for applications such as safety messaging, traffic and congestion monitoring and general purpose Internet access. VANETs are characterized by high mobility, rapidly changing topology, and ephemeral, one-time interactions. Basically, both VANETs and MANETs are characterized by the movement and self-organization of the nodes (i.e., vehicles in the case of VANETs). VANETs applications enable vehicles to connect to the Internet to obtain real time news, traffic, and weather reports. VANETs also fuel the vast opportunities in online vehicle entertainments such as gaming and file sharing via the Internet or the local ad hoc networks. Applications such as safety messaging are near-space applications, where vehicles in close proximity, typically of the order of few meters, exchange status information to increase safety awareness. The aim is to enhance safety by alerting of emergency conditions. Applications for VANETs are mainly oriented to safety issues (e.g., traffic services, alarm and warning messaging, audio / video streaming and generalized infotainment, in order to improve the quality of transportation through time-critical safety and traffic management applications.

III. DESIGN

A. Module 1: Node Creation In Ns2

The decentralized nature of wireless ad hoc networks makes them suitable for a variety of applications where central nodes can't be relied on and may improve the scalability of networks compared to wireless managed networks, though theoretical and practical limits to the overall capacity of such networks have been identified. Network Simulator (Version 2), widely known as NS2, is simply an event driven simulation tool that has proved useful in studying the dynamic nature of communication networks. Simulation of wired as well as wireless network functions and protocols (e.g., routing algorithms, TCP, UDP) can be done using NS2. In general, NS2 provides users with a way of specifying such network protocols and simulating their corresponding behaviors.

A. Technical requirements

An ad hoc network is made up of multiple "nodes" connected by "links." Links are influenced by the node's resources (e.g., transmitter power, computing power and memory) and behavioral properties (e.g., reliability), as well as link properties (e.g. length-of-link and signal loss, interference and noise).

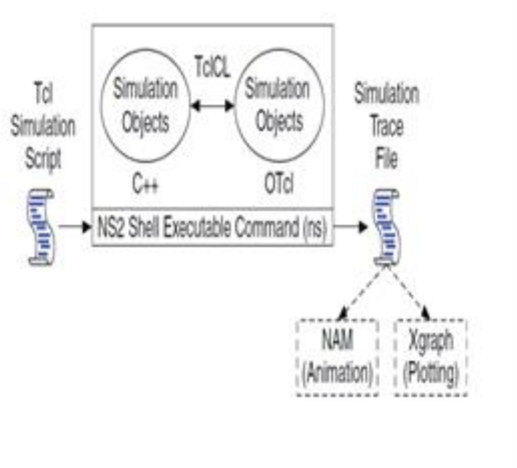
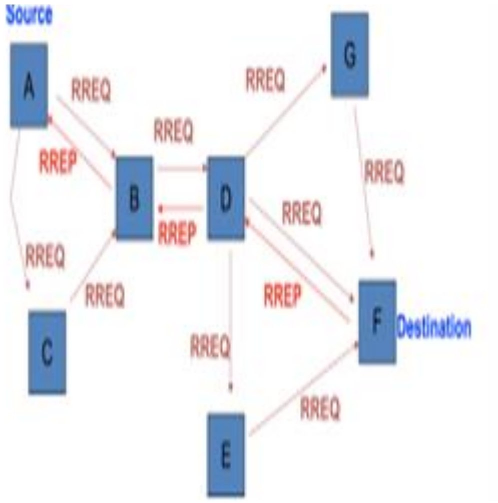


Fig.: Basic Architecture of NS2

B. Module 2: Creating A Network Among Nodes And Transmitting Messages Using TCP Over AODV Routing Protocol

The connectivity information is broadcasted periodically by local Hello messages (special RREQ messages) to its immediate neighbors that are a part of an active route. If Hello messages stop arriving from a neighbor beyond some given time threshold, the connection is assumed to be lost. It removes the routing entry and sends a REER message to neighbors that are active and use the route whenever a node detects that a route to its neighbor node is not valid; this is possible by maintaining active neighbor lists. This procedure is repeated at nodes that receive REER messages. A source that receives an REER can reinitiate a RREQ message. AODV does not allow to handle unidirectional links.



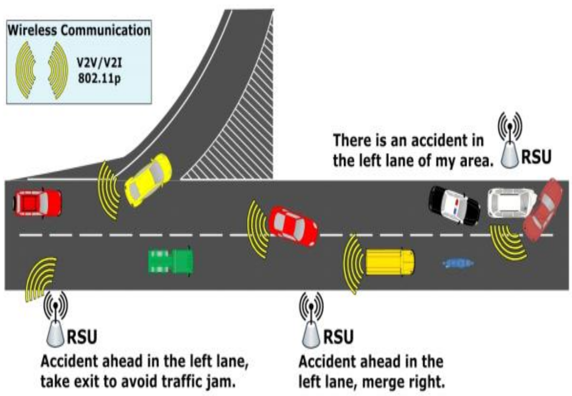
B. Module 3: Sensing A Traffic Situation And Broadcasting A Traffic Situation Message

B. Broadcasting In MANET

Network-wide broadcasting aims at distributing messages from the source node to all other nodes in the network. Broadcasting is a major communication primitive required by many applications and protocols in MANETs. Broadcast protocols are a fundamental building block to realize principal middleware functionalities such as replication, group management and consensus. Furthermore, broadcasting is frequently used to discover and advertise resources. A simple example of resource discovery is the route discovery in many reactive routing protocols. Broadcasting is also frequently used to distribute content to all network participants, such as alarm signals or announcements. In highly dynamic scenarios, broadcasting serves as a robust way of realizing other communication primitives, such as multicast. Some of the methods include Simple Flooding method, Probability based Approach , Area Based Methods, Distance-Based Scheme, Location-Based Scheme and Neighbor Knowledge Method.

IV. IMPLEMENTATION

We have implemented the following scenario in NS2.35



The above picture describes the scene of an accident in a traffic control enabled smart city. ITLs (Intelligent Traffic lights) are installed throughout the city, which sense the traffic scenario by receiving the traffic situation messages from the victim cars or the nearby cars. In the above picture, the ITL (shown as RSU in the picture) to the right receives a traffic situation message (TSM) about the accident in the left lane of its area. These ITLs act as the stationary nodes in the generated ad hoc network (VANET) and the cars on the road act as mobile nodes in the network. This ITL transmit this TSM message to the nearby car and it uses flooding over the AODV protocol to transmit this message to all the nearby cars and also to the next installed ITL. This 28 transmitted message will help the cars on the lane either to continue on the same lane or take a turn before the accident spot.

A. Simulation and Results

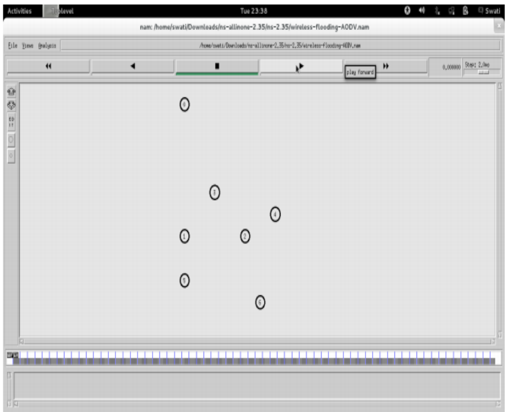


Fig: Implementation of Above Scenario

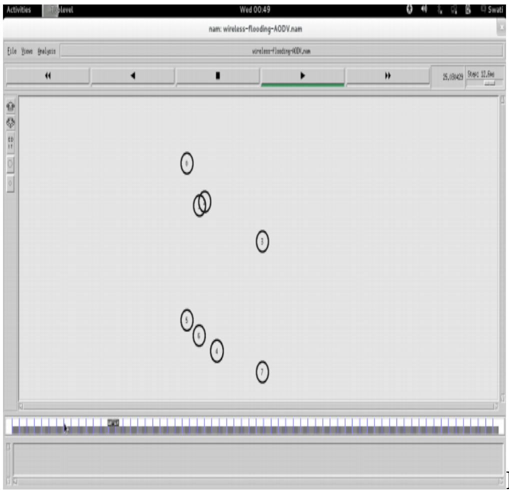


Fig: After 2 nodes collide

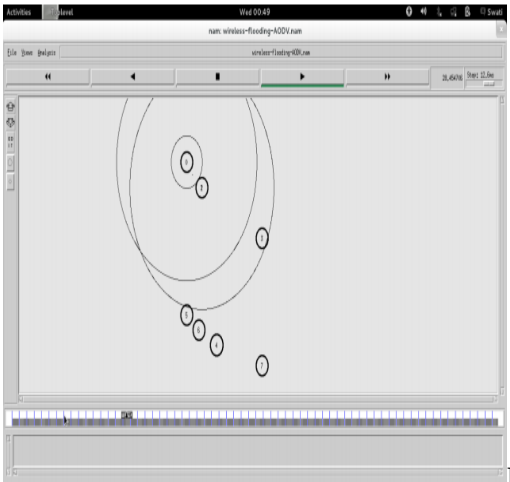


Fig: ITL flooding TMS

V. POSSIBLE HARDWARE IMPLEMENTATION

A. Smart City Network

The smart city framework we have designed includes ITLs set in some of the crossroads. These ITLs collect real-time traffic data from the passing vehicles and calculate traffic statistics such as traffic density in the adjacent streets (between consecutive crossroads). At the same time, these ITLs can communicate the traffic information to passing vehicles and alert them with warning messages in case of accidents. These ITLs also form a sub-network that allows ITLs to share the collected information and calculate statistics of the whole city. Thus, vehicles are well informed of the traffic situation in the city. The following sections describe how this smart city framework is designed and which use the ITL will have. In the smart city projected, blocks have a regular square design and buildings on its four sides.

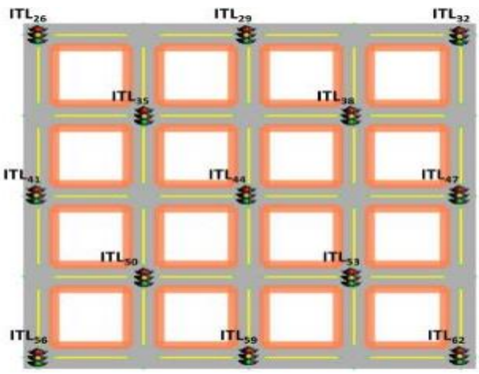


Fig: Smart City Network

ITLs are responsible of managing the traffic of the vehicles, which form a VANET. These ITLs do not have to be located at each intersection. Within all the traffic lights that are traditionally located in a city, only a few will be replaced by ITLs. This is because each ITL covers a whole intersection and the 4 streets that converge on this intersection. ITLs are placed as shown in Figure above. To cover all this area the antenna pattern used is an Omni-directional propagation pattern.

Therefore, each ITL receives data from all passing vehicles on its cover range (the four streets and the 31 intersection). Not having an ITL on each intersection is more economic when implementing this framework.

B. Smart Vehicles

A smart vehicle is equipped with the following devices and technologies: (i) a Central Processing Unit (CPU) that implements the applications and communication protocols; (ii) a wireless transceiver for data transmissions among vehicles (V2V) and from vehicles to RSUs (V2I); (iii) a Global Positioning Service (GPS) receiver for positioning and navigation services; (iv) different sensors laying inside and outside the vehicle to measure various parameters (i.e., speed, acceleration, distance from neighboring vehicles, etc.); (v) an input/output interface for human interaction with the system. The basic idea of smart vehicles is addressed to safety issues, and then by a proper combination of functionalities like control, communications, and computing technologies, it will be possible to assist driver decisions, and also prevent wrong driver's behaviors. The control functionality is added directly into smart vehicles to connect the vehicle's electronic equipment. The technology used for control should take into account the need of limit vehicle weight; as a matter, the added wiring increases vehicle weight, and weakens performance. It has been proven that for an average well-tuned vehicle, every extra 50 kilograms of wiring —or extra 100 W of power— increases fuel consumption by 0.2 liters for each 100 kilometers traveled.

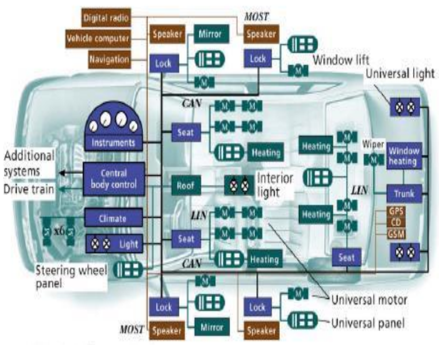


Fig: Smart Vehicle

VI. CONCLUSION

The implementation scenario shown above was the result of study on ad hoc network and the ns2 simulation. This simulation could be extended to simulating the whole smart city. The traffic situation message generated in the network will spread the news of congestion due to accident to the cars in the nearby area so that the drivers can take adequate decisions of changing their path before getting in struck in the traffic jam. Along with the TSM messages this generated network can be used for infotainment. This paper can even be merged with the present GPS (Global Positioning System) to show the driver the shortest possible path along with the path with least congestion (traffic). The system if implemented could bring revolution in the market. This could result in reduction in traffic jams due road accidents to almost 90 %, thus saving time and fuel. Future implementation could be developing a phone application for such a system on different platforms.

REFERENCES

[1] IEEE802.16e: IEEE Standard for Local and metropolitan area networks Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems, 2005.

[2] IEEE802.16: IEEE Standard for Local and metropolitan area networks Part 16: Air Interface for Fixed Broadband Wireless Access Systems, 2004.

[3] Economist.com, "World domination postponed the prospects for WiMAX technology has been hugely overhyped, Jan. 27th, 2005.

[4] Alexander Sayenko, Henrik Martikainen, Alexander Puchko, "Performance Comparison of HARQ and ARQ Mechanisms in IEEE 802.16 Networks",

[5] www.qualnet.com

[6] Shwetha D, Thontadharya H. J, Subramanya Bhat.M and Devaraju J.T,

"Performance Analysis of ARQ Mechanism in WiMAX Networks"

[7]7.http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=6136344&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D6136344

[8]http://www.ijetae.com/files/Volume3Issue1/IJETAE_0113_34.pdf

[9]http://article.sapub.org/pdf/10.5923.j.jwnc.20130303.02.pdf