TRAFFIC CONGESTION CONTROL USING VEHICULAR AD-HOC NETWORK

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Abstract: Nowadays traffic is becoming a major problem indeveloped cities. With the advancement in technology vehicles themselves could be used to compile and analyze traffic data and relay it to the drivers in a format that will allow them to make smart decisions to avoid congested areas, resulting in congestion control. Vehicular Ad-Hoc network is one of the best solution which enables vehicle to vehicle communication. Vehicular ad-hoc networks are a form of mobile ad-hoc networks that provide communications between nearby vehicles and nearby fixed equipment. We present a strategy to control traffic congestion with the help of vehicle-to-vehicle and vehicle to infrastructure communication. This is achieved by transmission of messages which alerts the drivers about possible traffic breakdown. The message transmitted will guide the driver so as to take the decision needed to control the traffic congestion.

Keywords: Vehicular Ad-Hoc network, mobile ad-hoc networks, vehicle to vehicle communication, vehicle to infrastructure communication Traffic congestion

I INTRODUCTION

During the last decades, worldwide road traffic density has been increasing year after year. This case has led to the fact that, currently, motorway traffic congestions are one of the most common phenomena that motorists have to face in their trips. Apart from being a quite-stressful experience for current drivers, they also have a negative impact on the environment and the economy. In addition, the road traffic conditions affect the safety of the population since 1.2 million people worldwide are estimated to be killed each year on the roads.

For this reason, nowadays the automotive industry and governments invest many resources to increase road safety and traffic efficiency, as well as to reduce the impact of transportation on the environment. One of the most promising areas of research is the study of the communications among vehicles and road-side units, or more specifically the Vehicular Ad-hoc Networks (VANETs). This kind of networks are self-configuring networks composed of a collection of vehicles and elements of roadside infrastructure connected with each other without requiring an underlying infrastructure, sending and receiving information and warnings about the current traffic situation.

To achieve the efficiency in transportation with the help of vehicular communication, our approach is based on following points. Data packets are generated and broadcasted by affected vehicle itself which contains decision message. Based on decision vehicles adapt the driving behaviour and helps in controlling congestion. Roadside infrastructure monitors the traffic and if traffic is above threshold value it broadcasts the messages.

In this technique the data packets will be generated in case of event occurrence only. This further reduces the packet flooding problem of broadcasting as periodically data packets are not transmitted. Data packets are broadcasted to all neighbors in reception range and receiving vehicles will rebroadcast the data packet thus receiving vehicle will be responsible for forwarding the message along to the rest of the vehicles. Roadside units are continuously monitoring the traffic and if the traffic is above predetermined threshold value they will broadcast control messages, ex: Reduce the speed. The previous studies have focused on detection of traffic congestion.

II LITERATURE REVIEW

Various researchers are working on VANET to find the solution for current crucial congestion problem. A paper by Florian Knorr aims to identify „critical road segments and to prevent a traffic jam before it actually occurs. Their work focuses on the aspects related to traffic dynamics (Florian Knorr, 2012).

ElmarSchoch was proposed five distinct communication patterns that form the basis of almost all VANET applications. These patterns can serve as a base for future development. The classification also reflects that the close coupling between applications and communication in VANETs shifts the focus to a more integrated system architecture which ultimately also includes information aggregation. The patterns can form the basis for security and privacy analysis and thus allow for a bottom-up discussion of security in order to achieve tailored security and privacy solutions

Francisco J. Martinez presents a comprehensive study and comparisons of the various publicly available VANET simulation software and their components. The work focuses on an Event-Driven Architecture (EDA) as a novel mechanism to get insight into VANET messages to detect different levels of traffic jams; furthermore, it also takes into account environmental data that come from external data sources, such as weather conditions (Fernando Terroso-Sáenz,2012). This paper presents a comprehensive study and comparisons of the various publicly available VANET simulation software and their components. In particular, we contrast their software characteristics, graphical user interface (GUI), popularity, ease of use, input requirements, output visualization capability, accuracy of simulation.

JosianeNzouonta presents a class of routing protocols called Road-Based using Vehicular Traffic (RBVT) routing, which outperforms existing routing protocols in city-based Vehicular Ad hoc Networks (VANETs). RBVT protocols leverage Real-Time vehicular traffic information to create road-based paths consisting of successions of road intersections that have, with high probabiliity, network connectivity among them. Geographical forwarding is used to transfer packets between intersections on the path, reducing the path s sensitivity to individual node movements.

H Fusseler describes Vehicular Ad Hoc Networks has basically picked up the consideration of today's examination endeavors ,while ebb and flow answers for accomplish secure VANET, to shield the system from foe assaults still insufficient ,attempting to achieve an acceptable level, for the driver and maker to accomplish wellbeing of life and infotainment. In this paper a different kind of security issues and difficulties of VANET been examined.

M Raya describes Wireless networks are gaining popularity now days, as the users require wireless connectivity irrespective of their geographic position. VANETs are the promising approach to provide safety and other applications to the drivers as well as passengers. They discuss the VANET architecture, security issues, characteristics in VANETs.

III METHODOLOGY

In this method for traffic congestion control is based on VANET. Traffic congestion control is achieved by broadcasting the messages. The proposed communication is vehicle to vehicle communication as well as vehicle to infrastructure communication. The vehicle is assumed to be equipped with communicating device. The communicationis initialized by the affected vehicle. The vehicles which are involved in the communication are called as nodes. These nodes are mobile in nature hence while selecting the communication pattern this mobile nature has to be considered. In MANET all the nodes are fixed, hence if we try to apply same protocols for VANET packet loss takes place. To avoid this, an intelligent communication pattern has to be chosen.

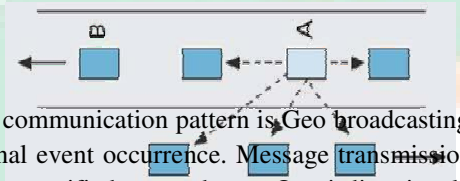
Causes of congestion	**Percentage (%)**
Bottlenecks	40
Traffic incidents	25
Work zones	10
Bad weather	15
Special events	5
Poor signal timing	5

Table 1: Major Causes of Congestion

Wireless Access in Vehicular Environment

There are greater challenges in wireless traffic patterns .To know the challenges of IEEE MAC layer operations for vehicular communication scenario, IEEE802.11p Wireless Access in Vehicular Environments (WAVE) was introduced. 802.11p is an IEEE standard that supports Real Time Traffic Transportation Systems (RTTS) ITS)applications in the context of Vehicle to Vehicle (V2V) and Vehicle to Infrastructure communications (V2I) that are being developed, namely the Dedicated Short Range Communications(DSRC) operating in 5.9 GHz band. WAVE has become a standard that can be universally adopted across the world. At present DSRC based on the Wi-Fi standard is widely used in VANETs as it connects infrastructure to vehicles and also vehicles to- vehicles using two way short range radio which is of lower costs compared to other wireless standards available. DSRC/WAVE systems fill a niche in the wireless infrastructure by facilitating low latency, geographically local, high data rate, and high mobility communications.

Communication Pattern



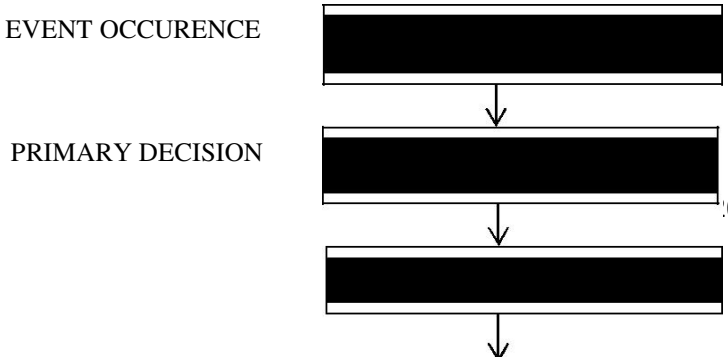
In this method the implemented communication pattern is Geo broadcasting. The messages are not transmitted periodically; they are transmitted only in case of external event occurrence. Message transmission is unidirectional. The message is transmitted to all the vehicles which are coming in the specified range, hence Omni directional antenna is used for broadcasting and the unidirectional forwarding is achieved by rejection of messages if from behind or from other lane. Communication is single hop communication and message forwarding is done by the next vehicle in range.

Fig 3: Single Hop Communication

Field Name	Description
Vehicle Id	Vehicle Identifier
Speed	Speed of vehicle
Lane Id	Lane identifier
Status	Status of Lane
Decision	Decision message broadcasted by affected Vehicle
Decision	Decision message broadcasted by Road side unit

Table 2: Field structure of Message

Process



VEHICLE

INFORMATION TRANSFER

NEXT VEHICLE IN RANGE

Fig 4: Decision Making

The NS2 is free for commercial and non-commercial use, and they are supported by applying above communication algorithm the congestion control is achieved. Diagram given below indicates the achieved congestion control. For simulation is used. It provides the services common o creating desktop applications -- such as window and menu fully support JDK 5.0 features. Road is assumed to be divided in three lanes, two outer lanes for heavy and small vehicles traffic and the middle one is for overtaking. By broadcasting the messages, status of the road & event information is given to all the vehicles. This enables management, settings storage and is also the first IDE to vehicles to take intelligent decision and thus to avoid the congestion. In above diagram the whiteera indicates the communication range of corresponding vehicles. The communication is possible in this range only and the overlapping of era indicates communication occurrence. The affected vehicle is shown which is initializing the message transmission hence overlapping can be observed. As soon as message received by the neighbouring vehicle, it follows the decision and behaves accordingly.

IV RESULTS AND DISCUSSION

Traffic at three different times is observed on a road and we simulated the output of traffic by using NS2 software.

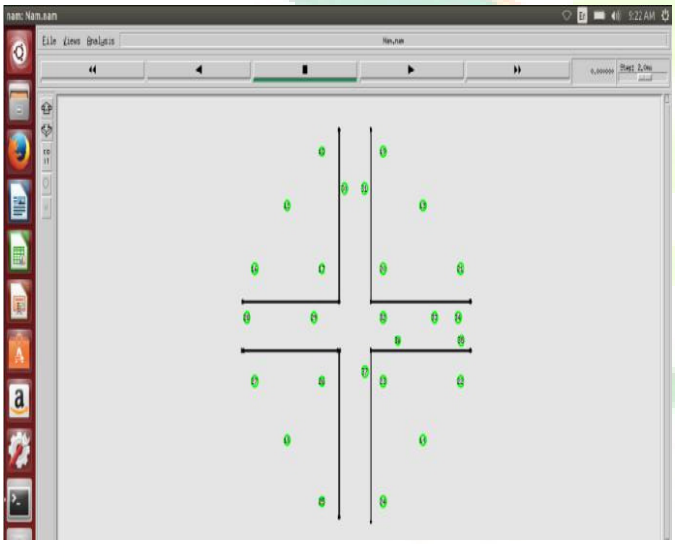


Fig 5: Initial stage of road traffic

This is the stage at which traffic occurs between the vehicles.

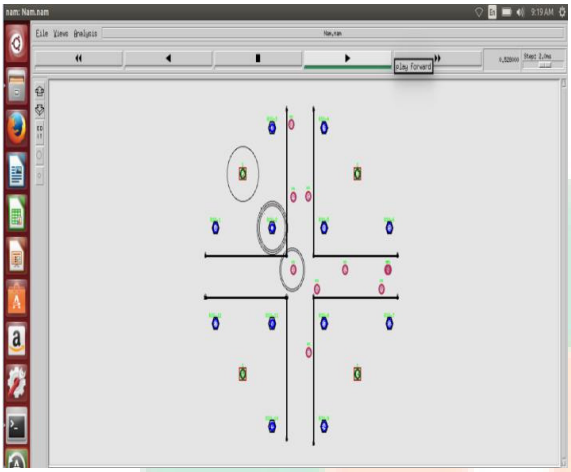
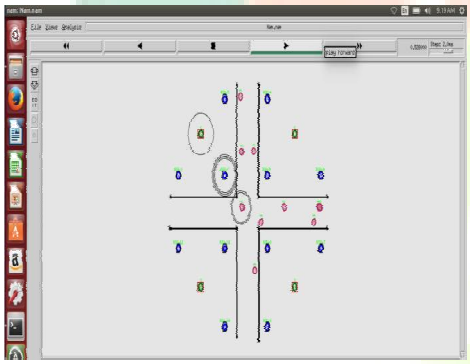


Fig 6:second stage detecting the road traffic



In the next stage the congestion between the vehicles is detected.

After the detecting blocked road the vehicle is diverted to take another path. In this way traffic is minimized by giving prior information to the vehicle.

V CONCLUSION

This study addresses the problem of heavy traffic congestion especially in urban areas. This study proposes an effective solution based on VANET. In proposed method the main focus is on traffic congestion control which can be achieved by broadcasting the prior information about the status of road. With updated knowledge now traffic is moving according to the decision of the broadcasted message, thus resulting in congestion control.

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