Traffic Admission System For Ambulances Using NS-2

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Abstract**—** *Real traffic time data acquisition, currently used in vehicle navigation systems, can be very expensive, and also inaccurate and biased. Therefore, researchers have been motivated to develop alternative systems in emergency medical services .This research presents an intelligent navigation system for ambulance drivers, with an aim of finding the least travel time route that is independent of using real time traffic data. This system helps the drivers to overcome decision making errors due to time pressure and stress, about which route to follow.*

Here , the specific focus is on building a set of rules from the knowledge and experiences of various ambulance drivers , and is associated with factors that might affect the response time to reach the incident locations .This is done by light roads according to such factors in order to calculate relatively accurate travel times along these roads . In addition, this system also considers the time of the day and locations. According to the research in the vehicle navigation system (IVNS)-mounted in ambulance vehicles, am used to guide the drivers by following the quickest path from the dispatch location to the incident location. This navigation is presently supported by real time data of the current traffic conditions of the roads.

The real time traffic data inputs am collected using traffic sensors (detectors, which am either mounted on specially equipped moving vehicles or situated on the road sides). These sensors are either buried under the roads surfaces or are camera-based. In the present scenario of heavy and fast moving traffic the idea of real time traffic controlling system can be of great help. Buried and road side sensors can provide the information about the spots that ambulance are situated in.

Keywords**—** Knowledge, Vehicle, Location, Sensors, Ambulance

I. INTRODUCTION

Efficient city planning and traffic management can reduce congestion to some extent. Widening of roads, creating one ways, installing traffic lights at specific crossroads, controlling these lights so they best allow vehicles through and strict traffic laws can curb congestion. There are, however limits to how effective these techniques are in combating congestion. The problem has to be tackled directly, at the source. The cars themselves must be able to communicate with each other and tackle congestion. This is where vanets come in.

VANET is an emerging technology to achieve intelligent inter-vehicle communications, seamless Internet connectivity resulting in improved road safety, essential alerts and accessing entertainment and news. The technology integrates WLAN/Cellular and Ad hoc networks to achieve continuous connectivity. VANETs are a special kind of Mobile Ad-hoc network (MANETs).VANETs are distributed, self-organizing communication networks which are frequently disconnected, characterized by very high node mobility and limited degrees of freedom.

Bangalore city has one of the largest populations in India, an estimated 8 million people. The amount of traffic too, is proportional to the number of people; 3.5 million bikes and cars roam the streets. Traffic congestion is a very serious problem plaguing Bangalore city, the traffic having increased by a drastically.

Increased traffic congestion means many more accidents due to negligence and speeding. What all this means that by improper traffic routing algorithms, we can also reduce the many, many lives lost due to accidents. When we look at such figures, we must also have an efficient system of transporting victims to the nearest hospitals. During times of congestion, ambulances cannot be expected to follow the routes of the general traffic. Efficient routing algorithms will ensure victims reach hospitals quickly and safely. By allowing the individual vehicles to communicate with each other and letting them predict traffic congestion as a whole, we can solve many, if not most of the above problems.

II.PROPOSED SYSTEM

Using VANETs, cars can gather data about the vehicles around them, compile it and make intelligent decisions related to routes. What we propose is a mobile sensor in each car that is capable of WLAN/Cellular data that collects data from itself (Location using GPS, average speed and direction of travel) and cars around it. Such a system would be able to work with little to no assistance from Road side units (RSUs). The most basic component of a congestion detection algorithm is the ability to gather information from its environment. Each vehicle must be equipped with one or more devices that are capable of gathering data such as current location and speed. The strength of any distributed system is in the numbers; therefore information must be shared between vehicles. Vehicles must be equipped with a device that allows them to transmit and receive information wirelessly to and from other vehicles in their vicinity by creating a vehicular ad-hoc network (VANET).The congestion detection algorithm will chose what data is disseminated and when, taking into consideration the relevance of such information and the network’s bandwidth. The data can then be processed by the unit inside the vehicle itself, to conserve bandwidth and to avoid taxing the network. The data is finally converted into meaningful information in the form of possible traffic congestion zones. This data is then relayed to the other vehicles to confirm traffic congestion zones. Finally, the information can be broadcasted over a large area to allow vehicles at a distance about the congestion ahead. The information thus gathered is created and compiled in real time. As a congestion zone grows, information is broadcasted and vehicles are also intimated when a current congestions dies out. Data therefore is gathered constantly and verified and information is re-evaluated.

We propose that cars themselves analyse their speed, location and compare it with the cars around them. Cars can group themselves as ‘congested’ if they are going below a certain speed. Cars going at a higher rate do not belong to this group and consist of another, namely ‘uncongested’. We then calculate the total number of cars and the ratio of congested cars to uncongested cars. If this ratio is higher than a set fixed ratio, the group of cars is set to be in a congestion zone. Initially, each car analyses only the cars around it within a radius of a single hop. As soon as congestion is confirmed, the information about the location of the congestion can be broadcast over an area of several hops, to allow distant cars to avoid the particular route and take another one if possible.

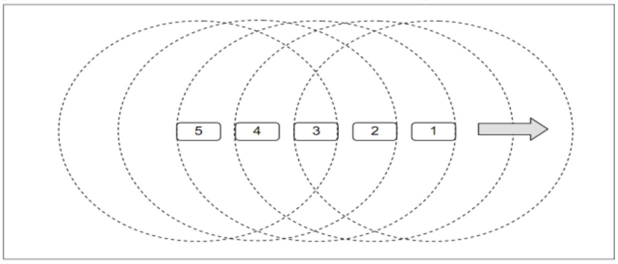

Fig. 1 Communication Ranges of Vehicles in Traffic (An Ideal Scenario)

In order to keep the transmissions of each car discrete, we do not use any unique ID for the vehicles. Instead, we have opted to use the window technique. In this technique, each car sends messages once every fixed interval of time. The clocks which are responsible for transmitting the messages need not be synchronized; it is enough that ALL cars transmit only once in every interval. Each car then calculates the number of cars around it by simple addition of the signals it receives. Duplicate entries are discarded by the fact that at the end of the particular time interval, the number of cars is reset to zero and the count begins again. This eliminates the issue of synchronizing clocks of every car and greatly reduces the infrastructure required to create such units.

The following parameters are to be considered:

- Congestion location
- Congestion area
- Average speed of vehicle/congestion
- Timestamps of transmitted data
- Agreement/disagreement of vehicle in congestion
- Number of vehicles

The system is further hoped to provide driver specific congestion and alternate route information on request. The network model is generated on ns-2. The amount of information transmitted increases as congestion information is aggregated. The efficiency of packet transmission are to be simulated in ns-2. The traces thus generated are used to calculate the above efficiency.

A. Geographic Routing

Geographic routing algorithms use position information for making packet forwarding decisions. Unlike topological routing algorithms, they do not need to exchange and maintain routing information and work nearly stateless. This makes geographic routing attractive for wireless ad hoc and sensor networks. Routing decisions are not based on network addresses and routing tables; instead, messages are routed towards a destination location. With knowledge of the neighbour’s location, each node can select the next hop neighbour that is closer to the destination, and thus advance towards the destination in each step.

1) Greedy Perimeter Stateless Routing (GPSR)

Greedy Perimeter Stateless Routing (GPSR), a novel routing protocol for wireless datagram networks that uses the positions of routers and a packet’s destination to make packet forwarding decisions. GPSR makes greedy forwarding decisions using only information about a router’s immediate neighbours in the network topology. When a packet reaches a region where greedy forwarding is impossible, the algorithm recovers by routing around the perimeter of the region. By keeping state only about the local topology, GPSR scales better in per-router state than shortest-path and ad-hoc routing protocols as the number of network destinations increases. Under mobility’s frequent topology changes, GPSR can use local topology information to find correct new routes quickly.

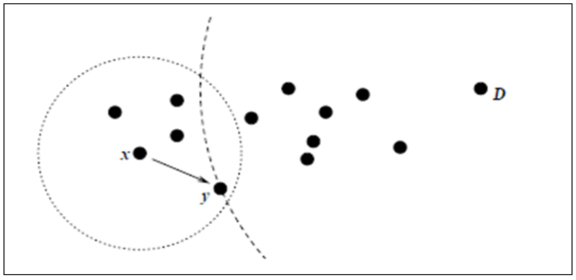

Fig. 2 Greedy Forwarding in GPRS

Here, **x** receives a packet destined for D. x's radio range is denoted by the dotted circle about x, and the arc with radius equal to the distance between y and D is shown as the dashed arc about D. x forwards the packet to y, as the distance between y and D is less than that between D and any of x's other neighbours. This greedy forwarding process repeats, until the packet reaches D. There is neither a widely-accepted mobility trace nor a propagation model used to evaluate these protocols7. Mobility traces can be either obtained from a close-to-reality traffic simulator or from actual traces. Because of the accessibility and limitation8 of these traces, most evaluations use a mobility simulator. Yet, specifications about these simulator parameters are mostly non-standard. Because of the differences in simulator implementation, some parameters cannot directly be translated over. The propagation model in urban environments has recently been caught with much attention. Most of the work thus far has based their propagation model on simple road blocking model or sophisticated analytical model.

B. Standards for Wireless Access in VANETS

Standards simplify product development, help reduce costs, and enable users to compare competing products. The use of standards can the requirements of interconnectivity and interoperability be guaranteed and the emergence of new products be verified to enable the rapid implementation of new technologies. There are many standards that relate to wireless access in vehicular environments. These standards range from protocols that apply to transponder equipment and communication protocols through to security specification, routing, addressing services, and interoperability protocols.

1) Dedicated Short Range Communication (DSRC)

Dedicated Short Range Communications (DSRC) is a short to medium range communications service that was developed to support vehicle-to-vehicle and vehicle-to-roadside communications. Such communications cover a wide range of applications, including vehicle-to-vehicle safety messages, traffic information, toll collection, drive-through payment, and several others. DSRC is aimed at providing high data transfers and low communication latency in small communication zones.

The DSRC spectrum is organized into 7 channels each of which is 10 MHz wide. One channel is restricted for safety communications only while two other channels are reserved for special purposes (such as critical safety of life and high power public safety). All the remaining channels are service channels which can be used for either safety or non-safety applications. Safety applications are given higher priority over non-safety applications to avoid their possible performance degradations and at the same time save lives by warning drivers of imminent dangers or events to enable timely corrective actions to be taken.

C. Standards for Wireless Access in Vehicular Environments (Wave) (IEEE 802.11p**)**

Wireless connectivity between moving vehicles can be provided by existing 802.11a compliant devices with data rates of up to 54 Mbps being achieved with 802.11a hardware. However, vehicular traffic scenarios have greater challenges than fixed wireless networks, caused by varying driving speeds, traffic patterns, and driving environments. Traditional IEEE 802.11 Media Access Control (MAC) operations suffer from significant overheads when used in vehicular scenarios.

For instance, to ensure timely vehicular safety communications, fast data exchanges are required. In these circumstances the scanning of channels for beacons from an Access Point along with multiple handshakes required to establish communication are associated with too much complexity and high overheads (for example, in the case of a vehicle encountering another vehicle coming in the opposite direction, the duration for possible communication between them is extremely short making it difficult to establish communications). The IEEE 1609.4 resides above 802.11p and this standard supports the operation of higher layers without the need to deal with the physical channel access parameters.
WAVE defines two types of devices: RoadSide Unit (RSU), and OnBoard Unit (OBU) which are essentially stationary and mobile devices respectively. RSUs and OBUs can be either a provider or a user of services and can switch between such modes. Normally stationary WAVE devices host an application that provides a service, and the mobile device which hosts a peer application that uses such a service. There may also be applications on devices remote from the RSU whose purpose is to provide services to the OBU. This WAVE standard describes applications that resides on the RSU but is designed to multiplex requests from remote applications thus providing them with access to the OBU. WAVE uses Orthogonal Frequency Division Multiplexing (OFDM) to split the signal into several narrowband channels to

provide a data payload communication capability of 3, 4.5, 6, 9, 12, 18, 24 and 27 Mbps in 10 MHz channels.

Road-Side Unit (RSU), the Passive unit (repeater) is deployed to transmit data during blind spots along which vehicles would not traverse or obstacles being present restricting propagation of signal where in there is a demand from the centralized location at any instant to perform other intelligent operations. The information thus obtained can be presented to the ambulance driver on the existing On- Board Units (OBUs) or via text messages, variable signboards, LCD displays etc. The main parameters used are the speed of the vehicle, location of the vehicle, direction, type of road/junction, time of the day and allowable vehicular density of the roads in the algorithm.

All ambulance (nodes) is GPS enabled to read the parameters and broadcast to the neighbouring vehicles (nodes). Periodically the node updates the speed of its neighbouring nodes to predict a possible congestion and transfers this information. If the nodes around these are not moving at a slower speed than this node, they increment a counter to indicate the number of vehicles moving normally.

In case the neighbouring vehicle agrees with the congestion state of the initializing vehicle, a congestion counter is incremented and as the value exceeds the normal moving vehicles values by a certain predefined limit, then congestion is confirmed. Vehicle receiving any information checks its own status for congestion and proceeds else it updates and transmits congestion information into the geographical map with a flag indicating modified information by the immediate sender to indicate the ambulance that it better take an alternate path to let the casualties reach hospital early.

III.RESULTS AND DISCUSSIONS

A. SIMULATION SETUP

The parameters which are used in the Tcl script written for the purpose of setting up the simulation are as follows:

General Parameters:

- Channel Type – Wireless channel
- Radio Propagation Model – TwoRayGround
- Network Interface Type – Phy/WirelessPhy/OFDM
- MAC Type -802.11
- Interface Queue Type –DropTail Priority Queue
- Link Layer Type – LL
- Antenna Model –Omni Antenna
- Maximum Packets in Interface Queue – 50
- Routing Protocol – DSDV: Destination Sequenced Distance Vector (Routing is done through the Base Station)

Network Architecture Parameters:

- Number of Base Stations – 67, 68, 69
- Number of Sink Nodes – 70
- Number of Subscriber Nodes – Varied from 1 to 99 (excluding Base Nodes and Subscriber Nodes)
- Base Station Coverage – 20 meters

Once a packet is forwarded to any one of the BS, the BS will be able to forward the packet to the end hosts according to the routing paths that are pre-computed by the standard NS2 implementation. In this particular program, the traffic models for congestion hot-spots and their vicinity in Bangalore is considered and created by generating network model on ns-2. Based on the simulation, it is found that packets could get less end to end delay with awareness of routing protocol when the traffic on the network is high. This low end to end delay is meaningful for real time transmissions. When the traffic is relatively high on the network, not all the routes that are found by the AODV routing protocol have enough free data rate for sending packets ensuring the low end to end delay of each packet. As a result, the protocol works well and shows its effects when the traffic on the network is relatively high. The reason is routing protocol uses a link layer feedback for neighbour detection.

B. SIMULATION ANALYSIS

Generation of Node Movement:

A tool called “setdest” is used for generating random movements of nodes in the wireless network. It defines node movements with specific moving speed toward a random or specified location within a fixed area. When the node arrives to the movement location, it could be set to stop for a period of time. After that, the node keeps on moving towards the next location. The location setdest is at the directory of ~ns/indep-utils/cmu-scen-gen/setdest/. Nodes will move at a random speed chosing from the range [0, maxspeed]. The output file that will be used in .tcl file during simulation In output files, besides the movement scripts there are also some other statistics. They include link changes and route changes.

Traffic Generation:

To generate random flows of Traffic, A Tcl script can be used. This script helps to generate the traffic load. The load can be either TCP or CBR. This script locates in the directory of ~ns/indep-utils/cmu-scen-gen. The file name is given with .tcl extension.

The parameters used are in the Tool Command Language (Tcl) script that we have written. It produces a detailed account of the activities going on during the simulation. It shows the details of specific events on the traffic congested road through simulation. The following can be inferred from the output scenario:

- Prospective congestion hot-spots are to be modeled. Different traffic densities are simulated. Start of congestion, number of cars in the congestion, congestion radius is determined. Efficiency of model using different routing protocols AODV and GPSR are obtained.
- Time and distance of propagation of congestion knowledge for the given scenario is also found out.

Scenario 1:

In the following scenario, an arbitrary road map is constructed. The node under consideration begins its journey at indicator node (100) towards its destination indicated by node (99). Congestions are created at 3 junctions. The process of taking alternate routes is demonstrated. The moving red node resembles an ambulance carrying casualty toward a hospital that is located in traffic congested area. All the other moving nodes resemble road traffic. At the time the ambulance is trying to take the casualties to the hospital, the traffic scene in the vicinity of the hospital is very hectic.

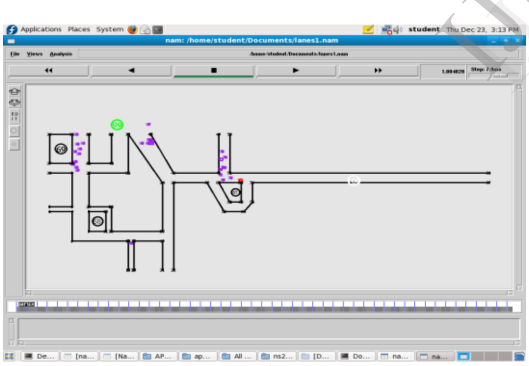

Fig.3 Start of Simulation

Scenerio 2:

In the second scenerio we can see that the ambulance is moving along a path that is comparitively having less traffic. The main priority of this project is to enable the reaching of any casualty on road to hospitals at a faster pace and by not getting tangled in any congest situations. It is seen that the ambulance smartly avoids the route of traffic and thus does not get mingled in any of the on-road chaos.

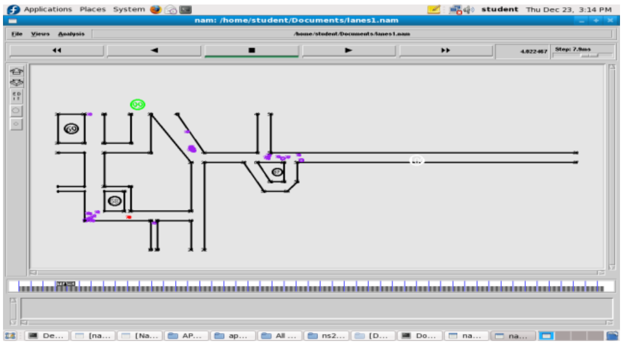

Fig.4 Simulation at 4.0 Seconds

IV.CONCLUSION

This paper proposes a dynamic routing system which is based on the integration of GPS and real time traffic conditions. It uses GPS for determining the position of the emergency vehicles and helps in reaching the hospitals early. This is used as a powerful functionality for planning optimal routes based on on-line travel time information. The result of this study illustrates that dynamic routing of emergency vehicle compared with static solution is much more efficient. This efficiency will be most important when unwanted incidents take place in roads and serious traffic congestion occurs. It also involves integration individual roads in the transport system which leads to a well developed system for emergency vehicles. The proposed system thus finds application where traffic congestion is detected by the vehicles and the information can be shared with the ambulances through a central base system which simulates to fix priority routes for the driver carrying accident victims; patients etc., and avoid congested routes saving valuable time. By using a method similar to the one proposed, prospective congestion hot-spots are to be modeled. Different traffic densities are simulated. Start of congestion, number of cars in the congestion, congestion radius is determined. Efficiency of model using different routing protocols AODV, DSDV, GPSR are obtained. Time and distance of propagation of congestion knowledge for a given scenario is also found out. The AODV routing protocol is more significant to be sent especially when the traffic on the network is high (corresponding to a situation where the data rate of the traffic flow is high in the simulations), since that improves the performance of the network remarkably. The protocol allows the mobile hotspot to exhibit traffic engineering control over the on-board users' downlink data traffic in the architecture. This allows the hosts to perform independent uplink and downlink traffic engineering that takes into consideration the asymmetric link and user data traffic characteristics in the uplink and downlink direction.

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