

An Traffic Collision Avoidance System due to Driver Impairment using Vehicular ad hoc Networks (VANETS)

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ABSTRACT: Traffic collisions may result in Damage to the vehicle, Tangible costs (repair costs, medical treatments, insurance costs) ,Intangible costs (pain, suffering) ,Hospitalization, Handicapped and Death. There are various factors that contribute to the risk of collision. These include no control over the speed, wrong interpretation of distance and speed. Interpreting speed, time and distance is the very basic and important need for effective and safe driving. So, this paper proposes traffic collision avoidance system using Vehicular ad hoc network (VANET). Vehicular Ad hoc Network can ease our life by making driving safe in near future. Routing in these networks is highly complex due to moving nodes and hence many protocols have been developed. We selected two routing protocols (i.e. DSDV and AODV) for comparison. Performance parameter used for comparisons are throughput, end-to-end delay, and packet delivery ratio.

KEYWORDS: VANET, AODV, DSDV, alert, safety

I.INTRODUCTION

With the increase in motorization, urbanization and population growth, road accidents are also increasing at a very fast rate. The reasons behind these accidents are lack of earlier knowledge about traffic congestion, road condition, lane changing, etc. All these problems can be solved with VANET. VANET is used for communication between Vehicles. Not only for communication purpose, VANET also structured for traffic controlling, Navigation, and other application in VANET. VANET provides three types of communication: Vehicle-to-Vehicle (V2V) ,Vehicle-to-Roadside (V2R) and Routing based communication. The communicating nodes are either vehicles or base stations (Roadside units) that can exchange information about traffic issues, road condition. The communication between two nodes is wireless.

In order to facilitate communication within the network, a routing protocol is used to discover routes between nodes. The primary goal of such an ad hoc network routing protocol is correct and efficient route establishment between a pair of nodes so that messages may be delivered in a timely manner.

In this paper we examines two routing protocols for vehicular ad hoc networks– the Destination Sequenced Distance Vector (DSDV), the table- driven protocol and the Ad hoc On- Demand Distance Vector routing (AODV), an On – Demand protocol.

A. DESTINATION SEQUENCED DISTANCE VECTOR

DSDV is a proactive protocol that maintains route to all the destinations before requirement of the route. Every mobile station maintains a routing table that lists all available destinations, the number of hops to reach the destination and the

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sequence number assigned by the destination node. The sequence number is used to distinguish stale routes from new ones and thus avoid the formation of loops. The stations periodically transmit their routing tables to their immediate neighbours. A station also transmits its routing table if a significant change has occurred in its table from the last update sent. So, the update is both time-driven and event driven.

The routing table updates can be sent in two ways: a “full dump” or an incremental update. A full dump sends the full routing table to the neighbours and could span many packets whereas in an incremental update only those entries from the routing table are sent that has a metric change since the last update and it must fit in a packet. If there is space in the incremental update packet then those entries may be included whose sequence number has changed. When the network is relatively stable, incremental updates are sent to avoid extra traffic and full dump are relatively infrequent.

B.AD HOC ON-DEMAND DISTANCE VECTOR ROUTING (AODV)

AODV is a routing protocol especially useful for mobile networks. AODV allows mobile nodes to find routes quickly for new destinations and does not require nodes to maintain routes to destinations that are not in active communication. It helps in both unicast and multicast routing. It is a reactive protocol i.e. it establishes a route to a destination only when there is a demand for that route. It makes sure that the route is shortest and does not contain loop.

AODV makes use of <RREQ, RREP> pair to find the route. The source node broadcast the RREQ i.e. Route Request message to its neighbours to find the route to destination. This RREQ contains the source identifier, the destination identifier, the source sequence number, the destination sequence number, the broadcast identifier and the time to live field. Nodes that receive RREQ either if they are the destination or if they have a fresh route to the destination, can respond to the RREQ by unicasting a Route Reply (RREP) back to the source node. Once the source node receives a RREP it can begin using the route to send data packets.

The source node rebroadcasts the RREQ if it does not receive a RREP before the timer expires. It attempts discovery up to some maximum number of attempts. If it does not discover a route after this maximum number of attempts, the session is aborted.

A source node may receive multiple RREP messages with different routes but updates its routing entries if and only if the RREP has a greater sequence number, i.e. fresh information. Sequence number of a node helps in determining the latest message from that node. A message with higher sequence number signifies the more accurate information.

As the nodes are mobile, the established route breaks after sometime. A node came to know about link failure when it stops receiving beacons from its neighbor. Then the node sends RERR message to all the nodes that are using this link to send message by incrementing the sequence number of destination. When a node receives RERR message it marks its route to destination as invalid. When source node receives this RERR message, it initiates route discovery again by using destination sequence number as large as incremented sequence number in RERR message with new request ID.

II. RELATED WORK

Vikram Singh Kushwaha et.al. [1] Proposed a new dimension in order to allow early response and rescue of accident victims, saving lives and properties. The system uses the capability of GPS and GSM along with the android phone to provide a solution which can be used to precisely detect the accident spot and to send the emergency notification to the nearby hospitals ICU and to the victim's relatives. The proposed system consists of two units namely, Crash Detector Embedded Unit and Android Control Unit. Crash Detector Embedded Unit is responsible for detecting the accident condition using three-axis accelerometer sensor, position encoder, bumper sensor and one false alarm switch. Bluetooth module (HC-05) is used to send the accident notification to the victims' android phone where an android app will get the GPS location of accident spot and compare it with all the nearby hospitals location in order to calculate the shortest path and send the notification to the nearest hospitals ICU in the form of SMS. R. Rajesh Kumar et.al. [2] Proposed Distance Based Accident Prevention in Intersection Using Vanet .In urban area there will be many intersections of roads without traffic signal. Most of the accidents occur at intersections, because the driver can't see what's come in the other road which is colliding in his moving road. When vehicles move in such area the communication between vehicles is necessary. The process of accident prevention process begins by getting the location of each vehicles, and calculating which vehicle is near to the intersection. After the calculation the vehicles position towards the intersection

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the vehicles will be getting the data or information about the other vehicle's position towards the intersection. When communication has been established between vehicles then the vehicle user can able to know about the arrival of other vehicle at the same time to intersection, so the driver will be alert of the vehicles arrival. Irshad Abbasi et.al. [3] describes traffic flow oriented routing (TFOR) protocol, a routing protocol for VANETs. It includes two major phases: first, it selects the next junction optimally, based on directional as well as the non-directional density, and secondly, it uses two-hop neighbour information for routing between the junctions. Simulation outcomes in urban scenarios show that TFOR minimizes average end-to-end delay and routing overhead by on average 15.3% and 19.5%, respectively, compared to GPSR. It reduces routing overhead up to 17% compared to GSR. TFOR maximizes packet-delivery ratio on an average of 17.5%, 10.7%, and 7.2% compared to GPSR, GSR, and E-GyTAR, respectively. Sherali Zeadally et.al.[4] describes some of the simulators currently available to VANET researchers for VANET simulations and assess their benefits and limitations. In addition to this, this paper reviewed some of the main areas that researchers have focused on in the last few years and these include security, routing, QoS, and broadcasting techniques.

III. PROPOSED SYSTEM

This paper puts forwards the design of traffic collision avoidance system that provides Communication between vehicles by means of wireless technology .The proposed system is implemented using Simulation. The simulation would be implemented using Network Simulator (NS2).

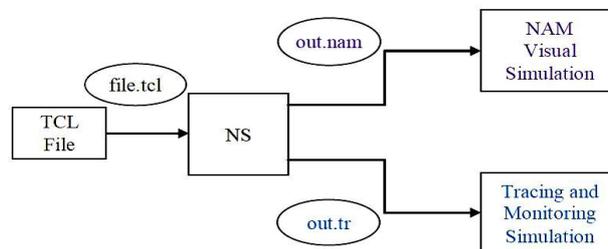


Fig. 1. Flow of running a TCL file in NS-2

Fig.1.shows the working of NS-2 for analysis..NS2 uses Tcl language for creating simulation scenario file. Network topology, transmission time , using protocol etc.. are defined in scenario file. If we execute this scenario file, the simulation result will be output to out.tr and out.nam file.

out.tr: contain all the information about communication. This file is called as trace file.

out.nam: The network animator (NAM) is use to visualize the simulations.

Network simulators are mainly used in ad-hoc networking research and support popular network protocols, offering simulation results for wire and wireless networks. To design wireless network the information about all the components in nodes are required. These components are:

- Link Layer (LL)
- Interface Queue (IfQ)
- The MAC layer
- The PHY layer: The wireless channel that the node transmit and receive signals from

Additionally, we need to define other parameters that are used by mobile nodes like

- The type of antenna.
- The propagation model.
- The type of ad-hoc routing protocol

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IV.FLOW OF OPERATIONS

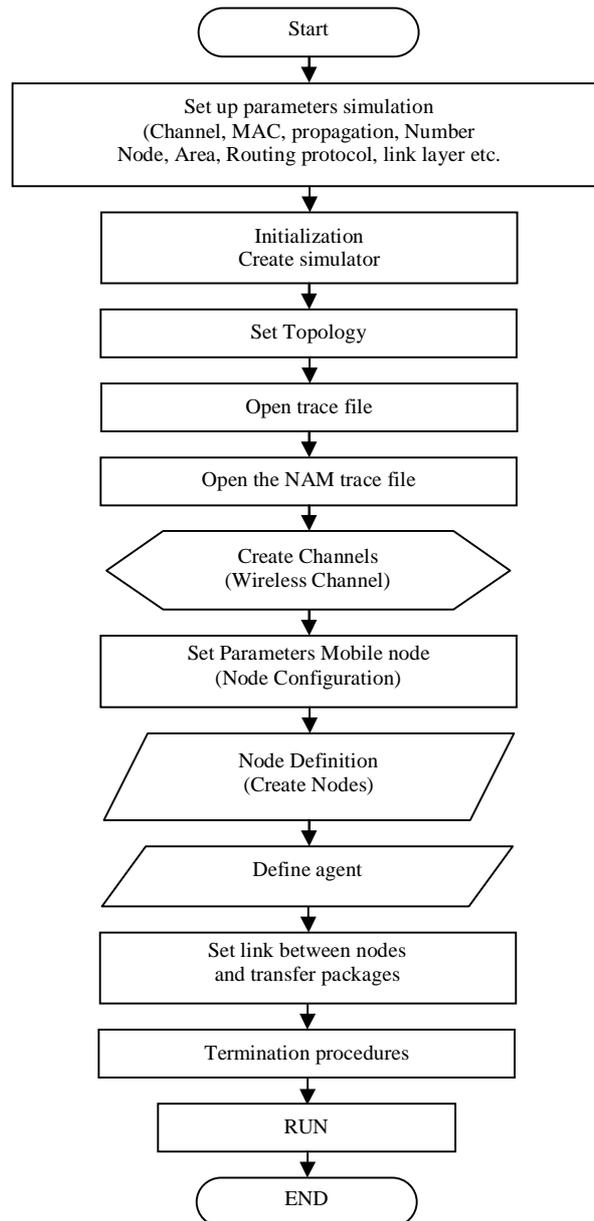


Fig.2. Flow of Operations

Fig.2 shows the detailed flow of operations in creating a wireless scenario. At the beginning of a wireless simulation, we need to define the type for each of the network components. Additionally, we need to define other parameters like the type of antenna, the radio-propagation model, the type of ad-hoc routing protocol used by mobile nodes etc. Next we go to the main part of the program and start by creating an instance of the simulator. Next we create a topology object that keeps track of movements of mobile nodes within the topological boundary. Then setup trace support by opening trace file. We need to configure nodes before we can create them. Node configuration API may consist of defining the type of the type of adhoc routing protocol (AODVSDV), MAC layer (IEEE 802.11), radio propagation

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model (Two- ray ground) etc. After configuring the nodes the next step is to define an agent. We are using TCP Agent for simulation. After defining the agent a TCP connection is set up between two Nodes. The sender Agent is known as TCP Agent while the receiver agent is known as TCPSink Agent. When receiving a packet, TCPSink Agent will reply an acknowledgment packet (ACK). Termination procedures include defining stop time i.e. time when the simulation ends. Finally, after saving file click on the (Run) button in the Nam window.

V.RESULTS

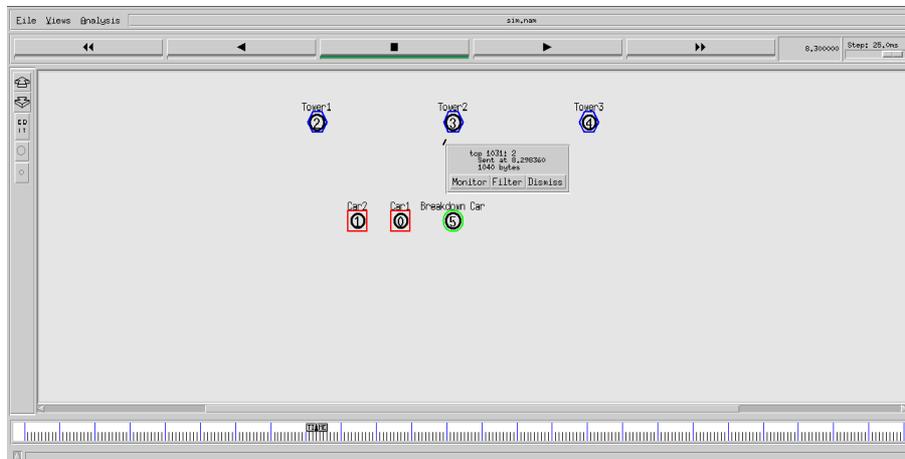


Fig.3. Vehicle-to-Roadside signal detection

Fig.3.Shows Vehicle-to-Roadside communication. The Vehicle-to-Roadside communication configuration represents a single hop broadcast where the roadside unit sends a broadcast message to all equipped vehicles in the vicinity. A TCP connection is setup between the two nodes. Packets are exchanged between the nodes as they come within range of one another.

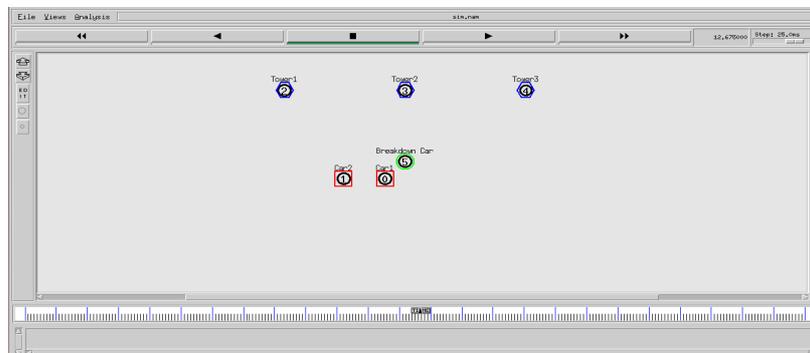


Fig .4.Vehicle-to-Roadside after signal detection

Fig.4. Shows After getting the signal the node (vehicles) change their route.

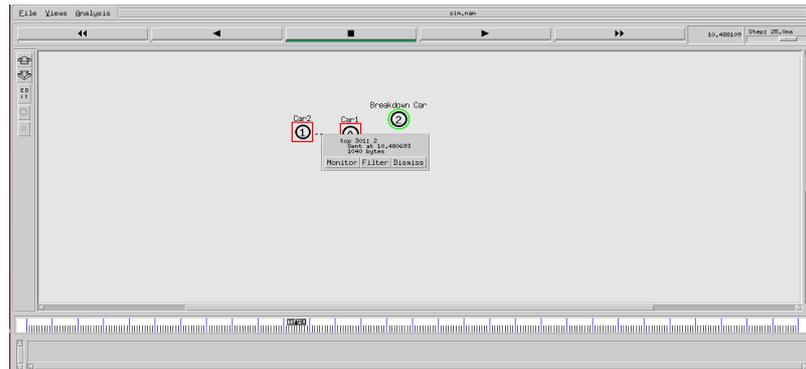


Fig .5. Vehicle-to-Vehicle communication

Fig.5. Shows vehicle-to-vehicle communication. The Vehicle-to-Vehicle communication configuration use to transmit messages from one vehicle to another.

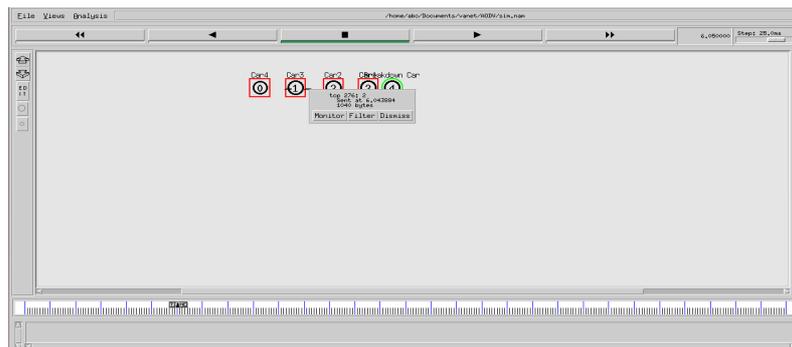


Fig .6. Routing Based Communication

Fig.6. shows Routing Based communication. The routing-based communication configuration is a multi-hop unicast where a message is propagated in a multi-hop fashion until the vehicle carrying the desired data is reached. It is used when the intended recipient is greater than one-hop away.

The protocols are evaluated for throughput, end-to-end delay and packet delivery ratio.

- Throughput: It is defined as amount of data that has been conveyed per unit time from one node to another.
- End to End Delay: This metric gives the overall delay, from packet transmission by the application agent at the source node till packet reception by the application agent at the destination node.
- Packet Delivery Ratio (PDR): It is defined as the ratio of the total data packets received by the destinations to those that are generated by the originator i.e. source.

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Table 1 : Simulation Parameter

Parameter	Value
Simulator	NS-2
Channel Type	Wireless
Protocol studied	AODV, DSDV,
Propagation model	Radio Propagation
MAC protocol	802.11
Queue type	Drop Tail/ Pri Queue
Antenna type	Omni-directional
Simulation area	1000x800
Simulation time	30ms

Simulation parameters use are listed in table 1. The simulation models are built using the Network Simulator tool (NS-2). The channel type is wireless as the communication between two nodes is wireless. Routing in these networks is highly complex due to moving nodes and hence many protocols have been developed. We selected two routing protocols (i.e. DSDV and AODV) for comparison. The propagation models are used to compute the received power. When a packet is received, the propagation model determines the attenuation between transmitter and receiver and computes the received signal strength. The IEEE 802.11 protocol is used for providing connectivity between wireless stations and wired networking infrastructures. A queue object is a general class of object capable of holding and discarding packets as they travel through the simulated topology. The mobile nodes move within an area whose boundary is defined as 1000m X 800m. Simulations are run for 30ms.

The graphs of AODV and DSDV obtained from simulation are as shown below.

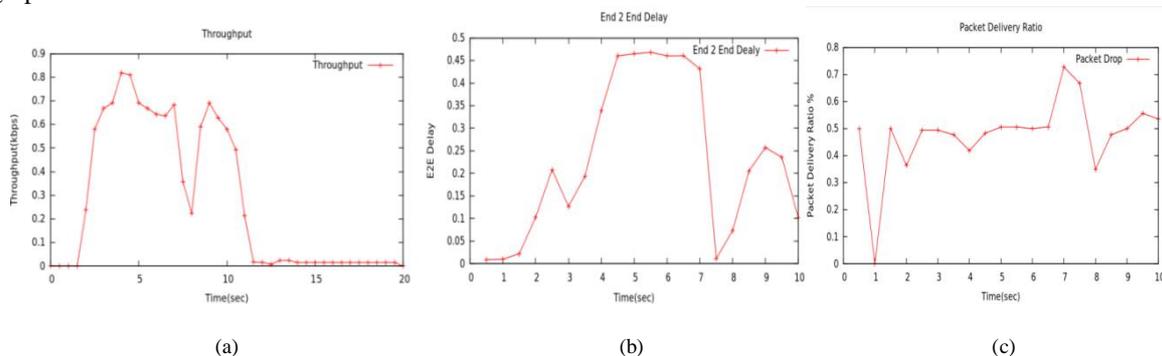


Fig.7. Graphs of AODV for Vehicle-to-Roadside Communication (a) Throughput (b) End-to-End Delay (c) Packet Delivery Ratio

Fig.7. shows the graphs of AODV for vehicle-to-roadside communication. a shows the graph of throughput, b shows the graph of end-to-end delay and c shows the graph of packet delivery ratio. From fig.a the throughput is 0.29 kbps, from fig.b the end-to-end delay is 0.25s and from fig.c the packet delivery ratio is 0.85%.

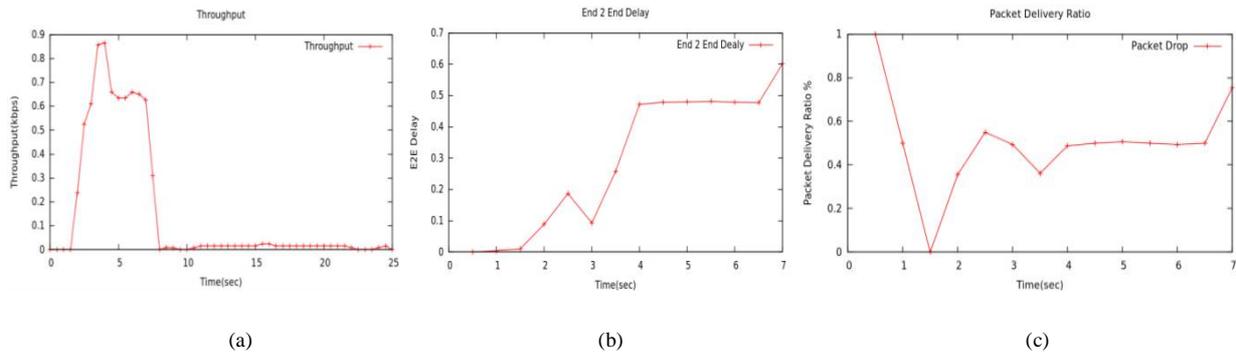


Fig.8. Graphs of DSDV for Vehicle-to-Roadside Communication (a) Throughput (b) End-to-End Delay (c) Packet Delivery Ratio

Fig.8. shows the graphs of DSDV for vehicle-to-roadside communication. a shows the graph of throughput, b shows the graph of end-to-end delay and c shows the graph of packet delivery ratio. From fig.a the throughput is 0.19 kbps, from fig.b the end-to-end delay is 0.27s and from fig.c the packet delivery ratio is 0.74%.

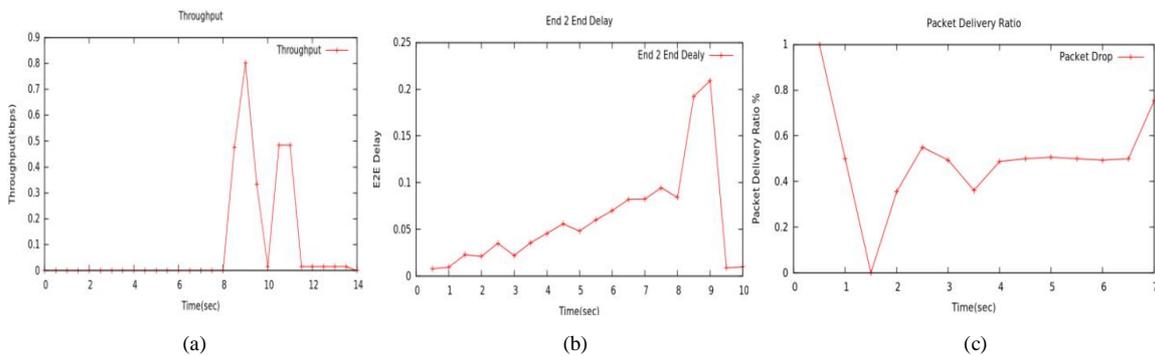


Fig.9. Graphs of AODV for Vehicle-to-Vehicle Communication (a) Throughput (b) End-to-End Delay (c) Packet Delivery Ratio

Fig.9. shows the graphs of AODV for vehicle-to-vehicle communication. a shows the graph of throughput, b shows the graph of end-to-end delay and c shows the graph of packet delivery ratio. From fig. a the throughput is 0.17 kbps, from fig.b the end-to-end delay is 0.05s and from fig.c the packet delivery ratio is 0.46%.

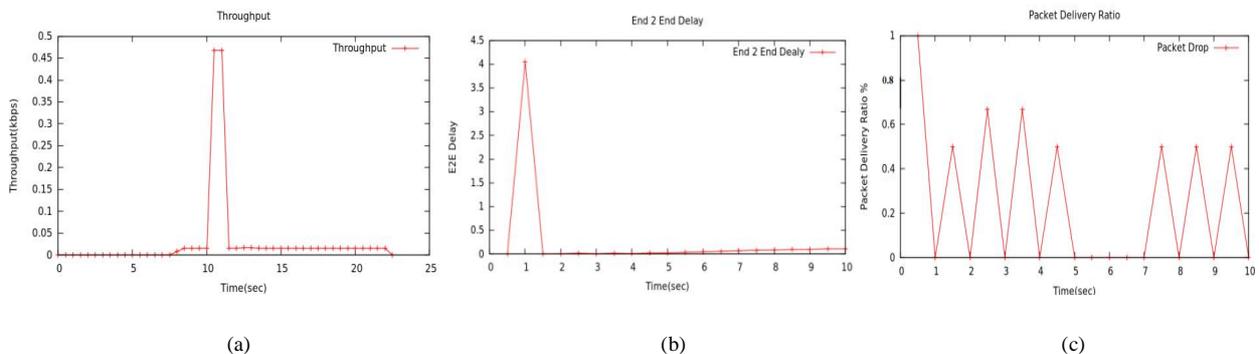


Fig.10. Graphs of DSDV for Vehicle-to-Vehicle Communication (a) Throughput (b) End-to-End Delay (c) Packet Delivery Ratio

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Fig.10. shows the graphs of DSDV for vehicle-to-vehicle communication. a shows the graph of throughput, b shows the graph of end-to-end delay and c shows the graph of packet delivery ratio. From fig.a the throughput is 0.03 kbps, from fig.b the end-to-end delay is 0.28s and from fig.c the packet delivery ratio is 0.28%.

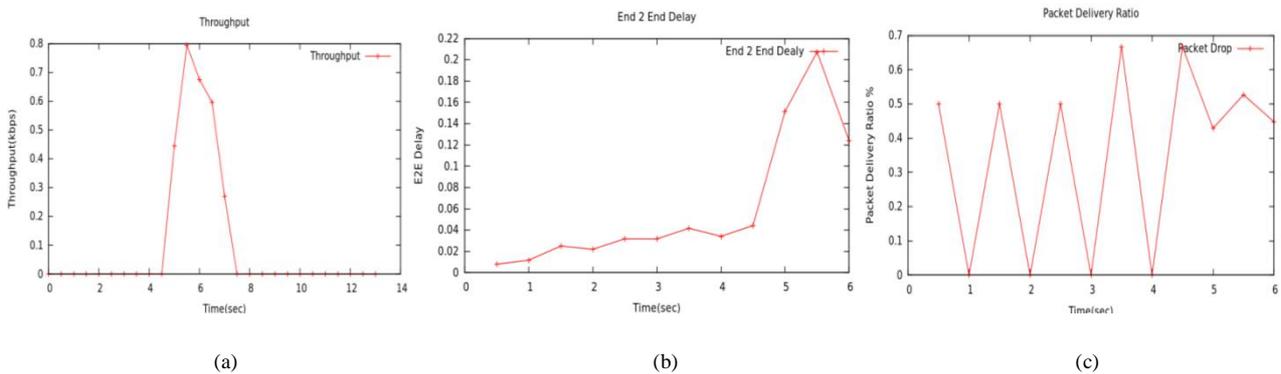


Fig.11. Graphs of AODV for Routing Based Communication (a) Throughput (b) End-to-End Delay (c) Packet Delivery Ratio

Fig.11. shows the graphs of AODV for Routing Based communication. a shows the graph of throughput, b shows the graph of end-to-end delay and c shows the graph of packet delivery ratio. From fig.a the throughput is 0.39 kbps, from fig.b the end-to-end delay is 0.05s and from fig.c the packet delivery ratio is 0.34%.

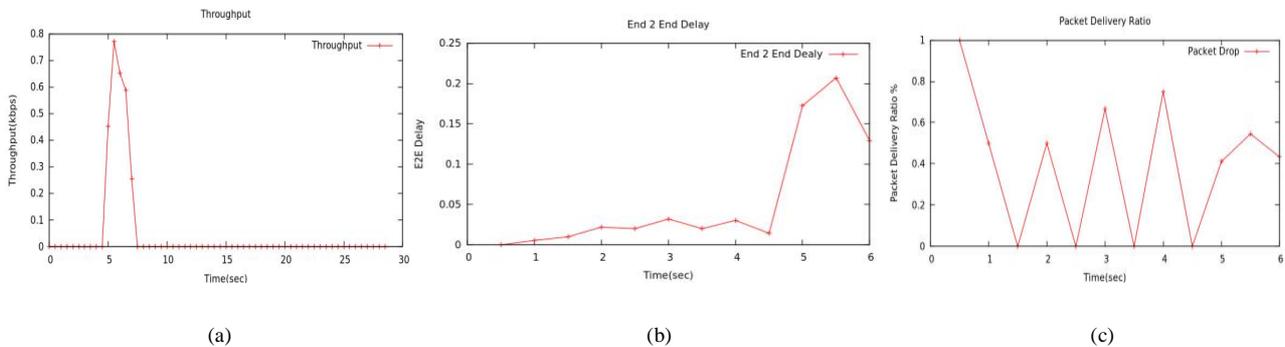


Fig .12 Graphs of DSDV for Routing Based Communication (a) Throughput (b) End-to-End Delay (c) Packet Delivery Ratio

Fig.12. shows the graphs of DSDV for Routing Based communication. a shows the graph of throughput, b shows the graph of end-to-end delay and c shows the graph of packet delivery ratio. From fig.a the throughput is 0.38 kbps, from fig.b the end-to-end delay is 0.04s and from fig.c the packet delivery ratio is 0.39%.

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Table 2. Results

	AODV			DSDV		
	Throughput	End-to-End delay	Packet Delivery ratio	Throughput	End-to-End delay	Packet Delivery ratio
V2R	0.29	0.25	0.85	0.19	0.27	0.74
V2V	0.17	0.05	0.46	0.03	0.28	0.28
Routing Based	0.39	0.05	0.34	0.38	0.04	0.39

The above table shows the performance of AODV and DSDV protocols in three scenarios. As each protocol has its own merits and demerits, none of them can be claimed as absolutely better than other. To evaluate the performance of protocols we use three performance metrics throughput, end-to-end delay and packet delivery ratio. Finally after comparing the two routing protocols in three scenarios we have reached to a average conclusion that throughput is high in AODV compared with DSDV, end to end delay is low in AODV compared with DSDV, packet delivery ratio is high in AODV compared with DSDV.

VI.CONCLUSION

Accidents are being major problem in roadways in both urban and rural areas. Accident leads to loss of human life, injury to human, traffic congestion, and may also leads to other accidents there is a necessity to find a way to reduce or prevent these accidents.

This system provides a solution in order to reduce accidents, minimize the traffic jam and to reduce fuel consumption. We have analysed the performance of AODV and DSDV routing protocols. In DSDV, throughput is low whereas In AODV, throughput is high. While comparing two protocols, we also focus on two performance measurements such as End-to-End delay, Packet Delivery ratio. End-to-End delay is low, Packet delivery ratio is high in case of AODV as compared to DSDV.

We have analysed the different communication i.e. in the presence and absence of RSU. Since it is not possible to use RSU throughout the road and hence in such a case when RSU is not present Vehicle-to-Vehicle communication is useful.

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