Webology (ISSN: 1735-188X)
Volume 18, Number 3, 2021

Quality Of Service Optimization in Vehicular Ad-Hoc Network

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ABSTRACT

Vehicular Ad-hoc Networks (VANETs) refers a network which creates in an Ad-hoc manner, between different moving vehicles and other connecting devices which come in contact over a wireless medium for the exchange of useful information with each other. The On Base Unit (OBU) connected to Road Side Unit (RSU) is also configured in cars. The sensor collect information and share it with drivers. VANETs Quality of Service (QoS) is the ability of a network to provide improved service to selected network traffic over various underlying technologies. It offers flexibility, scalability, efficiency, adaptability, software reusability, and maintainability. In particular way, QoS features provide improved and most predictable network service by supporting dedicated bandwidth, improving loss characteristics, avoiding and managing network congestion. QoS is affected by various mobility factors such as dynamic changes in distances, communication links, and density of vehicle. VANETs use pre-defined static Transmission Power, Packet Reception Power Threshold and Ready to Send (RTS) which causes degradation in QoS. In this research, dynamically created different transmission parameters i.e., Transmission power, Packet Reception Power threshold and ready to send were used to find Average throughput, average End-to-End delay and Average Packet loss to check QoS in VANETs.

Keywords: VANETs, QoS, SUMO, NS-2, RTS, Transmission Power and Packet Reception Power Threshold.

I. INTRODUCTION

Methods of mobile communication have transformed the automotive industry by providing communication ubiquities connectivity among different devices. This ease of communication agrees to the discussion of valued facts among the means of transportation. The continuous transferring of information on a real time basis has turned out to become a new model in the manufacturing. Vehicular Ad-hoc Networks (VANETs) is one of the improvement sin communication technology that releases new prospects to lead the use of safety applications. VANETs refers to a system that creates in an Ad-hoc method different moving means of transportation and other linking devices. These linking devices come in interaction through a wireless medium for the conversation of convenient information with each other. In this way, communication is built among the nodes to increase the way to join or leave the set-up. New types of vans coming in market, are now fitted out with OBU (on board unit) to join and combine the network easily. This increases the assistance of VANETs. VANETs is a unique kind of Mobile Ad-hoc Networks (MANETs) in which packets are swapped between mobile nodes, (Any Sources) travelling on controlled paths. It also provides an opportunity for inter-vehicle communication and runs communication among vehicles to vehicles and vehicles to Road Side Units (RSUs). This type of network consists of sensors and OBU, which are connected to road side unit and also configured in cars. The sensor collects information and shares it with driver, the information then can be transmitted to road side unit that depends on how the data is important. The road side unit plays a major role in the broadcast of data among means of transportation which makes it smart and helps to escape disaster (Dalal et al., 2012).

VANETs develops the nodes which forward messages and packets from one node to another. In VANETs, most nodes are always moving and this mobility of nodes changes the topology regularly. VANETs comes in the category of wireless network area. VANETs uses Radio waves or Electromagnetic waves as a medium to exchange messages between vehicles. The key goal of VANETs is the vehicle as well as passenger safety; it also provides relief to road users (Setiabudiet al., 2016).

The advances in mobile transportations and the up-to-date changes in Ad-hoc networks lead to different placement designs for vehicular system in highways, urban and rural environments. This supports various applications with different Quality of Service (QoS) desires.

1.1 Quality of Service in VANETs

Quality of Service (QoS) is the ability of a network to afford improved service to select network traffic over various technologies. It offers elasticity, scalability, efficiency, flexibility, reusability of software, and maintenance. VANETs Qo Soffersa set of service supplies that need to the network while carrying a packet stream from a source to destination. It is the measurement to satisfy service of present to the end-user. QoS provisioning often needs cooperation between host and network, resource arrangement, call admission control and priority scheduling of packets. In particular, QoS types provide improved more probable network service by supporting devoted bandwidth, improving loss appearances, avoiding and managing network jamming, network traffic shaping, and setting traffic significances across the network. QoS gives the administrator a control over network resources. It allows to manage the network from a business perspective, rather than a technical. QoS also ensures that time-sensitivity and mission-critical applications have the resources as required while allowing new application's access to the network. QoS also reduce cost for the need of expansion and up gradation. QoS also provides improve users experience in the network.

Routing is a mechanism that allows the nodes of a vehicular network to communicate constantly and provide information of the best routes. Quality of Service (QoS)is the challenging point to achieve in VANETs. QoS is affected by various mobility factors; such as dynamic changes in distances, communication links, and density of vehicle and sometime disconnection of network. VANETs use pre-defined static Transmission Power, Packet Reception Power Threshold and Ready to Send (RTS) which cause degradation in QoS. There is a need of research activity which can address to find out and use the suitable dynamic values of Transmission Power, Packet Reception Power Threshold and Ready to Send (RTS) with respect to changing distance between vehicles in VANETs. This study focusses on improvising the QoS in VANETs in vehicular ad-hoc routing protocols for city scenarios in VANETs.

II.RELATED WORK

VANETs is a sub form of MANET, VANETs gives many types of services i.e. Safety of road, alarming about road condition and excess to destination gets easy. In VANETs, the communication is prepared through electromagnetic wave. Thus it is a completely self-controlled and organized network. To achieve such type of services, VANETs faces some challenges and requires efficient routing protocol. His study presents a complete overview of the routing protocol in VANETs. Post-analysis of the protocol reveals that no requirement of maintenance of the route from sender to receiver, makes position based protocol greater in performance as compared to other protocols. Position based routing has good utilization, low delay and has the capability to decrease chances of accidents (Patil et al., 2015).

VANETs is the emerging area which provides communication with the help of wireless. VANETs is totally different from traditional ad-hoc network. It is totally self-dependent changing behaviour. VANETs communication has three types: V2V which means vehicular to vehicular communication, V2I which means vehicle to infrastructure and the third category which contains vehicular to vehicular and vehicular to infrastructure both. In VANETs, the mobility is very high and very rapid changes occur due to the high speed of scenario changes. End- to -End delay and packet delivery ratio are the issues in this network. Such issues need to be resolved on the basis of better and efficient network protocol. VANETs is a good quality network. Secondly, it is costless and can be installed everywhere in the world. VANETs big failure is that the security institutions don’t trust it (Qureshi et al., 2015).

VANETs is a new technology with an objective of providing security to the vehicles. The contribution is presented in the features of VANETs and the protocol work packet route in dense scenario. VANETs consists of two types of communications: One is vehicle to vehicle V2V means communication between two vehicles and the other is vehicle to infrastructure V2I means communication between vehicle and infrastructure. VANETs has many advantages; like road safety, road jam alertness and internet facility through infrastructure. But the major problem in VANETs is of security. High speed, mobility and the fast topology changes are the causes which give birth to security issue. VANETs goes through the same issue till date and no one has resolved. No protocol has been designed yet to solve such serious problem. Such protocols are the need of time which give better performance and control on overhead and packet delay (Arora and Monga, 2016).

Different position- based routing protocols, and topology- based routing were recently introduced an advanced routing protocol that is more user’s friendly and efficient for VANETs environment. According to the reviews, they analyze the features of several routing protocols in VANETs like AODV, DSR, and TORA used several performance metrics like Scalability, packet delivery ratio and delay (Nair, 2016). A lot of new excited applications; like safety and facilitating drivers with different benefits. But security is the main issue of VANETs. Security does not enable this network to prove itself accurately. For instance, threat and security to VANETs network. The vehicular ad-hoc network is the basic need of this modern world, but it has not been fully deployed in any country. It looks ideal for under-developed countries. Security is the main concern of VANETs. It means that till now no security protocols exist that cover all the security challenges in VANETs (Saini, 2016).

There exist many similarities and dissimilarities in mobile ad-hoc and vehicular ad-hoc network. VANETs scenario always deal with chosen, correct path between packets from source to destination. In VANETs, the vehicle moves from one place to another very quickly that is, the topology of VANETs changes regularly. Then it is very difficult to find the node and control data packet wastage. It means that finding out a technical routing protocol is very difficult to identify the VANETs use wireless on basis of vehicle to vehicle (V2V) and vehicle to infrastructure (V2I). The V2V is the communication between the two vehicles and the V2I is the communication between vehicles to infrastructure (Sivakumar, 2016). Quality of Services in VANETs are very serious in nature as end users can be affected due to low grade data sending and receiving. Network efficiency also depends upon routing protocol. So, it is necessary to change network performance, Quality of Services and the behavior of the routing protocol. According to review, various routing protocols like (AODV, LAR, OLSR) are analyzed to achieve the Quality of Services over VANETs (Waraich and Batra, 2016).

Vehicular ad hoc networks (VANETs) have gained great attention by the researcher by last few years. The routing and Quality of service is the major area of great interest in VANETs. In the field of VANETs the mobility is challenge is a big challenge for achieving. Because here the topology are changing very quickly and it is very difficult for find protocol for this type of situation. Great efforts have been made to increase the good routing protocols capabilities in presence (Lugayizi et al., 2016).

QoS will get improved if we have maximum throughput, less delay and low Packet loss. In VANETs, the mobility is very high and very rapid changes occur due to the high speed of scenario changes. End- to- End delay and Packet Delivery ratio are issues in this network. Such issue needs to be handled through better and efficient network protocol. VANETs is a good quality network, is costless and can be installed everywhere in the world (Mchergui et al., 2017). Keeping the integrity and availability of data in video streaming is the attractive services, offered by VANETs. To check the above application, he used GPSR and DSR protocol and also took performance metrics, Average delay, packet sent and receive. His study clearly showed that GPSR gave greater performance as compared to DSR in a video streaming application (Zaimi et al., 2017). Traffic congestions and road accident is a big problem in urban areas it lead to loss lot of life and harms. Here for that type of issue to solve this type of problem proposing an algorithm for right route management. The Path planning is based on multi-constrained QoS routing in VANETs. This is implemented for alternate path provide in urban areas to remove the road congestion. An algorithm is required which will guarante reliable routing to satisfying multiple users in the road. This type of algorithms at a result give a minimize delay and increase in delivery ratio (Shaikh and Ahmad, 2017).

Vehicular Ad hoc Networks (VANETs) very difficult to achieve good QoS because of high speed of mobility. The difficulty of routing protocols by such factors which is traffic load, high density in the road at a result the topology change on regular base. The researcher used the enhancement of routing protocol technique to improve the QoS in VANETs. Therefore, Quality of Service (QoS) is strongly needed to improve and enhance routing performance and also improve the overall network performance. In short, different routing protocols are utilized to evaluate the performance of routing protocol in VANETs whether it is highway, city, freeway or any other scenario by different researchers. Different Routing protocols are used to calculate the performance of these Routing Protocols. Already various authors have used different routing protocols like ZRP, DSR, TORA, OLSR and FSR in comparison with reference of performance of VANETs. The different researcher fined the best QoS for these different Routing protocols (Al-Kharasani et al.,2018). In VANETs maintain the QoS is very different task because here the vehicles have a very high mobility. Vehicle change their position very quickly. In this research, focus is on different transmission parameter which is transmission power, Packet reception power threshold and ready to send find on based of QoS which is average packet loss, average end to end delay and average throughput.

III. QoS Optimization in VANETs

In this thesis here different transmission parameters are used which is transmission power, Packet Reception power threshold and ready to send. These parameters are used to find out best QoS in VANETs. The pseudo code 3.4 diagram shows the way how to handle this research and find the best results. In the transmission parameters first find out the transmission power and set different values are set in the trace file and at the end select those values which have high QoS with respect to distances. In the second step find out the Packet reception power threshold here different values are set and select those values which have good QoS. If the results are not good then change the values in packet reception power threshold and select the good once. In the RTS/CTS are basically use for avoidance collision. In RTS/CTS first set sending side RTS/CTS and after that set the receiving side RTS/CTS for avoid collision in traffic. After that select those RTS/CTS values which have high throughput, less end-to-end delay and less packet loss.

The SUMO and NS2 simulators are used, consisting of a number of the scenarios to check the performance of AODV and DSDV Routing Protocol. In SUMO, the real-world scenarios are used to show the real traffic road mobility. In this thesis, SUMO-0.9.8 is used to generate mobility, the mobility images and then import these images in the SUMO.

NS2 is used for simulation purpose. The two Routing Protocols AODV and DSDV are checked with respect to QoS. This research article focused to find out different transmission Parameters which dynamically define the transmission Power, Packet Reception Power with respect to different distances. The configuration of simulation parameters are mentioned in Tale 3.1

Table 3.1: Parameters Configurations for Simulation

Parameters	Description
Simulators	NS 2 (Network simulator) and SUMO (simulation urban mobility)
Technology used	IEEE 802.11b (2.4 GHz)
Simulation time	20 Minutes
Packet size	1024 bytes
Number of nodes	48 nodes
Node speed	7 m/s (25 km/h)
Protocol used	AODV,DSDV
Performance Metrics	Average end to end delay, Average packet Loss, Average Throughput.
Transmission Parameters	Transmission power, Packet Reception power Threshold, Ready to send.

IV. RESULTS AND DISCUSSIONS

In this chapter different scenarios have been done to analyse the QoS in VANETs using the NS-2 simulator. The results and graphs for analysing the QoS in VANETs with respect to different distances discussed are as under:

4.1 Transmission Parameters

The transmission Parameters contain Transmission Power, Packet Reception Power Threshold and Ready to send, which are checked on the basis of following three performance parameters i.e., Average Throughput, Average End-to-End Delay and Average Packet Loss to check QoS in VANETs with respect to different distances.

4.1.1 Transmission Power

Transmission power means how much power is required for a packet to send from one place to another place. Transmission Power provides reliability and efficiency in the network environment. It is also less expensive for the ad-hoc network. In this research, different transmission power has been identified with respect to different distance to improve the QoS in VANETs.

$$\mathrm{Pt} = \mathrm{PtInit} * \frac{\mathrm{RemEng}}{\mathrm{InitEng}} \quad (4.1)$$

The transmission power can be calculated with the help of formula 4.1.Where Pt is the transmission power and Pt Init is the first transmission power, Rem Eng is the left over energy of the node, and Init Eng is the first energy of the node.

Figure 4.1 shows transmission power best throughput for 100 meters to 1000 meters. The graph consists of ideal throughput which means transmission power best throughput. The other is two routing Protocols which is AODV and DSDV Routing Protocols throughput.

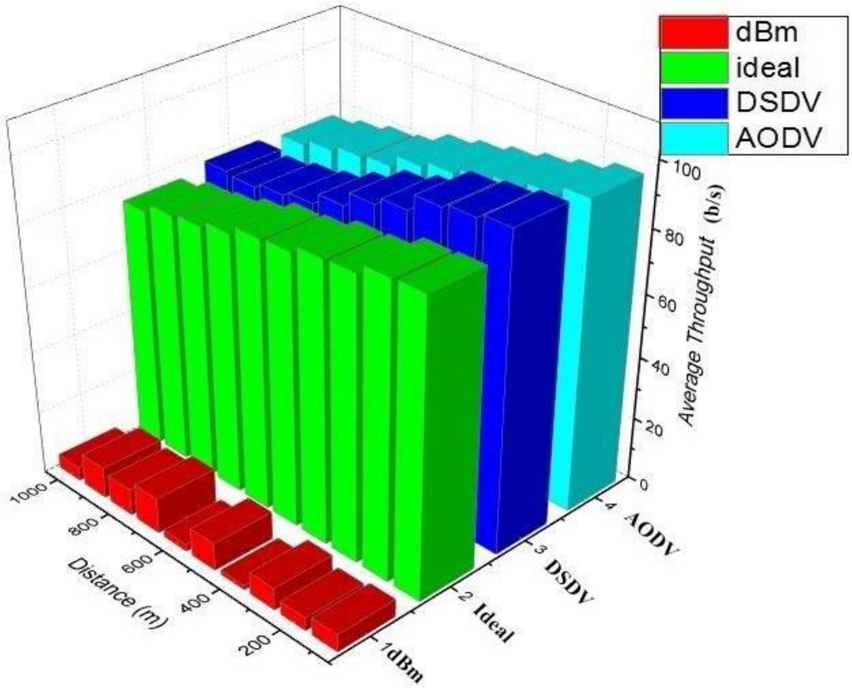

Figure 4.1: Performance of Transmission Power Best Case Average Throughput

Results demonstrate that DSDV throughput gives better results. These are the best values of transmission power which shows in the diagram. In the Routing Protocols, DSDV gives better throughput than the AODV Routing Protocol. The reason is that DSDV Routing protocol gives the best results in a small number of nodes network. While on the other hand, AODV Routing Protocol uses large number of bandwidths.
y node sends and responds to the messages.

Figure 4.2 shows transmission power best average end-to-end delay for 100 meters to 1000 meters. The graph shows an idea lend- to end- delay which means transmission power and best average end-to-end delay. Other is two Routing Protocols; which is AODV and DSDV Routing Protocols throughput. Results show that AODV Routing Protocol has higher end-to-end delay as compared to ideal and DSDV Routing Protocols. The basic reason is that AODV Routing Protocol takes more time to construct the routing table in VANETs. Results also reflect that DSDV Routing Protocol has less end- to-delay. Secondly, no latency exists in the discovery of routes.

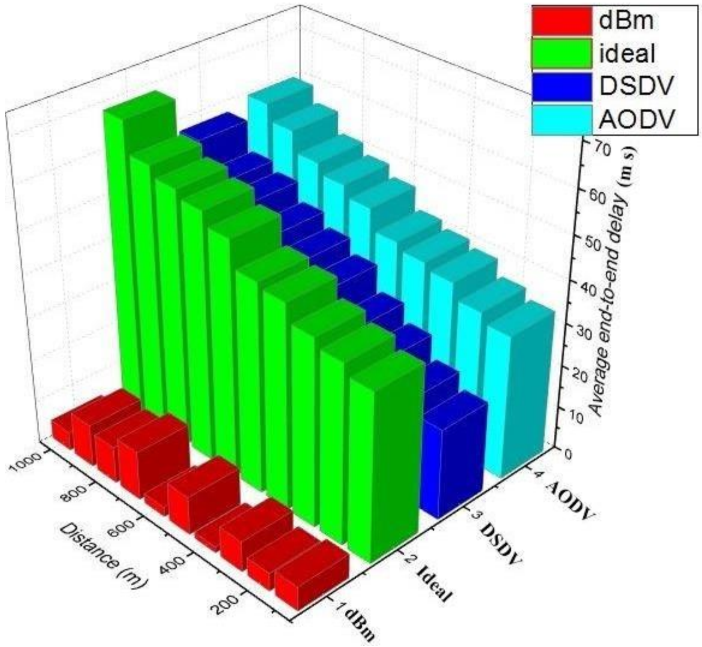

Figure 4.2: Transmission Power Best Case Average End-To-End Delay

Figure 4.3 shows the transmission power best average Packet loss for 100 meters to 1000 meters.

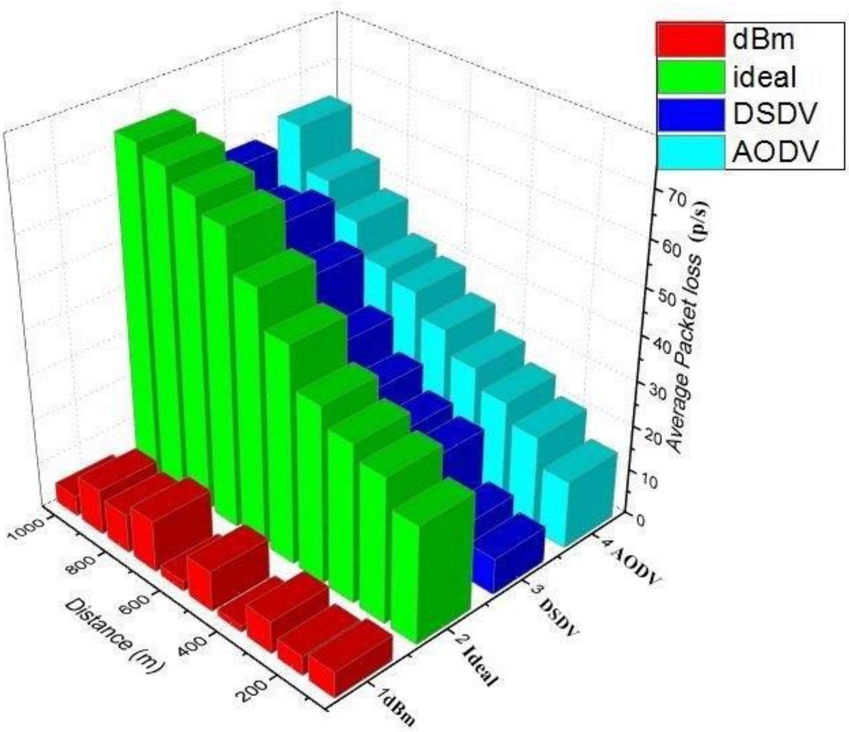

Figure 4.3: Transmission Power Best Case Average Packet Loss

The graph shows different transmission power and ideal scenarios, AODV, DSDV Routing Protocols average packet loss. Results assert that ideal scenario has higher packet loss than AODV and DSDV Routing Protocols. But with the increase in distance from 700 meters to 1000 meters, AODV average packet loss decreases than other two scenarios. The reason is that they AODV Routing Protocol reduce broadcast in network.

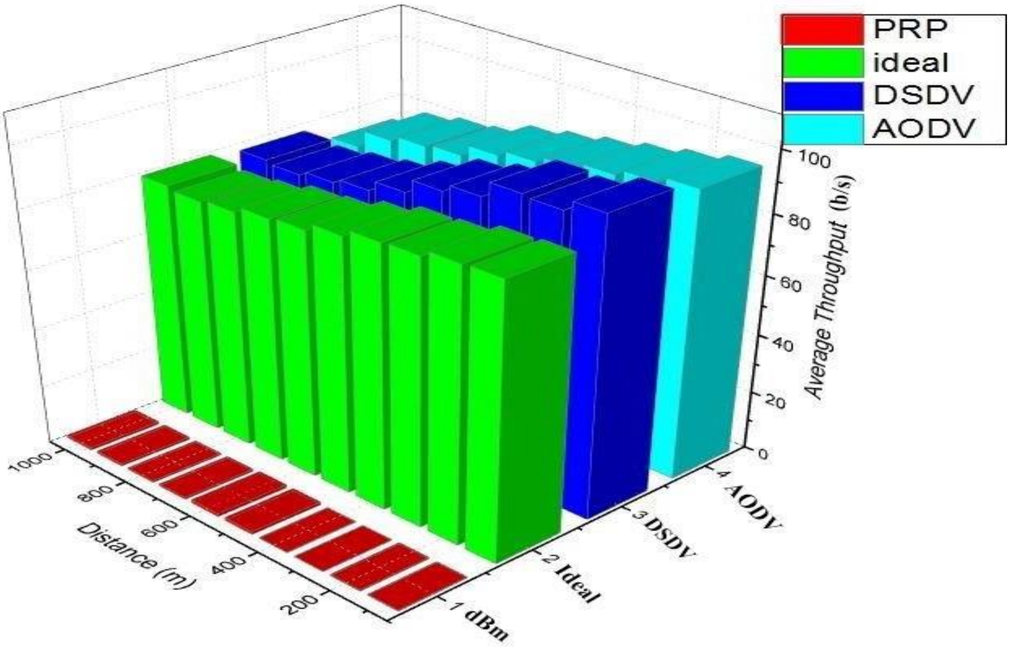

Figure 4.4: Packet Reception Power Best Case Average Throughput

4.1.2 Packet Reception Power Threshold

Packet Reception power Threshold is the power, required to receive a packet from source to destination. The packets whose reception powers are less than the threshold will not be sensible by the Mac. Such packet may still cause interference noise at the receiver. In this research, different packet reception power threshold have been figured out with respect to different distance, which improve the QoS in VANETs. The researcher finds out different packet reception power best and worst values to show those values which have high QoS.

Figure 4.4 shows packet reception power best average throughput for 100 meters to 1000 meters. The graph shows an ideal scenario throughput which means packet reception power best average throughput. Other is two routing Protocols; AODV and DSDV Routing Protocols throughput.

Results conclude that, in Packet reception power the DSDV Routing Protocol gives the best average throughput than ideal scenario and AODV Routing Protocol. The reason is that in DSDV, mobility factor does not disturb the packet delivery. It provides multiple paths for a packet from a source to destination.

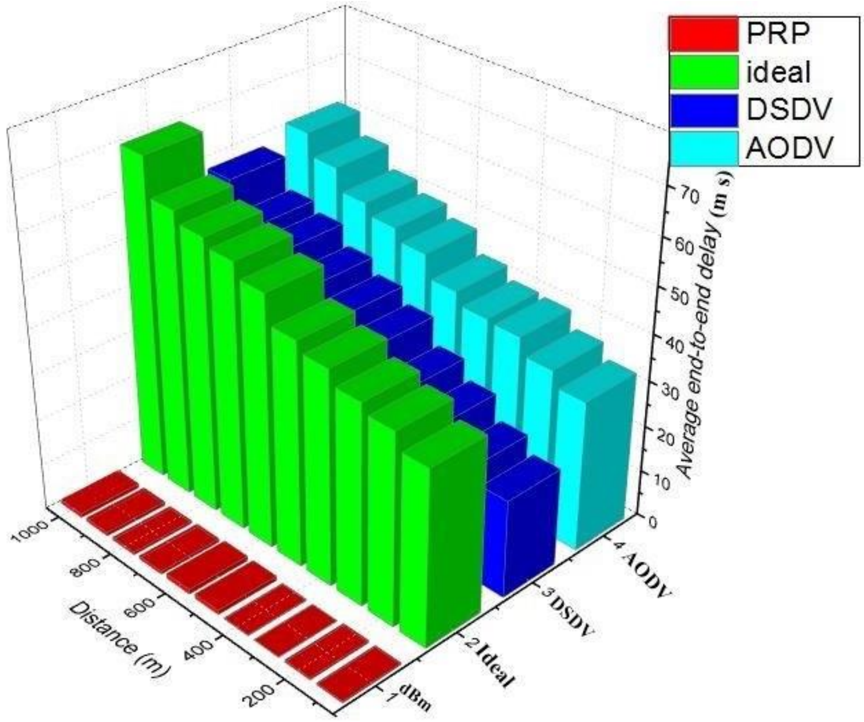

Figure 4.5: Performance Of Packet Reception Power Best Case Average End-To-End Delay

The DSDV has lesser average end-to-end delay than ideal scenario when compared with reference to different distances as shown in figure 4.5. The major reason is that DSDV Routing Protocol does not require latency in a route discovery in a network. Figure 4.6 shows Packet Reception Power best average Packet loss for 100 meters to 1000 meters.

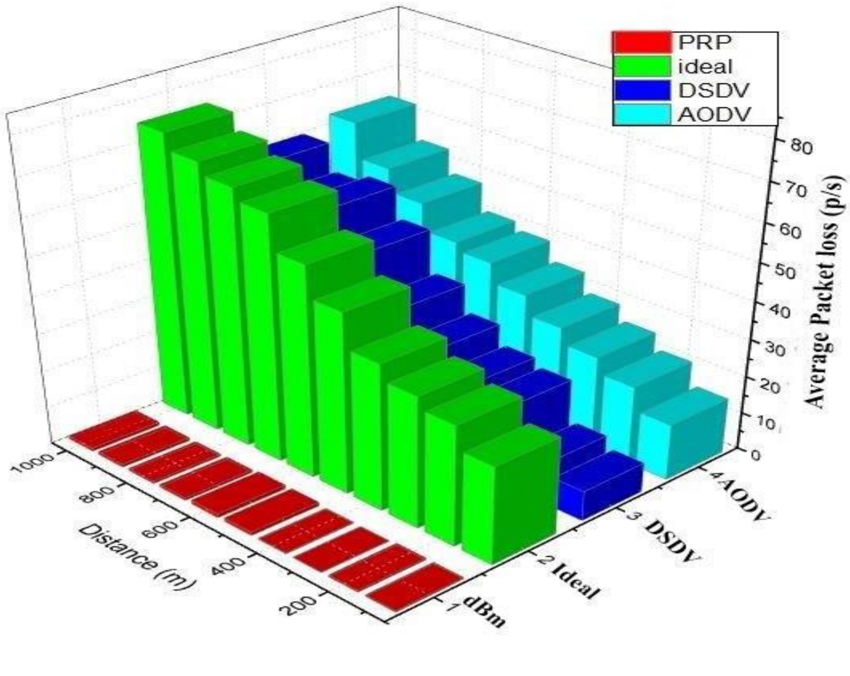

Figure 4.6: Performance of Packet Reception Power Best Case Average Packet Loss

Results demonstrate that the Packet reception power of DSDV Routing Protocol gives better results as compared to ideal scenario and AODV Routing Protocol with respect to different distance in VANETs. Results shows that when the distance increase the Average packet loss also increases. In DSDV Routing Protocol, provides an alternative path for packet from source to destination. This is not possible in AODV Routing Protocol.

4.1.3 Ready to Send

RTS/CTS is a technique to avoid collision. The RTS/CTS is ready to send and clear to send it is basically a collision avoidance technique and it is used where large number of vehicles don't transmit the data. This technique is basically use for avoid the hide problem in the network. In RTS/CTS technique first the request send from sender side to receiver side to check the collision. When they reach to receiver side with the help of acknowledgement back reply to sender. The RTS/CTS is infrastructure base network and the RTS/CTS range is 0-2347.

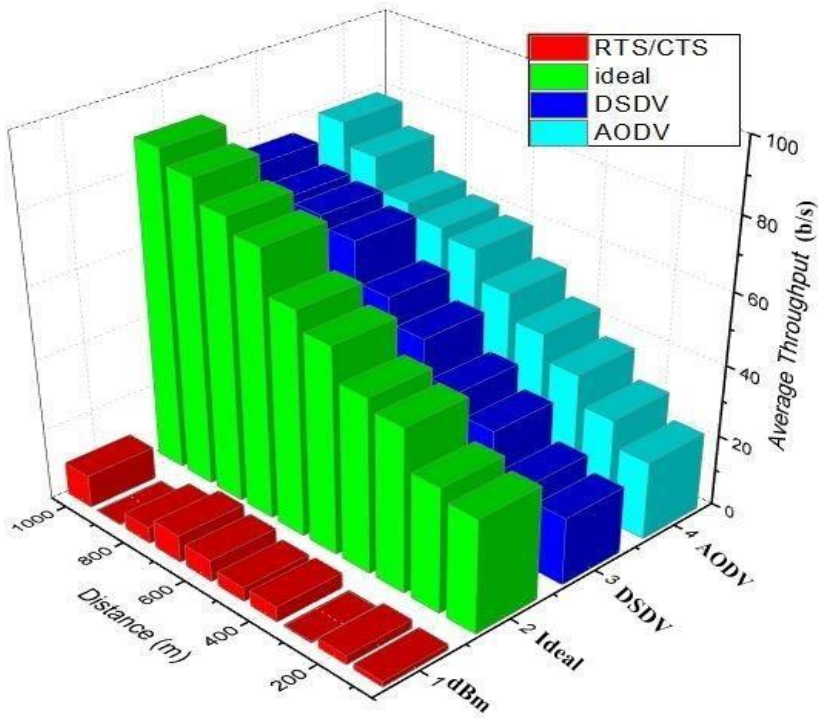

Figure 4.7: Performance of RTS/CTS Best Case Average Throughput

Figure 4.7 shows the RTS/CTS best average throughput for 100 meters to 1000 meters. The graph shows an ideal throughput which means packet reception power best average throughput and two routing Protocols: AODV and DSDV Routing Protocols throughput.

Results explore that DSDV Routing Protocol gives better average throughput than ideal scenario and AODV Routing Protocol with respect to different distances in VANETs. AODV Routing Protocol takes more time to create routing tables, which affects the performance. While on other hand, DSDV Routing Protocol possess a proper hierarchy structure.

Figure 4.8 shows the RTS/CTS best average end-to-end delay for 100 meters to 1000 meters. Results conclude that DSDV Routing Protocol gives lesser average packet loss as compared to two other scenarios ideal and AODV Routing Protocol. The reason is that in DSDV, Routing Protocol provides multiple paths from source to destination. Similarly, it gives better results when the number of nodes is less in a network. The results also shows that when the distance is increases the average end-to-end delay increases.

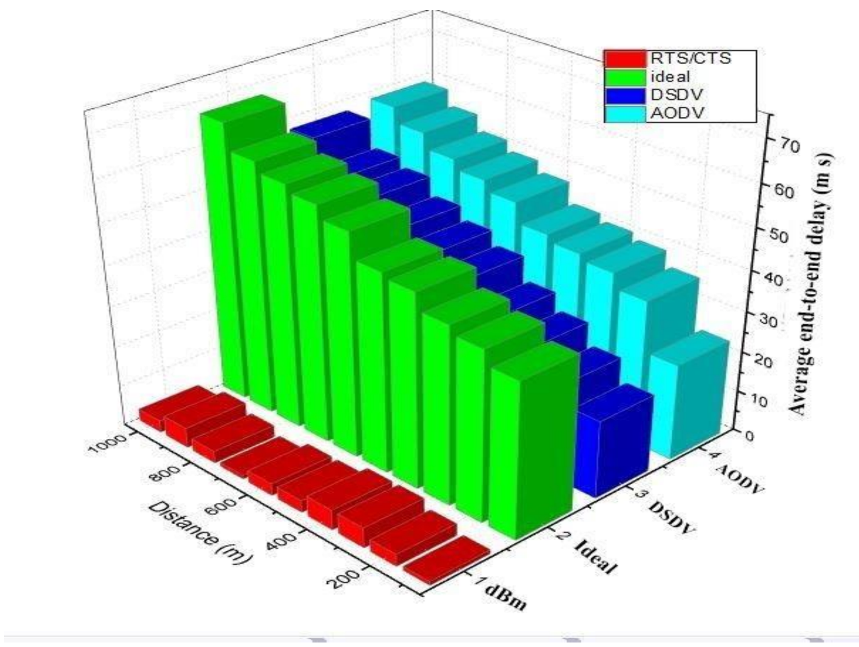

Figure 4.8: Performance of RTS/CTS Best Case Average End-To-End Delay

Results assert that after the ideal packet loss, DSDV Routing Protocol gives better results as compared to ideal scenario and AODV Routing Protocols as shown in figure 4.9. The reason is that in DSDV Routing Protocol, less delay is involved in the process of setting up a route. While AODV Routing Protocol delay is very high that time.

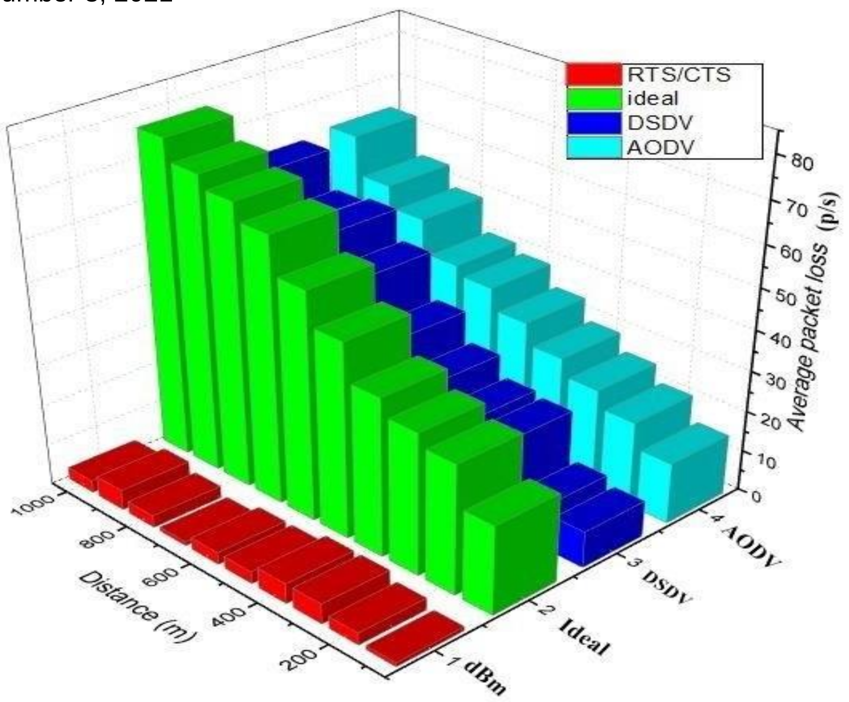

Figure 4.9: Performance of RTS/CTS Best Case Average Packet Loss

V. CONCLUSION AND FUTURE WORK

In VANETs, Routing Protocol has a vital role important role to send and receive message between moving vehicles. The VANETs big issue is mobility. The major reason is that in vehicular ad-hoc networks, vehicles change distance very rapidly. This mobility issue in turn has bad impact on QoS in VANETs. To solve this mobility issue, a lot of work is required. Before this work, researchers focused on different static transmission parameter, but VANETs dynamically defines transmission parameter with respect to different distances. This research has taken AODV and DSDV Routing protocol; which has three parameters and each parameter has specific range of values. The main purpose of this research is to find out suitable transmission parameters; like Transmission Power, Packet Reception Power Threshold and Ready to Send. This enhances QoS for the best and worst results in VANETs. The two Routing Protocols: AODV and DSDV Routing Protocols with parameters; Average Throughput, Average Packet Loss, Average End-to-End delay. Result concludes that which transmission parameter is best for suitable distance. The simulation tool used is: Network Simulator-2 and SUMO. Therefore in future work, one will be able to compose the use of some other protocol to check the performance on the basis of QoS with respect to these transmission parameters.

This research works to analyse QoS in VANETS with respect to different Parameters; like Transmission Power, Packet Reception Power and Ready to Send. This research finds out the best and worst values of Transmission Power, packet reception power threshold, and ready to send and find for different distance from 100 meters to 1000 meters. The best and worst values are decided on basis of QoS, Quality of service. This means that the transmission parameters have high throughput and less Packet Loss and End-to-End delay. This research also enhances two Routing Protocols AODV and DSDV Routing Protocols on the basis of these worst and best values of transmission parameters. Consequently, this research also finds out that DSDV Routing Protocol gives better QoS as compared to AODV Routing Protocol. Similarly, when Range increases from 100 meters to 1000 meters, average throughput decreases, Average Packet Loss, and Average End- to- End delay increase. This reveals that when distance increases, Throughput decreases which causes End-to-End delay and Packet Loss and other mobility issues in VANETs.

This research study analyses QoS in VANETS with respect to different transmission Parameters; like transmission power, packet reception power and ready to send. This research finds out the best and worst values of Transmission Power, Packet Reception Power Threshold, and Ready to send for different distances ranging from 100-1000 meters. This study focusses on analysis of performances of two Routing Protocols on the basis of worst and best values of transmission parameters. Results show that DSDV Routing Protocol gives better performance on basis of QoS. The Routing Protocols is checked on the basis of Average Throughput, Average Packet Loss and Average End-to-End delay. The simulation tool uses Network Simulator-2 and SUMO. In future work, one will be able to compose the use of some other protocol to check the performance on the basis of QoS with respect to these transmission parameters.

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