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Design and Developments of AODV & TAODV Routing Protocols for VANETs

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ABSTRACT

Ad_hoc Vehicle Networks (VANETs) are self-convening networks that are formed between shifting vehicles equipped with wireless transmission devices. This type of network develops within the framework of intelligent transit systems to achieve a significant refinement in the overall performance of the transportation system.

As the foundation regarding that network will increase implementation, challenges have to be taken into account. These challenges are broadcasting, routing, precedence scheduling, safety then privacy. In this research, orientation is viewed as a research factor. Several routing protocols have been introduced and evaluated to restructure the efficiency of VANET. Follow-up research about VANETs has established that the Ad_hoc on-demand distance vector (AODV) has the very best efficiency in structure-based protocols.

The research analyzes and evaluates the performance of AODV under specific node densities. Different sets of node densities are used to compare the overall performance of the mentioned protocol. Then the obtained simulation outcomes are compared among graphic shapes below specific parameters such as delay rate, on the one hand, packet size, packet loss, etc. on the other.

The proposed research suggested the most useful path using the cloned routing protocol via customizing interpretation, simulation, data visualization, and results then comparative evaluation into the current AODV routing protocol and the TAODV cloned routing protocol. The objective of this research is to Unveil the Development and Design of Routing Protocols for VANETs.

The result in this paper of dropped packets affects the AODV protocol during the entire lifetime of the network, but in the case of TAODV, it is only partially affected by the time the malicious node is identified and eliminated. The increased network throughput in the case of using TAODV is attributed to each node using its local table of other nodes' trust values in choosing the next hop node to establish the data path.

In this paper, AODV simulations are performed on simulators with the aid of the used network simulator NS-2 which approves customers to create real-world kinetic models for VANET simulation.

Keywords: VANETs, AODV, TAODV, NS2, Ad_hoc, Routing-protocol, OBU, RSU, RREQ, RREP.

1 INTRODUCTION

Wireless technology is the trendy technology as has come down to us due to the fact that the necessity to control systems by way of cell technology. In order to do this process, partial innovations have been taken of the area as may assist create certain a form of technology. Numerous researches have been conducted on that subject as have contributed to the construction of a huge database of literature. An intelligent transit system is one in which different aspects regarding sensing, control then analysis technology are integrated. This is done in order to improve security services within a system that may share data and process information for a variety of purposes. The benefits of using that rule are to carry many advantages within phrases about a protected and secure surroundings and efficient traffic management [1]. These types about systems can be used for both non-public and general purposes and are absolutely efficient in nature. It is undoubtedly one of the excellent communication channels constantly used for wireless techniques network. It is an advanced form of networking that objective to supply a secure environment for automobiles.

However, the current study tries to evaluates VANET routing protocols to measure overall performance , vehicle complaint rate and energy utilization levels. [2,3,4].

VANET is made up of certain compounds that are connected together. It can be assumed that these automobiles are transferring in a high-traffic transmission range. These vehicles are capable to move in any direction and be able communicate directly using a wireless link [5,6]. However, there is a connection that occurs among the destination vehicle and the source that supports some cars participating in the GPS receiver, wireless interface, and computing device [7,8].

MFR is a routing protocol that utilizes information about nodes and their loop-free paths to efficiently send packets across networks. This research has demonstrated its capacity for providing reliable performance while eliminating loops in the network, resulting in increased throughput and enhanced speed of communication. [9,10].

There are certain forwarding strategies also where adhoc and linear vehicular networks have been used and within it technique greedy forwarding is assigned [11,12 and 13]. In a certain cases, there are some overall performance networks where transmission mistakes exist that cover longer distances. However, in case of growing the distances, certain level of transmission quality is located. It has the certain characteristic and having the views like packet delivery. It has incomplete packet delivery services that can eliminate massive degradation [14,15and 16]. This method is pretty beneficial because of it motive and utilizes the techniques which are set for a period of time.

2 THE VARIOUS ELEMENTS REGARDING THE VANET ARCHITECTURE

For information technology, public and core infrastructure includes many vehicles certain as cellular nodes, backbone and core network, yet base stations [17,18, 29]. The main components on the ITS structure are illustrated in Figure (1).

The main elements of the rule are described as given below:

2.1 On Board Unit

For getting the data about time and location,our Wave Device is an On-Board Unit that can be installed on a vehicle, allowing it to exchange data with other OBUs and Road Side Units using radio frequency channels based on IEEE 802.11p standards to communicate in real-time its whereabouts as well as those of other onboard units through wireless links, It is a reliable and accurate solution for fleet tracking and monitoring, providing data about time and location [17,18].

.2.2 Application Unit

Within vehicles, an AU is a device which is equipped and uses applications by which the provider provides the use of OBU's communication capabilities. RSU is usually installed along roads, is a router, and is also installed in designated locations such as parking a lot and other road junctions [17,18].

2.3 Road Side Unit

With the network device, RSU is equipped for dedicated short-range communications then radio technology primarily based about IEEE 802.11p. It execute additionally be combined with other tools on the community so that it can be ideally used between infrastructure network communications.

Generally, RSU hosts applications that grant superior services. The services provided are used by a peer device. Optimize solutions using well-known OBUs. In OBU and RSU, services can exist. The provider is the device that hosts the applications while the users are described as like the devices that utilizes that particular software [17,18].

For a ad_hoc network RSU extends the reach. The source of the data here is the RSU which works in this way and gives OBU with an net connection. OBUs get theirs public connection to the Internet using RSUs. There is a set of sensors in each vehicle alongside with the OBU and this is done to gather and process the data consequently so it can be sent as a message to the other vehicles. It can additionally remain dispatched to RSUs via a wireless medium [19, 20 and 21]. With RSUs, some key functions are aligned as well as actions such as:

- Security purposes operate easily.
- For OBUs, an internet connection is provided.

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For an ad hoc network, the communication range is extended and that is done by using redistributing the data to the OBUs of other vehicles, to the other RSUs, the information is dispatched before existence resent to the other OBUs [22,23 and 24].

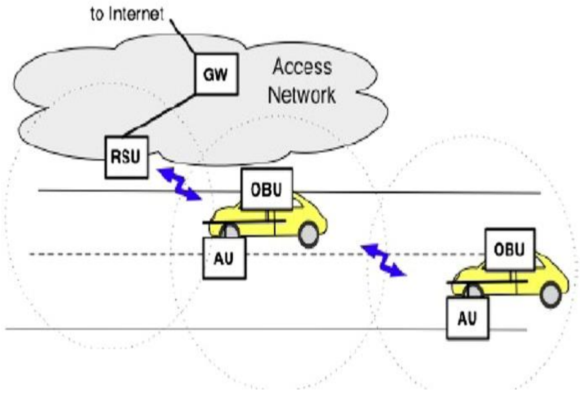

Figure (1) Architecture of VANET [26]

3 TRUSTED AD HOC ON-DEMAND DISTANCE VECTOR (TAODV)

TAODV have mechanism to communicate, there are two types of messages which used: TREQ (Trust Request Message), and TREP (Trust Reply Message). If node_1 wants to know node_2's latest trustworthiness, it will broadcast (TREQ) message to its neighbors. If one of node_1's neighbors receives the (TREQ) message then the neighbor will reply with a (TREP) message.

TAODV is a routing algorithm that extends the AODV protocol via applying a confidence limit according to routing messages [17,28,30]. The confidence of the stimulus with respect to some node N is decided beyond the neighbor node confidence estimates for the large diversity of neighbors of the node.

Some new fields have been added to the routing table such as trust data and neighbor list. The path confidence can be guessed based on the number of packets dispatched and the number of packets obtained relying on the target or the limit of another organization.

3.1 Algorithm:

1. start

2. S_n= node receives an RREQ control packet, it broadcasts the same to all of its neighbors.

3. N_n= update its Route Table with the latest information from all available sources.

4. If route-entry =exit nodes, then originates RREP control packets to S_n nodes & performs periodic routing table updates Else "rebroadcast RREQ packets to its neighbors

5. Source=waits for up 4 RREPs from neighbors

6. R_T = "Hop Count =30%" + "Route Trust = 70%"

7. while keeping the system intact and secure , Sort RREP in ascending order depends on R_T value

8. Choose first five RREP packets

9. For (m =0; m < 5; m++)

10.Take Neighbor[m]

11.end

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4 METHODOLOGY

Experimental data will be collected from the essential data source, or we can say that the runtime records recording. The records sources will be the traffic map or the routing aspect of the car which is at the moment of the run time at the time about the data recording. So the experiment data will remain made beside the 2D/3D runtime map with live transmission of the selected area. The second step is to explore the .cfg files with the NS2 software to extract the diff number of files.

Creating AODV clones by optimizing the end result concerning the "Vehicle Routing Network protocol", we are working growth on the protocol files. This procedure is recognized as cloning as shown in Figure (2). Therefore, the clone regarding the AODV protocol is known as TADOV, here T stands for temporary and is intended for experimental studies.

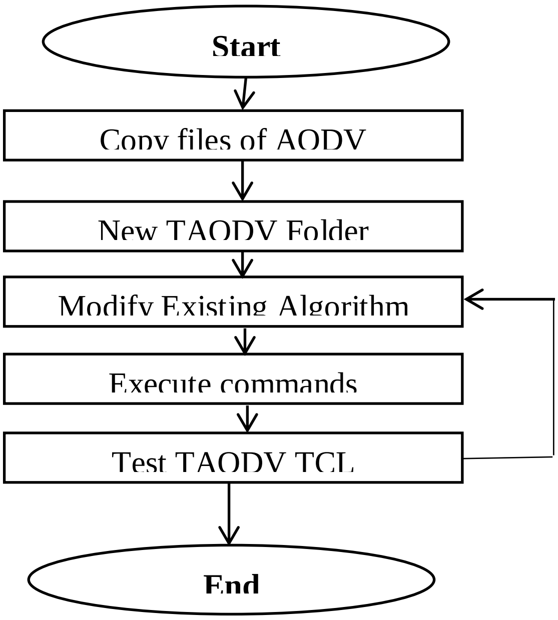

Figure (2) Creation of clone of the AODV

The experimental data will be collected from the main data source, or we can say the execution record is saved. The sources of the logs will be the traffic map or the routing side of the vehicle that is at runtime at the time of data logging. Thus, the experience data will remain created parallel to the 2D/3D execution map with live transmission of the selected area. The second step is to explore the .cfg files using the NS2 software to extract a different number of files.

Creation of AODV transcripts by optimizing the bottom line related to the Vehicle Routing Network protocol, we develop the protocol files. This procedure is recognized as cloning as shown in figure (2). Therefore, the transcription related to the AODV protocol is known as TADOV, here T stands for temporary and intended for experimental studies.

Table (1) Network information Aodv.tr[27]

Simulation length (sec.)	396,5959165
No. Nodes	20
No. sending (nodes)	20
No. receiving (nodes)	20
No. generating (packets)	158144
No. sent (packets)	153565

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No. forwarded (packets)	5
No. dropped (packets)	6945
No. lost (packets)	33464
Min. size (packets)	25
Max. size (packets)	1075
Avg. size (packets)	319,2370
No. sent (bytes)	42786961
No. forwarded (bytes)	12239
No. dropped (bytes)	4867168
Dropping nodes (packets)	0;1;2;3;4;5;6;7;8;9;10;11;12;13;14;15;16;17;18

Table (2) Network information Taodv.tr[27]

Simulation length (sec.)	398,8917765
No. Nodes	20
No. sending (nodes)	20
No. receiving (nodes)	20
No. generating (packets)	89884
No. sent (packets)	89810
No. forwarded (packets)	12
No. dropped (packets)	2795
No. lost (packets)	20656
Min. size (packets)	25
Max. size (packets)	1078
Avg. size (packets)	312,8739
No. sent (bytes)	26657510
No. forwarded (bytes)	4080
No. dropped (bytes)	295432
Dropping nodes (packets)	0;1;2;3;4;5;6;7;8;9;10

The typical network information for the experiment using the TAODV routing protocol as like follows of Table (2)

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5 RESULT

5.1 Throughput and Packet Delivery with AODV

The general environmental statistics which is associated with the AODV routing protocol for the experimental are as follows in Table (3):

Table (3) Throughput and Packet Delivery with AODV

Pause Time (ms)	Avg. Through put	Sent (Packet)	Receive (Packet)	Drop (Packet)	Delivery Ratio (Packet)
1000	226,84	55819	55800	23	98,95
800	226,66	44621	44598	21	98,94
600	226,35	33419	33400	22	98,92
400	227,99	22221	22199	17	98,91

5.2 Throughput and Packet Delivery with TAODV

The general environmental statistics which is associated with the clone of the AODV, TAODV routing protocol for the experimental are as follows in Table (4).

Table (4) Throughput and Packet Delivery with TAODV

Pause Time (ms)	Avg. Through put	Sent (Packet)	Receive (Packet)	Drop (Packet)	Delivery Ratio (Packet)
1000	412,71	111309	99684	11624	89,55
800	412,50	88911	79638	9270	89,58
600	412,05	66510	59579	6929	89,58
400	412,10	44119	39512	4600	89,58

5.3 Throughput and Packet Delivery with AODV & TAODV

The general environmental statistics of the AODV routing protocol are compared to those of the AODV clone, TAODV. These comparisons are based on "average throughput, packets transmitted, packets received, packets dropped, and packet fractions" ,The statistics for both protocols are shown below, as shown in Table (5)

Table (5) Throughput and Packet Delivery with AODV & TAODV

Pause Time (ms)	Avg. Through put		Sent (Packet)		Receive (Packet)		Drop (Packet)		Delivery Ratio (Packet)	
	AODV	TAODV	AODV	TAODV	AODV	TAODV	AODV	TAODV	AODV	TAODV
1000	226,84	412,71	55819	111309	55800	99684	23	11624	98,95	89,55
800	226,66	412,50	44621	88911	44598	79638	21	9270	98,94	89,58
600	226,35	412,05	33419	66510	33400	59579	22	6929	98,92	89,58
400	228,19	412,10	22221	44119	22199	39512	17	4600	98,91	89,58

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6 RESULT ANALYSIS

6.1 Packet Size V/s Average Throughput of receiving packets AODV & TAODV

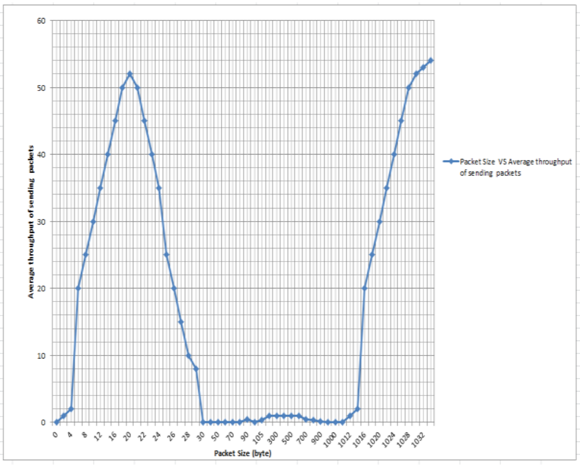

Figure (3) Throughput of receiving V/s Packet Size in AODV

The graph shows that the average throughput corresponds to maximum packets with small size and packet size from 0 to 1100 bytes. The initial value of the average received packet rate graph starts from zero and continues for a long time. Note that the highest value on the y-axis immediately rises to approx. 52 packets (average packet count/TIL) and the packet size is 40 bytes at the time indicated on the y axis. Then the values decreased with the increasing size of the packet. Finally, with 1100 bytes of packet size, the average throughput was zero. So we can say that according to the packet reception graph, the average maximum throughput for small packet size and zero packet size is 0 to 1100 bytes.

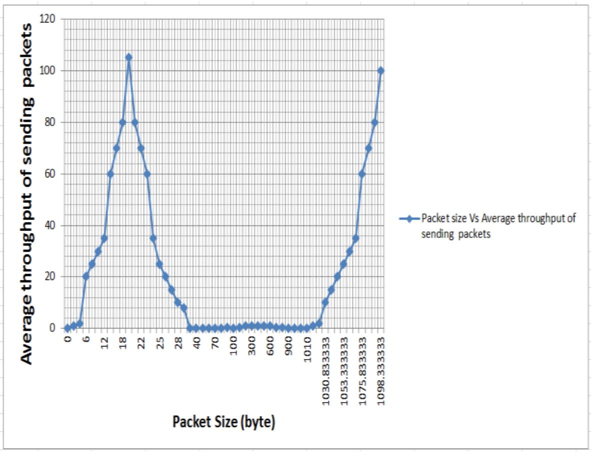

Figure (4) Throughput of receiving packets V/s Packet Size in TAODV

The graph shows that the average throughput corresponds to maximum packets with small size and packet size from 40 to 1100 bytes. The initial value of the average received packet rate graph starts from 0 to 120 for 30-40 bytes for a short time, then reaches 0 and continues for a long time. Note that the highest value on the y-axis immediately rises to approx. 80-120 packets (maximum number of packets/TIL) and the packet size is 120 bytes at the time indicated by the y axis. Then the values decreased with the increasing size of the packet. Finally, with 1100 bytes of packet size, the average throughput was zero.

7 CONCLUSION

In the study, It was found that the lower rate in throughput of the cloned TAODV protocol (412.71) is lower than the current AODV protocol(226.84). It was noted in the study that the result of the cloned TAODV protocol is better from the current protocol. The result of dropped packets affects the AODV protocol during the entire lifetime of the

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network, but in the case of TAODV it is only partially affected by the time the malicious node is identified and eliminated. The increased network throughput in the case of using TAODV is attributed to each node using its local table of other nodes' trust values in choosing the next hop node to establish the data path.

According to the comparisons between the AODV routing protocol and the cloned routing protocol TAODV, the packet loss rate was (23) and (11624) respectively. So, according to the result of the experiment, it is clear that the cloned routing protocol has lower packet loss rate. Therefore, the efficiency of the cloned protocol is better than that of the original protocol.

7.1 LIMITATIONS

Our focus has been on studying and evaluating routing protocols within the framework of the NS-2 network simulator to create real-world kinematic models of traffic map data sources in a VANET simulation. Therefore, this may not be the case in a real world scenario. Moreover, we did not evaluate dynamic vehicle speed changes based on conditions in our simulations. Other environmental factors that may affect performance are outside the scope of this particular study.

7.2 Future Works

The new generation of VANETs will feature exhilarating autonomous vehicles with high mobility, low latency, real-time applications and connectivity. All compounds act as a node, and if something happens with the hub, it will cause a fault within the entire tire, and the beam will fall off. Therefore, some components need to be explored to overcome this problem and drive out the defective behavior.

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List of Notations

AODV : "Ad hoc On-demand Distance Vector"

TAODV:" Trusted Ad hoc On-Demand Distance Vector"

GPS : "Global Positioning System"

MAC : "Media Access Control"

MANET : "Mobile Ad Hoc Network "

MOVE : "Mobility model generator for Vehicular networks"

NS : "Network Simulator"

OBU : "On-Board Unit"

RSU : "Road Side Unit "

VANET : "Vehicular Ad Hoc Network "

WAVE : "Wireless Access in Vehicular Environments"

WLAN : "Wireless Local Area Netwok"

S_n: " Source-node"

N_n: "Neighbor-node"

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