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Deterministic AODV Routing Protocol for Vehicular Ad-Hoc Network

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Abstract: **Vehicular ad hoc networks (VANETs) can provide scalable and cost-effective solutions for applications such as traffic safety, dynamic route planning, and context-aware advertisement using short-range wireless communication. To function properly, these applications require efficient routing protocols. However, existing mobile ad hoc network routing and forwarding approaches have limited performance in VANETs. This dissertation shows that routing protocols which account for VANET-specific characteristics in their designs, such as position and mobility of Vehicle, can provide good performance for a large spectrum of applications.**

Increased vehicular traffic demands smart vehicles which can interact with each other and roadside infrastructure to prevent accidents. Vehicular Ad-hoc Network (VANET) provides this flexibility to the vehicles. In this desertion we initially analyze the performance of AODV and OLSR, and further we improve the performance of AODV by selecting the node on the basis of trust value of the successive nodes, we also reduce the neighbor hood expiry time and correspondingly update the route table of AODV, with this purposed approach we would be able to reduce the end-to-end delay of AODV sufficiently also the performance of AODV increase in terms of Throughput and packet delivery ratio.

Keywords: **VANET, AODV, ROUTING, ROUT TABLE.**

I. INTRODUCTION

Vehicular Ad Hoc Network (VANETs) is a mobile network where a short lived and self organizing network is formed among the vehicles. Network operates either in an infrastructure network (V2X) or in an infrastructure less network (V2V). In an infrastructure network, Road Side Units (RSUs) interacts with vehicles' wireless equipments in a sporadically mode when a vehicle passes by it. In an infrastructure less network, Vehicles communicate with other vehicles' on-Board Units (OBUs) to exchange security messages. Each vehicle is equipped with a set of sensors such as GPS, Radar, and Directional antenna [1].

The characteristics of this network are: wireless medium, mobile nature, high mobility, absence of infrastructure, high dynamic network topology [2].

Due to lack of fixed infrastructure, nodes are prone to varied attacks. Securing the communication among\ vehicles is the main challenge that lies in the vehicular network. Deployment of network intrusion detection system helps in identifying the attack taken place in vehicular network [3]. Nodes in VANET are subjected to various types of impersonation attacks, few of which are hard to deal with, even if any security mechanisms are enforced. Some of which are Sybil attack, stolen identity attack, Man-in-the- Middle attack. Identification of the node and its authentication are of fundamental importance within a secure network [4].

Over the last few decades, many researches and efforts have been done to investigate various issues related to V2I, V2X areas. Several approaches to deal with identification of the node and its authentication in VANET have been proposed in the literature. Norbert Bibmeyer [9] et al proposes a scheme based on data plausibility check that ensures positional reliability in order to assess the trustworthiness of the neighboring node. S. RoselinMary [3] et al proposes an attacked packet detection algorithm to detect the position of the vehicle and checks whether the packet sent by the vehicle has been attacked or not. The proposed scheme floods the beacons into the network to discover the presence of the neighboring vehicles and accurate position of the messaged vehicle is detected. It verifies the MD5 hashes assigned to the VANET nodes and once a malicious node is detected, warning message will be broadcasted to all the trusted VANET nodes and the malicious node is isolated from the communication environment. Authentication is done through VANET Content Fragile Watermarking. In this paper

We focus on security, faulty node detection and authentication schemes. A city scenario is considered with 10 vehicles and 3 RSUs and it is further analyzed on the basis of various performance metrics. In this section we thoroughly discussed about different routing methods used for VANET. The reason of conducting detailed literature review for VANET routing methods was to check how the VANET routing is influenced by routi ng protocols which are currently being used by MANET and VANET. Furthermore, MANET routing protocols which are suitable to some extent for VANET were also kept in context while conducting the literature review. In addition, it also assisted us in selecting the suitable routing protocols in order to make comparison with VANET routing protocols. This comparison was based on evaluating the performance of these routing protocols in VANET.

In general, there are two methods of vehicle detection: intrusive technologies (pneumatic road tubes, inductive loop detectors, piezoelectric sensors) and non-intrusive technologies (video image processors, microwave radars, infrared sensors, and ultrasonic sensors) [25]. An inductive loop detector consists of three components: a loop, a loop extension cable and a detector [26]. Loop detectors are placed at specified locations on roadways to count vehicles and to estimate vehicle speed based on the occupancy time of vehicles on the detectors. However, installing these detectors requires a great number of saw-cuts on roadway surfaces, which makes them difficult to deploy and maintain. This work is much more expensive on roadway sections which need a large number of loop detectors. Moreover, loop detectors can provide data only from vehicle to infrastructure and not vice versa.

In order to improve the vehicle detection technique for ITS, wireless communication systems have already been studied. Wireless communication systems used in ITS can be classified into 2 types: vehicle-to-vehicle communication (V2V) and vehicle-to-infrastructure communication (V2I). Some systems such as VETRAC [14] and COC [15] which employ V2V and V2I to provide more functions for roadway security and management are being developed.

Azzedine Boukerche et.al (2008) [17] paper proposes a vehicle volume and speed measurement method using wireless communications between roadside equipment and vehicles. Vehicles are equipped with Global Positioning System (GPS) receivers and wireless communication devices, to detect their geographical location and to provide ad-hoc network connectivity with the roadside unit respectively. To carry out the functions of a loop detector, roadside equipment collects data from vehicles to detect their locations periodically and then counts the number of vehicles passing a given position in a period, but the authors have taken the scenario that the ranges of RSUs are set in such a way that they do not overlap with each other but also there should not be any gap in the coverage range of the RSUs. This scenario gives a good detection result but could not be applied to the sparse RSUs region where no of RSUs are less.

Rajendra Prasad et al. (2013) [18] the authors propose a novel RF-based Vehicle detection and Speed Estimation system (ReVISE). It makes use of the fact that the wireless signal strength in an RF environment is affected by the presence and motion of objects and hence the wireless signals can be used to infer the state of the environment and identify objects in the area Of interest only, not in all regions. So a vehicle can move to any speed in the area where there is no existence of RF signal. In order to overcome these all drawbacks we propose a novel detection system which can detect vehicles in all regions.

SeonYeong Han et al. (2013) [19] coveys that in mobile ad-hoc networks, local link connectivity information is extremely important for route establishment and maintenance. Periodic Hello messaging is a widely used scheme to obtain local link connectivity information. However, unnecessary Hello messaging can drain batteries while mobile devices are not in use. This paper proposes an adaptive Hello messaging scheme to suppress unnecessary Hello messages without reduced detect ability of broken links. Simulation results show that the proposed scheme reduces energy consumption and network overhead without any explicit difference in throughput. In this paper, they proposed an adaptive Hello interval to reduce battery drain through practical suppression of unnecessary Hello messaging. Based on the event interval of a node, the Hello interval can be enlarged without reduced detects ability of a broken link, which decreases network overhead and hidden energy consumption.

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Ehsan Mostajeran, RafidahMd Noor et al. (2013) [20] conveys that Ad-hoc On-Demand Distance Vector (AODV) is one of the ad-hoc routing protocols utilized in MANET and VANET. On-Demand routing protocols find their destinations based on the process of flooding a request to neighbors searching for their destinations. Neighbors of nodes are detected based on the neighbor discovery method, which periodically broadcasts HELLO messages to detect available neighbors at time. Generating routing packets and neighbor discovery messages produce high overhead in the On-Demand routing protocol, such as AODV. In order to overcome such issues, a novel scheme in Ad-hoc networks based on Intelligent-AODV (I-AODV) is proposed. This scheme functions to exploit neighbor discovery and reduce the overhead of neighbor discovery processes. This paper introduced an innovative, improved neighbor discovery method for Mobile Ad-hoc routing protocols, called Intelligent-AODV. It provides reasonable performance by updating the neighbor list based on routing packets such as RREQ, RREP and RERR. Moreover, the broadcast of HELLO messages is filtered by checking the destination node in the neighbor list to reduce overhead. Simulation results of the proposed neighbor discovery method based on mobility in various scenarios and compared with the original AODV demonstrate that I-AODV performs better.

II. PROBLEM EXPLANATION AND PROPOSED WORK

a) PROPOSED WORK:

The AODV maintains the neighbors which used in recently transmission sending event of the node. But AODV does not validate next neighbor frequently as VANET are highly dynamic scenario so nodes changing its position very frequently. To solve this problem of the AODV we have proposed a dynamic neighborhood expiry time so that whenever nodes changing its position frequently they can dynamically update neighbor table and nodes transmitted its packet to the nodes which is more trusted as compare to the nodes which already exist in the neighbor table, to solve this problem we basically reduces the neighbor hood expiry time of protocol as well as improve the packet salvaging, in the next section of the paper our results proves the effectiveness of our approach.

III. RESULTS AND DISCUSSIONS

The performance of I-AODV and OLSR routing protocol is compared against representatives from the main classes of routing protocols that are AODV and OLSR. where AODV and OLSR are topology based routing protocols. A review of these routing protocols already taken in previous chapters. In this chapter, we describe how simulation is done and what the results of the simulation are. The simulation is done in 2 phases and two different simulator have been used One is SUMO(Simulation of Urban Mobility) for road traffic simulation and Veins (Vehicular environment in Network Simulation) for network simulation

We use simulation to evaluate the performance of the proposed I-AODV, AODV and OLSR routing protocols with respect to PDR (packet delivery ratio) and end to end delay time features. We simulate network consisting of nodes field of 2500m × 8000m square area. Nodes have different transmission rate 100,200,300,400,500,600,700 and 800. The simplest and usually the first thing to setup a network is creating a node. A network is build up from its layers components such as Link layer, MAC layer and PHY layer. The components have to be defined before a node can be configured. Table 5.1 shows the parameters used in the simulation.

Table 1.1: Network parameter definition

Parameter Name	Parameter Value
channel type	Channel/Wireless Channel
mac protocol	Mac/802_11
number of nodes	10, 20, 30, 40, 60
routing protocol	AODV, IAODV,OLSR
grid size	2500 x 800 sq.m
packet size	1000
simulation time	Different
traffic type	Cbr

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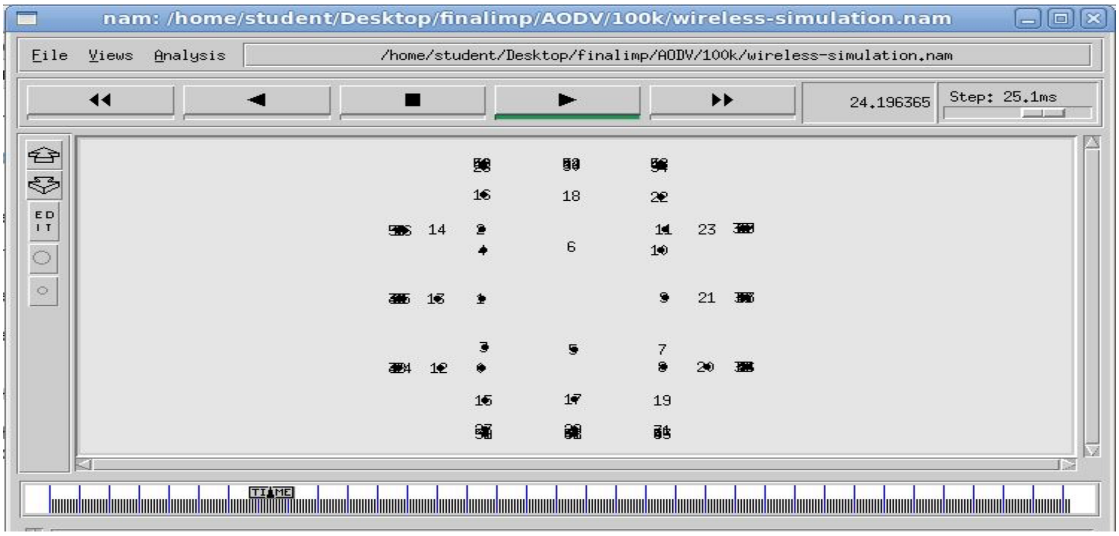

Figure 1.1: This scenario shows that the initial position of the vehicle at time 316.2ms

Graphs Display

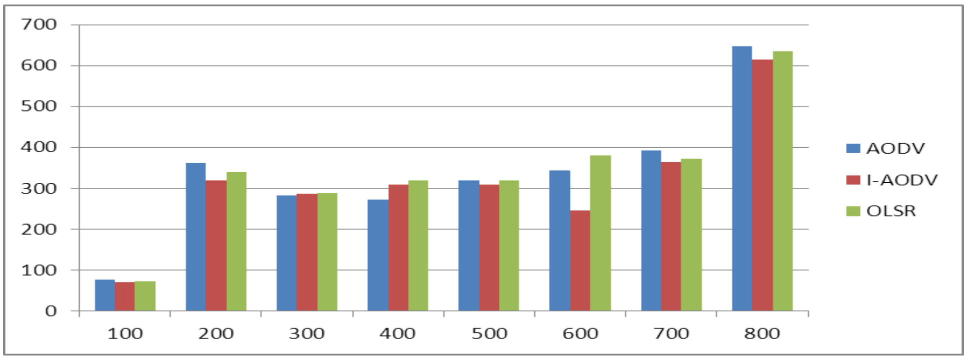

Figure 1.2: End to End delay comparison of AODV, OLSR and I-AODV

End to end delay in highway scenario: The simulation results of end to end delay in highway scenario vehicle environment is shown in below figure 5.20 from this figure it is clear that I-AODV and OLSR are perform better than AODV routing protocols. It means that end to end delay is reduced while we uses I-AODV and OLSR routing protocols in highway scenario. In highway scenario it is clear from below figure 5.20 that AODV is worst routing protocol when we considering end to end delay. AODV routing protocol working very well in MANET but in VANET area it is not give optimum results as it give in MANET environment. When we talking about end to end delay then I-AODV has also better perform than OLSR because I-AODV consumes some time in calculation of trust value of nodes.

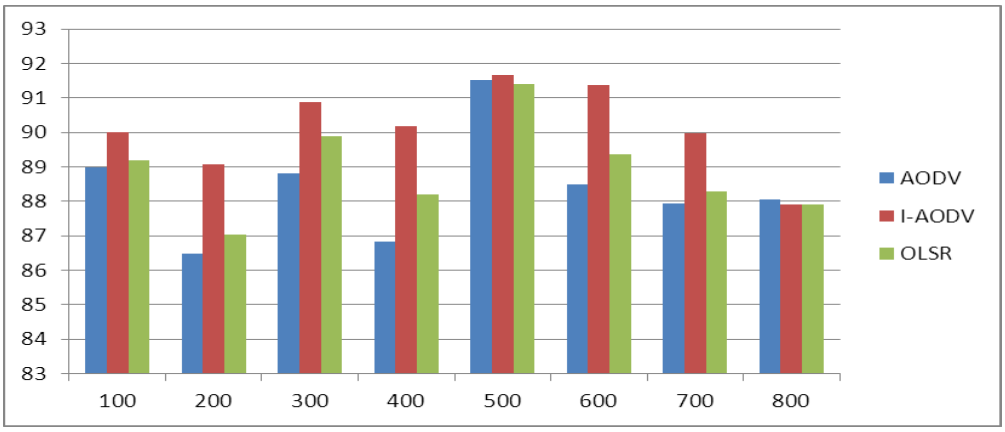

Figure 1.3: Packet Delivery ratio of AODV, OLSR and I-AODV

PDR in highway scenario: The simulation results of highway scenario vehicle environment is shown in below figure 5.21 from this figure it is clear that I-AODV is perform better than AODV and OLSR routing protocols. It means that packet drop is reduced while we uses I-AODV routing protocol either in open scenario or highway scenario. In highway scenario it is clear from below figure 5.21 that AODV is worst routing protocol when talking about PDR values.

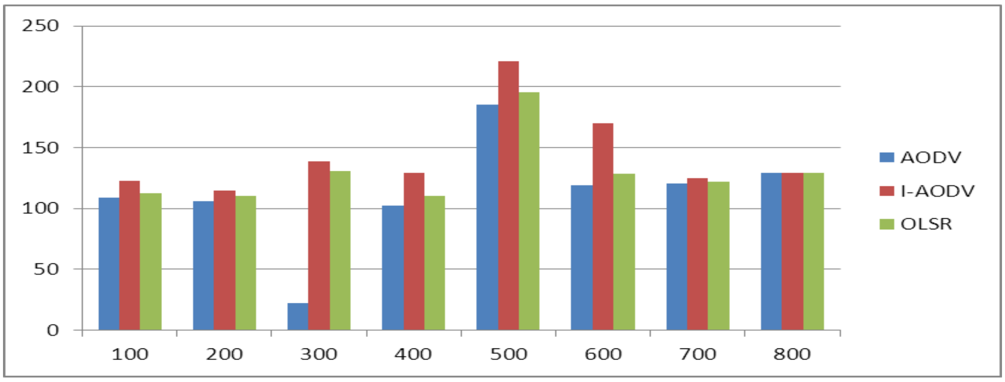

Figure 1.4: Comparison of throughput between AODV, OLSR and I-AODV

Throughput in highway scenario: The simulation results of highway scenario vehicle environment is shown in below figure 5.22 from this figure it is clear that I-AODV is perform better than AODV and OLSR routing protocols. It means that throughput increases while we use I-AODV routing protocol either in open scenario or highway scenario. In highway scenario it is clear from below figure 5.22 that OLSR is worst routing protocol when talking about THROUGHPUT values.

This thesis work briefly describes about the four routing protocols for VANETS. It includes detailed discussion of AODV, OLSR and I-AODV which is the most widely used protocols that perform better than the rest of protocols. These are compared with our proposed routing protocol I-AODV which takes the benefit of AODV. I-AODV improves the PDR as compared to AODV because I-AODV selects the node on basis of trust value and trust value for any node becomes low if that node drops packets. If we have two equidistant nodes form source and destination, then we select the node with higher trust value to forward the packet. This approach results in reducing the total number of packets dropped and hence will result in increased packet delivery ratio of the network.

The advantage of I-AODV protocol is that it selects the most trustworthy node which drops less number of packets. So the selection of the node with highest trust value increases packet delivery ratio of I-AODV in comparison to AODV and OLSR.

The drawback of the I-AODV protocol is the computation required for calculating trust value of node, results in increase of end to end delay. So end to end delay is slightly more than AODV but it is very less as compared to OLSR.

IV. CONCLUSION

In this paper briefly describes about the routing protocols for VANETS. It includes detailed discussion of AODV and OLSR which are the most widely used protocols that perform better than the rest of protocols. In further we improved AODV in terms PDR, End to End Delay and throughput and successfully compared with existing AODV and OLSR protocol.

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