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Comparative Study of Various Routing Attacks Detection in VANETS

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***Abstract*—** Vehicular adhoc networks (VANETs) play a significant role to design an intelligent transportation system. Secured routing in VANETs is still an ill-posed problem. Because, in VANETs communication of packets between vehicles and Road side units (RSUs) is achieved by using public networks. Therefore, VANETs are prone to various routing attacks such as Blackhole, Grayhole, Wormhole etc. The overall objective of this paper is to study various routing attacks, then compare them with each other. The main goal behind this is to determine best secure routing protocol. Also, to evaluate various research gaps in existing research on VANETs. From, extensive review it has been observed that no technique is efficient for every circumstance.

***Keywords*—** VANETS, Classification of Routing Protocols, Attacks in VANETS Component

I. INTRODUCTION

A promising area for the application of MANET is in the automotive sector. An individual vehicle generates a lot of self-contained information, available only to that particular vehicle. VANET is a special category of MANETs which is composed of moving vehicles, acting as nodes. Vehicular Ad-hoc Networks is aimed at increasing inter-vehicular communication, so that information collected in a vehicle can be shared with other vehicle users, with the aim of improving driving experience. VANET do not require any infrastructure and use On-Board Units (OBU) and Road Side Units (RSU) like traffic signals and base stations for communications. Vehicles can collect the essential information and share it with other vehicles [*2*]. This information can be related to the traffic jam situation, road condition detection, accident warning, tourism information, etc. The collected information would be helpful for the users to plan their route. VANETs acts as a safety aid for the driver and passengers too. If the person caught up with some abnormal situation, current positional information of the vehicle can be sent to the police station or nearby hospital [4, 6]. In order to establish the communication VANET, each vehicle is as a node which can act both as receiver and sender and hereby broadcast different information between the vehicles. In these networks, the vehicles are equipped with wireless terminals with standards like DSRC with sending limit extendable up to 1000m. Because of limited radio range of each node in VANETs, it is required to re-broadcast the received broadcasted message for the neighbours. This type of sending is called multi-hop and requires routing algorithms. Routing in VANETs is very complicated and difficult because of some characteristics like high dynamism, high speed of vehicles and high broadcasting scale of information and the old routing methods are not sufficient in these networks.

In multi-hop sending, the received limit of a message is gradually extended; but in this case the exponential increasing of the number of nodes re-broadcasting the message brings the problem of broadcast storm in broadcasting of information. Inter-vehicular communication is a research position that's rapidly expanding resulting from substantial advancements during cell phone additionally instantaneous transmission programs, together with the advancement of small management functions indoor present day vehicles, in addition to switching vehicles. The primary goal of VANET is to provide safety and comfort for passengers. With the sharp increase of vehicles on the roads, driving has become challenging and dangerous; roads are saturated; reasonable speed and safety distance are being violated [10]. Collision warning, traffic signal violation, lane change warning and other road information dissemination are some of the common safety applications of VANET. Entertainment, traffic conditions, weather, gas station, restaurant location and other interactive communication are some of the other key applications of VANET. Vehicular ad-hoc networks cover an ample range of applications ranging from safety to convenience.

A. Characteristics of VANET

A few characteristics such as short radio transmission range, low bandwidth and self-organization are trivial for every ad-hoc network including VANETs. However, there are a

number of characteristics which differentiate VANETs from other ad-hoc networks listed as follows:

- Uneven distribution of vehicles on the roads affects the network connectivity. There are frequent network disconnections if the vehicle density is low.
- Vehicle speed depends on two factors, driver's wish and the congestion on the road.
- Due to the flexible speed of vehicles, there is a consistent change in the network topology.
- Communication end points are not defined by identifiers; instead they are defined by geographical areas.
- Nodes are vehicles, so there is no energy (power) and computation constraints.
- Vehicles are equipped with on-board sensors to get the location information which is required for communication.

B. Vehicular Communication paradigm

VANET communication can be broadly classified into different type of communication as:

1.2.2 Vehicle-to-Vehicle communication (V2V)

In V2V communication, each vehicle is used as routers to exchange messages. V2V communication would be further classified into single hop or multi hop communication [13].

1) Vehicle-to-Vehicle communication (V2V)

In single hop communication, two vehicles would exchange data directly, while in multi hop communication, messages would be propagated to distant vehicles through many hops using vehicles as forwarders to send the message. Multi-hop communication is required to transmit messages to vehicles which are out of the communication range. V2V communication is suitable in areas where RSUs are not available and can provide direct communication for small to medium distances.

2) Vehicle-to-Road communication (V2R)

In V2R communication, vehicle would exchange messages with RSUs. This type of communication can be used to transmit real-time traffic and commercial information to the vehicles travelling on the road [9]. Vehicle can also collect data from on-board or road-side sensors and send to RSUs. RSUs can collect data from vehicles, weather centres and traffic control centres and send appropriate messages to all vehicles.

V2R communication would provide better service in long distances especially in sparse areas where the number of vehicles travelling on the road is less and V2V communication is not feasible. If more than one communication mode; V2V and V2R are simultaneously possible, then the vehicle could switch over to an optimal mode, which could be chosen based on end-to-end delay, losses, and consumption of bandwidth [6].

Figure 1. Vehicular communications in VANETs

*C. **Attacks on VANET***

An attacker in VANETs may passively look for sensitive information by applying analysis and monitoring, eavesdropping without affecting the natural of data in the sensor networks, thus remains beyond the knowledge of the user. But there exists various active attacks like DoS, alteration of data, fabrication, black hole, repeated transmission of packets, sinkhole, spoofing, jamming, overwhelm, man-in-the-middle attack, selective forwarding and fake node [21]. A few of them are listed below:

- Denial of Service (DOS) – The adversary may try to disrupt the normal operation of the node or the entire network by sending super packets and services become unavailable to the authorized users [22].
- Black hole/Sinkhole Attack – An attacker can get the access to stream of packets by implanting a powerful node to pull or misdirect all the packets, while listening and responding to routing requests from the deployed nodes and acting as a shortest path to BS while in the routing [23].
- Hello Flood Attack – A node belonging to the adversary with very high transmission range sends HELLO packets to all reachable nodes. The victim nodes may confuse the attackers' node as a neighbor and use it during data transmission to BS [24].
- Wormhole Attack – is a threat to distance based routing mechanism without compromising a node in the sensor network whereby the attackers' node attempts to provide a single-hop fake shorter route thatcan actually be reached through multi-hop [25]. Hence it creates an illusion of a tunnel, where the two end points seem to be nearer than the actual distance [26].

D. Some Common Mistakes

VANET operates on a wireless network, which means security attacks can be triggered by any node in any direction to target any other node in the range. Similarly, other security issues include message replay or delay, message distortion and message leakage [27]. These facts convey the lack of comprehensive defence mechanism in VANET. The VANET needs to have a secure distributed architecture of high mobility nature [28]. The security techniques ideally need to be implemented 'on-demand' and that they should be able to deal with big dynamic clusters at any point in time [29]. Following are the most common routing attacks in the VANET. Different routing protocols have actually developed for VANETS in many types based on the various factors i.e. divided with several types such as for example protocols properties, methods used, routing details, quality of services, network architecture, routing algorithms etc [30]. Routing protocols can be categorized i.e. based on:

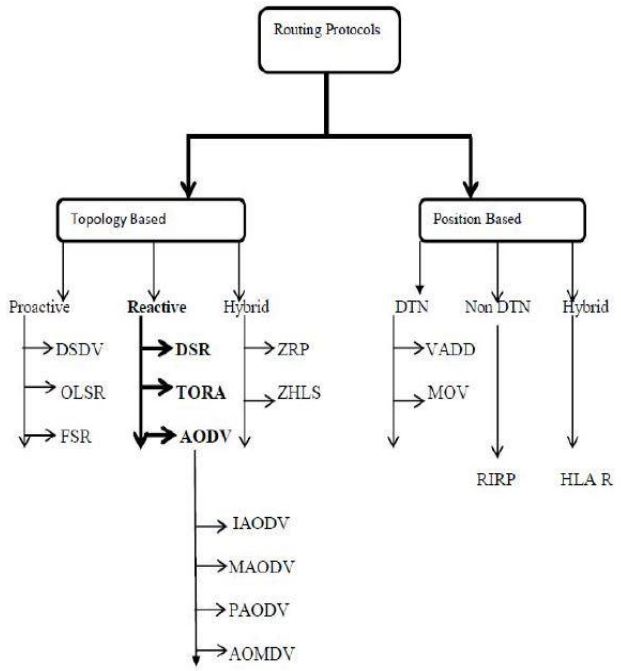

Figure 2. Taxonomy of Routing Protocols in VANETS

1) Topology Based Routing Protocols

Topology Based Routing Protocols makes use of shortest path algorithms. The packet forwarding is accomplished on the basis of link information stored in the routing table. The best possible shortest route between source node and destination node is searched by Route discovery process. It is Beaconless protocol and supports unicast, multicast and broadcast Routing [31]. Furthermore, it is High overheads in system.

2) Position Based Routing Topology

It implements Position determining Service. The data packets are forwarded on the basis of vehicle position. It is not essential to have Route discovery and route maintenance processes. It beaconing feature is required and suitable under High mobility environment.

II. RELATED WORK

Abdalla et al. [2007] has proposed vehicular Networks are experiencing lots of particular attention because of the wide selection of companies they could provide. Its apps range between protection and also lock up protection so that can Online and also multimedia. Like for example, volume portion, specifications regarding natural and also hyperlink levels, redirecting algorithms, and also stability difficulties and also innovative applications. **Al-Rabayah et al. [2012]** has offered ahoc systems (VANETs) are very cellular wireless systems that are made to help vehicular protection, traffic checking, and different commercial applications. Within VANETs, car mobility may cause the communication hyperlinks between vehicles to often be broken. A fresh hybrid location-based routing project has been planned that is specially developed to deal with that issue. **Ben Ding et al. [2014]** have discussed "how AODV routing protocol used in MANET can be improved in terms of optimization in route discovery and route selection for better performance in VANET. The routing protocols need to be efficient as VANET is becoming popular emerging technology and is capable of providing Intelligent Transportation applications, comfort and many other applications. Modification in AODV in two steps gives improved route stability and decrease overhead". **Bhakthavathsalam et al. [2011]** has suggested cellular WiMAX is a strong network technology with varied programs, one being useful for VANETs. The performance metrics such as for example Suggest Throughput and Box Reduction Proportion for the procedures of VANETs adopting 802.16e are computed through simulation techniques. Next they considered the similar performance of VANETs employing 802.11p, also called WAVE (Wireless Accessibility in Vehicular Environment). **Buchenscheitet al. [2009]** has applied scenario to get car communities usually are purposes which connect with disaster vehicles. Beyond just the common alarm, they may apply r / c conversation to be able to notify other motor vehicles or even preempt targeted visitors lights. These kinds of a credit application is effective in reducing automobile accident challenges for the duration of disaster reaction journeys and even support conserve beneficial time. **Chen et al. [2014]** has discussed that vehicular *ad hoc* networks (VANETs) will probably be an essential connection commercial infrastructure in your relocating life. The style of vanet standards within VANETs can be an important and also required problem for promoting VANET-based applications. Having said that, because of higher range of motion, regular hyperlink disconnection, and

also wrinkled submitting regarding motor vehicles.**Da Cunha et al. [2014]** have proposed VANETs are located for an exhilarating study along with use area. Significantly cars have been with set alarms, digesting along with Wi-Fi communicating functions opening up some sort of many prospects intended for impressive along with probable living transforming apps with safe practices, overall performance, ease, general public alliance along with response when they're for the road. **El-atty et al. [2014]** has proposed Advanced heterogeneous vehicular system (AHVN) is just a encouraging structure for providing vehicular solutions within the next generation of vehicular networks. AHVN is an integrated structure between vehicular ad hoc communities and present mobile wireless networks. In this function, they planned a multi-hop vehicular connectivity model in V2V program, which is dependent upon the bodily faculties of the roadways and fake hop initiation connectivity. Then, they established the disappointment probability of vehicular connectivity in V2V system. Based on interoperability utility, they applied the disappointment connectivity likelihood as a handover criterion to communicate with V2R networks. **Feng et al. [2014]**has mentioned that information aggregation is really a of use technology that can decrease the communication bandwidth cost in the process of information gathering in VANETs. But, information aggregation may lose some information accuracy. **Geravand et al. [2013]**has described the vanet with safety dilemmas is one of the main and complex jobs various networks experience today. A large amount of safety formulas have been planned to boost safety in a variety of forms of networks. Many of these solutions are either right or indirectly predicated on *Bloom filter* (BF), a space- and time-efficient probabilistic information structure introduced by Burton Bloom in 1970. **Hager et al. [2015]** has proposed vehicular ad hoc network (VANET) technological know-how good authorized IEEE 802.11p typical along with the appending inter-vehicle conversation (IVC) provides the possible ways to considerably customize the means transport programs work. The essential thought will be to vary the average person tendencies for each car or truck through interchanging details amid targeted traffic players to understand their helpful plus more productive transport system. **Jiang, Daniel et al. [2008]** has proposed vehicular situations impose a couple of new requirements on today's wireless conversation systems. Vehicular security communications applications can't tolerate extended connection establishment delays before being enabled to communicate with different vehicles experienced on the road. Likewise, non-safety applications also need effective connection startup with roadside stations giving companies (e.g. digital map update) because of the limited time it requires for a car to drive through the protection area. **Kakkasageri et al. [2014]** has proposed vehicle populace raises every day this particular brings towards accidents. Consequently to get rid of this particular we now have applied the type, intersection type this deals with car range of motion along with displays the specific communicating involving car to help car (V2V) along with car to help system (V2I).**Kesting et al. [2010]** has proposed inter-vehicle conversation (IVC) helps motor vehicles to change information inside a minimal send out selection thereby self-organize in to dynamical car advert hoc networks. With the long run, nevertheless, an immediate connection amongst outfitted motor vehicles one way has never been possible. All of us thus take a look at an alternate setting by which information tend to be saved simply by get across motor vehicles operating a other direction, as well as sent to motor vehicles inside the initial route in the after time. **L. Rongxing et al. [2012]** have offered attained an auto visitor's comfort availability although helping the important up-date overall performance regarding location-based companies (LBSs) inside motor offer hoc cpa networks (VANETs), any energetic privacy-preserving important supervision structure known as DIKE offers proposed. **Molina-Gil et al. [2014]** has discussed that vehicular ad hoc networks are usually wifi communities by which visitors info is shipped by quite a few solutions to several destinations. Consequently, their own deployment demands info authorization things so that they can identify almost any harmful tendencies regarding buyers, including adjustment and also replay attacks. **Ruikar et al. [2013]** have studies printed annually by Transportation Research Wing of the Ministry of Road Transportation & Highways and National Crimes Files Office of Ministry of House Affairs, Government of India explain national mathematical tendencies and normalized indications of street incidents, accidents & fatalities. **Saleet et al. [2011]** have shown a class of redirecting methods for vehicular advertising hoc systems (VANETs) called the Intersection-based Geographical Routing Protocol (IGRP), which outperforms existing redirecting systems in town environments. IGRP is based on a fruitful collection of path intersections by which a package should move to achieve the gateway to the Internet. **Toutouh et al. [2012]** have mentioned that recent improvements in wireless technologies have provided increase to the emergence of vehicular offer hoc systems (VANETs). Such systems, the restricted protection of WiFi and the high mobility of the nodes make frequent topology improvements and network fragmentations. That report handles the optimal parameter setting of the enhanced link state routing (OLSR), which is really a well-known cellular offer hoc network routing project, by defining an optimization problem. **Wisitpongphan et al. [2007]**have proposed vehicular ad hoc network (VANET) may well showcase the illness tendencies, i.e., the system can certainly be either thoroughly related or perhaps sparsely related with respect to the period or perhaps out there vaginal penetration fee on the mobile transmission devices.

III. COMPARSION TABLE OF ROUTING ATTACKS WITH THEIR EFFECTS AND SECUROITY REQUIREMENTS

Routing Attacks	Impact/Effect	Security Requirements
Denial of Service (DOS) Attack	Slow down efficiency in addition to results for the networking	Availability
Black Hole Attack	Slow down efficiency in addition to efficiency for the networking	Confidentiality
Wormhole Attack	Prevent the creation from correct passages & lead to info packages actually misplaced	Authentication as well as Confidentiality
Sinkhole Attack	Make the networking problematic, choose to by simply enhancing the data packages or simply by simply cernuous all of them	Availability
Illusion Attack	Trigger motor vehicle collisions, targeted visitors jellies & reduce the results for the networking when it comes to data transfer usage consumption	Authentication
Sybil Attack	Take over this affect around large networking & add fictitious info around the container similar to targeted visitors over-crowding, accident.	Authentication

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IV. CONCLUSION and Future Scope

From, the existing literature it has been concluded that the designing an efficient secured routing protocol is still an ill-posed problem. Each secure routing protocol is designed by considering a single attack at a time. However, in real-time VANETs more than single types of attacks exist. Therefore, it is required to evaluate the best protocol from the literature and then modify it to handle multiple attacks at a same time. Therefore, in near future we will design novel secure routing protocols for VANETs to detect multiple types of attacks.

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