Journal of Advanced Research in Wireless, Mobile and Telecommunication
Volume 6, Print Issue 2 - 2023, Pg. No. 1-6
Peer Reviewed Journal

Review Article

An Investigation into AI-Driven Pathfinding Routing Protocols within Vehicular ad hoc Networks (Vanets)

Sunil Khullar[1], Shallu Sehgal[2], Satinder Kaur[3]

[1]Professor and Head CSE and CSA Department, LCET , Katani Kala.
[2]Associate Professor Shoolini Institute of Life sciences and Business Management, Solan, Himachal Pradesh.
[3]Assistant professor in LCET college, Katani Kala.

I N F O

Corresponding Author:
Sunil Khullar, Professor and Head CSE and CSA Department, LCET , Katani Kala.
E-mail Id:
sunilkhullar222@yahoo.co.in
Orcid id :
https://orcid.org/0009-0008-8559-0746
How to cite this article:
Khullar S, Sehgal S, Kaur S. An Investigation into AI-Driven Pathfinding Routing Protocols within Vehicular ad hoc Networks (Vanets). *J Adv Res Wire Mob Telecom* 2023; 6(2): 1-6.

Date of Submission: 2023-09-03
Date of Acceptance: 2023-10-05

A B S T R A C T

Due to network and wireless technology advancements, researchers have been interested in vehicle ad hoc networks (VANETS) for decades. Vehicular ad hoc networks (VANETs) have replaced MANETs. VANETs improve safety and comfort by connecting on-road automobiles to roadside equipment. Due to the dynamic nature of VANETs, there is no optimal routing method for each VANET application. Most current research focuses on security, routing, and quality of service. Routing algorithms, services, and the optimum mobile network design need further study. To propose a new routing method or update an existing one, one must have a detailed grasp of past routing protocols. This paper reviews VANET routing methods and their benefits and cons. This poll will aid academics studying VANET routing and proposing new methods. This article compares routing methods using several criteria in the final section. This comparison helps clarify each protocol's applicability.

Keywords: MANET, Routing Protocols, VANET,Mobility Modeling, Dynamic Topology

Introduction

Researchers have been concentrating their efforts on wireless communication over the last several decades, which has led to the creation of vehicular ad hoc networks (VANETs), which are a significant application of mobile ad hoc networks (MANETs) [1]. VANET lets automobiles, buses, lorries, and vans talk to one other and roadside equipment. Each VANET vehicle is a mobile node that exchanges data as a source, destination, or router. VANET, a subset of MANET, is dynamic because mobile nodes move quickly. Routing in a dynamic network is harder than in MANETs, and scholars struggle to find a suitable algorithm for all VANET applications. Figure 1 depicts a vehicle ad hoc network.

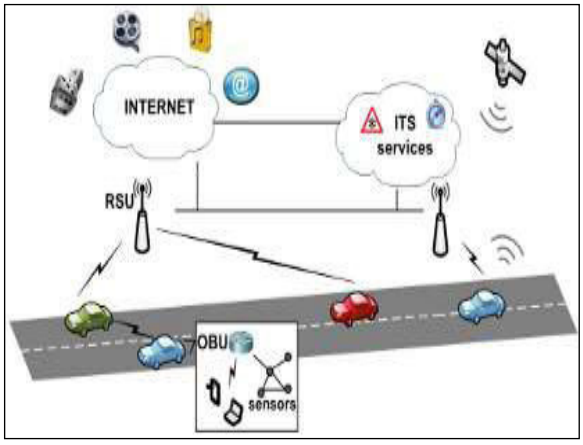

Figure 1.Flow Chart of Methodology

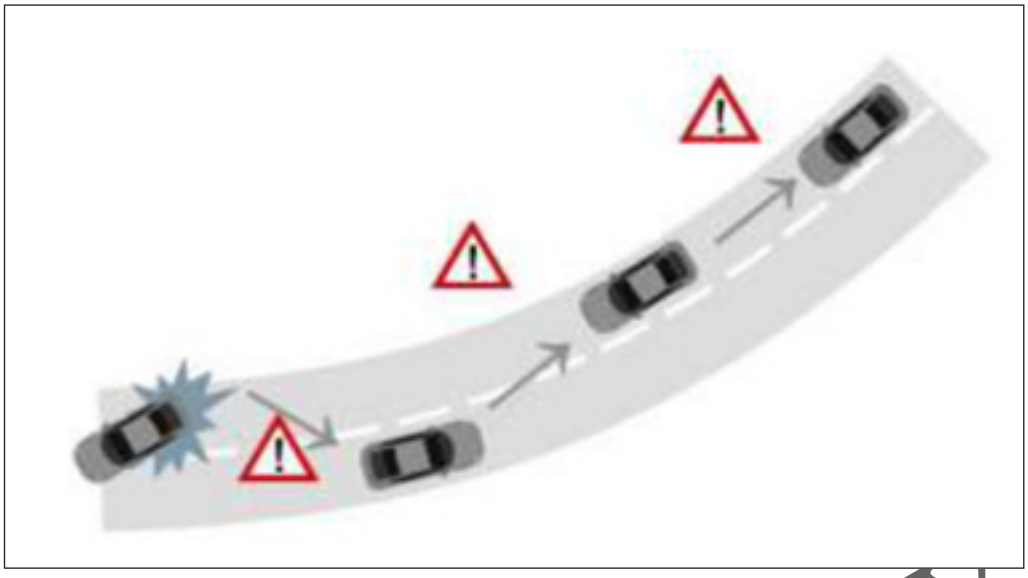

Figure 2.Vehicle-to-vehicle communication

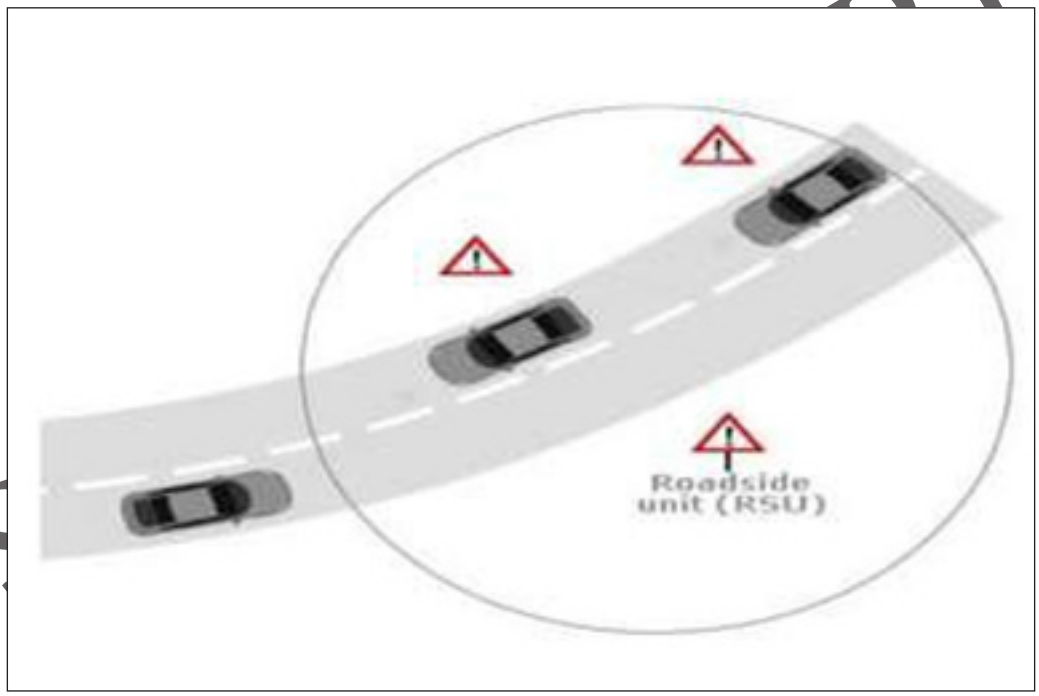

Figure 3.Communication from vehicle to roadside

The routing protocol in automotive networks determines the numerous paths to the goal, ensures their integrity, and maintains them. c) Selecting the most efficient route is the last and most important stage. Figure 2 shows vehicle-to-vehicle communication in VANETs. Figure 3 shows car-to-roadside communication.

The vast majority of VANET routing algorithm research has been on single ad hoc routing algorithms, classic ad hoc topology-based routing algorithms, and some position-based routing algorithms. This is not true in an ad hoc scenario since we need many routing strategies to fulfill varied requirements. In this work, we investigated numerous classic routing techniques for VANETs in order to increase performance. Section II discusses features, Section III discusses VANET applications, and Section IV discusses all ad hoc routing protocols and their advantages and disadvantages. Section V examines future routing challenges. Section VI summarizes the study and contrasts the various methods.

Characteristics of Vanet

Because of their unique features, VANETs are hard to identify from MANETs and difficult to design new applications for. These problematic ones include:

Dynamic Topology

Because automobiles move, VANET's topology is continually changing, making it the hardest task.

functioning rapidly. Two 15-meter-per-second automobiles are going opposite ways. The connection lasts six seconds (180/30) if their radio range is 180 meters. Such networks have dynamic topologies.

Disconnection

Two vehicles sharing data may be unexpected since VANET topologies change quickly. They'll lose contact when one exits the other's radio range. This prevents their transmission.

Mobility Modeling

Mobile nodes move at different rates, making representation difficult. Different patterns are emerging among them. Mobility modeling also considers driver traits and behaviour.

Battery Capacity and Longevity

Current automobiles employ long-lasting, high-capacity batteries. characteristic VANET outperforms MANET in battery-challenged nodes.

Communication Setting

automobiles in dense networks communicate differently than automobiles in sparse networks, like highways, since motorways have no communication barriers. Dense networks have many buildings and other obstacles. Thus, VANET communication mechanisms should vary per circumstance.[2]

VANET Applications

Public Safety Apps

The roadside priority should be occupant safety. Most existential risks Accidents cause it. To avoid this, VANET programs give collision warnings, road condition warnings, merging assistance, and deceleration warnings. Cars should be the first to get a collision alarm.

Comfort Apps

Traveling should be fun. VANET provides backseat games. TV, internet, and van chats. This will improve travel for passengers.

Informational Apps

Maps, GPS, and time- and location-limited communications may help a traveler acquire information on the road. Up-to-date information streamlines travel for travellers.

Traffic Management Apps

These applications examine a vehicle's performance to cut fuel consumption and travel time. Improving traffic flow. It also monitors the situation and calculates the fastest ambulance route. Traffic management apps balance city roads.

Payment Applications

In the past, long lines of people waited at toll gates. parking charge locations. When a vehicle crosses a toll road, the central taxation authority deducts the toll tax from the owner's account and sends a message to the customer's mobile. VANET entirely automates this operation.

Vanet Routing Protocols

Due to VANET's dynamic nature, these routing algorithms are unsuitable for ad hoc networks [3, 4], [5]. Thus, VANET communication cannot directly employ these protocols. VANETs may use routing protocols that are topology-based, position-based, geo-cast-based, broadcast-based, or cluster-based. Domains are used to organize protocols. Figure 4 depicts the various routing protocols used in VANETs.

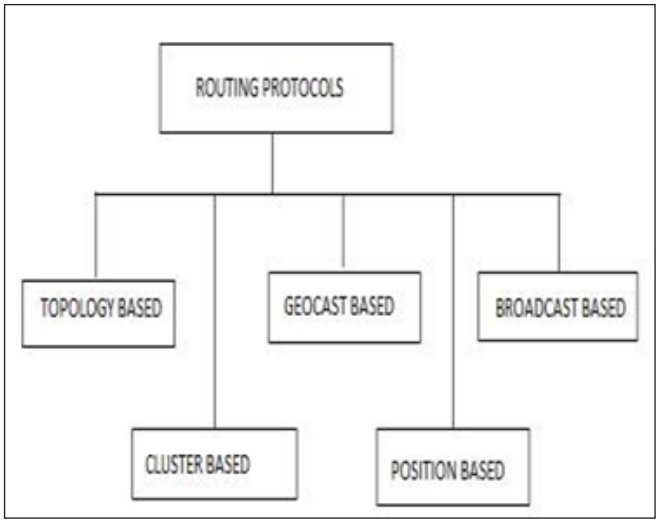

Figure 4.VANET routing protocols

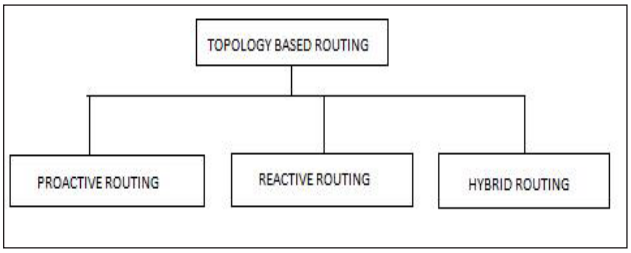

Figure 5.Topology-based routing

Routing that is Based on Topology

Before transferring data from the origin to the destination, the protocols store connection information in a table. Several algorithms have been developed to date on the basis of this routing approach. As shown in Figure 6, this strategy may be further classified into three categories: There are three types of routing: proactive routing, reactive routing, and hybrid routing..

Proactive routing is supported by table-driven protocols. In node-maintained tables, proactive routing algorithms preserve information about related nodes. Routing systems based on tables are proactive. When one of the network's nodes changes, the nodes' tables are updated. Fisheye state routing (FSR), Cluster head routing (CGSR), Wireless routing protocol (WRP), Optimal link state routing (OLSR), Destination Sequence Distance-vector routing (DSDV), Topology Dissemination Based on Reverse Path Forwarding (TBRPF), Global State Routing (GSR), and Source Tree Adaptive Routing (STAR) all use this method. These approaches are evaluated in studies.[6,12]

Benefits: No route finding is necessary since all connections are kept in the background. These protocols provide the finest end-to-end delivery in terms of high-load pricing.

Disadvantages

Low latency makes these protocols unsuitable for real-time applications.

Reactive routing protocols tackle proactive routing issues. On-demand routing systems find and establish a route only when needed to transport data between the right nodes. As a result, they are "on-demand" routing systems. Hop-by-hop or source routing may be used in reactive routing. Source routing data packets provide all of the necessary information regarding the packet's path and intermediary nodes. Data packet headers may be used by intermediate nodes to get routing information. Source routing enables intermediate nodes to deliver data packets without having to update complete metadata. This method is used by Ad Hoc On-Demand Distance Vector (AODV), Preferred Group Broadcasting (PGB), Dynamic Source Routing (DSR), Temporally Ordered Routing Algorithm (TORA), Junction-based Adaptive Reactive Routing (JARR), Associability Based Routing (ABR), and Signal Stability Based Routing (SSA) [13-19]. The link may be built as required, and no network pathways must be maintained. Because the route is determined on the fly, the route-finding latency is considerable. Flooding packets may cause network instability. It employs both reactive and proactive routing. Routing that is hybrid. It decreases the control overhead of proactive routing and the complexity of early route finding in reactive routing.. If the radio range is limited, automobiles may speak to roadside devices. Thus, roadside units route mobile nodes. This method divides automobiles into zones to find and maintain routes. This group includes ZRP and HARP.[20,21]

In, reactive and proactive routing flaws have been removed. It performs poorly in low-traffic areas.

Position-Based Routing

Instead of vehicle connections, position-based routing techniques employ vehicle locations. the fastest data transfer route. All vehicles in this technique have complete source, destination, and node information. These protocols outperform topology-dependent ones because to their reduced overheads. Position-based routing systems include beaconing, location services, recovery mechanisms, and forwarding strategies.[20] These protocols outperform topology-based protocols because they only link nodes when required. Position-based routing also has greedy V2V and delay-tolerant protocols.[22] A Greedy forwarding protocol intermediate vehicle transfers a data packet to the closest distant neighbor moving toward the next node or destination. Each node must know its location, its neighbor's location, and its destination. GPS can locate the car. Messages may locate a neighbor, but location services usually locate a destination. Quorum-based location services embedded into automobiles or dispersed location services may be employed if the location server is unavailable.

Vehicle tracking improves routing and reduces road accidents. These routing systems have drawbacks: GPS powers these routing algorithms. Location servers aren't always accessible.

Geocast Routing Protocols

Protocols employ location-based multicasting. This message will reach all nearby automobiles. Designated region. The ZOR receives messages from this source node. Directed

flooding within a ZOR reduces packet overhead in this way. Geo-cast protocols include IVG, DG-CASTOR, and DRG. Despite several successful methods, delivering packets in a geo-cast zone with high probability is difficult. IVG, DG-CASTOR, and DRG are Geo-cast routing protocols.

These protocols reduce network congestion and boost packet speed. Delivering packets to all ZOR nodes is tough.

Cluster-Based Routing Protocols

Cluster-based routing uses position and vehicle grouping for vehicle communication. This rectangle.

Cluster heads are selected after cluster formation. The cluster header handles inter-vehicle communication, whereas intra-vehicle communication is handled directly. The most important part of this kind of development is choosing cluster headers. This cluster header exchanges communications with others. Cluster-based routing techniques include COIN, LORA-CBF, and CBDRP.[23,25] These protocols scale well for medium-to-large networks.

One drawback of VANETs is cluster management, which is difficult.

Broadcasting-Based Routing

These guidelines assist us in responding quickly to emergencies, accidents, and traffic congestion. Send the message to as many nodes as possible within a certain range. These methods broadcast announcements to all vehicles. Flooding broadcasts signals to nearby receivers. These protocols waste bandwidth by sending nodes repeated packets. This method allows nodes to receive the message twice. This approach is the foundation of BROADCOMM, UMB, V-TRADE, and DV-CAST.[26] The message reaches all nodes rapidly, which is one of the benefits. Network congestion is caused by unused network capacity and message duplication.

Routing Protocol Obstacles

Mobile ad hoc networks (MANETs) have developed into vehicular ad hoc networks (VANETs), which enable wireless communication between moving automobiles or roadside infrastructure. Routing protocols are crucial to the operation of these dynamic networks. Several research and investigations have provided methods for these networks, however, no methodology works in every situation. Current algorithms work well in low-traffic situations. Proactive routing fails when topology changes quickly during information exchange. The reactive routing protocol cannot identify the whole network path due to partitioning. Position-based routing requires node locations. VANETs are too mobile for topology-based routing. Thus, academics face several challenges while designing a VANET-optimal routing system.

Table 1.A comparison of the different routing protocols used on the VANET

Protocols	Reactive protocols	Proactive protocols	Geo cast based	Cluster-based	Position based	Broadcast based
Earlier Form of the Forwarding Method	Multi-hop wireless network	Multi-hop wireless network	Multi-hop wireless network	Multi-hop wireless network	Multi-hop wireless network	Multi-hop wireless network
Virtual Infrastructure Requirement	yes	yes	yes	no	yes	yes
Digital Map Requirement Methods of Recuperation	no	no	no	yes	no	no
Scenario Earlier Form of the Forwarding Method	no	no	no	yes	no	no
Observable Patterns of Traffic Flow	Carry & forward	Multi-hop forwarding	flooding	Carry & forward	Carry & forward	Carry & forward
Virtual Infrastructure Requirement	urban	urban	highway	urban	urban	highway

Conclusion

Engineering advances add automobiles to our worldwide network. Wireless technology helped make these networks very contactable. This combination created VANETs, which are very dynamic, making routing algorithms for them difficult. This article discusses routing protocol merits and downsides and future issues. Table 1 compares these protocols using network and communication characteristics. A routing protocol that meets VANET's dynamic demands is still needed.

References

1. J.Hoebeke, I.Moerman, B.Dhoedtand and P.Demeester, "An Overview of Mobile Ad Hoc Networks: Applications and Challenges".
2. S.Zeadally, R.Hunt, Y.Chen, A.Irwin and A.Hassan "Vehicular ad hoc networks (VANETS): status, results, and challenges" Telecommunication SystemsAugust 2012, Volume 50, Issue 4, pp 217-241.
3. R.Kumar and M. Dave, "A Comparative Study of Various Routing Protocols in VANET", IJCSI International Journal of Computer Science Issues, Vol. 8, Issue 4, No 1, July 2011 ISSN (Online): 1694-0814.
4. B.Paul, Md.Ibrahim and Md.Bikas, "VANET Routing Protocols: Pros and Cons", International Journal of Computer Applications (0975 – 8887),Volume 20– No.3, April 2011.
5. M.Altayeb and I.Mahgoub,"A Survey of Vehicular Ad hoc Networks Routing Protocols", International Journal of Innovation and Applied Studies ISSN 2028-9324 Vol. 3 No. 3 July 2013, pp. 829-846
6. C.E.Perkins and P.Bhagwat, "Highly DSDV", 1994.
7. T.Clausen and et al., "Optimized Link State Routing Protocol (OLSR)", RFC 3626, Network Working Group, Oct. 2003.
8. M.Gerla, X.Hong, G. Pei, "Fisheye State Routing Protocol (FSR)", IETF Internet Draft, work in progress, draft-ietfmanet- fsr-03.txt, July 2002.
9. J. J. Garcia-Luna-Aceves and M. Spohn, "Source-Tree Routing in Wireless Networks", Proceedings of 7th International Conference on Network Protocols, 1999.
10. Laiq Khan, NohmanAyub and AamirSaeed " Anycast Based Routing in Vehicular Adhoc Networks (VANETS) using Vanetmobisim", World Applied Sciences Journal 7 (11): 1341-1352, 2009 ISSN 1818-4952 © IDOSI
11. C.S. Murthy, B.S. Manoj,"AdHoc Wireless Networks", Pearson, 2004 pp. 336-338 and 627.
12. R. Ogier and et al., "Topology Dissemination Based on Reverse- Path Forwarding (TBRPF)", 2004.
13. D. Johnson, B.D.A. Maltz, and Y.C.Hu, "The Dynamic Source Routing Protocol for Mobile Ad Hoc Networks (DSR)", draft-ietf-manet-dsr-10.txt, 2004.
14. C.E.Perkins and E. M. Royer, "Ad-Hoc On Demand Distance Vector Routing, Proceedings of the 2nd IEEE Workshop on Mobile Computing Systems and Applications (WMCSA)", pp. 90-100, 1999.
15. Zhan Haawei and Zhou Yun, "Comparison and analysis AODV and OLSR Routing Protocols in Ad Hoc Network", 2008, IEEE.
16. PrabhakarRanjan , Kamal Kant Ahirwar "Comparative Study of VANET and MANET Routing Protocols", Proc. of the International Conference on Advanced Computing and Communication Technologies (ACCT 2011) Copyright © 2011 RG Education Society ISBN: 978-981-08-7932-7
17. http://www.cse.wustl.edu/~jain/cis788-99/ftp/ adhoc_ routing/#intro
18. C.E.Perkins, "Ad hoc Networking", Addison Wesley , 2001.
19. NAUMOV V, "An evaluation of inter-vehicle ad hoc networks based on realistic vehicular traces", MOBIHOC 2006.
20. Harsch, C.; Festag, A.; Papadimitratos, P., "Secure Position-Based Routing for VANETs", Vehicular Technology Conference, 2007. VTC-2007 Fall. 2007 IEEE 66th , pp.26-30, Sept. 30.
21. James Bernsen and D. Manivannan "Greedy Routing Protocols for Vehicular Ad Hoc Networks", 2008 IEEE.
22. Yatendra Mohan Sharma, Dr. Saurabh Mukherjee " A Contemporary Proportional Exploration of Numerous Routing Protocol in VANET", International Journal of Computer Applications (0975 – 8887) Volume 50– No.21, July 2012.
23. J. Blum,"Mobility management in IVC networks", 2003.
24. R. A. Santos, "Performance evaluation of routing protocols in vehicular ad hoc networks", 2005.
25. Tao Song, "A Cluster-Based Directional Routing Protocol in VANET".
26. PoojaDuddalwar, AtulDeshmukh and S. S. Dorle "A Comparative Study of Routing Protocol in Vehicular Ad Hoc Network", International Journal of Emerging Technology and Advanced Engineering, ISSN 2250-2459, Volume 2, Issue 3, March 2012.