Published: 09 March 2021

Performance Evaluation of AOMDV on Realistic and Efficient VANet Simulations

Rana Muhammad Waseem,
Farrukh Zeeshan Khan,
Muneer Ahmad,
Anum Naseem,
N. Z. Jhanjhi &
Uttam Ghosh

Wireless Personal Communications (2021)Cite this article

Abstract

The digital transmission amongst vehicles and roadway equipment is necessary for the realization of smart transportation systems. Vehicular ad-hoc network (VANet) is an ascension field of engineering that presents brilliant transport applications, road safety, comfort and luxury to drivers. VANet protocols face many challenges because of the changing nature of vehicular ad-hoc network. VANet routing protocols perform a vital role in terms of the performance efficiency because they decide the mode of sending and receiving packets between mobile vehicular nodes. Finding suitable and efficient routing protocol is very important for the efficient implementation of VANet. The foremost objective of this research is to suggest the relevant and efficient VANet routing protocols in a high traffic density area. This research work presents a practical evaluation of the VANet topology's features with respect to time for the high traffic situations. This evaluation incorporates the actual creation of roadway layout. An accurate traffic flow is produced by extracting run-time facts and figures from PeMS (Freeway Performance Measurement System) database and assigning this extracted information into a microscopic mobility model. To achieve our goal, we consider three routing protocols i.e., AOMDV, AODV and DSDV. The simulation results prove that the performance of AOMDV is greater in comparison to DSDV and AODV protocols in high traffic density areas. The AOMDV protocol improves overall network performance by achieving maximum

throughput and minimum end to end delay.

References

1.

Ghori, M. R., Zamli, K. Z., Quosthoni, N., Hisyam, M., & Montaser, M. (2018). Vehicular ad-hoc network (VANet): Review. In *2018 IEEE international conference on innovative research and development (ICIRD), Bangkok* (pp. 10–16). https://doi.org/10.1109/ICIRD.2018.8376311

2.
Cooper, F. D., Ros, M., Safaei, F., & Abolhasan, M. (2017). A comparative survey of VANet clustering techniques. In *IEEE communications surveys and tutorials* (vol. 19, no. 1, pp. 657–681). https://doi.org/10.1109/COMST.2016.2611524

3.
Mirza, S., & Bakshi, S. Z. (2018). Introduction to MANET. *International Research Journal of Engineering and Technology*, *5*(1), 17–20.

Google Scholar

4.
Vimal, S., et al. (2016). Secure data packet transmission in MANET using enhanced identity-based cryptography. *International Journal of New Technologies in Science and Engineering*, *3*(12), 35–42.

Google Scholar

5.
Taha, A., Alsaqour, R., Uddin, M., Abdelhaq, M., & Saba, T. (2017). Energy efficient multipath routing protocol for mobile ad-hoc network using the fitness function. *IEEE Access*, *5*, 10369–10381. https://doi.org/10.1109/ACCESS.2017.2707537

Article Google Scholar

85
0
69
0

6.
Almusaylim, Z. A., Alhumam, A., & Jhanjhi, N. Z. (2020). Proposing a secure RPL based Internet of Things Routing Protocol: A review. *Ad hoc Networks*, *101*, 102096. https://doi.org/10.1016/j.adhoc.2020.102096

Article Google Scholar

25
0
18
0

7.
Sennan, S., Somula, R., Luhach, A. K., Deverajan, G. G., Alnumay, W., Jhanjhi, N. Z., et al. (2020). Energy efficient optimal parent selection based routing protocol for Internet of Things using firefly optimization algorithm. *Transactions on Emerging Telecommunications Technologies*. https://doi.org/10.1002/ett.4171

Article Google Scholar

2
0
1
0

8.
Eze, E. C., et al. (2016). Advances in vehicular ad-hoc networks (VANets): Challenges and road-map for future development. *International Journal of Automation and Computing*, *13*(1), 1–18.

MathSciNet Article Google Scholar

64
0

9. 56
Rasheed, A., et al. (2017). Vehicular ad hoc network (VANet): A survey, challenges, and applications. In *Vehicular ad-hoc networks for smart cities* (pp. 39–51). Springer.

10.
Rathi, D., & Ranade, R. (2017). Performance evaluation of AODV routing protocol in VANet with NS2. *IJIMAI*, *4*(3), 23–27.

Article Google Scholar

4
0

11. 4
Devangavi, A. D., & Gupta, R. (2017). Routing protocols in VANet A survey. In *2017 international conference on smart technologies for smart nation (SmartTechCon)*, Bangalore (pp. 163–167). https://doi.org/10.1109/SmartTechCon.2017.8358362

12.
Vimal, S., Kalaivani, L., Kaliappan, M., Suresh, A., Xiao-Zhi, G., & Varatharajan, R. (2018). Development of secured data transmission using machine learning based discrete time partial observed markov model and energy optimization in Cognitive radio networks. *Neural Computer and Applications*. https://doi.org/10.1007/s00521-018-3788-3

Article Google Scholar

28
0

13. 5
Vimal, S., Kalaivani, L. & Kaliappan, M. (2017). Collaborative approach on mitigating spectrum sensing data hijack attack and dynamic spectrum allocation based on CASG modeling in wireless cognitive radio networks. *Cluster Computing*. https://doi.org/10.1007/s10586-017-1092-0

14.
Mishra, R., Singh, A., & Kumar, R. (2016). VANet security: Issues, challenges and solutions. In *2016 international conference on electrical, electronics, and optimization techniques (ICEEOT)*, Chennai (pp. 1050–1055). https://doi.org/10.1109/ICEEOT.2016.7754846

15.
Sadovaya, Y., & Zavjalov, S. (2020). Dedicated short-range communications: Performance evaluation over mmWave and potential adjustments. *IEEE Communications Letters*. https://doi.org/10.1109/LCOMM.2020.3016634

Article Google Scholar

1
0

16. 0
Jain, M., & Saxena, R. (2017). Overview of VANet: Requirements and its routing protocols. In *2017 international conference on communication and signal processing (ICCSP)*, Chennai (pp. 1957–1961). https://doi.org/10.1109/ICCSP.2017.8286742

17.
Mutalik, P., Nagaraj, S., Vedavyas, J., Biradar, R. V., & Patil, V. G. C. (2016). A comparative study on AODV, DSR and DSDV routing protocols for Intelligent Transportation System (ITS) in metro cities for road traffic safety using VANet route traffic analysis

(VRTA). In *2016 IEEE international conference on advances in electronics, communication and computer technology (ICAECCT)*, Pune (pp. 383–386). https://doi.org/10.1109/ICAECCT.2016.7942618

18.
Anwar, M. N. B. (2020). Performance analysis of AODV, OLSR, DSDV routing protocols in MANET under black hole attack. In *Proceedings of the international conference on computing advancements*.

19.
Hamid, B., & Mokhtar, E. E. (2015). Performance analysis of the vehicular ad hoc networks (VANet) routing protocols AODV, DSDV and OLSR. In *2015 5th international conference on information and communication technology and accessibility (ICTA)*, Marrakech (pp. 1–6). https://doi.org/10.1109/ICTA.2015.7426885

20.
Fahad, T. O., & Ali, A. A. (2019). Compressed fuzzy logic based multi-criteria AODV routing in VANet environment. *International Journal of Electrical and Computer Engineering (IJECE)*, *9*(1), 397–401.

Article Google Scholar

8
0

21. 7
Mittal, S., Kaur, R., & Purohit, K. C. (2016). Enhancing the data transfer rate by creating alternative path for AODV routing protocol in VANet. In *2016 2nd International conference on advances in computing, communication and automation (ICACCA) (Fall)*, Bareilly (pp. 1–5). https://doi.org/10.1109/ICACCAF.2016.7748976

22.
Shibasaki, Y., Sato, K., & Iwamura, K. (2020). An AODV-based communication-efficient secure routing protocol for large scale ad-hoc networks. In *2020 IEEE 17th annual consumer communications and networking conference (CCNC)*, Las Vegas, NV, USA (pp. 1–6). https://doi.org/10.1109/CCNC46108.2020.9045743

23.
Makhlouf, A. M., & Guizani, M. (2019). SE-AOMDV: Secure and efficient AOMDV routing protocol for vehicular communications. *International Journal of Information Security*, *18*(5), 665–676.

Article Google Scholar

2
0

24. 0
Hasan, M. K., & Sarker, O. (2020). Routing protocol selection for intelligent transport system (ITS) of VANet in high mobility areas of Bangladesh. In *Proceedings of international joint conference on computational intelligence*. Springer.

25.
Afdhal, A., Muchallil, S., Walidainy, H., & Yuhardian, Q. (2017). Black hole attacks analysis for AODV and AOMDV routing performance in VANets. In *2017 international conference on electrical engineering and informatics (ICELTICs)*, Banda Aceh (pp. 29–34). https://doi.org/10.1109/ICELTICS.2017.8253244

26.
Behrisch, M., & Weber, M. (2018). *Simulating urban traffic scenarios*. Springer.

Google Scholar

27.
Kabrane, M., et al. (2017). Smart cities: Energy consumption in wireless sensor networks for road trafile modeling using simulator SUMO. In *2017 international conference on engineering and MIS (ICEMIS)*, Monastir (pp. 1–7). https://doi.org/10.1109/ICEMIS.2017.8273062

28.
Mooney, P., & Minghini, M. (2017). A review of OpenStreetMap data (pp. 37–59).

29.
Saluja, A. K., Dargad, S. A., & Mistry, K. (2017). A Detailed Analogy of Network SimulatorsNS1, NS2, NS3 and NS4. *International Journal of Future Revolution Computer Science Communication Engineering*, *3*, 291–295.

Google Scholar

30.
Yelure, B. S., & Sonavane, S. P. (2019) QoS wvaluation of VANet routing protocol. In *2019 international conference on communication and electronics systems (ICCES)*, Coimbatore, India (pp. 813–818). https://doi.org/10.1109/ICCES45898.2019.9002115

Download references

Author information

Affiliations

Department of Computer Science, University of Engineering and Technology, Taxila, Pakistan

Rana Muhammad Waseem & Farrukh Zeeshan Khan

Department of Information Systems, Faculty of Computer Science and Information Technology, University Malaya, Kuala Lumpur, Malaysia

Muneer Ahmad

Department of CS and IT, The University of Lahore, Islamabad Campus, Lahore, Pakistan

Anum Naseem

School of Computer Science and Engineering SCE, Taylor's University, Subang Jaya, Malaysia

N. Z. Jhanjhi

Department of EECS, Vanderbilt University, Nashville, TN, 37235, USA

Uttam Ghosh

Corresponding author

Correspondence to N. Z. Jhanjhi.

Ethics declarations

Conflict of interest

All authors declare that they have no conflict of interest.

Additional information

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Rights and permissions

About this article

Cite this article

Waseem, R.M., Khan, F.Z., Ahmad, M. *et al.* Performance Evaluation of AOMDV on Realistic and Efficient VANet Simulations. *Wireless Pers Commun* (2021). https://doi.org/10.1007/s11277-021-08358-7

- Accepted19 February 2021
- Published09 March 2021
- DOIhttps://doi.org/10.1007/s11277-021-08358-7

Keywords

- Multipath routing
- AODV
- AOMDV
- Vehicular ad-hoc network (VANets)