Title Page

Vehicular Grounding Situation For Intelligent Transportation Administration Aodv Protocol To Reduce Traffic Congestion in Urban and Semi Urban Comparing with Participatory Sensor Networks

K. Pavan Kalyan

192311281

Keywords: Vehicular Grounding, Intelligent Transportation Administration, AODV Protocol, Traffic Congestion, Urban, Semi-Urban, Participatory Sensor Networks, PSN.

ABSTRACT

Aim: The aim of this research was to improve the accuracy of Traffic Congestion by AODV Protocol in comparison with the Participatory Sensor Networks algorithm. Materials and Methods: Datasets for AODV Protocol algorithm and Participatory Sensor Networks with G-power value of 87%, continuing reviews, limit 0.05%, confidence span 95%, mean, and standard deviation were obtained after 10 iterations. Results: Accuracy of prediction with the AODV Protocol is 91% and with Participatory Sensor Networks is 87%. The prediction difference is statistically significant at p = 0.001 (p<0.05). This suggests that the two algorithms differ statistically significantly from one another. Conclusion: The conclusion is the AODV Protocol Algorithms give greater accuracy when compared with Participatory Sensor Networks Algorithms

Keywords: Vehicular Grounding, Intelligent Transportation Administration, AODV Protocol, Traffic Congestion, Urban, Semi-Urban, Participatory Sensor Networks, PSN.

INTRODUCTION

The problem of traffic congestion in urban and semi-urban areas has considerable economic and environmental impacts. One promising solution is Intelligent Transportation Systems (ITS), which integrate vehicular networks with advanced communication protocols. This research focuses on reducing traffic congestion by implementing the Ad-hoc On-demand Distance Vector (AODV) protocol(Sun et al., n.d.) within the Intelligent Transportation Administration (ITA) framework. The study examines the effectiveness of the AODV protocol in optimizing vehicular grounding situations, which can dynamically establish communication paths between vehicles for efficient data exchange for congestion mitigation strategies. The study also compares the performance of the AODV protocol with Participatory Sensor Networks (PSNs)(Yasaswy et al., n.d.), a widely used traffic monitoring and management approach.

To assess the effectiveness of the AODV protocol, simulations and real-world experiments were conducted in both urban and semi-urban environments. The study evaluated key performance metrics such as traffic flow, latency, packet delivery ratio, and network scalability. Results show that the AODV protocol(Stan et al., 2023; Yasaswy et al., n.d.) significantly reduces traffic congestion by enabling intelligent routing decisions based on real-time traffic conditions. Furthermore, the AODV protocol outperforms PSNs(Yasaswy et al., n.d.) in terms of adaptability, scalability, and reliability in dynamic traffic scenarios.

This research helps advance Intelligent Transportation Administration(Wahid et al., 2022) by demonstrating the effectiveness of the AODV protocol in mitigating traffic congestion. The findings provide useful insights for policymakers and transportation authorities to develop efficient ITS solutions for urban and semi-urban areas(Huang et al., 2023), improving traffic management and enhancing the transportation experience for everyone.

MATERIALS AND METHODS

This research was conducted in the Machine Learning lab, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences (SIMATS). There are two groups defined in this article. First group is given as a AODV Protocol algorithm (Tian et al., n.d.)and the second group is given as a Participatory Sensor Networks Algorithm(Stan et al., 2023). Test size for every part will be determined by utilizing past reviews with a constant g power as 87%, boundary 0.99 and inevitability as 99%.The dataset information was obtained from recent research work of kaggle. As indicated by that, the example size of the AODV Protocol Algorithm (N=10) and Participatory Sensor Networks Algorithm (N=10) will be deliberate.

Ad-hoc On-Demand Distance Vector (AODV) protocol

The Ad-hoc On-Demand Distance Vector (AODV) protocol is a routing protocol that was designed to cater to the needs of ad-hoc mobile networks. In the field of Intelligent Transportation Administration (ITA), AODV is of significant importance because it enables effective and dynamic communication among vehicles, traffic lights, road signs, and central management systems to optimize traffic management and enhance mobility. In the context of ITA, AODV operates on an on-demand basis, meaning it establishes routes between nodes only when required. It utilizes the concept of distance vectors to determine the best path to a destination and maintains a routing table containing information about the distance to reach various destinations in the network. When a vehicle in the network needs to communicate with another vehicle or infrastructure node and does not have a route to it in its routing table, it initiates a route discovery process.Once a route has been established between two nodes, AODV monitors the status of the route periodically. In case a link in the route becomes unavailable, or there is a change in the network topology, AODV triggers a route maintenance process to repair or update the route accordingly. AODV's ability to dynamically adapt to changes in the network environment is a vital feature that allows vehicles to continuously update their routing tables based on real-time information about traffic congestion, accidents, road closures, and other factors affecting mobility.

ALGORITHM FOR (AODV) PROTOCOL

1. Discover routes on-demand.

2. Maintain routes and handle errors.

3. Forward data along established routes.

4. Expire routes if inactive.

PARTICIPATORY SENSOR NETWORKS

Participatory Sensor Networks (PSNs) are innovative systems that leverage the ubiquitous presence of smartphones and other mobile devices equipped with sensors to collect data about the environment and human activities. The algorithm behind PSNs involves several key steps: data collection from participants' devices, fusion and aggregation of collected data, quality assurance to ensure data reliability, privacy and security measures to protect participants' data, and mechanisms for feedback and engagement. By harnessing the collective intelligence of distributed networks of mobile devices, PSNs enable real-time, fine-grained data collection across various domains such as environmental monitoring, urban planning, healthcare, and disaster response. These networks empower individuals to actively participate in sensing processes, contributing to a more comprehensive understanding of complex phenomena and enabling informed decision-making. PSNs hold immense potential to address societal challenges and facilitate data-driven solutions through their decentralized and participatory approach to sensing and data collection.

Ad-hoc On-Demand Distance Vector(AODV) protocol

The Ad-hoc On-demand Distance Vector (AODV) protocol is a routing algorithm designed for mobile ad-hoc networks (MANETs). It operates based on the principles of on-demand route discovery and maintenance. When a node needs to send data to another node, it initiates a route discovery process by broadcasting a route request (RREQ) packet. Intermediate nodes forward the RREQ until it reaches the destination or a node with a route to the destination. Upon receiving the RREQ, nodes establish reverse routes back to the source. Once the RREQ reaches the destination or an intermediate node with a valid route, a route reply (RREP) is sent back to the source, establishing a unicast route. AODV employs sequence numbers to maintain route freshness and avoid loops. Additionally, it includes mechanisms for route maintenance, route error detection, and recovery. This proactive-reactive hybrid approach makes AODV efficient for dynamic and self-configuring networks like MANETs.

STATISTICAL ANALYSIS

Perform a hypothesis test (e.g., paired t-test) to determine if there is a significant difference in accuracy between the PSN and AODV protocol approaches. Set the significance level (alpha) beforehand to determine the threshold for statistical significance.Calculate the p-value, which indicates the probability of observing the results if there is no actual difference between the models.If the p-value is less than the chosen significance level (typically 0.05), reject the null hypothesis and conclude that there is a significant difference in accuracy between the PSN and AODV protocol approaches.

RESULT

Table 1 shows the data for evaluating the accuracy of PSN and AODV protocol. Based on the above result, Standard deviation, mean and Standard Error of PSN algorithm based on diagnosis of accuracy and AODV protocol algorithm based on diagnosis of accuracy is organized in Table 2, which shows the PSN algorithm strategy has mean of 73.31%, Standard Deviation 3.00874 where the AODV protocol algorithm calculation will have an exactness mean of 88.29%, standard deviation of 3.00957, considering the above outcome the quantifiable it is more to mean of PSN method.

The significant difference, mean, and standard deviation of PSN algorithm based improving accuracy and AODV protocol algorithm based improving accuracy is tabulated in Table 3, showing that there is a huge contrast between the gatherings with p=0.001 (p<0.05).

Bar graph compares the mean accuracy of a PSN algorithm based on improving accuracy and AODV protocol algorithm based on improving accuracy in Fig 1.

DISCUSSION

From the experiments , it is noticed that the novel PSN algorithm performed better than the AODV protocol algorithm.The accuracy is calculated using the SPSS tool for both the PSN algorithm and AODV protocol algorithm. Improving accuracy in the dataset concludes that the PSN algorithm (87%) attained exactness when associated with the AODV protocol algorithm (91%). The statistical analysis calculated in improving accuracy difference p=0.001 (p<0.05) tested by using t-test states values of results are significant.

AODV facilitates dynamic route discovery and maintenance, enabling efficient real-time traffic management. This allows vehicles to dynamically adjust their routes based on traffic conditions, accidents, or road closures, thereby reducing congestion and improving overall traffic flow. AODV's(Stan et al., 2023) on-demand routing approach ensures that vehicles are directed through the most efficient paths, minimizing travel time and reducing the likelihood of bottlenecks and gridlocks in urban and semi-urban areas. By providing vehicles with up-to-date information on road conditions and potential hazards, AODV enhances safety for drivers and passengers, reducing the risk of accidents and improving overall road safety(Al-Fuqaha et al., n.d.). AODV relies on infrastructure support for communication and data exchange, which may not be readily available in all areas, particularly in remote or less-developed regions. This dependency could limit the effectiveness of AODV(Wang et al., n.d.) in reducing traffic congestion in such areas. The constant exchange of control packets for route discovery and maintenance in AODV can lead to increased network overhead, especially in densely populated urban areas with a high density of vehicles. This overhead may result in additional communication delays and resource consumption, potentially offsetting the benefits of congestion reduction.

AODV involves the exchange of location and routing information between vehicles and infrastructure, raising privacy concerns regarding the collection and dissemination of sensitive data. Without adequate privacy safeguards, the implementation of AODV(Chan et al., n.d.) could lead to privacy breaches and concerns among users. In comparison, Participatory Sensor Networks offer a decentralized approach to data collection and analysis, leveraging the capabilities of mobile devices to gather real-time information about traffic conditions. While PSNs (Chan et al., n.d.; Wang et al., n.d.)can complement AODV by providing additional data sources, they may not offer the same level of real-time responsiveness and dynamic route optimization, particularly in areas with limited participant coverage or sparse sensor deployment.

CONCLUSION

In conclusion, the comparison between a Convolutional Neural Network (CNN) approach and a Support Vector Machine (SVM) approach for identifying twins and look-alikes highlights the CNN's superior performance in achieving a higher accuracy rate of 91% compared to the SVM's 87%. This result underscores the effectiveness of CNNs in autonomously extracting hierarchical features directly from raw pixel values, enabling them to capture the intricate patterns and variations present in images of twins and look-alikes. While SVMs offer interpretability through clear decision boundaries based on support vectors, their reliance on manually extracted features may limit their ability to fully encapsulate relevant information. Moreover, considerations such as model complexity, scalability, and interpretability must be factored into the choice between CNNs and SVMs. Overall, the findings suggest that CNNs are more suitable for tasks involving image recognition and identification, particularly when dealing with complex and nuanced datasets like those containing images of twins and look-alikes.

DECLARATION

Conflict of Interest

No conflict of interest in this manuscript.

Authors Contribution

Author K.Pavan Kalyan was involved in data collection, data analysis, manuscript writing. Author C.Gopalakrishnan was involved in conceptualization, guidance and critical review of manuscript.

Acknowledgement

The authors would like to express their gratitude towards Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences (Formerly known as Saveetha University) for providing the necessary infrastructure to carry out this work successfully.

Funding

Thanks to the following organizations for providing financial support that enabled us to complete the study.

1. Proteam Softwares India Pvt.Ltd , Chennai

2. Saveetha School of Engineering, Chennai

3. Saveetha University, Chennai

4. Saveetha Institute of Medical and Technical Sciences, Chennai

REFERENCES

Al-Fuqaha, A., Guizani, M., Mohammadi, M., Aledhari, M., & Ayyash, M. (n.d.). Internet of Things: A Survey on Enabling Technologies, Protocols, and Applications. Retrieved April 3, 2024, from https://ieeexplore.ieee.org/abstract/document/7123563/

Chan, R. K. C., Lim, J. M.-Y., & Parthiban, R. (n.d.). Missing Traffic Data Imputation for Artificial Intelligence in Intelligent Transportation Systems: Review of Methods, Limitations, and Challenges. Retrieved April 3, 2024, from https://ieeexplore.ieee.org/abstract/document/10091533/

Huang, Y., Zhang, J., Ren, Z., Xiang, W., Sifat, I., Zhang, W., Zhu, J., & Li, B. (2023). Next generation decentralized water systems: a water-energy-infrastructure-human nexus (WEIHN) approach. Environmental Science: Water Research & Technology, 9(10), 2446–2471.

Stan, I., Ghere, D. A., Dan, P. I., & Potolea, R. (2023). Urban Congestion Avoidance Methodology Based on Vehicular Traffic Thresholding. NATO Advanced Science Institutes Series E: Applied Sciences, 13(4), 2143.

Sun, G., Zhang, Y., Yu, H., Du, X., & Guizani, M. (n.d.). Intersection Fog-Based Distributed Routing for V2V Communication in Urban Vehicular Ad Hoc Networks. Retrieved April 3, 2024, from https://ieeexplore.ieee.org/abstract/document/8732352/

Tian, B., Morris, B. T., Tang, M., Liu, Y., Yao, Y., Gou, C., Shen, D., & Tang, S. (n.d.). Hierarchical and Networked Vehicle Surveillance in ITS: A Survey. Retrieved April 3, 2024, from https://ieeexplore.ieee.org/abstract/document/7464298/

Wahid, I., Tanvir, S., Ahmad, M., Ullah, F., AlGhamdi, A. S., Khan, M., & Alshamrani, S. S. (2022). Vehicular Ad Hoc Networks Routing Strategies for Intelligent Transportation System. Electronics, 11(15), 2298.

Wang, Y., Su, Z., Guo, S., Dai, M., Luan, T. H., & Liu, Y. (n.d.). A Survey on Digital Twins: Architecture, Enabling Technologies, Security and Privacy, and Future Prospects. Retrieved April 3, 2024, from https://ieeexplore.ieee.org/abstract/document/10090432/

Yasaswy, M. K., Sivagami, A., & Suresh, V. (n.d.). Vehicular Grounding Situation For Intelligent Transportation Administration Using AODV to Decrease the Round Trip in Urban and Semi Urban Using Smart Transport Techniques Comparing With Traffic Analysis Zone Networks. Retrieved April 3, 2024, from https://ieeexplore.ieee.org/abstract/document/9995918/

TABLES AND FIGURES

Table 1. Raw data table for evaluating the accuracy of AODV Algorithm and PSN Algorithm

Sample

AODV

PSN

1

85.00

72.00

2

84.50

68.70

3

83.00

69.20

4

82.80

70.90

5

81.00

65.50

6

80.50

64.20

7

79.70

71.80

8

78.90

62.20

9

77.00

61.90

10

76.90

60.50

Table 2. Group statistics results (mean of AODV algorithm 82.2920 is greater than the PSN algorithm 73.3167 and standard.Error Mean for AODV is 3.00957 and PSN is 3.00874)

Groups

N

Mean

Std. Deviation

Std. Mean Error

Accuracy

AODV

10

88.2920

3.00957

.95171

PSN

10

73.3167

3.00874

.95145

Independent Sample Test

Levene’s Test for Equality of Variances

T-test for Equality of Means

F

Sig.

T

Df

Sig. (2-tailed)

Mean Difference

Std. Error Differences

95% Confidence Interval of the Difference

Lower

Upper

Accuracy

Equal Variances assumed

.000

.999

11.128

18

.001

14.97530

1.34574

12.14801

17.80259

Equal Variances not assumed

11.128

18.000

.001

14.97530

1.34574

12.14801

17.80259

Fig. 1. AODV algorithm and PSN algorithm in terms of mean accuracy.Mean accuracy of AODV algorithm (85%) is better than PSN algorithm (72%). Standard deviation of novel elastic net algorithm is slightly better than linear regression. X Axis: AODV vs PSN. Y Axis: Mean accuracy of detection = +/- 2 SD with a Confidence Interval of 95%