

Self adoptive Redundancy Elimination Clustering Distributed Load bandwidth Management Constraints for mobile Adhoc Network

Anit Sebi¹, Dr. D. Maheswari²

¹Research Scholar, Department of Computer Science, RVS College of Arts and Science, Sulur, Coimbatore.

²Head & Research Coordinator, School of Computer Studies-PG, RVS College of Arts and Science, Sulur, Coimbatore.

KEYWORDS

MANET,
MAC, data
redundancy and
network
performance

ABSTRACT

The Mobile Adhoc Networks (MANETs) are particular kind of wireless networks which can be easily deployed without any existing infrastructures. These are used in various contexts and in real life applications. However these MANETs also arises various new challenges which when used in a large network containing huge number of nodes. Numerous clustering algorithms are employed. Clustering algorithms gives a path by structuring the network into clusters of entities thus by creating a hierarchical structure. Each and every individual cluster consists of particular node called cluster head. Clustering of mobile nodes among their separate domains helps in solving scalability and the routing of MANETs. Resource management and the network performance are improved by embedding the clustering concepts into mobile and adhoc networks. The IEEE 802.11 for the adhoc networks implements distributed access mechanism in order to avoid collisions through carrier sensing, inter-frame spaces, and a back off mechanism. When the system is dense and congested MANETs may not work in the way it is designed to. To obtain efficacious solution Multi channel MAC protocols are employed so that various nodes are capable of accessing wireless channel simultaneously while broadcasting their packets. This is easily achieved by eliminating the redundancy of the data, increasing the network output so that it is easily implemented in the real life applications.

I. INTRODUCTION

MANETs usually consists of routable networking environment ahead of link layer ad hoc network. They comprises of mobile nodes which are interlinked wirelessly in self feeding network without a need for a fixed structure. Because of the changes that happened in the network topology, the nodes are always free to move randomly. Each node tends to behave as a router as they move forward in a network. MANETs operate as a standalone model. They tend to form a highly dynamic topology with multiple different transceivers which help in communication between the nodes. Yet many challenges exit in MANETs as it needs to consider each and every individual device so that the information is maintained properly among the route in network traffic. These MANETs comprises of peer to peer, self forming and self healing networks which can be used for the safety purposes. Because of scalability nature expansion of the network hub is made easy.

As MANETs are highly flexible and scalable these are easily implemented in military operations and in large scale deployments. These are also cost effective and widely used in the areas where the infrastructure is not available. Every node in the network is accomplished with radio transmitter and receiver so that a communication is allowed with the system via wireless and bidirectional communication. WiFi networks are often weak in most settings and hence it requires a long time to recharge or replace.

In spite of having so many pros, the researchers are working to improve the quality of services by implementing efficient routing protocols so that it provides the better bandwidth throughput and latency. Security, power management, support for multimedia are taken into consideration while doing research in MANETs for the efficient and effective progress.

Multi channel MAC protocol is implemented so that nodes can access this wireless channel simultaneously while transmitting their packets to various channels. Adopted channel allocation scheme is organised for multi hop environments along with the redundancy of the data to achieve the optimal performance without the loss of simplicity.

II. LITERATURE SURVEY

In order to increase the efficiency of the spectrum a deep analysis is done in cognitive radio technology. As per the researchers the usage of spectrum is not the same. With the point of increasing the efficiency OFDM based cognitive radio technology has been developed. A new methodology Yilmazel, R et al [1] is set by merging artificial intelligence techniques and spectrum reduction algorithms. By applying this technique to OFDM technology, the accuracy was analysed and recorded. For optimisation channel allocations and genetic algorithm is enabled. Integration of different spectrum allocation techniques for the secondary users through artificial intelligence is also made possible. Empty frequencies are simultaneously scanned and appropriate allocation of channel is also ensured.

Wireless channel optimisation technologies have been growing tremendously. It ways a path for the research in developing wireless spectrum. To overcome the spectrum shortage problem, cognitive radio technologies have been implemented. In cognitive radio networks the assignment of spectrum is considered as the real challenge. In this research Latif, S., et al. [2] an evolutionary optimisation algorithm has been proposed for the purpose of channel assignment in cognitive radio networks. Biological evolution techniques have inspired the evolutionary algorithms. Particle swarm optimisation is being used in the research paper. In order to increase the spectrum in cognitive radio networks a new repair process is introduced to eliminate the conflict among the secondary users. With the help of extensive simulations the performance of the proposed algorithm is evaluated. From the experimental, it is evident that the proposed algorithm has a better performance when compared to the existing algorithms.

To understand the impact of the global climate changes the researchers use wireless sensor network which provides them the first hand materials. Our recorded results yields that the wireless sensor network provides unbalanced energy consumptions among the relaying nodes and the other nodes may shorten the life span of the system in a long run. Referring to this problem EDA and energy efficient channel allocation based aggregation is proposed Zhou, X et al [3]. To meet the requirements adaptive cycle mechanism is designed in order to save all the unnecessary energy waste and also aims in proposing a constructive reference based channel allocation scheme. So from the results it's evident that the EDA can significantly help in reducing the energy consumptions while considering all the notes.

That exists a simultaneously transmit intrusion event in wireless network which can be avoided from being reported, may also lead to some kind of collusion or interference of channels. To avoid these problems wireless sensor network with multi channel has been employed. The proposed solution by Ebrahim, N.S et al [4] considers the channel inference optimizations under effective time management. Two algorithms has been proposed. Efficient scheduling is also implemented for reducing the interference caused by the packet transmission. From the experimental results it is evident that the proposed algorithm works efficiently by reducing the interference packet drop rate and also improves the throughput.

Information gains associated with the wireless specific traffic are basically found in the data link layers. The survey also takes into consideration of complexities and the challenges in deploying the wireless networks. This research tends to highlights the availability of network that are lacking. Knowledge discovery in the database is also analysed to project the various challenges of wireless intrusion and aims in proposing several guidelines to ensure the

appropriate method in the wireless network. The research done Humayun, M. et al. [5] initiates with the various intrusion reduction techniques collections of data and the placement methods. The paper is more focused to study the challenges associated with deploying the intrusion reduction systems in the wireless environment. MANETs and wireless sensor networks are considered in this research showing the importance of the designing an IDS considering the wireless network.

MANETs are widely used in many fields. For its efficiency and efficacy.. It's been anticipated that MANETs will play a significant role in the near future. The inter node communication is vulnerable that being the main challenges in MANETs. So the main aim of this research paper analysed by M.A. Al-Shareeda et al [6] is to analyse the strategies for the better MANETs considering the message delay and the message dropped assault. The result is evidence that the assaults have an important impact on various objects in manners. With the help of symmetrical cryptographers the proposed methodology will avoid various attacks that interpret the communications that happens between the legal nodes.

MANETs are widely used in many real time applications thus saving peoples time. Because of the network topologies nature, security might be the important point to be considered. MANETs has more security flaws that need to be eliminated for the better efficiency. Implementation of intrusion deduction helps in solving security problems. This research designed Srilakshmi, U., et al [7] for ageing optimization algorithm is implemented that helps in finding the ideal hops by advancing the routing. The fuzzy clustering algorithm is been activated first and then the cluster heads are chosen depending upon the nature. Also many valid nodes are identified based upon their trust levels. From the results the proposed algorithm yields the minimum energy with a maximum throughput by using selective packet dropping attack.

Adhoc networks explicitly shows some challenging issues that needs to be rectified for the betterment of the applications. Many detective systems use the supervised learning method in order to learn from there routing knowledge. Because of its deep future extraction and classification capability, deep learning is widely suggested and it is also the more suitable for problem solving in this type of network. More research have been done because of their limitation in learning nature. This research paper proposed by Rajendran, A., et al [8] and enhances the deep embedded median clustering Which tends to operate in 2 different phases. First the organization of latent future face and second using the K median clustering to group the various divergence.

This paper Salameh, H.B., et al [9] aims in studying the challenges of optimising the network by offering the distributed MIMO mode channel assignments. Commonly the combined MIMO mode and corresponding optimization for the channel is an NP hard combinational non linear problem. two stage optimization approach is used. The first technique tends to analyse the maximum amount of package that can be sent over an channel. Then the number of packets sent is computative in the following step. An admission control mechanism has been employed for allowing the CR users to access the information to the proposed method in a more distributed way. So from the experimental setup it is evident that the overall network performance is increased by 60 %.

The importance of multi channel scheme is widely increased because of the high throughput in wireless sensor networks. In order to exploit the channel resources single or multi radio sensors are widely used. The existing methods yields slow throughput and at times it is expensive. The research viewed through M.S. Shahryari et al. [10] tends to study the MC scheme to various networks so that the gap was easily filled. High throughput and the energy efficient algorithm is then proposed for the betterment of the clustering routing and the assignment of channels in the various heterogeneous setups. The algorithm tends to decouples the nature into various two phases and get solved by help of genetic algorithm. First phase is concentrated in constructing the channels. In the second phase the Ch and the channel normal mode are determined. It also noticed that the total energy consumption and corresponding

energy exhaustion are compared with the previous schemes.

FANET are recently developing area of research. This architecture Chinnathampy et al [12] can also be seen as a new special form of a distributed system in which unmanned aerial vehicles or considered to be the nodes with high dynamic behaviour. Results allocation problem is taken into considerations in any distributed architecture. In this research work FANET are modelled as an application of dynamic graph by emerging its properties in order to achieve the Distributed mutual exclusion. Neo4j is used as a model for the research work and optimal results are obtained.

As we all are aware that FANET is trending research area which considered as the special form because of their mobility in nature. The mutual exclusion plays an important role and ensures the accessibility of the shared resources which may run on various processors. The research workers Parihar et al [11] aimed in modelling the FANET by considering the dynamic graph on the token based allocation algorithms proposed in order to achieve the distributed mutual exclusion.

FANETs can be easily deployed in many real life applications. Unmanned aerial vehicles tend to perform in the real time communication through an efficient protocol for the routing purposes. However there comes a challenging in designing an efficient routing protocol for FANETs considering the all characteristics. It's been known that the Q learning based position helps in improving the performance of the routing in these kind of a networks. This article developed by Alam, M.M. et al [13] tends to provide an overall review of all kind of existing QL based routing protocols. On comparing the reviewed protocols considering various characteristics like operational futures and other metrics for performance.

Infrastructure and ad hoc network are the main architecture in wireless network Vigneshwaran, P et al [14]. MANETs are considered as the self organising structure . Omni directional antenna is implemented in MANETs. For isolation purpose in MANETs sector based routing is implemented. In this paper the efficacy is evaluated through different approach through reconfigurable directional antenna. Furthermore there exists a variation in a signal strength corresponding to the node numbers and other approaches in MANETs are addressed. This paper tends to conclude that the average collision rate is comparable in certain dynamic sectors, the efficiency, the resources are higher, and the strength of the signal power is gradually improved with consideration of the nodes in the network .

III.METHODOLOGY

Proposed Methodology consists of following Modules

1. Mobile Ad-Hoc Network Model Construction
2. Cluster based mobile Adhoc Network
3. Self adoptive Redundancy Elimination Clustering Distributed Load bandwidth Management Constraints for mobile Adhoc Network
4. Performance Evaluation

1. Mobile Ad-hoc Network Model Construction

MANETs, or Mobile Ad hoc Networks, are wireless networks comprising a routable environment beyond a link layer ad hoc network. In this setup, mobile nodes connect wirelessly in a self-configured network, independent of any predefined infrastructure. These nodes have the freedom to move within the network topology. Each node functions as a router, facilitating communication as they move toward other nodes in the network traffic. MANETs can operate autonomously or as part of the Internet. They typically exhibit highly dynamic autonomous topologies, facilitated by one or more transceivers between nodes. Communication in MANETs commonly occurs within the frequency range of 30MHz to 5GHz.

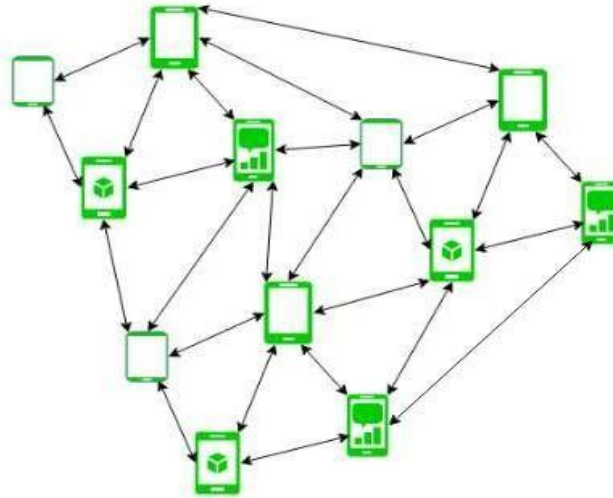


Fig 3.1 Mobile Ad-Hoc Network

2. Cluster based mobile Adhoc Network

A cluster-centric routing approach in the network has demonstrated its effectiveness. A cluster represents a subset of nodes that have convenient connectivity to other nodes. Initially, the protocol examines the current clusters available. The main objective of the protocol is to divide the graph into the necessary overlapping clusters. Changes in network topology directly affect cluster membership adjustments. The routing protocol contributes to enhancing cluster performance within the network graph. This method facilitates the straightforward application of existing routing protocols to the network, taking into account node replacements via clusters.

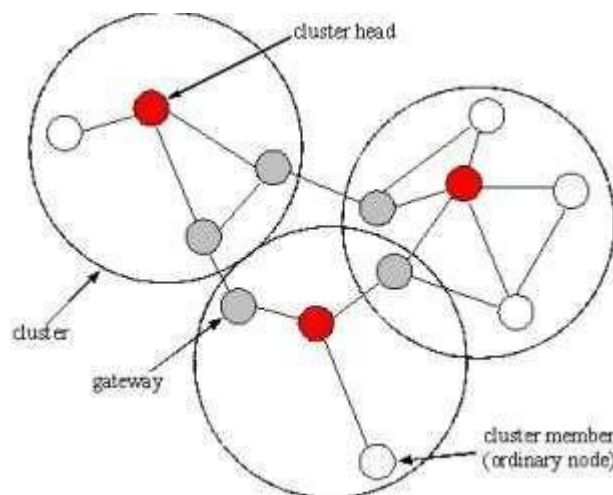


Fig 3.2 cluster heads, gateways and ordinary nodes in mobile adhoc network clustering

3. Self adoptive Redundancy Elimination Clustering Distributed Load bandwidth Management Constraints for mobile Adhoc Network

On analysing the literature survey it is clear that the data has to be eliminated while clustering the data affecting the efficiency in the mobile ad hoc network. The developed prototype comprises of different modules. Mobile network model consists of the various nodes This nodes are clustered into recovered groups each containing its cluster head. Then all these cluster heads are provided to the network where the redundancy of the data is highlighted for the betterment of the network efficiency. Later the network undergoes the performance evaluation, with the help of data throughput packet delivery ratio, bandwidth utilization and network overhead.

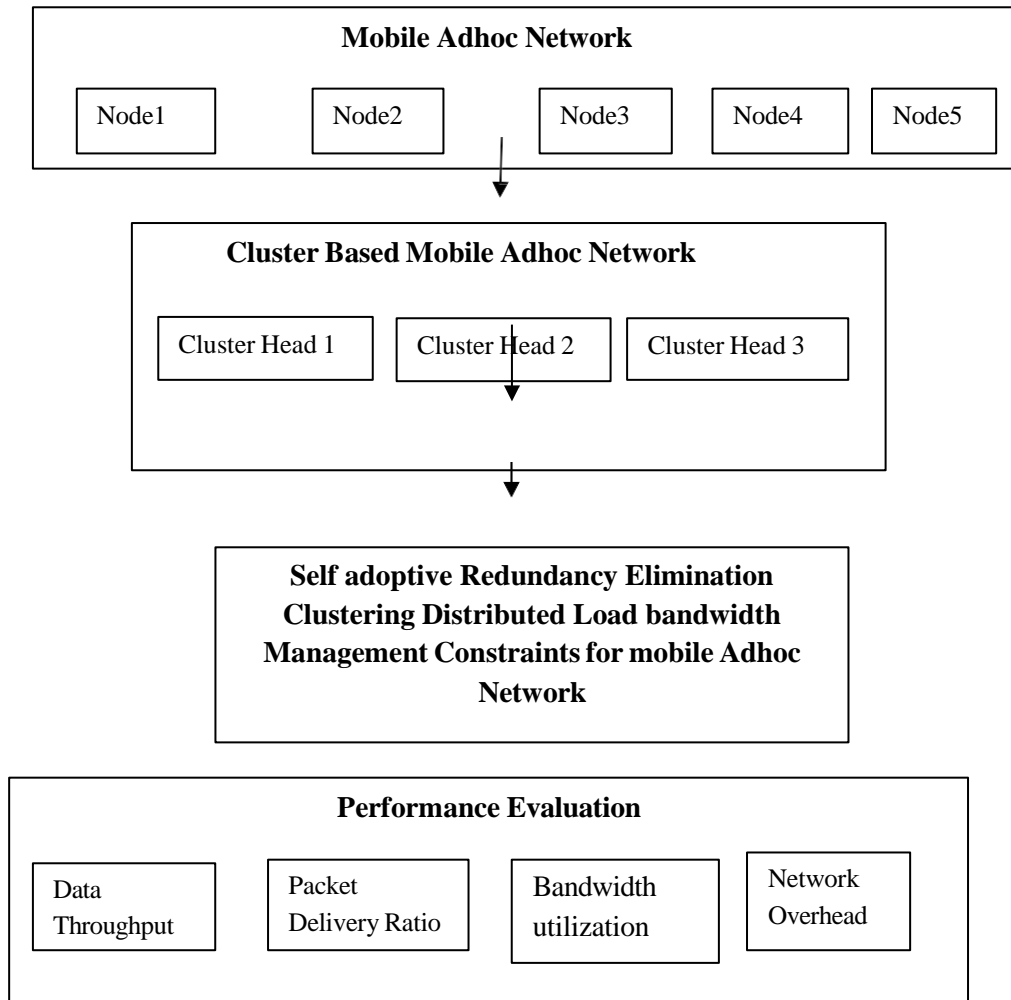


Fig 3.4 Proposed Methodologies

3. Self adoptive Redundancy Elimination Clustering Distributed Load bandwidth

Initialization:

- Initialize variables and data structures needed for clustering and monitoring bandwidth.
- Define thresholds for bandwidth utilization and load balancing.

Monitoring:

- Continuously monitor the network for bandwidth utilization and load balancing.
- Track incoming data packets and their sources.

Bandwidth Utilization Calculation:

- Calculate the current bandwidth utilization based on the amount of data transmitted and available bandwidth.

Load Balancing Calculation:

- Determine the load balancing across nodes in the distributed system.

- This could involve factors like CPU usage, memory usage, or number of active connections on each node.

Threshold Check:

- Compare the calculated bandwidth utilization and load balancing against predefined thresholds.
- If either threshold is breached, proceed to redundancy elimination clustering.

Redundancy Elimination Clustering:

- For each incoming data packet, check if it exists in any existing cluster.
- If not found, create a new cluster for the data packet.
- If found, eliminate redundancy by removing duplicates and merging clusters if necessary.
- Update the clusters accordingly based on the redundancy elimination logic.

Threshold Adjustment:

- After redundancy elimination clustering, update the thresholds if necessary.
- This adjustment could be based on the current state of the system and historical data.

Adaptation:

- Repeat the monitoring and clustering process iteratively.
- Adapt the clustering and thresholds dynamically based on changing network conditions.

Fault Tolerance:

- Implement mechanisms to handle node failures or network partitions.
- Ensure that the algorithm can continue functioning and adapt to changes even in the presence of failures.

Scalability:

- Design the algorithm to scale efficiently with the size of the distributed system.
- Consider factors like the number of nodes, volume of data, and network topology.

Optimization:

- Continuously optimize the algorithm for performance and efficiency.
- Identify bottlenecks and areas for improvement based on real-world deployment and testing.

Testing and Evaluation:

- Test the algorithm extensively in simulated and real-world environments.
- Evaluate its performance, scalability, and effectiveness in reducing redundancy and optimizing bandwidth utilization.

4. PERFORMANCE EVALUATION

A. Packet Delivery Ratio

The ratio of total packets delivered to total packets sent from source node to destination node in the network is known as the packet delivery ratio, or PDR. The maximum amount of data packets that must arrive at the destination is what is intended. The network's performance rises in tandem with the PDR value.

TABLE I Comparison of Packet Delivery Ratio

algorithmname	Packet_Delivery_Ratio
Redundancy Elimination and Load Balancing	38.0
Enhanced Self Adoptive Redundancy Elimination and Load Balancing	75.299999999999997

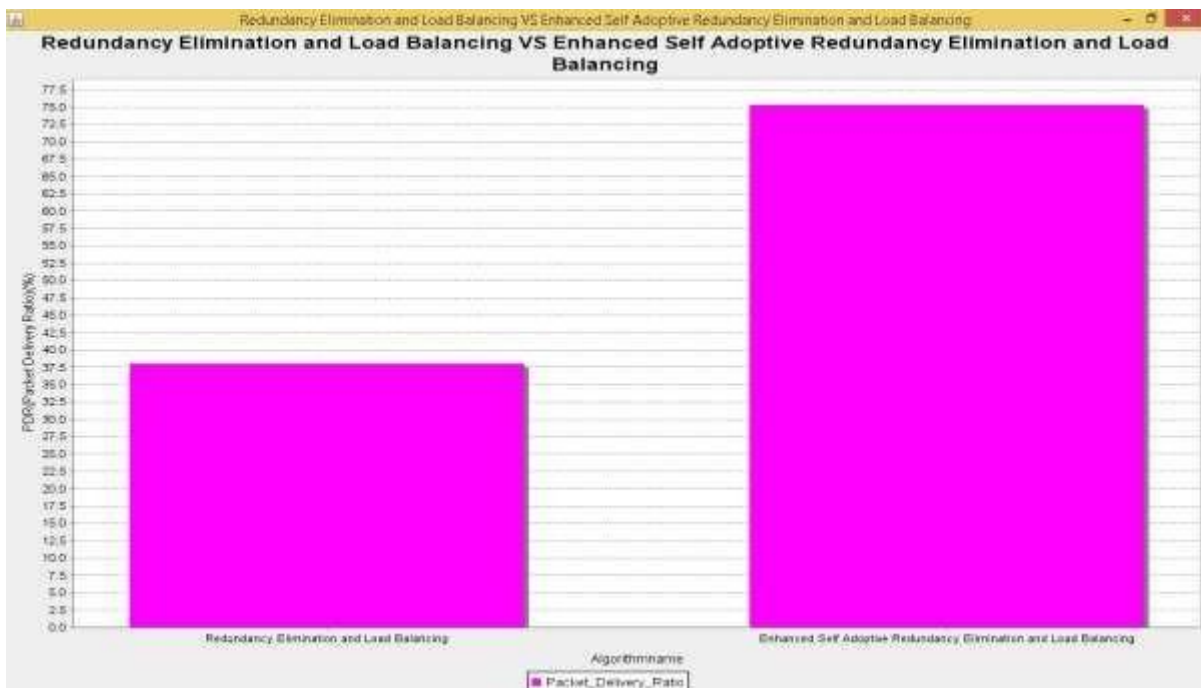


Fig 4.1 Packet Delivery Ratio of Redundancy Elimination and Load Balancing and Enhanced Self Adoptive Redundancy Elimination and Load Balancing

The above figure shows that efficient packet delivery ratio is obtained through Enhanced Self Adoptive Redundancy Elimination and Load Balancing.

B. Throughput

Throughput in wireless sensor networks is defined as the quantity of packets that are successfully sent from the source to the destination in a second. A well-designed network should have a high throughput value; if it is attacked, the throughput value will drop significantly.

TABLE II Comparison of Throughput

algorithmname	throughput
Redundancy Elimination and Load Balancing	1.600000...
Enhanced Self Adoptive Redundancy Elimination and Load Balancing	2.5

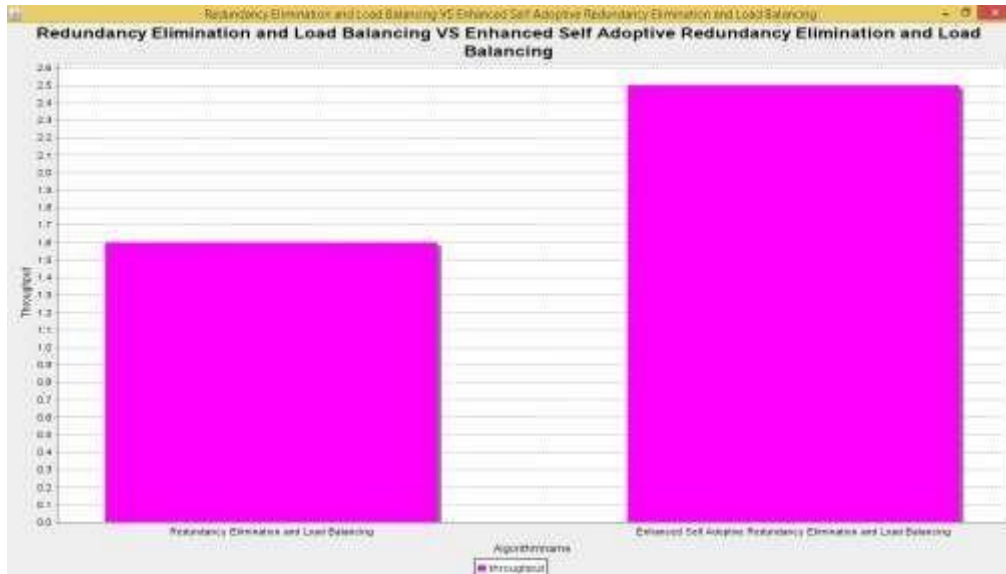


Fig 4.2 Throughput of Redundancy Elimination and Load Balancing and Enhanced Self Adoptive Redundancy Elimination and Load Balancing

The above figure shows that throughput obtained through Enhanced Self Adoptive Redundancy Elimination is better than compared with throughput obtained by Redundancy Elimination.

C. Execution Time (ms)

TABLE III Comparison of Execution Time for two different Strategies in Load Balancing

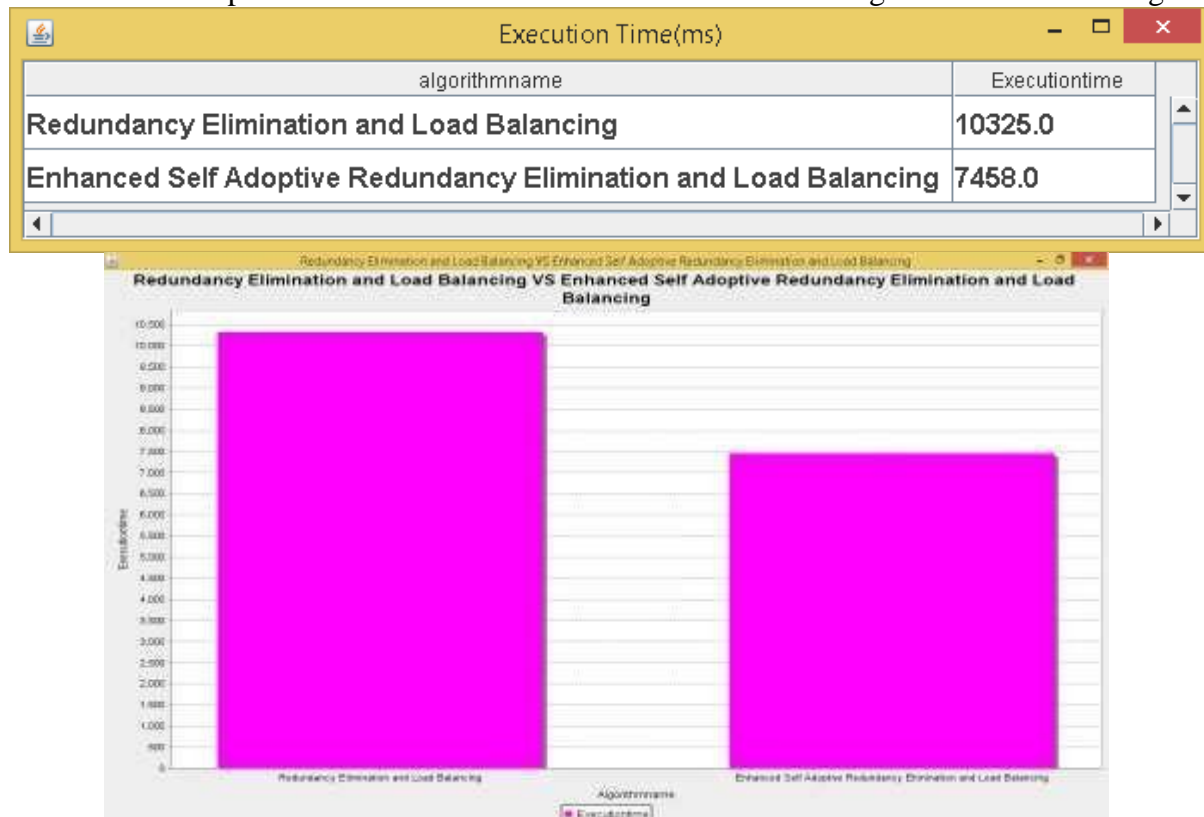


Fig 4.3 Execution Time of Redundancy Elimination and Load Balancing and Enhanced Self Adoptive Redundancy Elimination and Load Balancing

D. Network Overhead

TABLE IV Comparison of Network Overhead of two different Strategies in Load Balancing

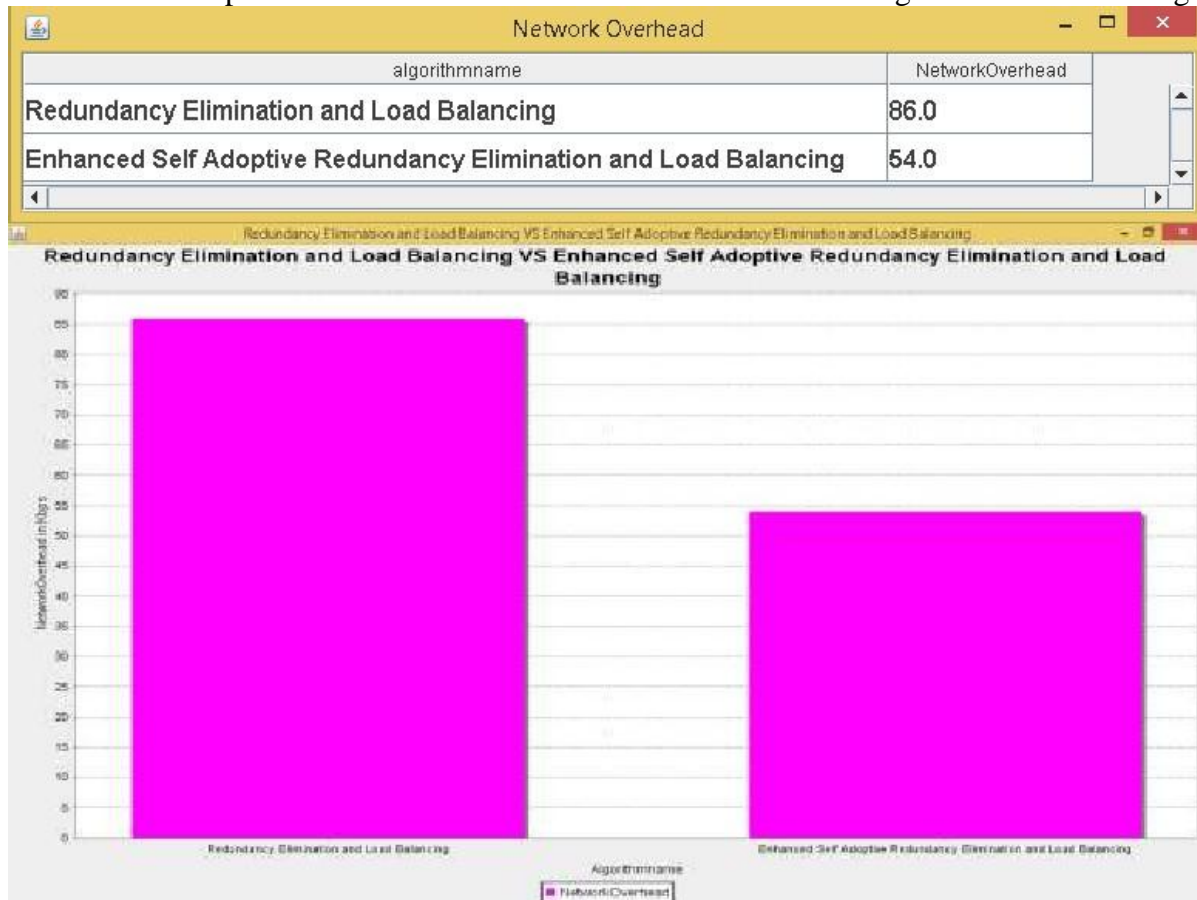


Fig 4.4 Network Overhead of Redundancy Elimination and Load Balancing and Enhanced Self Adoptive Redundancy Elimination and Load Balancing

V.CONCLUSION

Form the current scenario it is evident the mobile adhoc network plays a important role in many real time applications. The nodes in the network are stimulated with other in necessary conditions. The nodes are clustered for the high efficiency. The proposed model mainly focus on the elimination of the data redundancy for the betterment of the function . This is obtained by merging the other techniques using graph for achieving the efficacious result.

REFERENCES

- [1]. Yilmazel, R., Inanç, N. A Novel Approach for Channel Allocation In OFDM Based Cognitive Radio Technology. *Wireless Pers Commun* 120, 307–321 (2021).
- [2]. Latif, S., Akraam, S., Malik, A.J., Abbasi, A.A., Habib, M. and Lim, S., 2021. Improved channel allocation scheme for cognitive radio networks. *Intell. Autom. Soft Comput*, 27(1), pp.103-114.
- [3]. Zhou, X., Li, Y., He, D., Zhang, C. and Ji, X., 2021. Energy-efficient channel allocation based data aggregation for intertidal wireless sensor networks. *IEEE Sensors Journal*, 21(15), pp.17386-17394.
- [4]. Ebrahim, N.S. and Quasim, M.T., 2021. EMCSS: efficient multi-channel and time-slot scheduling. *Wireless Networks*, 27(4), pp.2879-2890.
- [5]. Humayun, M., Ponnusamy, V., Jhanjhi, N.Z., Yichiet, A. and Almufareh, M.F., 2022. Intrusion Detection Systems in Internet of Things and Mobile Ad-Hoc Networks. *Computer Systems Science & Engineering*, 40(3).

- [6]. Al-Shareeda, M.A. and Manickam, S., 2022. Man-in-the-middle attacks in mobile ad hoc networks (MANETs): Analysis and evaluation. *Symmetry*, 14(8), p.1543.
- [7]. Srilakshmi, U., Alghamdi, S.A., Vuyyuru, V.A., Veeraiyah, N. and Alotaibi, Y., 2022. A secure optimization routing algorithm for mobile ad hoc networks. *IEEE Access*, 10, pp.14260-14269.
- [8]. Rajendran, A., Balakrishnan, N. and Ajay, P., 2022. Deep embedded median clustering for routing misbehaviour and attacks detection in ad-hoc networks. *Ad Hoc Networks*, 126, p.102757.
- [9]. Salameh, H.B., Alkana'neh, A., Halloush, R., Musa, A. and Jararweh, Y., 2023. Joint opportunistic MIMO-mode selection and channel–user assignment for improved throughput in beyond 5G networks. *Ad Hoc Networks*, 144, p.103151.
- [10]. Shahryari, M.S., Farzinvash, L., Feizi-Derakhshi, M.R. and Taherkordi, A., 2023. High-throughput and energy-efficient data gathering in heterogeneous multi-channel wireless sensor networks using genetic algorithm. *Ad Hoc Networks*, 139, p.103041.
- [11]. Parihar, A.S. and Chakraborty, S.K., 2022. Handling of resource allocation in flying ad hoc network through dynamic graph modeling. *Multimedia Tools and Applications*, 81(13), pp.18641-18669.
- [12]. Chinnathampy, M.S., Thangavelu, A. and Narayanaperumal, M., 2022. Performance analysis of efficient spectrum utilization in cognitive radio networks by dynamic spectrum access and artificial neuron network algorithms. *Int. Arab J. Inf. Technol.*, 19(2), pp.224-229.
- [13]. Alam, M.M. and Moh, S., 2022. Survey on Q-learning-based position-aware routing protocols in flying ad hoc networks. *Electronics*, 11(7), p.1099.
- [14]. Vigneshwaran, P. and Suthaharan, S., 2022. Dynamic sectorized routing in mobile ad hoc networks using reconfigurable directional antenna. In *Proceedings of International Conference on Advanced Computing Applications: ICACA 2021* (pp. 165-175). Springer Singapore.
- [15]. Tabassum, K., Shaiba, H., Essa, N.A. and Elbadie, H.A., 2022. An efficient emergency patient monitoring based on mobile ad hoc networks. *Journal of Organizational and End User Computing (JOEUC)*, 34(4), pp.1-12.
- [16]. Chatzigeorgiou, R., Alevizos, P. and Bletsas, A., 2022, June. Evaluation of Inference Algorithms for Distributed Channel Allocation in Wireless Networks. In *2022 11th International Conference on Modern Circuits and Systems Technologies (MOCASST)* (pp. 1-4). IEEE.
- [17]. Parashar, V., Kashyap, R., Rizwan, A., Karras, D.A., Altamirano, G.C., Dixit, E. and Ahmadi, F., 2022. Aggregation-based dynamic channel bonding to maximise the performance of wireless local area networks (WLAN). *Wireless Communications and Mobile Computing*, 2022.
- [18]. Gimenez-Guzman, J.M., Marsa-Maestre, I., Orden, D., Fernandez, S. and Tejedor-Romero, M., 2022. On the benefits of channel bonding in dense, decentralized Wi-Fi 4 networks. *Wireless Communications and Mobile Computing*, 2022.
- [19]. Stojanova, M., Begin, T. and Busson, A., 2021. A Markov model for performance evaluation of channel bonding in IEEE 802.11. *Ad Hoc Networks*, 115, p.102449.
- [20]. Torgunakov, V., Loginov, V. and Khorov, E., 2022. A study of channel bonding in IEEE 802.11 bd networks. *IEEE Access*, 10, pp.25514-25533.
- [21]. Karmakar, R. and Kaddoum, G., 2022. IBAC: An intelligent dynamic bandwidth channel access avoiding outside warning range problem. *IEEE Transactions on Mobile Computing*.





