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ENHANCING MANET BATTERY LIFE USING MANET PERFORMANCE FACTORS AND CLUSTER HEAD

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ABSTRACT

Power management in a wireless network is a time-consuming process, especially in a Mobile Adhoc Network, because each node runs on its own node power. When the internal battery dies, the entire communication system fails. Several strategies are proposed to increase the performance of the MANET battery management, and this might be used to evaluate the MANET's performance metrics. This article presented new strategies that use internal node parameter adjustments such as muting ideal nodes, beacon signal utilization, and changes in MANET. This is achieved by forming a cluster head based on the mobile region which does the role of forwarding packets by a single node, amid the clustered to extend battery life, which is accomplished by a collaborative route management mechanism among the nodes. The proposed research was simulated using the Network simulator3 , and the produced result parameters were compared with the existing related research work in AODV protocol , with the result concluding that the unique method works best and saves 10 to 30 percent of power rather than existing AODV protocol **.**
Keywords: *Sleep And Awake, Battery Life Time, Route Management, Forwarded Packet, Cluster Head***.**

1. INTRODUCTION

In Mobile Adhoc Network (MANET), which is self-organized, has little infrastructure, and is used for many applications that require instant connectivity, and has numerous characteristics [1], the use of an internal battery is an important aspect in ensuring reliable communication. When deploying the MANET in an emergent scenario such as disaster management, if the battery fails, the entire communication may be in vain. To increase battery life, efficient power management techniques are required. Several routing protocols have been proposed to overcome MANET challenges, such as frequent topological changes due to MANET characteristics, collision due to hidden and exposed terminal problems, failure in packet forwarding due to internal threats or buffering capacity, all of which affect MANET Quality of Service [2].

Traditional methods for improving MANET battery performance begins with reducing gearbox power while also reducing energy utilization [3]. Power transmission includes packet route selection. Routing selection is based on topological ordering from MANET nodes. To address battery power management, various kinds of MANET protocols [5] are proposed, as well as several new categories of routing protocols [4] [5]. Recently, numerous research papers have been offered to improve the performance of the AODV protocol, such as AOMDV [7], SQR-AODV [8], AODV-BR [9], AODV-RD [10], AODV-BR [11], ATOMDV [12], and AMORLM [13], which are supports for extending battery life. MANET settings are also considered an essential factor in reducing battery power utilization, such as lowering MANET overhead to support better power management; various optimization techniques are based on this goal [6].

Cluster node selection with LEACH protocol improves life time span with energy distribution [14], Fitness function incorporates in FFAOMDV to reduce power consumed [15], Artificial Intelligence neural network based MANET to optimize MANET energy usage which supports network efficiency and overall performance [16].GPS and long-range technology, upon receiving signal strength indicator-based (RSSI) from the receiver strength [17], demonstrated long-term MANET utilization. EMBOA [18] combines butter fly optimization approaches with a machine learning methodology that utilizes less energy to strengthen multipath rouging. The major challenges in the MANET are security attacks, clustering algorithm support to overcome battery power issues [19]. Nodes in a MANET PEO-AODV algorithm [20] provided geographic position monitoring and estimated hop count parameter as aids in overcoming power difficulties.

MANET supports various power management strategies via routing protocol, as well as the most recent techniques of machine learning, artificial intelligence, and clustering, to optimize node battery power and life time. Still, more study is required to improve the MANET's battery power. This research article focuses on the optimization of power by supporting internal node parameters and making minor changes to the MANET's operating principles. Internal parameters used to avoid unnecessary packet forwarding, mute ideal node, and beacon signal consumption. This changed working concept will be simulated using Network simulator, and the results will be compared to the most recent power optimization techniques.

The article is organized as follows: Section II summarizes the various existing power optimization methods used in MANET thus far; Section III proposes the working principles of MANET, Discussion of the simulation setup to implement the research work, Results and Discussion in Section IV, and finally conclusion and Feature work in Section V.

2. RESEARCH WORK

This Section goes into detail about the energy optimization strategy that has been present in MANET technology since the beginning with regard to the classification parameter. The related research work carried out in the division of Mobility Awareness-, based on Topology Management, Based on the Algorithms, Cluster Head, and mobility aware Cluster, and Transmission Range etc.

Set of authors carried out research based on movement awareness in MANET to optimize battery power. M. AL-Gabri, L. I. Chunlin, et al. [21] discussed LEA-AODV methods, I. Woungang [22] uses RREQ modification in MANET REQ messages, C. Gu and Zhu [23] use Route Energy Comprehensive Index methods for energy optimization. L. Li, C. Li, and. Yuan [24] employ Network Lifetime. S. A. Alghamdi [25] employs LBMMRE-AOMDV methods of algorithm .Another group of academics focuses on how topological management can help with MANET energy conservation. Rashmi Chaudhry and Shashikala Tapaswi [26] used an Optimized Power Control technique, Xin Ming Zhang et al. [27] devised a novel M_AODV protocol, Santhi Sri et al. [29] presented a technique termed POR technique for energy optimization, T. et al. [30] developed the Secure Optimized Link State Routing Protocol for energy control,. Sridhar, S., et al. [31], given the TESAODV protocol, Rao, M., and Singh, N [32] propose the KF-MAC method, which achieves success in QOS parameters but fails to manage the delay.

Few writers developed a set of methods to help improve the residual energy in MANET. MUSTHAFA et al. [33] suggested a based on the SNDA technique, but the outcome generated a reliable communication but failed to provide security. Vij et al. [34] employ a Game Theory-Based Model for energy optimization. Nobahary et al. [35] use the Credit-Based. Veeraiah et al. [36] developed the IDSM approach Abirami et al. [37] implement the NCV-AODV protocol for MANET routing, Jim et al. [38] employ an artificial intelligence technique, and Ponnusamy et al. [39] proposed an Energy-Efficient Method. R, mesh et al. [40] devised the MSD-SNDT protocol Hasani et al. [41] proposed a fuzzy-based method. Nobahary et al. [42] proposed a game theory-based Hadi et al. [43] employed AODV .Several authors believe that a cluster head forming-based protocol can support MANET node life span. Suresh Kumar, R. [44]', Author employs the ORS methodology T. Venkatesh for MANET [45] invented HAMBOCHLD method, Author. [46] given HAODV cluster head protocol, Raj Kumar, N.P., and Bala [47] apply the EECAO clustering model ,author [48] use the ACO methodology, , Al-Najjar, A.A.M. [49], use PDR and NLT techniques to establish a Uniform Distribution Of Energy. Finally, Devika, B., and Sudha, P.N [50] established the C-SEWO innovation design

Hybrid clustering and mobility aware based technique research could help the MANET nodes' battery power. The authors Braik, M., Hammouri, A., et al [51] apply the AGS-ROA mobility aware cluster, Venkatasubramanian, S., [52] implement EPO-FGA method ,Hamza, F. and Vigila, S.M.C [53] uses cluster HPSO-GA technique ,Hamza, F. and Vigila, S.M.C [54] uses EEMST method, Sivapriya, N., and Mohandas [55] found that the MKMPE approach. Saravanan, R., Suresh, K., and Arumugam [56] presented an effective clustering strategy, Bisen, D., Mishra, S., and Saurabh, P [57] proposed E-MAVMMF method Arulprakash, P., Kumar, A.S., and Prakash [58] proposed EBDC method . Finally, research is focusing on gearbox range in physical later supports in order to reduce internal battery power use. The author Hajek [59] employs Dynamic and Adjustable methods, Ansari [60] use ATP-AODV, Balanced The Network's Energy Consumption, as reported by Z. S. J. and Y. Guo [61. Nagpal [62] employed MTPR and MHR. The use of Hello Messages by Neighbor Nodes advocated by Park [63] ,Energy Efficiency Through Transmission Power Optimization, as advocated by Porto and Stojanovic [64] ,W. Wang, X. Liu, Y. Yao, Y. Pan, Z. Chi, and T. Zhu's [65] Optimal Transmission Radius.

According to the study of related work, all of the research work carried out by cornering a specific domain in the MANET such as routing, mobility, clustering, and hybrids approaches transmission range also achieved success but other methods created bad results. More research is required to carry out power optimization in MANET. This research study focuses on the adjustment of internal node parameters and MANET working principles to accomplish power optimization in MANET.

3. SYSTEM ARCHITECTURE

The following factors of internal node parameters and MANET operating principles change are included in the system model established for this research work. Internal node parameters include aspects such as needless packet forwarding, optimal node muting, and beacon signal utilization. MANET operating principles have been modified by including the Sleep and Awake protocols.

3.1 Internal Node Parameters

The system model is initially created for the creation of internal node parameters. Figure 1 depicts the total architecture and with the intention of discussed the process of building a cluster and communicating with other nodes,

Construct the MANET graph MG = M, N, where M = $\{m_1, m_2 ...... m_m, ... m_n\}$ represents the total number of MANET nodes, $1 < m <= n$ denotes the entire number of nodes, and N = =$\{ l_1, l_2, ... l_v\}$ denotes the edges connecting the nodes. Assume S is the source, T is the targeted node, and H is the cluster head generated by forming a group of nodes in the region. The cluster head picked is based on the residual energy node, life duration, and connection connecting to the other nodes.

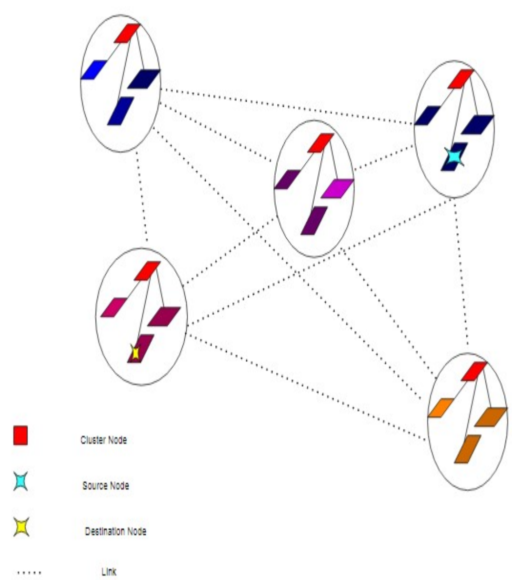

Figure *1 MANET System Model*

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3.1.1. Selection of Cluster Head

Based on battery power, mobility, link life time, and node mobility, one of the nodes in each region will become the cluster head. A cluster node will have the highest value of node life duration, connectivity, and battery power and the lowest value of node mobility and distance.

Life Time of the Link : For connecting two nodes and sending packets, the life time of each link is required. The link is utilized for packet transmission [91]. Because of changes in dynamic topologies, the link in MANET may disconnect, hence the life duration of the link should be determined in advance before picking the route. This could be calculated using an energy model.

$$Nn = \frac{1}{f}\sum_{g=1}^{f} Eg \quad \text{(Eq1)}$$

Where E_g Energy Dissipation of g^{th} node

Node Mobility: Mobility of the node is an important factor in MANET,

$$Nm = \frac{1}{|ph|}\sum_{g=Ph} Bg \quad \text{(EQ 2)}$$

$|p_h|$ - Set of neighbor nodes, BG relative mobility

Node Distance: Distance between the nodes used to estimate the link stability, which is evaluated using the formula

$$Rn = \sum_{fg=1} (Ug, Ph) \quad \text{(Eq3)}$$

$where\ Ph - Set\ of\ neighbour\ nodes$,
$Ug\ Energy\ of\ current\ node$

Node Power: Node power is essential parameter in MANET, Highest node power node will be the cluster Head node which is estimated as using the formula

$$P = \sum_{ng=1} Mmax * \frac{Mmin}{Mg} \quad \text{(Eq4)}$$

$n - total\ nodes\ where\ g\ between\ 1 < g < n$
$Mmax\ is\ Maximum\ power\ of\ the\ node$
$Mmin\ represent\ the\ receiving\ power\ of\ the\ node$
$Mg - g\ th\ node\ receiving\ power$

Connectivity

Creating bidirectional link between two nodes is called connectivity, which is computed using the formula of

$$Ch = \frac{1}{f}\sum_{ng=1}^{n} \frac{Cg}{e} \quad \text{(Eq5)}$$

$where\ Cg\ named\ as\ gth\ connectivity\ ,\ e\ total\ number\ of\ nodes\ connections$

Algorithm 3.1 Forming Cluster Head
Steps for Cluster Head forming

1. Collect the total number of nodes in each MANET region
$M = \{R1, R2, R3, \ldots \ldots Rn\}$
M MANET SET
R_1, R_2, R3 …Rn - Regions where each region R_I having set of N number of nodes, among one node will be a cluster Head.
2. for each Region Ri, Do follows
$for\ (i = 1; i \leq n; i++))$
{
• Gather all of the nodes' life time, mobility, distance, power, and connectivity.
• A cluster node will have the highest value of node life time, connectivity, and battery power and the lowest value of node mobility and distance.
}

Cluster Head selection is based on collecting the MANET nodes, with device mobility, life time, distance, power, connectivity, and forming the cluster head is based on the Algorithm 3.1, then the output of the set of nodes along with the cluster head will get as a processing output of the clustering head, as shown in Figure 2 below.

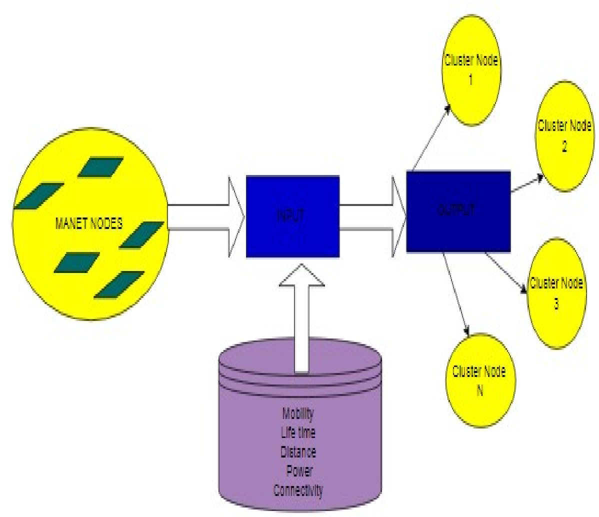

Figure 2 Cluster Node Selections

3.1.2 Role of the Cluster Head

Following the formation of the cluster Head in MANET, each cluster head is responsible for optimizing the node power. This might be accomplished by employing intelligent recommendations in MANET operation such as avoiding needless packet forwarding via flood, muting optimal nodes, and utilizing beacon signals.

Avoid unnecessary packet forwarding

In the MANET operation, each node is responsible for forwarding the packet to the next

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hop, resulting in a large number of identical packets floating in the MANET, consuming more energy. Cluster Head is responsible for preventing packets from being sent to cluster head nodes more than once.

Ideal node mute

When a node is not in the path of transmission, the cluster head puts it to sleep so that no energy is wasted. When a beacon signal arrives, the node awakens and checks its condition.

Beacon signal usage

The fundamental objective of using the beacon signal is to synchronies nodes. When the cluster head nodes are not involved in the transmission, the cluster head is responsible for sending the beacon signal. These three wise ideas could help MANET nodes cut power consumption.

4. OUTCOME AND DISCUSSION

4.1 Parameter for simulation

The suggested work is implemented in Network Simulator3 using a high-end system combination of Intel core CPU, 16 GB RAM, and Windows 10 operating system. Simulation Set Up is used to create the simulation results presented in table 4.1.

Existing AODV protocol with extra parameters incorporated in AODV named FPWP-AODV. Cluster Head formation, and cluster head support are all simulated with NS3 using the simulation parameters specified in the 1 table and the simulation parameters defined in table 4.2. Each and every parameter is done simulation by varying the total number of nodes from 50,100,150 and 200. All the simulation parameter gathered values is given in the Table 2 and simulation comparative result in pictorial comparison analysis is given in the Figure 3From the comparative analysis the results conclude that FPWP-AODV performance is better than AODV protocol performance.

5. CONCLUSION AND FEATURE WORK

The optimization of battery power and increasing the life time of MANET nodes for packet transmission is an emerging challenge in MANET. This research article proposes methods for energy optimization of by forming the cluster Head for each region by using the MANET nodes battery power, mobility, link life time, and node mobility. A cluster node will have the highest value of node life duration, connectivity, and battery power and the lowest value of node mobility and distance. The cluster head is then in charge of energy optimization via the Sleep and Awake approach and optimum routing path selection. The proposed work, FPWP-AODV, is simulated using the NS3 and the results are compared with the existing AODV protocol, which delivers superior performance and optimizes battery power. In particular, this effort will be carried out by incorporating it into other MANET protocols.

Table 1 Simulation Parameter

SIMULATION PARAMETER	VALUE SET
MANET Network Interface	*Wireless Physical Interface*
Dimension	*1500 * 1500Sq.m*
Antenna Defined	*Omni Antenna*
Number of nodes	*50,100,150,200*
Link count	*20 -50*
Source Transmission Type	*Constant Bit Rate Transmission*
Each Packet size	*512 Bytes*
Buffer Size	*60 Packets*
MAC Layer used	*802.11b*
Simulation Defined Model	*Random*
Propagation model	*2 Way Ground*
Maximum node speed	*30m/s*
Pause Time	*30 s*
Number of packet send between the interval	*2Packets*
Time set for Simulation	*50 sec, 100 sec ,*
Initial node Energy	*240 Joule*
Each Node transmission power	*0.9 J*
Each Node receiving power	*0.4J*
Sleep Power	*0.002J*
Changeover Time	*0.009s*

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Table 2 Simulation Result Value

Total Nodes	Parameter															
	Power (J)		Delay (J		Connectivity		Node Mobility		Energy Consumed (J)		Cluster Accuracy		Network Life time		Cluster Head lifetime	
	AODV	FPWP-AODV	AODV	FPWP-AODV	AODV	FPWP-AODV	AODV	FPWP-AODV	AODV	FPWP-AODV	AODV	FPWP-AODV	AODV	FPWP-AODV	AODV	FPWP-AODV
50	19.02	21.03	0.186	0.083	8	12	0.2	0.1	6	5	75	85	75	90	50	80
100	19.01	22.05	1.01	0.65	16	26	0.25	0.13	12	9	80	88	80	95	60	90
150	19.06	25.03	1.06	0.53	24	40	0.28	0.15	18	15	87	92	83	98	72	95
200	19.08	26.07	1.08	0.77	32	50	0.29	0.16	24	20	90	98	85	100	85	98

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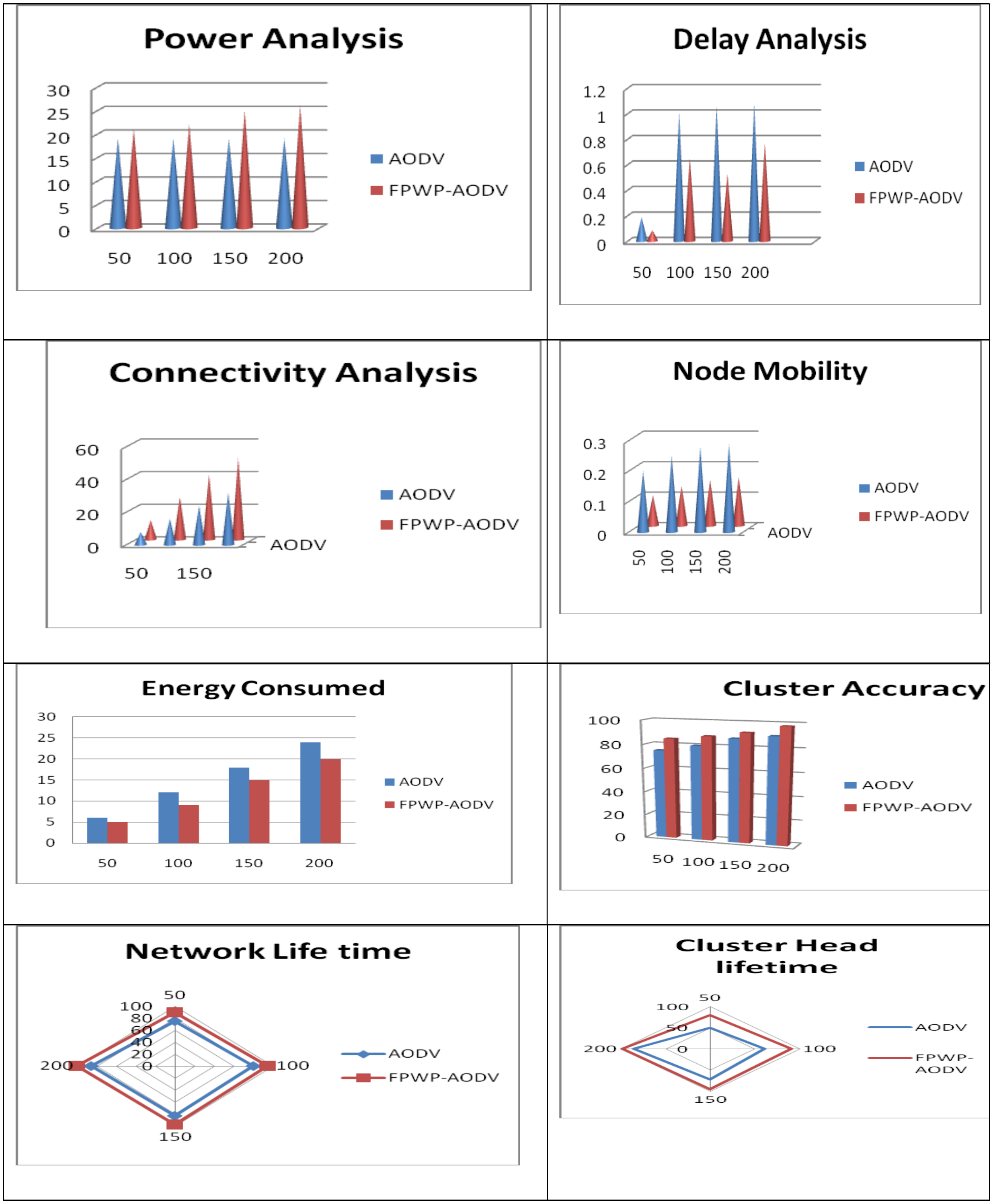

Figure 3 Simulation Result

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