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# A Survey on Power Optimization in Mobile Adhoc Network(MANET)

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***Abstract— In the last few years Wireless Adhoc Networks have become center of research interest due to the fact of being self-configuring networks. In mobile Adhoc networks (MANETs) a node forwards packet from source to destination over multiple hops, for other nodes benefit. The residual battery level of node is a very crucial and critical resource in Adhoc network for determining lifetime of network. This paper presents a survey of the work done by various researchers in the field of power optimization in MANETs.***
***Keywords— MANET; Power conservation; Adhoc networks; NS2; QualNet;***

## I. INTRODUCTION

Mobile Adhoc Network (MANET) is a collection of nodes connected through a wireless medium with rapidly changing topologies. It can be set up anytime, anywhere without the need of any centralized base station. Hence find wide applications in areas where network needs to be quickly established such as disaster recovery operation, battlefield communication etc. In traditional wireless network the nodes communicate with other nodes over the path defined by Base station (BS). In Adhoc networks tracking, routing and route maintenance is done solely by nodes. These nodes are mobile and battery operated. Due to limited battery resources and node mobility, multihop routes are used to cover changing network environment. Thus a single node failure in MANET can lead to losing connectivity and network partitioning. Moreover it is very difficult or even impossible to recharge or replace the batteries of nodes once deployed in many applications. It is therefore required to limit power consumption, improve the robustness of system and prolong the battery life. So designing routing protocols that conserve energy has been an active area of research as described by Toh C K (2002). The rest of the paper is organized as follows- Section II describes the Literature survey and Section III concludes the paper.

## II. LITERATURE SURVEY

1. Kumar (2013) has proposed Adhoc on Demand Distance Vector Algorithm with Power Consumption control in order to achieve maximum network lifetime and minimum power consumption during route establishment from source to destination. In the paper he has studied the impact of receiving energy on nodes and remaining energy in networks. The Energy optimization Model estimates the remaining energy due to energy consumption in receiving data. Initial locations and movements of the nodes are found using the random waypoint model. Sleep power, transition power and transition time are the three parameters considered by Energy management model. He has concluded that energy consumed in receiving data determines the nodes remaining energy and with the decrease in receiving energy remaining energy increases in network.

2. Tantubay et.al (2011) suggested various power consumption modes along with various power saving techniques for Adhoc networks. Transmission mode, Reception mode, Idle mode and Overhearing mode are the various power consumption modes discussed. The various power optimization techniques they have analyzed include controlling transmission power, using minimized Power Aware Routing protocol and Power Management Model. They have also studied conserving power at mobile nodes which include memory allocation and hard dusk scheduling methods. The work concludes that power saving at routing protocol level is much easier as compared to power saving at mobile node level

3. The performance of Variable Range Location Aided Routing protocol for Energy conservation in MANET is studied by Joshi and Joshi (2011). They have proposed modification in position based Location aided routing protocol ( LARI ) that controls transmission power of nodes according to distance between the nodes. QualNet Simulator is used for comparative analysis of proposed scheme and LARI. The Simulator model consists of traffic, mobility and energy and battery model. Conclusions drawn are that the ELARI-VAR protocol reduces energy consumption by 20%. It also maintains packet delivery ratio above 90%. Hence nodes in network can communicate with each other for a longer time.

4. Memarzedeh et.al (2010) described a consecutive quorum based power saving protocol (CQPS) which aims to provide QoS for

multimedia applications. They have evaluated proposed protocol, Adaptive quorum based energy conserving (AQEC) and IEEE802.11Power saving protocol using NS2 simulator (version2.33). Average remaining power of hosts, Packet dropping rate, Average end to end packet delay and energy_goodput are considered as basis of comparison. The result indicates that CQPS power saving protocol is more energy efficient and gives better performance by reducing the number of control frames transmitted and scheduling consecutive overlaps between active intervals of sending/ receiving host

5. A simple novel O (1) Optimal Fully Adaptive Asynchronous (OFAA) power management protocol has been presented by Chou et.al (2013) which provides power management in multihop asynchronous network. OFAA is compared with Adaptive cyclic quorum based power management protocols such as Adaptive quorum based energy conserving (AQEC), Hyper Quorum system (HQS) on the basis of Flow delay required, Traffic load, Station density and Survival ratio. The various procedures they have associated with OFAA protocol are new structure of Beacon interval, neighbor maintenance procedure, awake/sleep pattern prediction and data frame transfer scheme. Simulation Model is based on event driven approach. Mobility of station follow Random way point model. Results indicate that OFAA outperforms both AQEC and HQS.

6. The study of various energy aware routing protocols and their effect on QoS parameters have been discussed by Charu et.al (2013). To determine whether QoS and energy efficiency go hand in hand or not is their aim. Delay, bandwidth, packet loss, network lifetime, mobility are some of the parameters considered. They have discussed various protocols such as LAER, PEER, RA, DELAR and MRPC. The issue of congestion control is addressed by LAER, DELAR, MRPC and RA via being load aware but none consider multipath routing scheme to forward packets. Analysis indicates that DPC, PEER, RA and Random Cast have negative impact on network lifetime and efficiently using energy of nodes, Energy aware protocols increase network lifetime but certain metrics such as delay and bandwidth suffer due to hop count and excessive dissemination of packets. Hence very few Energy aware protocols are concerned with reliability.

7. Corbett and Everitt (2005) proposed a novel hybrid Power and Location Aware medium access control (MAC) protocol called Location aware MAC protocol (LAMP). The protocol has been designed for location aware MANETs such as sensor networks or for ubiquitous computing environment where mobility is bounded and identifying node location is important. Centralized approach is used for intercellular and intracellular communication. In LAMP gateway nodes are able to sleep for a large percentage of 88.2% under both light and heavy traffic and intended physical layer bounds its latency performance. Duty cycle and Latency of LAMP determine the power saving ability of LAMP. LAMP therefore shows ability to offer efficient MAC layer to network.

8. The paper by Gomati et.al (2006) provides modified version of Minimum drain rate scheme (MDR) called Extended Optimal Energy Drain Rate (EOEDR). They have drawn a comparison between EOEDR with MDR and MTPR (minimum transmission power routing). Both static and dynamic environments were considered for conducting experimental tests. Dynamic source routing (DSR) is used as the underlying route maintenance and route discovery protocol. Random waypoint model simulates node mobility with transmission range fixed to 250 meters. Except source and destination all nodes are assigned equal energy by them. Source and destination are provided with higher energy. Radio frequency energy has been used for propagation in NS-2 simulator (version 2.26).It is thus concluded that the performance of EOEDR is better as compared to MDR and MTPR both in static and dynamic environments.

9. Pushparaj and Dinakaran (2014) have discussed the energy limitation and energy aware routing challenges in MANET. They have studied different approaches of minimizing energy consumption by nodes which include Transmission power control and load distribution approach in active communication with Sleep power approach in inactive communication. Routing in MANET, Energy consumption model, Energy efficient approaches, Transmission power optimization etc are the various scenarios discussed. Transmission power control includes Flow Augmentation Routing (FAR), Online Maximum Minimum Routing (OMM) protocols etc. Under prevention of overloading of nodes Localized energy aware routing (LEAR) and Conditional Max_ Min Battery Capacity have been studied. They have thus summarized that Transmission power control controls network interferences and minimize energy consumption. Preventing nodes from overloading approach is more suitable for high network density and traffic. Lastly Power/ Idle down approach supports low network traffic. Developing Hybrid routing protocols combining all the above approaches will improve energy efficiency and network functioning time.

10. Choudary and Bathla (2011) have introduced a threshold or cutoff value concept for enhancing battery lifetime. Dijkstra's shortest path algorithm has been used for selecting a shortest path between source and destination. A particular node is selected only

when its battery power is greater than threshold value. If while transmitting over a chosen path a node runs out of power a warning message is send to all neighboring to change path of transmission. If path is not changed packet is not send. An error message is then generated at source node for 'Delivery Error'. Thus present a mechanism by which neighboring node become aware of energy depleting node and messages are routed via other node.

11. Wang et.al (2005) have introduced an efficient power saving protocol for multi-hop mobile Adhoc network called p-MANET. p –MANET reduces power consumption and transmission latency. In p-MANET each node is active during one beacon interval for n interval. Every mobile node uses a global hash function and its MAC address to determine the beacon interval to enter in listen mode. The beacon interval consist of beacon window (for sending beacon packet periodically), Multi-hop traffic indication map and Data window which is responsible for transmission of packets. They have compared p-MANET with Quorum-based protocol. Quorum-based protocol supports low power sleep mode to operate across multiple hops whereas p-MANET has higher fraction of survived nodes and lower neighbor discovery time.

12. Jasam and Yussof (2013) have compared and evaluated three reactive routing protocols – AODV, Routing information protocol (RIPv2) and Position based routing protocol Location aided routing (LARI) on the basis of energy consumption metric using QualNet 5.1 simulator. Numbers of nodes, area size, packet size, pause time, receive and idle modes are the various scenarios studied for the same. "User Specify" energy model has been used. The result obtained indicates AODV has best evaluation performance in utilization of energy in all the scenarios since it does not maintains routing information if there is no data to be send.

13. Power and Traffic Balance awareness path selection routing scheme (PTPSR) was proposed by Ang and Gwee (2007). PTPSR is both load and energy aware. It considers shortest path, power conservation and traffic load balancing in a unified way at the same time. Energy factor (EFpath) and Traffic factor (TFpath) is the path selection metrics. Ang and Gwee have compared PTPSR with Adhoc on demand multipath distance vector (AOMOV). They have used Glomosin for simulation. Performance metrics for evaluation include Average Throughput, Average end to end delay and Energy and Traffic load variance. In the end they have concluded that PTPSR possess the highest available energy and nodes with lower energy are least in number. Hence PTPSR is superior to AOMOV.

14. The paper by Malek et.al (2010) discusses new energy model EA_AODV that prolongs the lifetime of Adhoc on demand distance vector routing protocols. The paper presents the fact that by replacing long jump configurations with some short hop ones better energy saving choices will be available. Residual energy of source node is used as metric to prove efficiency of proposed protocol. A comparison has been drawn between EA_AODV and AODV on the basis of energy consumption and network lifetime. NS2.29.3 has been used for simulation. EA_AODV showed slightly smaller energy consumption as compared to AODV when they studied initial energy versus Total energy consumption. EA_AODV also consumed less energy when energy consumption was studied against pause time. From the results they have concluded that EA_AODV succeeded in obtaining dynamic energy distribution in network thus reached a balanced condition.

15. Srinivas et.al (2013) have applied Network coding concept to Total Dominant Pruning (TDP), Partial Dominant Pruning (PDP) and Dominant Pruning (DP). They have used Custom simulator (using Java) for network coding for simulation. Two-ray ground model has been used for experiments. Their study shows that energy gain is in the sequence NC-DP > NC-PDP > NC-TDP and delay at intermediate nodes increase coding opportunities and reduces number of transmissions.

16. Nash equilibrium and game theory concept has been applied by Borges et.al (2010) to Adhoc network in order to conserve the battery power of node. Their approach of using Nash equilibrium enables every node in a group to choose strategies which are best suited to them. Thus a uniform distribution of energy charge was obtained and maintained over entire network. Destination sequenced distance vector (DSDV) finds routes between source and destination. Path having maximum Power equilibrium (PE) is preferred. DSDV and AODV are compared using NS-2 simulator. FTP traffic modeled communication between nodes over TCP. Results predict that by using Nash equilibrium residual energy in network was 9 to 10 times more than that in case of DSDV. Nash equilibrium makes nodes dissipate energy at almost same rate ensuring uniform battery power. Multiple dissipation rates exist in AODV which bring down the network more quickly.

17. Kaneriya et.al (2013) described different approaches of energy efficient algorithm for MANET. Distance Factor (DF) & Time interval of RREP (TIRREP) are the two energy saving factors used. Based on the comparison of various protocols such as MACR, MMBCR, DEAR, ONM etc, AODV is declared as best. Their study concludes that 'HELLO' packets should be generated at any

fixed interval and by changing the time interval of 'HELLO' packet energy can be saved efficiently at each node. DF and TIRREP also play an important role in saving energy.

18. Wang et.al have suggested Q-learning-based Rate-Aware Power- Controlled Routing Scheme (QLRPCR) to address optimization of power, rate and routing jointly in an on demand and distributed manner. Network Simulator version 3.12.1 is used for simulations. They have compared QLRPCR with LMN, QLMAODV and PCR. Evaluation of node mobility and traffic load shows that QLRPCR improves the packet delivery ratio and average latency along with maintaining overhead level compared to other power controlled routing protocols.

19. The problem of distributing computational tasks amongst a set of mobile computing devices has been considered by Alsalih et.al in order to improve performance and conserve energy in Mobile Adhoc Networks. They have formulated a novel energy-aware scheduling problem and have also proposed a heuristic algorithm to solve it. Their Energy Aware (EA) heuristic is modified version of Level based List scheduling heuristic. Experiments are conducted on random tasks and processor models. A comparison between EA, LS and SP scheduling is drawn in terms of average makespan, average consumed energy & average total cost. EA excels in terms of total cost which is most important factor but the literature lacks an optimization method that finds good execution plan for predicting resource usage for different tasks.

20. A Modified Energy Saving Dynamic Source Routing in MANETs (MESDSR) by Gautam and Kumar utilizes the battery power of mobile nodes efficiently thus achieving more network lifetime. The various parameters used for simulation include Simulator- NS-2, Protocol under test- DSR, Traffic type- TCP, Packet size-512 bytes etc. The performance of ESDSR is better compared to DSR when packet delivery ratio, average energy consumption, throughput and end to end delay are studied. Hence ESDSR increase lifetime of network by consuming less amount of energy as compared to DSR.

21. Suresh et.al (2014) proposed efficient power aware routing (EPAR), a new power aware routing protocol that increases the network lifetime of MANET. In contrast to conventional power aware algorithms, EPAR identifies the capacity of a node not just by its residual battery power, but also by the expected energy spent in reliably forwarding data packets over a specific link. Using a mini-max formulation, EPAR selects the path that has the largest packet capacity at the smallest residual packet transmission capacity. This protocol must be able to handle high mobility of the nodes that often cause changes in the network topology. This paper evaluates three "ad-hoc network routing protocols" (EPAR, MTPR, and DSR) in different network scales, taking into consideration the power consumption. The proposed scheme reduces for more than 20% the total energy consumption and decreases the mean delay, especially for high load networks, while achieving a good packet delivery ratio.

22. Bagwari et.al (2012) analyzed the performance of reactive routing protocol via increasing number of nodes and observing its effect on Quality of Service (QoS) of Mobile Ad-hoc Network. As we know routing protocols make an important role for improving QoS in Mobile Ad-hoc Network. The QoS depends upon several parameters like end-end delay, throughput, date drop and network load. The reactive routing protocol which we are considering is AODV for this scenario with MCHG. Here we are observing performance of Routing Protocol via enhancing the network size on the basis of following parameters: delay, throughput, traffic sent, traffic received, data dropped and network load. Network simulation tool used in simulation is OPNET Modeler (Ver. 14.0). Finally, this paper conducts simulation experiments in the conditions where we can improve QoS of MANET Network performance.

23. Gouda et.al (2013) presented a paper to enhance the network performance of different routing protocols, when frequent link failure in network due to mobility of the nodes in the network. The performance analysis and simulation are carried out to evaluate network performance using Network Simulator (NS-2), based on the different load, node mobility, delay, packet sending rate and energy consumption. It has been verified through various simulations, which represent a wide range of network conditions that energy AODV deliver the better performance as that of the modern protocols DSDV, TORA, DSDV, DSR and AODV in terms of energy efficiency but it is observed that DSR needs significantly smaller energy overheads than other protocols.

## III.CONCLUSIONS

The conclusion we have drawn from our survey is that Power Optimization in MANETs has greater impact as the residual battery level of node is a very crucial and critical resource for determining lifetime of network. Hence designing of energy efficient routing protocols, routing schemes and algorithms is required. A lot has been done for the same with the scope wide open for further study and research.

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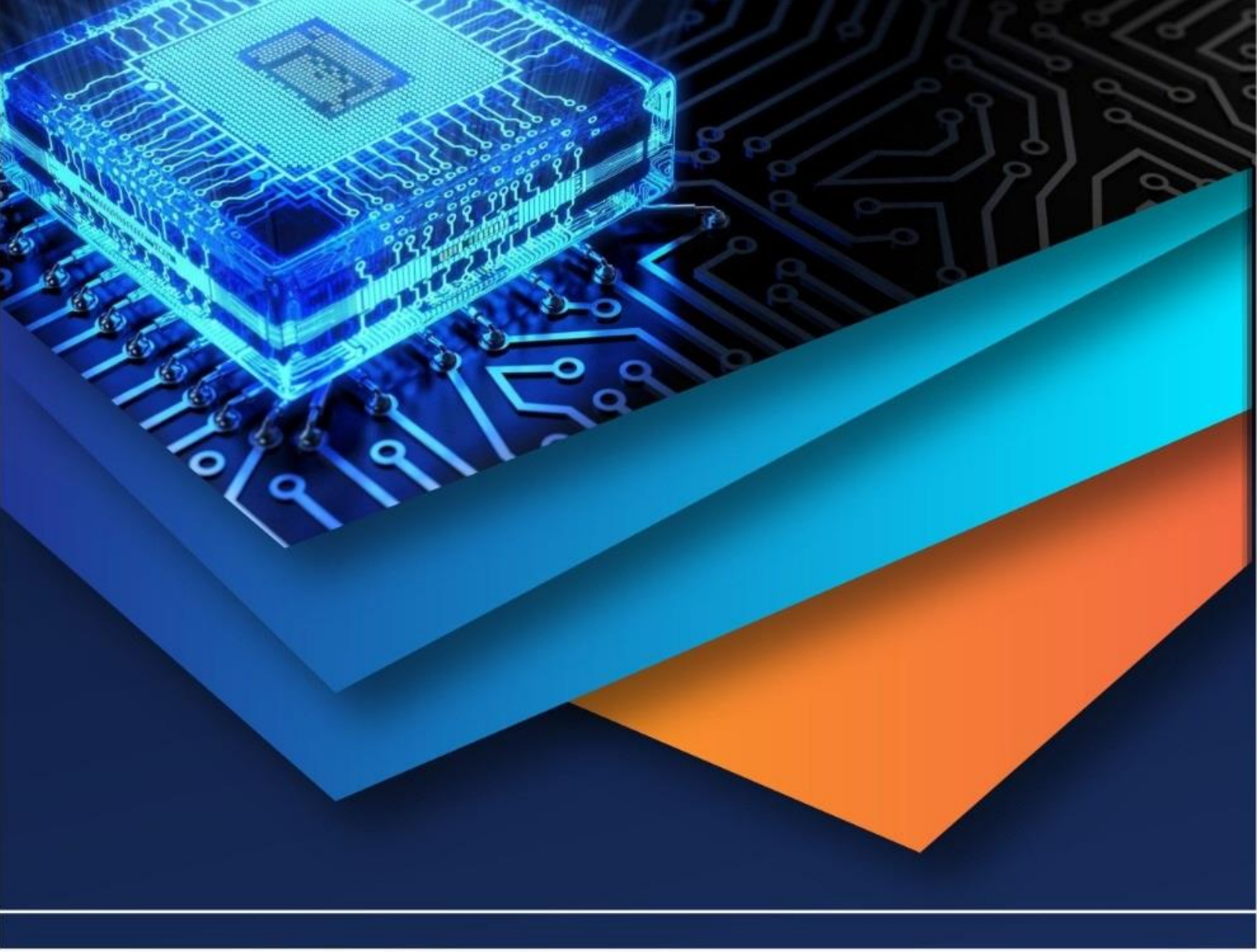
## REFERENCES

[1] Al-Gabri Malek, Chunlin Li.Li Laynan, Wang Bo, "New Energy Model: Prolonging the Lifetime of Adhoc-On Demand Distance Vector Routing Protocols (AODV)", 2nd International Conference on Future Computer and Communication (ICFCC), IEEE, vol2, 2010, pp.426-429.
[2] C-K Toh, Ad Hoc Mobile Wireless Networks, Pearson Education, Inc., 2002, pp.143-174.
[3] Charu, Vivek Arya, "A Quality of Service Analysis of Energy Aware Routing Protocols in Mobile Adhoc Network", 6th International Conference on contemporary Computing (IC3), IEEE, 2013, pp.439-444.
[4] Chiung-Ying Wang, Chi-Jen Wu, Guan Nan Chen, Ren-Hung Hwang, "p-MANET: Efficient Power Saving Protocol for Multi-Hop Mobile Adhoc Network", Proceedings of the Third International Conference on Information Technology And Applications (ICITA), vol2, 2005, pp. 271-276.
[5] Derek J Corbett, David Everitt, "A partitioned Power & Location Aware MAC protocol for Mobile Adhoc Network", IEEE Wireless Conference, 2005, pp.1-7.
[6] Hossien Memarzedeh, Mahdi Dehgham, Sam Jabbehdari, " A New Quorum based Power Saving Protocol to Maintain QOS for MANETs with Burst Traffic", IEEE 24th International Conference on Advanced Information Networking & Applications Workshop, DOI 10.1109, 2010, pp.674-679
[7] K.Srinivas, A.Nararaju, A.Venugopal Reddy, "Performance Evaluation of Network Coding-Aware Neighbor based Technology Control Protocol in MANETs", International Conference on Green Computing, communication & Conservation of Energy (ICGCE), 2013, pp.753-756.
[8] Kanika Lakhani Choudary, Himani Bathla, "A Power Efficient Technology to Avoid Packet Loss in MANET", IEEE, 2011, pp. 234-238.
[9] Ke Wang, Teck Yoong Chai, Wai-Choong Wong, "An on Demand Rate-aware Joint Power Control and Routing Scheme", IEEE, Wireless Communication and Networking Conference (WCNC), 2014, pp. 2126-2131
[10] Krishan Kumar, "Energy Optimization Model for Wireless Adhoc Network", International Journal of Advanced research in Computer science & Software engineering, vol3, issue1, 2013, pp.132-134.
[11] Methaq jasam, Dr. Salman bin Yussof, "Evaluation of Energy Efficiency of MANET Routing Protocols", International Journal of Scientific & Technology Research, vol2, issue3, 2013, pp.207-211.
[12] N.C Kaneriya, Dr. P.P Kotak, Prof. A.M. Lathigara, "A Review Paper on Energy Efficient Algorithm In MANET", Journal of Information, Knowledge And Research In Computer Engineering, vol2, issue2, 2013, pp. 463-466
[13] Neeraj Tantubay, Dinesh Ratan Gautam and Mukesh Kumar Dhariwal, "A Review of Power conservation in Wireless Mobile Adhoc Network (MANET)", International Journal of Computer Science Issues, vol8, issue4, ISSN (online): 1694-0814, 2011, pp 378-383.
[14] NiveditaN.Joshi, RadhikaN.Joshi, "Energy Conservation In MANET Using Variable Range Location Aided Routing Protocol", International Journal of Wireless & Mobile Network (IJWMN), vol3, no5, DOI: 10.521, 2011, pp. 265-280.
[15] R.Pushparaj, M.Dinakaran, "Energy Efficient Routing Issues and Challenges in Adhoc Network", 2nd International Conference on Current Trends in Engineering and Technology (ICCTET), IEEE, 2014, pp. 26-31
[16] S.Sankara Gomati, S.Krishnamurthi, Richard Chbeir, "Design of Extended Optimal Energy Drain Rate Algorithm for Mobile Adhoc Network", 1st International Conference on Digital Information Management, IEEE, 2006 pp. 240-247.
[17] Shipra Gautam, Rakesh Kumar, "Modified Energy Saving DSR Protocol for MANETs", International Journal of Electronics and Computer Science Engineering (IJECSE), vol1, no.4, ISSN 2277-1956, pp. 1982-1992
[18] Vijay Borges, Sanil Borkar, Chinmay Sardesai, Ankeeta Kamat, Purva Kumar, "Dynamic Power Conservation Routing in MANETs: A New Approach", 3rd International Conference on Emerging Trends in Engineering & Technology, IEEE, 2010, pp.808-812.
[19] Waled Alsalih, Selim Akl, Hossam Hassanein, " Energy-Aware Task scheduling Towards Enabling Mobile computing over MANETs", Proceedings of the IEEE International Parallel and Distributed Processing Symposium (IPDPS), IEEE, 2005, pp. 1-8.
[20] Yang Qin Y.Y.Wen H.Y.Ang, Choon Lim Gwee, "A Routing Protocol with Energy and Traffic Balance Awareness in Wireless Adhoc Network", International Conference on Information & Communication System (ICICS), IEEE, 2007, pp. 1-5.
[21] Zi-Tsan Chou, Yu-Hsiang Lin, Tsang Ling Sheu, "Asynchronous Power Management Protocols With Minimum Duty Cycle and Maximum Adaptiveness for Multihop Adhoc Network", IEEE Transactions on Vehicular Technology, vol62, no7, 2013, pp. 3301-3314.
[22] Bagwari, Ashish, et al. "Performance of AODV Routing Protocol with increasing the MANET Nodes and its effects on QoS of Mobile Ad hoc Networks." Communication Systems and Network Technologies (CSNT), 2012 International Conference on. IEEE, 2012.
[23] Gouda, Bhabani Sankar, Ashish Kumar Dass, and K. Lakshmi Narayana. "A comprehensive performance analysis of energy efficient routing protocols in different traffic based mobile ad-hoc networks." Automation, Computing, Communication, Control and Compressed Sensing (iMac4s), 2013 International Multi-Conference on. IEEE, 2013.
[24] Suresh, Hosahalli Narayanagowda, Golla Varaprasad, and Guruswamy Jayanthi. "Designing Energy Routing Protocol with Power Consumption Optimization in MANET." Emerging Topics in Computing, IEEE Transactions on 2.2 (2014): 192-197.



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