

Power Control MAC Protocol with Improved Throughput for Mobile Ad Hoc Networks

Ajay Singh Thakur

M.Tech Scholar

Electronics & Comm. Engineering
Green Hills Engineering College
Kumarhatti, Solan (H.P)

Ravikant Sharma

HOD

Deptt. Of Electronics & Comm. Engineering
Green Hills Engineering College
Kumarhatti, Solan (H.P)

ABSTRACT:

Ad Hoc network is a collection of mobile nodes forming a network without the assistance of any centralized structure. It is an application based network. There are many issues in Ad Hoc networks like battery consumption, scheduling, clustering, packet loss etc. There are many algorithms which are available to reduce these issues. In this paper we introduced new technique which is based upon adaptive technique to reduce the power consumption and prevent packet loss. This proposed technique is better than existing technique.

Keywords: Ad Hoc, Power Conservation Battery Consumption, Media Access.

1. INTRODUCTION

An Ad Hoc network consists of a large number of nodes spread over a specific area where we want to look after at the changes going on there [2]. A node generally consists of sensors, actuators, memory, a processor and they do have communication ability. All the nodes are allowed to communicate through a wireless medium. The wireless medium may either of radio frequencies, infrared or any other medium, of course, having no wired connection. These nodes are deployed in a random fashion and they can communicate among themselves and form an ad-hoc network. If the node is not able to communicate with other through direct link, i.e. they are out of coverage area of each other; the data can be sent to the other node by using the nodes in between them. This property is referred as multi-hopping [3]. All sensor nodes work cooperatively to serve the requests. Generally WSNs are not centralized one as there is peer-to-peer communication between the nodes. So there is no requirement of prior established infrastructure to deploy the network [5]. WSN gives flexibility of adding nodes and removing the nodes as required. But this gives rise to many drastic changes to deal with in the network topology such as updating the path, or the network tree, etc. In an ad hoc network the node that gathers the data information refers to sink. The sink may be connected to the outside world through internet where the information can be utilized within time constraints [4]. The well known problem in using these networks is limited battery life. This is due to fact that the size of a sensor node is expected to be small and this leads to constraints on size of its components i.e. battery size, processors, data storing memory, all are needed to be small.

So any optimization in these networks should focus on optimizing energy consumption. In sensor networks a lot of sensed data and routing information has to be sent which often have some time constraints so that the information can be utilized before any mishap occurs, e.g. industrial monitoring, machinery monitoring, etc. The energy power consumption is much higher in data communication than internal processing.

So energy conservation in WSN is needs to be addressed. In 2nd section we will do literature survey. In 3rd section we introduced CSMA/CA.

2. Review of Literature

Fan Xiangning and Song Yulin in this [1] paper studies LEACH protocol, and puts forward energy-LEACH and multi-hop LEACH protocols. Energy-LEACH protocol improves the choice method of the cluster head, makes some nodes which have more residual energy as cluster heads in next round. Multihop-LEACH protocol improves communication mode from single hop to multi-hop between cluster head and sink. Simulation results show that energy-LEACH and multihop-LEACH protocols have better performance than LEACH protocols. Low-Energy Adaptive Clustering Hierarchy (LEACH) protocol is a clustering based protocol to collect data from wireless network. In the network, hundreds and thousands of wireless sensors are dispersed that collects and transmit data. Also in these networks cluster heads are elected out of the sensors to transmit the data collected to base station. Also, with the each of the sensor nodes being inexpensive and simple, their power level is low cannot be replaced and because of this, each sensor must take its turn as being a cluster head to make the protocol energy efficient. Bilal Abu Bakr and Leszek Lilie in this paper [5], they propose the LEACH-SM protocol, which modifies the prominent LEACH protocol by providing an optimal energy-saving spare management, including spare selection. LEACH-SM adds the spare selection phase to LEACH.

Maciej Nikodem and Bartosz Wojciechowski in this paper [2] focuses on the theoretical aspects of clustering in wireless sensor networks, as a mean to improve network lifetime. We investigate whether clustering itself (with no data aggregation) can improve network lifetime in particular application when compared to non-clustered networks. We use integer linear programming to analyze 1D and 2D networks, taking into account capabilities of real-life nodes. Our results show that clustering itself cannot improve network lifetime so additional techniques and means are required to be used in synergy with clustering.

F.J. Atero, J.J. et al. in this [3] paper they propose a new architecture called HARP, a Hierarchical Adaptive and Reliable Routing Protocol, a clustering algorithm which builds intercluster and intra-cluster hierarchical trees, which are optimized to save power. This architecture is scalable and can be used in both homogeneous and heterogeneous wireless sensor networks. By means of the addition of a recovery slot in the scheduling scheme, HARP provides efficient link fault tolerance and also supports node mobility management.

The same process can additionally function as a joining mechanism for newly deployed nodes. This architecture is highly adaptive to specific application requirements and provides bounded-time data transmissions. Furthermore, a new cluster heads election formulation and its associated data gathering protocol (s-HARP) is proposed. This protocol optimizes and balances the energy consumption in the network.

Dahlila P. Dahnil, et al. in paper [4] presents a comparative study of clustering techniques and cluster quality of a single criterion cluster heads election and cluster formation in Wireless Sensor Networks. The HEED, LEACH and Energy-based LEACH protocols are simulated and their performance are compared in terms of the number of cluster head generated, cluster size, cluster head distribution, scalability and coverage. The results of these protocols are presented to show how the cluster formation helps to prolong the network lifetime. We investigated scalability aspects in the presence of advanced nodes in the network and its effect on the network lifetime. We proposed to investigate A HEED and AE-LEACH protocols, a new approach for cluster heads election that improved network lifetime in the presence of advanced nodes. The simulation shows that having fraction of advanced nodes in the network gives significant improvement in network lifetime.

2. Existing CSMA/CA Protocol and its drawback

CSMA/CA (Carrier Sense Multiple Access/Collision Avoidance) is a protocol for carrier transmission in 802.11 networks. Unlike CSMA/CD (Carrier Sense Multiple Access/Collision Detect) which deals with transmissions after a collision has occurred, CSMA/CA acts to prevent collisions before they happen. In CSMA/CA, as soon as a node receives a packet that is to be sent, it checks to be sure the channel is clear (no other node is transmitting at the time). If the channel is clear, then the packet is sent. If the channel is not clear, the node waits for a randomly chosen period of time, and then checks again to see if the channel is clear. This period of time is called the back off factor, and is counted down by a back off counter [8]. If the channel is clear when the back off counter reaches zero, the node transmits the packet. If the channel is not clear when the back off counter reaches zero, the back off factor is set again, and the process is repeated. Carrier sense multiple access with collision avoidance (CSMA/CA) in computer networking, is a network multiple access method in which carrier sensing is used, but nodes attempt to avoid collisions by transmitting only when the channel is sensed to be "idle" [9]. The basic idea behind CSMA/CD is that a station needs to be able to receive while transmitting to detect a collision. When there is no collision, the station receives one signal: its own signal. When there is a collision, the station receives two signals: its own signal and the signal transmitted by a second station [10]. To distinguish between these two cases, the received signals in these two cases must be significantly different. In a wired network, the received signal has almost the same energy as the sent signal because either the length of the cable is short or there are repeaters that amplify the energy between the sender and the receiver. This means that in a collision, the detected energy almost doubles. In a wireless network much of the sent energy is lost in transmission. The received signal has very little energy. Therefore, a collision may add only 5 to 10 percent additional energy. This is not useful for effective collision detection. We need to avoid collisions on wireless networks because they cannot be detected. Carrier sense multiple access with collision avoidance (CSMA/CA) was invented for this network. Collisions are avoided through the use of CSMA/CA's three strategies: the inter-frame space, the contention window, and acknowledgments [11]. In controlled access, the stations consult one another to find which station has the right to send. A station cannot send unless it has been authorized by other stations. Three popular controlled-access methods: First reservation method, second Polling method and third one Token passing. CSMA/CA performance is based largely upon the modulation technique used to transmit the data between nodes.

The CSMA/CA is the protocol which is used for the channel sensing in the wireless networks. As, the mobile ad hoc networks is the self configuring type of network in which the mobile nodes can leave or join the network when they want, In such type of network clocks of mobile devices are not synchronized which reduced the efficiency of the CSMA/CA. The overall networks throughput will be reduce and end to end delay will be increased as due to the reduction in the efficiency of the CSMA/CA packet collision will be there in the network. In the present work the sensor nodes are not synchronous to each other. The packet collision occurs due to the mismatch of timing.

4. Proposed Methodology

The route from the source to destination is established with the Proactive and reactive routing protocols. The Proactive routing protocols are those which store the route matrix and with the use of these matrixes reliable route is established between source and destination. In the MANET, it is very difficult to maintain such matrixes due to its self configuring nature. In such, case another type of routing protocol, i.e. Reactive routing protocols is used for the route establishment. In reactive routing protocols routes are established between source and destination only when required. AODV and DSR are two most common types of protocols which are used for the route establishment. In AODV routing protocol dijkstra's algorithm is been used, as compared to DSR it is single source algorithm and belmans ford algorithm is used for route establishment. Both the protocol, i.e. AODV and DSR use the flooding approach for the route establishment. The route request messages are flooded into the network, and intermediate nodes which are having the path to destination will reply back with the route reply packets. The source selects the best path on the basis of Hop count and sequence number. In the approach of flooding, the

network resources like bandwidth, node energy will get wasted. To overcome the problem of flooding approach will be replaced with the multicasting approach. In this work, we mainly focus on to embed the approach of multicasting in AODV protocol for route establishment between source and destination.

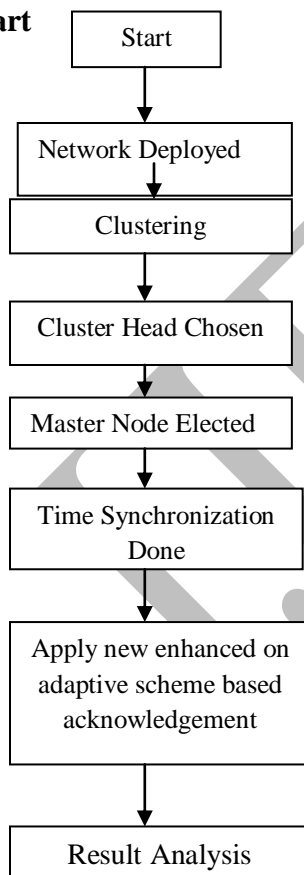
The whole network is divided into clusters and cluster heads are chosen by election algorithm. All the cluster nodes transmit their data to cluster heads and cluster heads forward it to other cluster heads until data do not reach at destination.

It Reduces number of nodes taking part in transmission. In this nodes save their energy for future use. This also Reduces communication overhead for both single and multi hop.

In our work within the clustering virtual path is established by using AODV routing protocol between source to destination. By using virtual paths the packet loss is less because paths do not break again and again during the communication. In this way retransmission is also less and energy consumption is automatically reduced. Only cluster heads communicate to each other and cluster nodes do not take part in the transmission. Only source node and destination node take part in the communication. In this the energy of sensor nodes are saved and nodes use saved energy for future communication. To reduce the energy consumption it increases the lifetime of the network. So it also improves the performance of the wireless sensor networks.

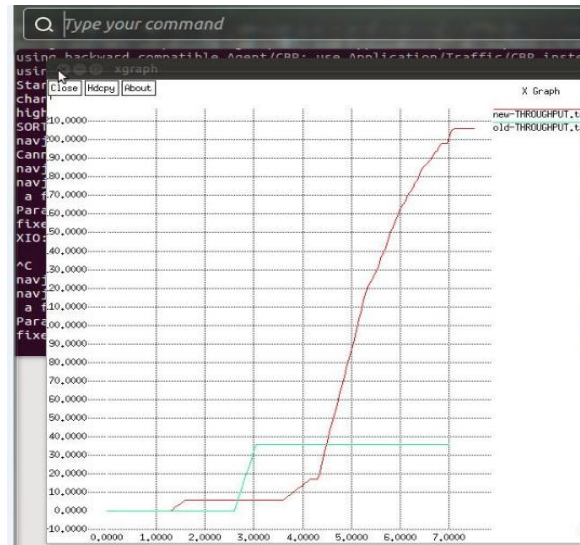
Packet collision is also less because master node is used to synchronous all the sensor nodes in the network. All the nodes share their timing information with the Master Node. Whenever a node has to transmit to particular node it first accesses the master node to check the status of destination node. If the destination node is free it further sends the request for connection establishment. Slotted aloha is used for sensing the channel and it provide the safe communication without any collision. This technique provides the less retransmission of packets and it save the energy of the sensor nodes. For the clustering many protocols are used LEACH, E-LEACH, HARP, HEED, HCA chain clustering, and so on.

5. Flow Chart

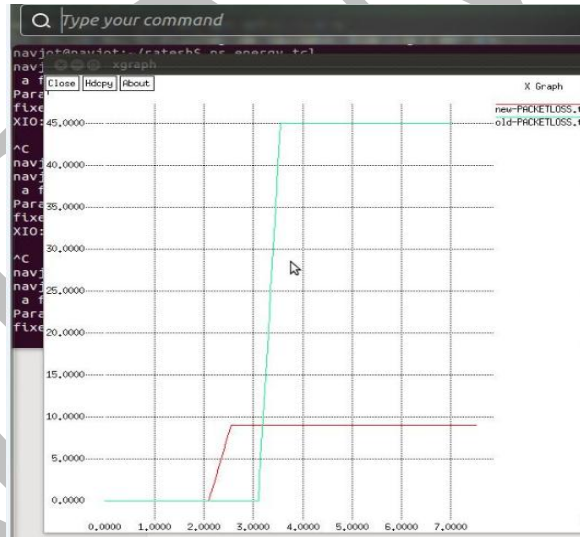


6. Results

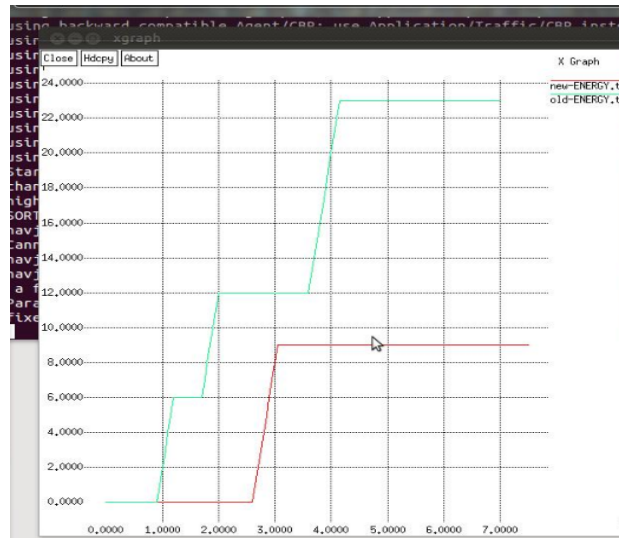
We have used Network Simulator 2 for the experimental demonstration of the proposed technique. It is an event driven simulation tool that has proved useful in studying the dynamic nature of communication networks.



Graph 1 of Throughput



Graph 2 of packet loss



Graph 3 of energy level

Graph 1 shows that throughput of network increase with proposed method as compare to existing method. Graph 2 Packet loss the network also decreases with new proposed technique. Red line show new packet loss and green line shows old packet loss.

Graph 3 shows that the energy consumption reduces substantially with the new proposed scheme. Red line shows the energy consumption in proposed scheme and green line shows in the old one.

7. CONCLUSION AND FUTURE WORK

The main objective of this research paper is to discuss various challenges and technique of Ad Hon networks. We also focused on adaptive technique and its procedure. We believe that proposed technique discussed in this paper will give benefit for various research scholars. Its experimental results show that proposed technique gives better result which has low power consumption, better throughput and less packet loss as compared to existing techniques.

In our work we consider a stable network environment. Mobility of the nodes was not taken into consideration. In future works we can consider the mobility of the nodes to make it more suitable for mobile ad hoc networks.

References

1. Fan Xiangning, Song Yulin "Improvement on LEACH Protocol of Wireless Sensor Network" International Conference on Sensor Technologies and Applications, pp. 260 -264, IEEE, 2007.
2. Sudhanshu Pant, Naveen Chauhan "Effective Cache based Policies in Wireless Sensor Networks: A Survey" International Journal of Computer Applications (0975 – 8887) Volume 11– No.10, December 2010
3. F.J. Atero, J.J. Vinagre, E. Morgado, M.R. Wilby "A Low Energy and Adaptive Architecture for Efficient Routing and Robust Mobility Management in Wireless Sensor Networks", pp. 172 -181, 2011 IEEE.
4. Dahlila P. Dahnil, Yaswant P. Singh, Chin Kuan Ho "Energy-Efficient Cluster Formation in Heterogeneous Wireless Sensor Networks: A Comparative Study" ICACT, Feb. 2011.
5. Bilal Abu Bakr, Leszek Lilie "A Quantitative Comparison of Energy Consumption and WSN Lifetime for LEACH and LEACH-SM" International Conference on Distributed Computing Systems Workshops, 2011 IEEE.
6. Archana Bharathidasan, Vijay Anand Sai Ponduru "Sensor Networks: An Overview" Department of computer science, University of California, volume 2, Issue 2, march 2002.
7. Arun K. Somani, Shubha Kher, Paul Speck, and Jinran Chen "Distributed Dynamic Clustering Algorithm in Uneven Distributed Wireless Sensor Network", 2004.
8. Basilis Mamalis, Damianos Gavalas, Charalampos Konstantopoulos and Grammati Pantziou "Clustering in Wireless Sensor Networks" RFID and Sensor Networks, pp. 323, June 2009.
9. Bilal Abu Bakr, Leszek Lilie "A Quantitative Comparison of Energy Consumption and WSN Lifetime for LEACH and

- LEACH-SM” International Conference on Distributed Computing Systems Workshops, 2011 IEEE.
10. Daniele Puccinelli and Martin Haenggi “Sensor Networks: applications and challenges of ubiquitous sensing”, IEEE circuits and systems magazine, volume 5, Issue 3, pp.19-31,2005, IEEE
 11. Ossama Younis, Marwan Krunz, and Srinivasan Ramasubramanian “Node Clustering in Wireless Sensor Networks: Recent Developments and Deployment Challenges”, Volume 20, Issue 3, pp. 20-25, 2006 IEEE.
 12. Ossama Younis and Sonia Fahmy “HEED: A Hybrid, Energy-Efficient, Distributed Clustering Approach for Ad-hoc Sensor Networks” Department of Computer Sciences, Purdue University, volume 3, Issue 4, pp. 366-379, 2004 IEEE.
 13. Peyman Neamatollahi, Hoda Taheri, Mahmoud Naghibzadeh “A Hybrid Clustering Approach for Prolonging Lifetime in Wireless Sensor Networks” International Symposium on computer networks and distributed systems (CNDS), pp. 170 – 174, 2011 IEEE.

IJERMT