International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 03 | Mar -2017 www.irjet.net p-ISSN: 2395-0072

# A Literature Survey on Energy Efficient MAC Protocols for WSN

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**Abstract –** *WSNs (Wireless Sensor Networks) uses a collection of nodes for communication purpose. As these nodes are battery operated and the replacement of batteries is not an easy task. So using the energy of a WSN in an efficient way is the basic requirement of any WSN (Wireless Sensor Network). To make the WSN mode energy efficient a large number of MAC protocols are developed. This paper deals with a survey on active research work on Energy Efficient MAC protocols.*

***Key Words***: **WSN (Wireless Sensor Network), Energy Efficiency, MAC Protocols, Survey**

## 1. INTRODUCTION

Wireless Sensor Network which can also be called as Wireless Sensor and Actuator Network (WSAN)[1][2] are sensor based network which are used to monitor environmental or physical conditions. The physical conditions may be temperature, pressure sound etc. In these networks data is collected by sensors and sent to main location. WSN is made up of nodes which can vary in numbers from a few to several thousands. Each node contains a sensor, a radio transceiver, a microcontroller and the most important a battery. The battery has a limited power making the energy saving a very important task to be considered in a WSN. That's why MAC protocols are used to save energy. They do it by making decision about wireless channel. Means how to use wireless channel for communication purpose is decided by MAC protocols. There is a large number of MAC protocols developed so far but the correct choice of MAC protocol make the WSN more efficient in terms of energy. The choice of MAC protocol depends on application. There has been a rapid development in the research in the area of MAC protocol for energy efficient transmission.

The rest of the paper is organised as follows. Section 2 describes some cause of energy wastage in WSN. Section 3 describes some energy efficient MAC protocols and finally in section 4 we have concluded.

## 2. CAUSE OF ENERGY WASTAGE IN WSN

**2.1 Collided Packet:** When more than one packet is received by a given node at the same time then this packet is called collided packet and it needs to be retransmitted which in terns increases energy wastage in WSN.

**2.2 Overhearing:** When a packet which is destined to any node is received by some other node then this situation is called overhearing. The overheard packet is discarded and retransmitted to the given node. This retransmission leads to energy wastage in WSN.

**2.3 Control Packet Overhead:** Control packet are transmitted in addition to data for proper communication between nodes. This increases wastage of energy. By sending minimum number of control packet energy can be saved.

**2.4 Idle Listening:** Listening to idle channel and expecting to receive possible traffic.

**2.5 Over Emitting:** This is the situation when the receiver is not ready to receive still the sender is sending the message.

A good MAC protocols must prevents these causes of energy wastage in order to save energy in WSN.

## 3. LITERATURE SURVEY

**3.1 Song Wen-miao, Liu Yan-ming, Zhang Shu-e [3]:** This paper describes about SMAC protocol which is an energy efficient protocol of WSN. According to this paper SMAC adopts a periodic listen and sleep mechanism to save energy from idle listening. Energy is saved when the node goes to sleep interval.


Figure-1 Frame= $T_{listen}$ + $T_{sleep}$

A complete cycle is called a frame. All nodes can choose their own listen/sleep schedules. Neighbor nodes synchronize together to reduce control overhead. To avoid collision and overhearing, SMAC protocol uses RTS/CTS mechanism. To reduce the control overhead of RTS and CTS SMAC reserves the medium for transmitting all the fragments in burst.

**3.2 Rohan Parmar, Dr. R C Poonia "A Literature Survey on Energy Efficient MAC Protocols for WSN" [4]:** This paper describes TMAC protocol which is a successor of SMAC. TMAC protocol is used to overcome the problem faced by SMAC i.e. performance under variable traffic load. In T-MAC listening period ends when no activation event has occurred for a time threshold *TA*. The decision for *TA* is presented along with some solutions to the early sleeping problem defined in. Variable load in sensor networks are expected, since the nodes that are closer to the sink must relay more traffic. Although T-MAC gives better results under these variable loads, the synchronization of the listen periods within virtual clusters is broken. This is one of the reasons for the early sleeping problem.

**3.3 Changsu Suh and Young-Bae Ko [5] :** This paper describes a MAC protocol named as TEEM (Traffic aware Energy Efficient MAC) in which the duration of listen and sleep modes are not fixed like SMAC rather they are adaptive by utilizing traffic information of each node which results in low consumption of power. By utilizing the traffic information the listen time of nodes can be reduced by putting them into sleep state earlier when they expect no traffic to occur. It is done by modifying SMAC in two aspects: Firstly, the nodes are turned off when they expect no traffic to occur. Secondly, by eliminating separate RTS control packet when data transfer is likely to occur. Also the size of control packet is reduced by combining the RTS and SYNC packet. The combined packet is called $SYNC_{rts.}$

**3.4 R. Ramya, G. Saravanakumar and S. Ravi "MAC Protocols for Wireless Sensor Networks" [6]:** This paper describes about a MAC protocol named as μ-MAC which is a type of TDMA based MAC protocol. In μ-MAC high sleep ratio are obtained which is retaining the message reliability and latency. It is based on a schedule-based approach by which shared medium is accessed, which is predicted by behavior of traffic. Single time-slotted channel is used in μ-MAC protocol. Operations of this protocol alternate between a contention-free period and contention period.

**3.5 Zahra Rezaei , Shima Mobininejad "Energy Saving in Wireless Sensor Network" [7]:** In this paper a MAC protocol named as DEE-MAC has been explained which lets the idle listening nodes go into sleep using synchronization performed at cluster head. It is a TDMA based MAC protocol. A round is the time duration between a node disseminates its interest to the event and receives the response from the event. Each round comprise of a cluster formation and transmission phases. DEE-MAC operations comprise of these two phases. Each of the rounds includes a cluster formation phase and a transmission phase. In the cluster formation phase, a node decides whether to become the cluster head based on its remaining power. The node with the highest power level is elected as the cluster head. Each new round introduces formation of another cluster with different group of nodes based on the current node power level and the network structure changes. After the successful cluster head election, the system enters the transmission phase. This phase comprises of a number of sessions and each of the session consists a contention period and a data transmission period. The time of the contention period, each of the nodes keeps their radio on, and indicates interest to send a packet to the cluster head. After this period, the cluster head knows which of the node has data to transmit.

3.6 **Ji-Jun Zhao; Xiang Sun; "MAC protocol based on T-MAC multi-hop reservation for short-latency wireless sensor network"[8]:** This paper describes about a MAC protocol named as MR-MAC which is used for short latency in WSNs. This protocol is based on TMAC multi hop reservation. This is done by booking some nodes to decrease or eliminate the problem of long latency which is caused by periodical sleep of the node. Although on the issue of energy consumption MR-MAC increases the control packet, it solves the compromise between the energy problem and latency. Taking both energy consumption problems and latency into account is the future research direction of the MAC protocol.

**3.7 Zahra Rezaei , Shima Mobininejad "Energy Saving in Wireless Sensor Network"[9]:** This paper describes about Z-MAC protocol which is a hybrid protocol. Hybrid protocol makes the use of both TDMA and CSMA technologies. Z-MAC starts with a preliminary setup phase in which each node builds a list of two hop neighbor. Then a distributed slot assignment algorithm is applied to ensure that any two nodes in two hop neighborhood are not assigned to same slot. Due to this algorithm there will be no transmission interference between one hoop neighbor and two hoop neighbors. In Z–MAC, CSMA is considered as the baseline MAC scheme and TDMA is used to improve the contention resolution.

**3.8 R. Ramya, G. Saravanakumar and S. Ravi "MAC Protocols for Wireless Sensor Networks"[10]:** In this paper AMAC protocol has been discussed. It is proposed for collision free, no overhearing and fewer idle listening. In AMAC the nodes are notified prior to reception. They are activated only during reception or sending only otherwise they go to sleep.

## 4. CONCLUSIONS

We have done a survey on various types of energy efficient MAC protocols of WSN which is the prominence on the energy efficiency. Energy efficiency is the most critical issue for WSN as the sensor nodes are battery operated. So the key problem is the designing an energy efficient MAC protocol for WSN. The other major challenge is the choice of MAC protocol for a given application as choice of MAC protocol depends on application. Energy saving in wireless sensor networks has attracted a lot of attention in the recent years and introduced unique challenges compared to traditional wired networks. Extensive research has been conducted to address these limitations by developing schemes that can improve resource efficiency. In this paper, we have summarized some research results which have been presented in the literature on energy saving methods in sensor networks. Although many of these energy saving techniques look promising, there are still many challenges that need to be solved in the sensor networks. Therefore, further research is necessary for handling these kinds of situations.

## ACKNOWLEDGEMENT

Thanks to my teacher **Mr. Tejender Malik** *(Assistant Professor MRIEM ROHTAK, ECE Department)*. He had given me lots of advice and help. Here, I want to express my gratitude for all of his kindness. I will work harder to live up to what he expect of me to avoid letting him down.

## REFERENCES

[1] A Survey on Centralized and Distributed Clustering Routing Algorithms for WSNs (PDF). IEEE 81st Vehicular Technology Conference. Glasgow, Scotland: IEEE. Spring 2015. doi:10.1109/VTCSpring.2015.7145650. Retrieved March 4, 2016.

[2] I. F. Akyildiz and I.H. Kasimoglu (2004). "Wireless Sensor and Actor Networks: Research Challenges". Ad Hoc Networks. 2 (4): 351–367. doi:10.1016/j.adhoc.2004.04.003.

[3] SONG Wen-miao, LIU Yan-ming, ZHANG Shu-e" Research on SMAC protocol for WSN" 978-1-4244-2108-4/08/$25.00 © 2008 IEEE

[4] Rohan Parmar et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 5 (3) , 2014, 3421-3424

[5] Changsu Suh and Young-Bae Ko "A Traffic Aware, Energy Efficient MAC Protocol for Wireless Sensor Networks" Korea Science & Engineering Foundation, University IT Research Center Project and a grant of the 21C Frontier R&D Program.

[6] R. Ramya, G. Saravanakumar and S. Ravi "MAC Protocols for Wireless Sensor Networks" Indian Journal of Science and Technology, Vol 8(34), DOI: 10.17485/ijst/2015/v8i34/72318, December 2015.

[7] Zahra Rezaei , Shima Mobininejad "Energy Saving in Wireless Sensor Network" International Journal of Computer Science & Engineering Survey (IJCSES) Vol.3, No.1, February 2012 DOI : 10.5121/ijcses.2012.3103

[8] Ji-Jun Zhao; Xiang Sun; "MAC protocol based on T-MAC multi-hop reservation for short-latency wireless sensor network" 978-1-4244-2251-7/08/$25.00 ©2008 IEEE.

[9] Zahra Rezaei , Shima Mobininejad "Energy Saving in Wireless Sensor Network" International Journal of Computer Science & Engineering Survey (IJCSES) Vol.3, No.1, February 2012 DOI : 10.5121/ijcses.2012.3103

[10] R. Ramya, G. Saravanakumar and S. Ravi "MAC Protocols for Wireless Sensor Networks" Indian Journal of Science and Technology, Vol 8(34), DOI: 10.17485/ijst/2015/v8i34/72318, December 2015.