LIFE TIME MAXIMIZATION OF WIRELESS SENSOR NETWORK USING MODIFIED AS-MAC PROTOCOL

S.Nandhini*

C.Nanthini*

S.Narmadha*

Mr.T.Senthil**

ABSTRACT

Wireless sensor network (WSN) is a group of wireless nodes where each node consists of transceivers, microcontrollers, electronic sensors and power supply. Usually, the power supply source is battery which is impossible to recharge and reuse. So Energy efficiency is the main task in most wireless sensor network applications for maximizing the life time. MAC protocol is designed to conquer the energy consumption in wireless sensor networking, as most of the power consumption in the sensor node is due to the communication subsystem….. Here, existing AS-MAC protocol is modified to wakeup nodes periodically to receive packets in order to increase the energy efficiency. It is used to coordinate asynchronously the wake up times of neighboring nodes to drain overhearing, contention and delay. Besides, it exploits Low Power Listening (LPL) to minimize the periodic wake up time. Thus it improves the life time.

KEY WORD:

Energy saving, Duty cycle, MAC scheduler, Performance evaluation, Wireless Sensor Network, Round Robin scheduling method.

* B.Tech Scholar, Department Of ECE, Kalasalingam University

** Assistant professor, Department Of ECE, Kalasalingam University

INTRODUCTION:

Wireless sensor network is a distributed collection of nodes that coordinate to perform a particular task. In many applications, the nodes are battery powered and it is often very difficult to recharge or reuse. Network lifetime is the major problem in WSN. Transmission period of sensors are high. Thus, WSN MAC protocol needs to be energy efficient. Sources of energy waste includeidle listening, collisions, overhearing and over emitting. Idle listening consumes between 50-100% of the energy required for receiving. Idle listening, listen to receive possible traffic that is not sent. Overmitting, transmission of message when receiver is not ready.

Main security threats in WSN are, Radio links are insecure, Sensor nodes are not temper resistant – if it is compromised then the attacker obtains all security informations and availability of the communications and computations. The existing system uses the early duty cycled MACs like S-MAC, T-MAC are high duty cycle, and it has a poor performance with variable loads. It has some drawbacks like Overhearing; high contention means high packet loss and low throughput, High delay. TDMA-based protocols are used to avoid collisions by providing a slot time for each sensor node in a given cluster, which helps to overcome the effects of overhearing problem, because in this situation each node knows his corresponding slot time to transmit data packet. The Contention-based protocols are known as CSMA-based protocols which are usually used in the multi-hop wireless networking due to their simplicity. When these protocols are used, collision occurs in receiver side, as when two sensor nodes transmits data packet simultaneously to it. These collisions generate useless retransmissions which cause wastage of energy and time. To decrease these collisions and to reduce considerably other sources of energy wastage, the Wake-up/Sleep mechanisms and the control messages RTS/CTS/ACK defined in 802.11x standard, are used to design energy efficient MAC protocols. Asynchronous Scheduled MAC protocol is designed to avoid idle listening and uses low power listening to reduces periodic wake up time. Here, nodes store the wake up schedule of their neighbors. So there is no need to add long preambles during transmission. The radio transmitter is active only when nodes actually send or receive. This approach reduces power consumption with the phenomenon of idle listening and it increases the network lifetime. The information stored in each node is periodically updated.

RELATED WORKS:

Early duty cycled MACs like S-MAC, T-MAC is high duty cycle, and it has a poor performance with variable loads. In existing system LPL protocol which includes the B-MAC, X-MAC have long preambles.SCP-MAC, SCP-MAC, a synchronous scheduled energy-efficient scheduling MAC protocol, minimizes the preamble by combining preamble sampling and scheduling techniques. LPLs are very sensitive to tuning for neighborhood size and traffic rate. By synchronizing channel polling times of all neighbors, long preambles are eliminated and ultra-low duty cycles (below the LPL 1-2% limits) are possible. It synchronizes the wakeup time of neighboring nodes, which minimizes the length of preamble. It also minimize the periodic wakeup time by LPL.

The main problem in this SCP-Mac are, Overhearingavoidance, High contention means high packet loss and low throughput, High delay.SCP-MAC addresses this issue with adaptive channel polling, but this only works with high loads. A drawback of this scheme is the need for a long periodic wakeup time that has to include the collision avoidance back off, RTS-CTS exchange and compensation for clock drift as well as waiting for eventual transmissions from the neighbors. In addition, due to its synchronization procedure, it results in increased contention and delay **.**In S-MAC, All nodes periodically listen, sleep and wakeup. Nodes listen and send during the active period and turn off their radios during the sleep period. Long frames are fragmented and transmitted as a burst.

S-MAC controls the duty cycle to tradeoff energy for delay. T-MAC employs an adaptive duty cycle by using a very short listening window at the beginning of each active period. LPLs are very sensitive to tuning for neighborhood size and traffic rate. This approach uses duty cycling, asynchronous, scheduled MAC protocol, and need to store one hop neighbor table, this make the system complex.There are many disadvantages in these approach the primary disadvantage is that Asynchronous wakeup interval in AS-MAC is the inefficiency of broadcast because here the system uses the one hop neighbor table to overhead the protocol for broadcast. The collisions generate useless retransmissions which cause energy consumption wastage and time consuming in data transmission. To decrease these collisions and to reduce considerably other sources of energy wastage, the Wake-up/Sleep mechanisms and/or the control messages RTS/CTS/ACK defined in 802.11x standard, are used to design energy efficient MAC protocols for WSN like S-MAC, T-MAC, B-MAC and Z-MAC.

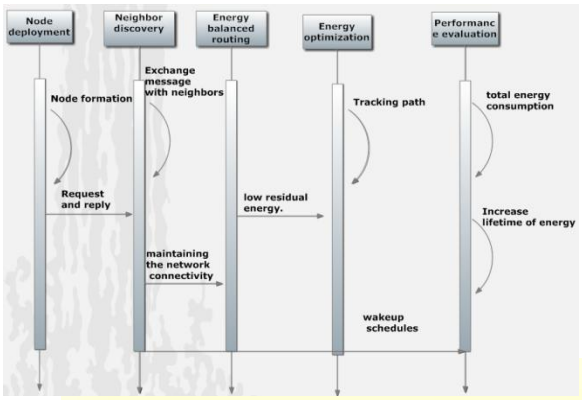

Fig.no 1: Sequence diagram of AS-MAC protocol

PROPOSED ALGORITHM:

Understanding existing AS-MAC protocol and finding the problems stated and addressed. Compare the proposed and constraint of each algorithm. Simulate algorithms and compare performance with and without cyclic mechanism. To optimization of the network lifetime, data processing algorithm, and communication protocols targeting efficient energy usage as their design goal.

The proposed system introduce Cross layer optimization approach to optimize energy consumption. OSI-based protocols are not flexible, not optimal and consequently reduce network performances. To mitigate these drawbacks, a new MAC approach called Cross-layer MAC optimization, is emerged and showed the effectiveness of DRR-MAC protocol in terms of energy consumption and latency.

The protocol is optimized dynamically by a constrained optimization problem. The objective function is the total energy consumption for transmitting and receiving packets from the edge cluster to the sink. Finally we compare the performance of the existing & the proposed system. The parameters such as throughput, packet delivery ratio, delay are also compared. We have proposed a novel energy efficient MAC protocol using a Cross layer optimization approach, named DRR-MAC. This protocol has been modeled using time Petri nets based on Round Robin Scheduling method and validated using NS2 tool. The simulation experiments undertaken on several network topologies of wireless sensor networks showed the effectiveness of AS1-MAC protocol in terms of energy consumption and latency.

The simulation work has been done with the Network Simulator ns-2, Version 2.29. It has been performed on a network of 56 nodes and a fixed base station. The nodes are

initially placed randomly in the network. On-demand reactive routing protocol that uses routing tables with one entry per destination. When a source node needs to find a route to a destination, it starts a route discovery process, based on flooding, to locate the destination node. Upon receiving a route request (RREQ) packet, intermediate nodes update their routing tables for a reverse route to the source. Similarly, the forward route to the destination is updated upon reception of a route reply (RREP) packet originated either by the destination itself or any other intermediate node that has a current route to the destination.

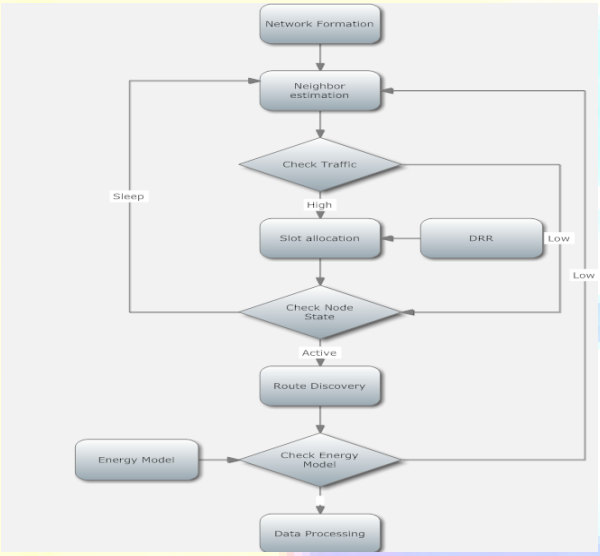

Fig.no:2: Flow diagram of Distributed Round Robin method.

In Round Robin Scheduling method sleeping nodes will be less which gradually decreases the delay and packet loss. In this scheduling process waiting time will be equal to the time. It randomly sends the packet in fixed interval. The time can be rescheduled i.e., balance scheduling in this method, which can avoid the traffic among nodes.

ROUND-ROBIN SCHEDULING ALGORITHM:

Round-robin (RR) is one of the time slices are assigned to each process in equal portions and in circular order, handling all processes without priority (also known as cyclic executive). Round-robin scheduling is simple, easy to implement algorithms employed by process and network schedulers in computing. As the term is generally used, and starvation-free. Round-robin scheduling can also be applied to other scheduling problems, such as data packet scheduling in computer networks.

- Every frame consists of N mini-slots and x data-slots
- Every station has its own mini-slot and can reserve up to k data-slots using this mini-slot (i.e. x = N * k).
- Other stations can send data in unused data-slots according to a round-robin sending scheme (best-effort traffic)

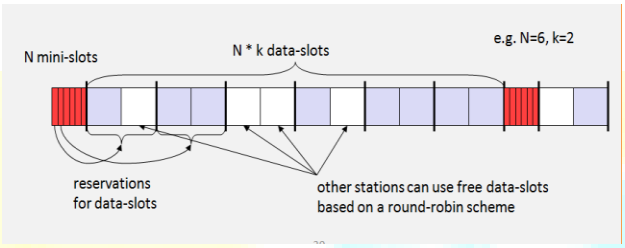

Fig no3: Round Robin scheduling algorithm

PERFORMANCE EVALUATION:

For reliable data packet transmission, AS-MAC usesACKs after data packet receptions and retransmission with exponential back off up to the maximum retransmission limit. When a sender has a packet to send, it wakes up at the wakeup time of the intended receiver and transmits the data packet. After transmitting a data packet, the sender stays awake for a brief period of time (i.e. processing time and transmission time), to allow it to receive an ACK packet. If the sender does not receive the ACK from the intended receiver, in order to save energy, the sender goes back to sleep state and retransmits it at the next wakeup time of the receiver. The retransmission is performed with exponential back off within the maximum retransmission limit. The receiver wakes up at its periodic wakeup time. If there is an incoming packet and it is valid, the receiver transmits ACK packet and goes back to sleep. If the reception is unsuccessful, the receiver goes back to sleep without transmitting the ACK packet. Collision occurs when there is high traffic. This is the main disadvantage in AS-MAC protocol. To overcome these problems by Round robin method, it minimizing the sleeping nodes which reduces the traffic among the nodes and increases the energy of sensor nodes. Using round robin method delay can be drastically reduced when compared to AS-MAC protocol, basic CSMA MAC protocol and DRR-MAC protocol.

SIMULATION RESULT:

We used Network Simulator 2 (NS2) to simulate these different strategies to reduce the energy consumption through Distributed Round Robin Method.The model is extremely accurate in predicting the system throughput, delay, energy efficient.

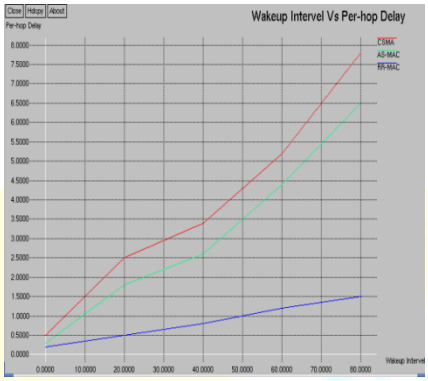

Fig.no (4a): The above graph denotes the wakeup interval Versus Per-hop delay which used to compare the CSMA AS-MAC and DRR.

The above x-graph denotes the delay of each connecting nodes of the wakeup interval and we compared the three different Mac protocol to show the decrease in energy consumption of CSMA(Carrier Sense Multiple Access) AS-MAC and DRR .Through this comparison of CSMA and AS-MAC protocol the proposed system DRR (Distributed Round Robin) reduces the energy of each node of the interval that has been allotted. X-axis is denoted as wake up interval and y-axis is denoted as per-hop delay.

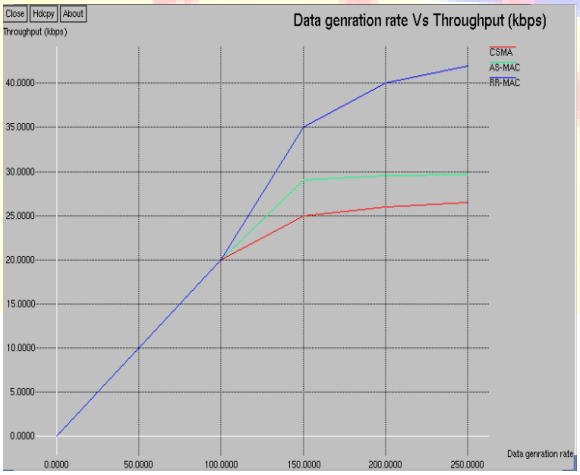

Fig...No (4b): Comparison for data generation versus throughput of DRR, AS-MAC, CSMA

When the generation of data is maximum then the throughput is also maximum. i.e the generation of data is directly proportional to throughput. Therefore ,if all nodes have been declared and generated then the throughput will increase ,otherwise for 56 nodes only 20-30 nodes are generating means then throughput used to decrease.

CONCLUSION:

We present a duty cycling, asynchronous, scheduled, energy-efficient MAC protocol; in the proposed approach, each node stores the wakeup schedules of their neighbors. The protocol asynchronously coordinates the wakeup times of neighboring nodes to reduce overhearing, contention

and delay being unavoidable in synchronous scheduled MAC protocols.When compared to AS-MAC protocol, the delay in transmission of packets can be gradually reduced by reducing the sleeping nodes by using the Round Robin Scheduling method. This will increases the network life time. Using this process energy consumed by the nodes are reduced.

ACKNOWLEDGEMENT

We thank the Department of Electronics and Communication Engineering of Kalasalingam University, (Kalasalingam Academy of Research and Education), Tamil Nadu, India for permitting to use the computational facilities available in Centre for Research in OST lab which was setup with the support of the Department of Science and Technology (DST), New Delhi under FIST Program in 2013.

REFERENCE:

1. Luca Anchora, Antonio Capone, Vincenzo Mighali, Luigi Patrono, Francesco Simone: “A novel MAC scheduler to minimize the energy consumption in a wireless sensor networks.”,2013-ELSEVIER.
2. Beakcheol Jang.Jum Bum Lim,Mihail L.Sichitiu :An Asynchronous Scheduled MAC protocol for Wireless sensor Network-.2012-ELSEVIER
3. Tae Rim Park, Kyung-Joon Park, and Myung J. Lee:”Design and Analysis of Asynchronous Wakeup for Wireless Sensor Networks”- IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS, VOL. 8, NO. 11, NOVEMBER 2009.

4. Christophe J. Merlin and Wendi B. Heinzelman:"Duty Cycle Control for Low-Power-Listening MAC Protocols"-IEEE TRANSACTIONS ON MOBILE COMPUTING, VOL. 9, NO. 11, NOVEMBER 2010.
5. C. Cano, B. Bellalta, A. Sfairopoulou, M. Oliver:"Low energy operation in WSNs: A survey of preamble sampling MAC protocols"-2011 ELSEVIER.
6. Raja Jurdak, Member, IEEE, Antonio G. Ruzzelli, and Gregory M.P. O'Hare. "Radio Sleep Mode Optimization in Wireless Sensor Networks- IEEE TRANSACTIONS ON MOBILE COMPUTING, VOL. 9, NO. 7, JULY 2010.
7. Hongseok Yoo, Moonjoo Shim, and Dongkyun Kim:"Dynamic Duty-Cycle Scheduling Schemes for Energy-Harvesting Wireless sensor Networks". IEEE COMMUNICATIONS LETTERS, VOL. 16, NO. 2, FEBRUARY 2012. G. Anastasi, M. Conti, M. Di Francesco, A. Passarella, Energyconservation in wireless sensor networks: a survey, J Ad HocNetworks 7 (3) (2009).