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Mobility Aware and Energy efficient Medium Access Control Protocol in WSN

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Abstract: *Mobility together with energy efficiency in wireless sensor networks have imposed challenges on Medium Access control (MAC) protocol. Various MAC protocols are designed to provide reliable communication with better data rates. More energy consumed by sensor nodes at the time data transfer.an adaptive mobility aware & energy efficient medium access protocol (MEMAC) for mobile wireless sensors network. MEMAC protocol is hybrid based MAC protocol which has the advantages of energy efficiency in mobile environment. MEMAC differentiates between message as data & control. MEMAC uses dynamic frame size to allow protocol to adapt itself to changes in mobility conditions. Also it includes only those nodes in schedule which have data to send. It handles the channel access through the following phases synchronization, request /leave/join, schedule calculation and distribution and data transfer. By simulation experiments of MEMAC protocol performance analysis done in terms of energy consumption, throughput and average packet delay.*

I. Introduction

At present , Wireless Sensor Network (WSN) are one of the first practical real-world examples of the pervasive Computing paradigm concept of small, inexpensive, robust, networked processing devices eventually permeating The environment A WSN is an ad hoc network of autonomous low-powered sensors that are spatially distributed And communicate wirelessly to co-operatively achieve a task. Collection of sensor nodes organized into co-operative network. Each sensor node consist of processing capacity (one or more microcontrollers,CPUs or DSP Chips), may contain multiple types of memory (program, data and flash memories),have a RF transceiver (usually with a single omnidirectional antenna), have a power source (e.g., batteries and solar cell), and accommodate various Sensors. The nodes communicate wirelessly and often self-organized after being deployed in a ad hoc fashion,System of 1000s or even 10,000 nodes are anticipated.

Implementation of different MAC protocols for mobility is challenged task in WSN areas. Our aim is to implement such protocol which will support parameters like mobility, adaptability in wireless network.

MAC protocol in wireless sensors network can be classified into three general groups: scheduled, unscheduled, and Hybrid protocols. Scheduled MAC protocols attempts to organize the communication between sensor nodes in an ordered way. The most common scheduling methods which organizes sensor noes in slots is Time Division Multiple Access(TDMA), where each sensor node is a assigned a timeslot. Organization sensor nodes provides the Capacity to reduce collision and message retransmission at the cost of a fine grained synchronization and state distribution . Unscheduled protocols attempt to conserve energy by allowing sensor node to operate independently with minimum of complexity. In a addition unscheduled MAC protocols typically do not share information or maintain states. There benefits come at the cost of collision and idle listening which may occur and cause degradation in the protocols efficiency. Hybrid MAC protocols combines the strengths of scheduled and unscheduled MAC protocols while avoiding their weakness to better address the special requirements of wireless sensor networks. The greatest advantage of the hybrid MAC protocols comes from its easy and rapid adaptability To traffic conditions which can save a significant amount of energy.

The most widely used MAC protocols for sensor networks is S-MAC[1-9]protocols. S-mac introduces a low duty cycle operation in multi- hop wireless sensor wireless sensor network, where the nodes spend most of their time in sleep mode to reduce energy consumption Under variable traffic loads S-MAC does not perform well. S-MAC has a main drawback that is the probability of collision increase as the network size and/load increases, which degrades channel utilization and wastes energy.

MS-MAC is an improved version of the S-MAC[9] to handle mobility. Different forms of MS-MAC, our MEMAC Controls the channels access through scheduling the nodes in different times slots which leads to efficient usage of energy resources of the sensor's node. MMAC[8] is an improvement of the TRAMA under mobile scenarios .

There are various MAC protocols proposed for the sensor networks [2] but not a one standard protocols for sensor Network that means it will be application dependent.MEMAC combines the benefits of both

contentions based and scheduled based protocol to achieve significant amount of energy savings also suitable for mobile sensor network.

II. Performance Parameters of MAC For Mobile Sensor Network

In order to evaluate performance of MAC, following parameters are to be considered.

i) Energy Consumption per bit

The energy efficiency of the sensor nodes can be defined as the total energy consumed / total bits transmitted. The unit of energy efficiency is joules/bit. The lesser the number, the better is the efficiency of a protocol in transmitting the information in the network. This performance matrices gets affected by all the major sources of energy waste in wireless sensor network such as idle listening, collisions, control packet overhead and overhearing.

ii) Average Delivery Ratio

The average packet delivery ratio is the number of packets received to the number of packets sent averaged over all the nodes.

iii) Average Packet Latency

The average packet latency is the average time taken by the packets to reach to the sink node.

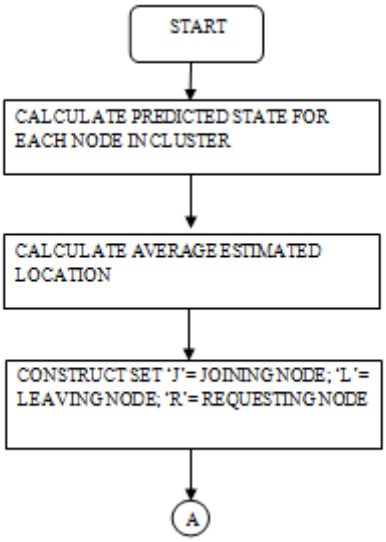
iv) Network Throughput

The network throughput is defined as the total number of packets delivered at the sink node per time unit.

III. MEMAC Protocols

In sensor network nodes may fail(eg. Power drain) or new node may added(additional sensor may deployed) sensor node may physically moved from the location, either because of the motion of medium (eg water, air) or by means of special motion hardware in the mobile sensor nodes to accommodate these topology dynamics our MEMAC protocols is use a hybrid approach of contention-based and scheduled-based scheme as in our previous mac protocols(SEHM protocol).

IV. Flowchart for Mobility Adaptive Algorithm



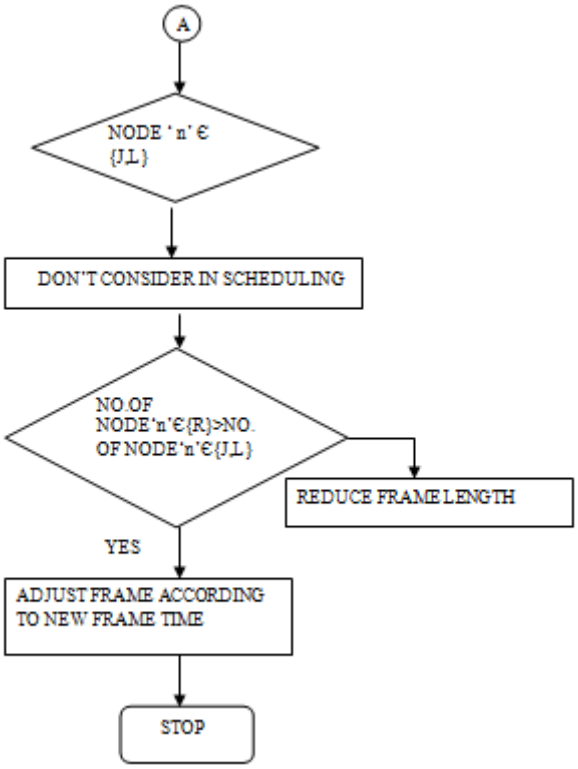


Figure 1: Flowchart for mobility adaptive algorithm

To implement MEMAC Protocol, we considered following parameters for Simulation Environment .

Table 1. Simulation Environment.

Environment Variables	Associated Values
Simulation Tool	Ns- allinone-2.34 under Linux Platform
Bandwidth of the WSN Environment:	1 Mb
Channel Used	Wireless
Initial Energy	1000 Joules
Antenna Type	Omni Directional
Base Protocol	AODV
Total No of Nodes	100
Queue length	50
MAC protocol	IEEE 802-11
Propagation model	Two Ray Ground Model
Simulation Time	150s.

V. Result

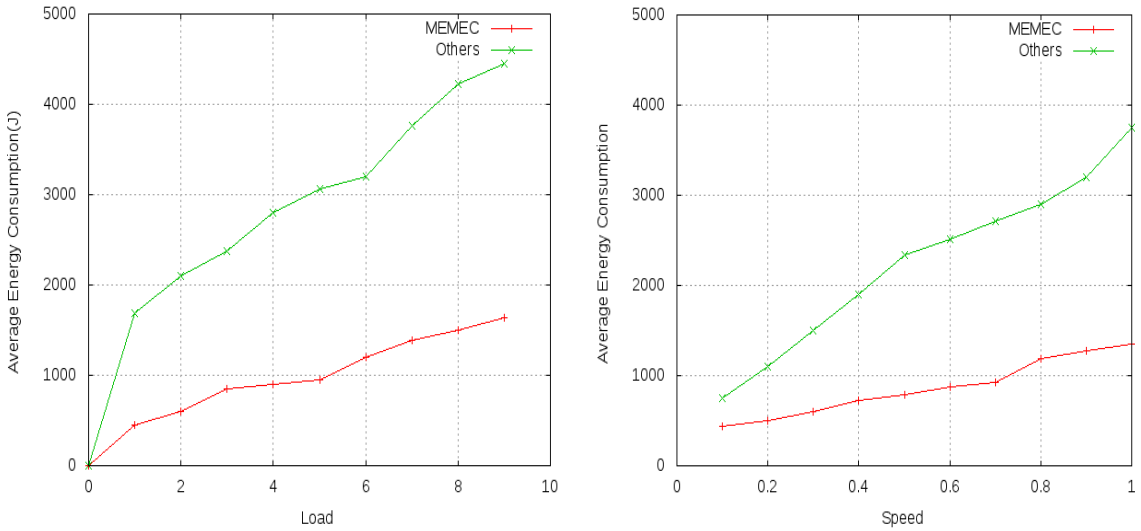
TCL Script is simulated in NS2 with the help of NAM Animator, Results are plotted using GNUPLOT. Results are taken in terms of Energy consumption, Throughput and packet delay.
Energy Consumption.

i) Average Energy Consumption vs Load.

Energy efficiency is most important performance metric in WSN. Figure shows energy consumption of MEMAC with other i.e. MMAC protocols under the variable load. By gradually increasing load , MEMAC outperforms than MMAC for average energy consumption. Readings are taken from analysis of trace file and energy.pl.

ii) Average Energy Consumption vs Speed.

Figure b) shows that when nodes are become more mobile, MEMAC outperforms the other MMAC.
Readings are taken by varying speed of nodes , and total energy consumption is observed. Command is used for varying speed is ./setdest –v 2 – n – s - m - M - t - P - p - X – Y/100.scen

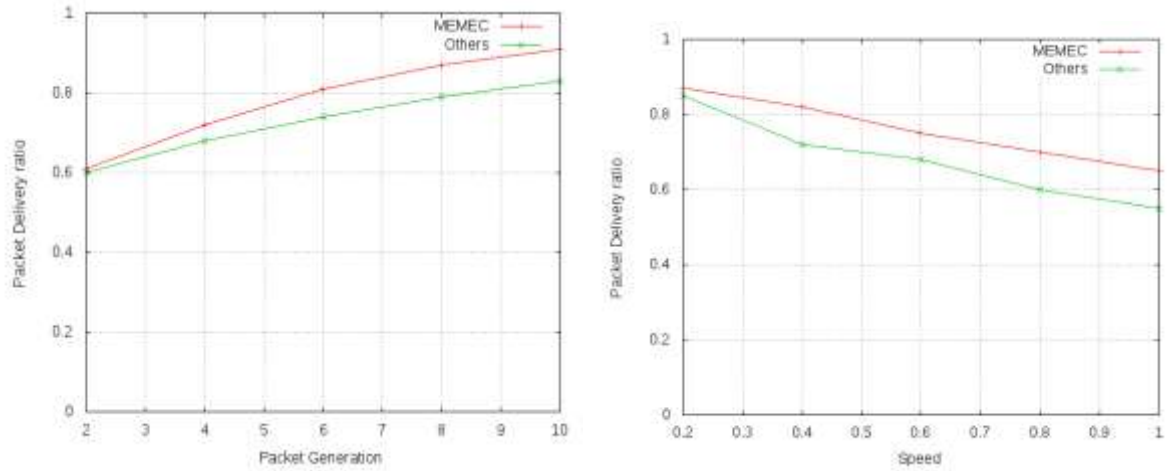


(a) Average Energy Consumption vs Load (b) Average Energy Consumption vs Speed Speed

Figure 2. Average energy consumption.

2 Throughput

Figure 3 a) and 3 b) shows average percentage of data packets successfully delivered to the base station. Figure 3 a) shows MEMAC slightly performs MMAC. In 3 b), as mobility increases packet delivery ratio for MMAC decreases significantly , while MEMAC exhibits minimum decrease.

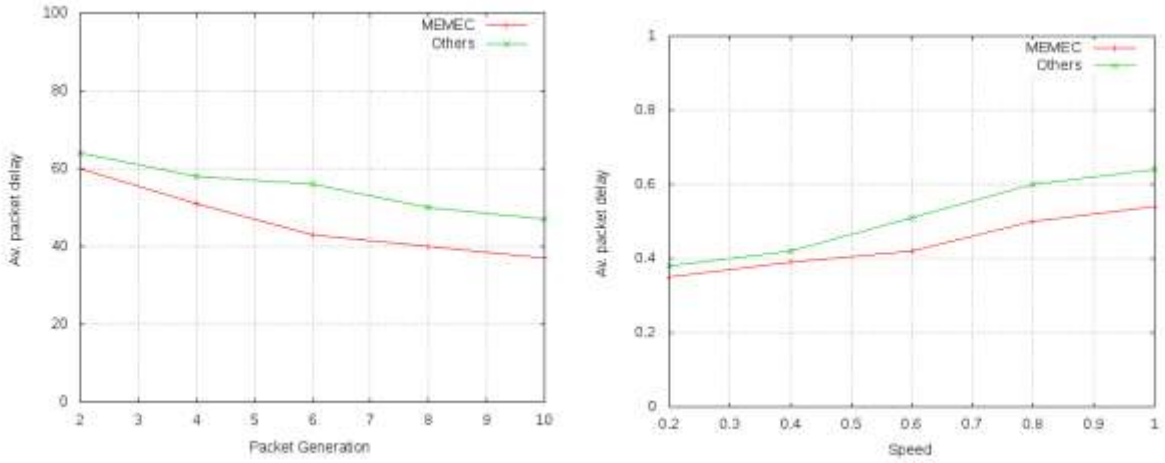


(a) Packet Delivery Ratio vs Packet generation. (b) Packet Delivery Ratio vs Speed

Figure 3.Throughput.

3 Packet Delay

Figure shows average packet delay for MEMAC and other as MMAC Protocol. By changing the packet generation time on the source node, we vary traffic load. Figure 4 a) shows relatively same average packet delay but in mobile scenario, MEMAC slightly shows better performance.



(b) Average Packet Delay vs Packet generation (b) Average Packet Delay vs Speed

Figure 4: Average packet delay for MEMAC and other as MMAC Protocol.

VI. Conclusion

A scenario of 100 mobile nodes was taken for modeling and simulation. The nodes were moving with RWP mobility model. Different variations of speed and data rates were taken for observation and calculations. It was observed that when the speed of movement increases it increases the energy consumption. Also, higher CBR rates results in higher energy consumption. When data rate is increased the average end to end delay also increases. All these parameters viz. energy consumption, Delivery ratio and packet delay of MEMAC protocol were compared with the protocol without clustering.

After extensive simulation and execution of protocol MEMAC, it was found that the energy consumption in MEMAC protocol is less than the protocol without clustering. The average delivery ratio is better than other protocol. It is found that packet delay goes on increasing when the load is increased. But still MEMAC proves to be more efficient than the protocol without clustering.

Thus the MEMAC protocol proves to be an energy efficient protocol along with mobility consideration.

References

[1]. Bashir Yahya, Jalel Ben-Othman,"An Adaptive Mobility Aware and Energy Efficient MAC Protocol for Wireless Sensor Networks" IEEE,2009

[2]. Ilker Demirkol, Cem Ersoy, and Fatih Alagöz, "MAC Protocols for Wireless Sensor Networks:a Survey"

[3]. Huan Pham, Sanjay JhaAn, "Adaptive Mobility-Aware MAC Protocol for Sensor Networks (MS-MAC)", IEEE 2004

[4]. Yi Zhi Zhao , Thuy Ngoc Nguyen , Maode Ma , Chunyan Miao ,"An Energy-Efficient MAC Protocol with Adaptive Scheduling for Wireless Sensor Networks" , IEEE, 2009

[5]. Wendi B. Heinzelman, Anantha P. Chandrakasan, Hari Balakrishnan,"An Application-Specific Protocol Architecture for Wireless Microsensor Networks" , IEEE, 2002Brunzell JD, Davidson M, Furberg CD, et al. Lipoprotein management inpatients with cardiometabolic risk:consensus statement from the American diabetes association and the american college of cardiology

[6]. Yuvraj Krishna Rana, Bao Hua Liu, Alfandika Nyandoro, Sanjay Jha, "Bandwidth Aware Slot Allocation in Hybrid MAC".

[7]. Zainab R. Zaidi , Brian L. Mark, "Mobility Estimation for Wireless Networks Based on an Autoregressive Model", IEEE 2004

[8]. Muneeb Ali, Tashfeen Suleman,and Zartash Afzal Uzmi,"MMAC:A Mobility adaptive, Collision-free MAC Protocol for Wireless Sensor Networks",IEEE 2004

[9]. W.Ye, J.Heidenmann, and D. Estrin ,"An Energy efficient MAC proocol for wireless sensor networks", IEEE 2004.

[10]. Haun Pham and Sanjay Zha,"An Adaptive mobility-aware MAC protocol for sensor networks (MS-MAC)",IEEE 2004.

[11]. V. Rajendran, K. Obraczka, and J. J. Garcia-Luna-Aceves,"Energy-efficient, collision-free medium access control for wireless sensor networks",IEEE 2003

[12]. Anjali Raja, Xiao, Su, "Mobility Handling in MAC for Wireless a Ad-Hoc Networks" ,Wiley series on Wireless communications and mobile computing,2008.