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Comparative Study on MS-MAC and LMS-MAC With Pros and Cons

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ABSTRACT

A wireless sensor network (WSN) is a wireless networks consisting of number of sensor nodes to monitor physical or environmental conditions. In wireless sensor network, nodes are generally battery-powered devices, the critical aspect is to reduce the energy consumption of nodes and many researches is being undergone continuously. In this paper MS-MAC protocol was analyzed and new LMS-MAC protocol was introduced to detect the node clustering.MS-MAC protocol is compared with LMS-MAC and it shows that LMS-MAC provides more energy efficient than the MS-MAC protocol, which also reduces the delay and increase the throughput. In LMS-MAC a new adaptive Localization Mobility-aware MAC protocol for Sensor networks based on localization algorithm is proposed. The adaptation algorithms are used to localize mobile nodes and predict the quality of link it established at the link layer and reduces much of energy consumption while the sensor nodes are in movement.

***Keywords*: -** Wireless Sensor Network, MS-MAC Protocol, LMS-MAC Localization Techniques.

I. INTRODUCTION

Introduction in networking, wireless sensor networks is most commonly used for discovering routing and other energy efficiency techniques. Wireless sensor network consist of small sensor nodes that can be easily communicate with each other by using radio signals and has the quality to sense, monitor and understand the physical world. Sensor nodes are also called as motes. WSNs can provide a communication between the real and the virtual world. WSNs can be processed in various modes like sleep, idle and active. WSNs are deployed with batteries and these batteries cannot be charged or changed. WSNs can be used in many applications like industry, civil infrastructure, military, science and security. Sensor nodes are used to monitor environmental conditions like temperature, pressure, humidity, sound, vibration, position etc. In many real time applications the sensor nodes are performing different tasks like neighbour node discovery, smart sensing, data storage and processing, data aggregation, target tracking, control and monitoring, node localization, synchronization and efficient routing between nodes and base station.

II. MS-MAC PROTOCOL

MAC layer is a sub layer of the data link layer presented in the OSI model. The function of the MAC layer is to transfer the data from the upper layer. And it can be used in error protection and access to one channel shared by all the nodes. The WSNs MAC layer protocol must be energy efficient to maximize the battery life time.

MS-MAC protocol was proposed by Huan Pham and Sanjay Jha for wireless sensor networks in order to save energy when the sensor nodes are in mobility. The MS-MAC protocol is extended by SMAC to support the node mobility. In wireless sensor networks the sensor nodes can be stationary or mobility according to the requirement of the application[5]. In MS-MAC the sensor nodes can work very efficiently when the nodes are stationary and can perform low level of energy efficiency with the mobile nodes. The advantage is that it can work very efficient when the nodes are stationary. The disadvantage in MS-MAC is it loses energy by listening for a long time and it could not save much

of energy in mobile sensors. In MS-MAC the protocol supports two types of method.

A. Sleep

In the sleep mode the node does not transfer any information or packets from one to another. In this method the node state where the radio is turned off. So that, no wastage of energy can be obtained in sleep mode.

B. Idle listening

Another source of wasting energy occurs when a node has its radio on, listening to the medium when there is no transmission. In this stage the node will be waiting for the packets for 2 minutes, after 2 minutes if there is no message from the near node the listening time becomes waste. This is one type where the energy can be easily wasted

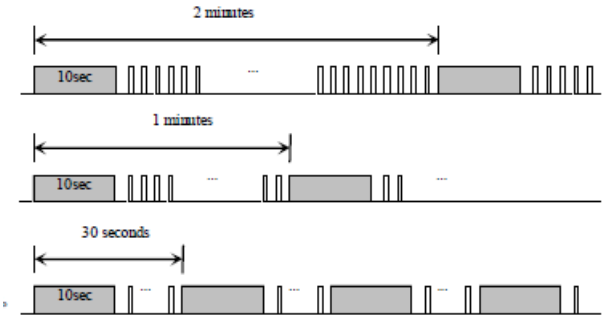


Fig.1 sleep and idle listening of MS-MAC

III. LMS-MAC PROTOCOL

Each and every node in the wireless sensor networks can be stationary or mobility depending on the application requirement. Optimizing energy in mobile sensor network is a current challenge in recent research. It mainly focuses to minimize the energy consumption, to reduce the delay and to improve the throughput while the sensor nodes are in movement. A new adaptive Localization Mobility-aware MAC protocol for Sensor networks (LMS-MAC) based on localization algorithm [1]. The adaptation algorithms are used to localize mobile nodes and predict the quality of link it established at the link layer and reduces some level of energy consumption while the sensor nodes are in movement. The advantage of LMS-MAC is it can save high level of energy with the mobile nodes. The disadvantage is that it uses GPS to access the nodes if it is lost or far away from the range.

It uses distance estimation method to calculate the distance between the two nodes. By calculating the distance, the information can be easily transferred and the energy can be saved. The approaches are

A. Angle of Arrival (AOA)

This scheme can be used to find the location of the unlocalized node. It can be determined by estimating absolute or relative angles between the neighbor's. It is also called as direction of arrival (DOA). It is measured in degree with clockwise direction from the north.

B. Time of Arrival (TOA)

This scheme is used to find the location of the unlocalized node by calculating the speed of wavelength and time of radio signals transverses between anchor node and unlocalized node [10]. All the sensor nodes will transmit the signal to the neighbour node with the same velocity. After receiving the signal will be send back to the transmitter.

C. Received Signal Strength Indicator (RSSI)

Radio signal energy is an electromagnetic wave. These wave strength decreases when it starts moving forward. When transmitting the data packet by sensor nodes the RSSI values is calculated. The sensor node will hear the transmitted signal by the access point [9]. The absolute measurement cannot be shown by RSSI. By using this, the estimation of distance between the transmitter and the receiver is calculated.

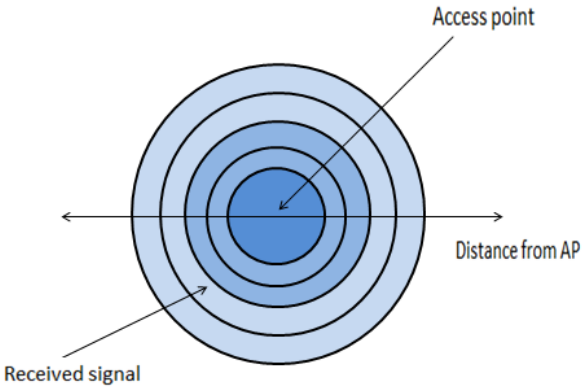


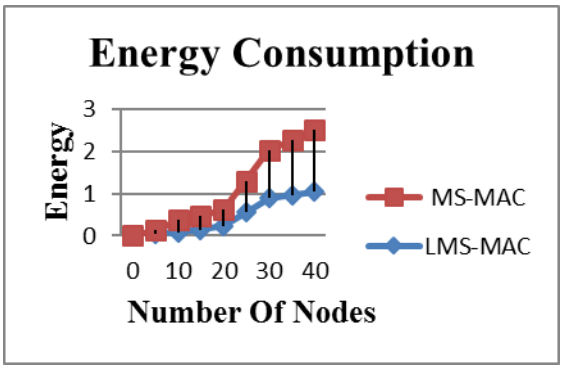
Fig.2 Received signal strength and separation distance between access points and receivers

IV. COMPARISON BETWEEN MS-MAC AND LMS-MAC

Both MS-MAC and LMS-MAC protocols are used. Both the algorithm uses some technique to save energy in sensor nodes. LMS-MAC works well with both stationary and mobile nodes but MS-MAC works badly with mobile nodes. The comparisons between both the protocols are based on

A. Average Energy Consumption

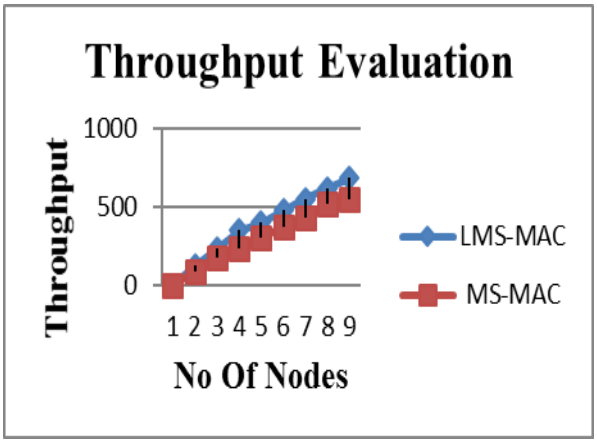
It measures the average difference between the initial level of energy and the final level of energy that is left in each node. Energy consumption of the node is the subsequent metric to be conducted. LMS-MAC energy consumption is much lesser when compared to other MS-MAC localization scheme. It keeps node energy consumption of node at reduced state through increment of network size normally occurs. The energy efficiency of LMS-MAC is more consistent as the results shows from the experiment conducted and the effect of increasing the size of the network shows smaller effects and comparing it to other localization schemes and their performances diminishes when the network size becomes bigger.



B. Throughput Evaluation

Throughput is defined as the total number of packets delivered over the total simulation time. Mathematically, it can be defined as:

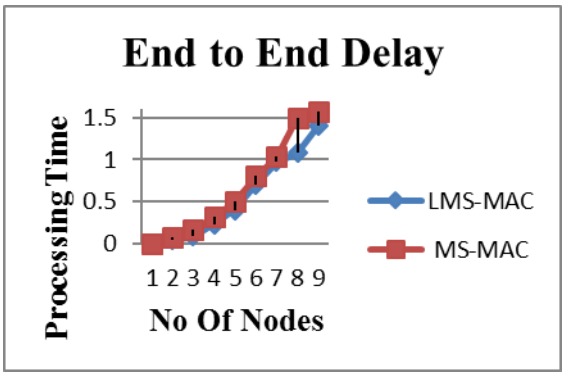
$$\text{Throughput} = N/1000$$



Where N is the number of bits received successfully by all destination. It is noted that the LMS-MAC protocol attains higher throughput when compared with the existing MS-MAC. The reason is that, the probability of the processing time decreases with localization method.

C. End To End Delay

It defines as the average time taken by a data packet to arrive at the destination. Only the data packets that successfully delivered to destinations that counted. The average packet delay is described. Showing that in comparison with other schemes the LMS-MAC having the shortest delay is a great benefit to the scheme. Through the use of the LMS-MAC, as estimated the data packets can easily reach the destination with shortest time.



V. CONCLUSION

In this paper, we have made a comparative study on MS-MAC and LMS-MAC Protocol. The techniques, advantages and disadvantages of both protocols are discussed briefly. Both the protocols efficiently save energy in sensor nodes where, MS-MAC works well in stationary and LMS-MAC works efficiently in both stationary and mobile nodes. In future, techniques can be found to reduce the usage of GPS and the technique which improves the effectiveness of energy further.

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