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Energy Efficient E-BMA Protocol for Wireless Sensor Networks

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Abstract: *Recent advancement in wireless communication has enabled the development of low-cost sensor networks. The sensor networks can be used for various application areas (such as health, military, home and etc.,). In earlier research, an energy-efficient cluster-based adaptive time-division multiple access (TDMA) medium-access-control (MAC) protocol, named EA-TDMA, has been developed. In this work, a new protocol, named E-BMA, which achieves even better energy efficiency for low and medium traffic by minimizing the idle time during the contention period has been proposed. Simulation results for the energy consumption of TDMA, EA-TDMA, BMA, and E-BMA have been presented to demonstrate the superiority of the E-BMA protocols.*
Keywords: *Mac protocol, Energy consumption, Contention period.*

I. Introduction

Sensor networks comprise a large number of low-cost miniaturized computers each acting autonomously and equipped with short-range wireless communication, limited processing and memory, and a physical sensing capability. Decisions in daily life are based on the accuracy and availability of information. Sensor networks can significantly improve the quality of the information as well as the ways of gathering it. For example sensor networks can help to get higher fidelity information, get information in real time, get hard-to-obtain information and reduce the cost of getting information. Therefore it is assumed that sensor networks will be applied in many different areas in the future. Application areas might be production surveillance, traffic management, environmental supervision, medical care or military applications.

II. Problem Statement

A wireless sensor network (WSN) comprises a large number of wireless sensor nodes. A wireless sensor node (WSN) is a node in a wireless network that is able to collect the information from sensors, process it and communicate wirelessly with other nodes in the network. There are two kinds of sensor nodes used in the sensor network. One is the normal sensor node deployed to sense the phenomena and the other is gateway node that interfaces sensor network to the external world.Wireless sensor nodes are battery-powered devices with limited processing and transmission power. Energy efficiency is one of the most important design factors for the WSNs as the typical sensor nodes are equipped with limited power batteries.

III. Proposed System

A new protocol, named E-BMA, which achieves even better energy efficiency for low and medium traffic by minimizing the idle time during the contention period has been proposed. This work also compares the results of E-BMA protocol with other protocols like TDMA, EA-TDMA and BMA.

IV. System Design

The following modules are includes in system design

- Nodes creation and network formation.
- Cluster formation.
- Scheduling .
- Routing mechanism.
- Evaluation.

4.1 Nodes Creation And Network Formation

In wireless sensor networks, the node is capable of performing some processing, gathering sensory information and communicating with other connected nodes in the network. No of Nodes are created depends on the application .Communication between two unconnected nodes is achieved through intermediate nodes.

4.2 Cluster Formation

Nodes divided in virtual group according to some rules. Nodes belonging in a group can execute different functions from other nodes. Involves grouping nodes into clusters and electing a CH.Members of a cluster can communicate with their CH directly. CH can forward the aggregated data to the central base station through other CHs.

4.3 Scheduling

Each node is assigned a specific slot in the contention phase. A node transmits a 1-bit control message during its scheduled slot to reserve a data slot if it has a data packet to transmit, otherwise, the node remains in sleep mode during that contention slot. After the contention period is completed, the CH sets up and broadcasts a transmission schedule for the source nodes. The source node keeps the data packet in the buffer, and it waits for one frame duration to see if there is a consecutive data packet to send

4.4 Routing Mechanism

Data transmission phase is divided into several frames. Each frame transmit and receive the data from sensor node. The size of each frame is fixed. Nodes send their data to the CH at the rate of one per frame. During the data transmission phase, each source node turns on its radio in its allocated data slot and transmits data to the CH. After receiving all data from the nodes of a round, data aggregation takes place to reduce unwanted data. The resultant data are sent from the CH to the BS using a spreading.

4.5 Evaluation

Simulation result shows that proposed E-BMA protocol consumes less energy for various traffic loads. This project is also compare the results of E-BMA protocol with other protocols like TDMA,EA-TDMA,BMA.The results shows that E-BMA protocol consumes less energy than other protocols.

V. Experimental Results

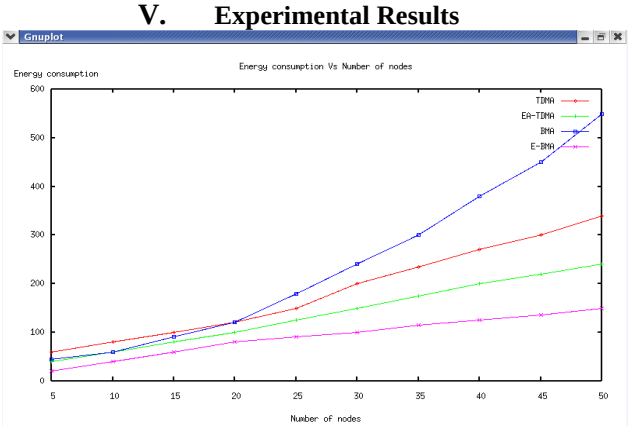

Figure 5.1: Energy consumption ratio

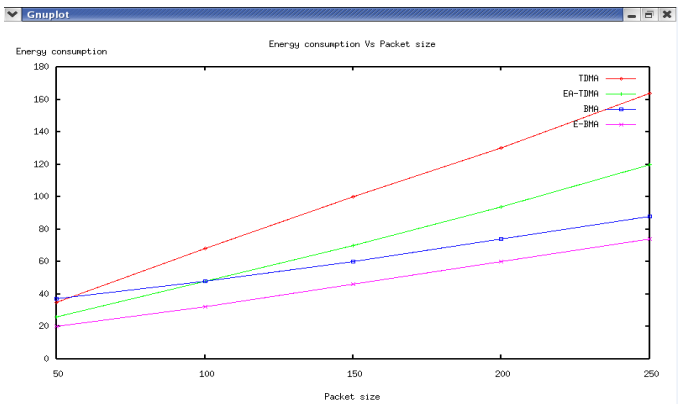

Figure 5.2: Energy consumption with packet size

VI. Conclusion

In this work a new protocol called E-BMA is proposed and it is compared with TDMA , EA-TDMA and BMA protocols. Simulation models have been developed for the proposed E-BMA protocol, and its performance has been compared with the EA-TDMA, TDMA, and BMA protocols in terms of energy efficiency. Simulation results show that the E-BMA protocol outperforms the EA-TDMA ,TDMA and BMA protocols.

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