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The Empowerment Of Energy-Efficiency, Security & Scalablity In Wireless Sensor Networks Using Mac And TMP Protocols

M.Bobby [1], Bauvya Kuruvila.K [2]
Assistant Professor, Research Scholar
Department Of Computer Science, Sri Adi Chunchanagiri Women's College and Cumbum
Tamil Nadu - India

ABSTRACT

A wireless sensor network is a wireless network comprising of spatially disseminated independent devices use sensors to observe physical or environmental conditions. Wireless network refers to two or more computers communicating using standard network rules or protocols. In turn a wireless sensor network refers to two or more sensor nodes transmitting the data. In health care, wireless devices make less insidious patient monitoring and health care possible. For utilities such as the electricity grid, streetlights, and water municipals, wireless sensors offer a lower-cost method for collecting system health data to reduce energy usage and better manage resources. Remote monitoring applications include environmental monitoring of air, water, and soil; structural monitoring for buildings and bridges; industrial machine monitoring; process monitoring; asset tracking. However owing multidisciplinary nature of this field, researchers have to face many technical hitches. In this paper, providing a solution to such problem of energy inefficiency. In future implements an Acknowledgement state in order to rectify the recent problems occurring in the field of wireless sensor networks.

Keywords :— Sensor Nodes, Protocols, Multidisciplinary, Energy Inefficiency

I. OBJECTIVES

1. To monitor the causes of inefficiency in energy consumption of the sensor nodes.
2. To provide the energy efficiency using topology maintenance and Mac protocols.

II. INTRODUCTION

Wireless sensor networks(WSN) sometimes called wireless sensor and actuator networks (WSAN) [1] is built of "nodes" –form a few to several hundreds or even thousands , where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically numerous parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of Energy harvesting. In computer science and Tele-communications, wireless sensor networks are an active research area with numerous workshops and conferences.

A. Sensor

A Sensor is a converter that measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument. Sensors are used in everyday objects such as touch-sensitive elevator buttons and lamps which dim or brighten by touching the base. A sensor is a device which receives and responds to a signal. A sensor's sensitivity indicates how much the sensor's output changes when the measured quantity changes. Sensors are used in everyday objects such as touch-sensitive elevator buttons and lamps which dim or brighten by touching the base. There are also innumerable applications for sensors of which most people are never aware. Applications include cars, machines, aerospace, medicine, manufacturing and robotics.

B. Design of Sensor Network

The design of a wireless sensor network is a very application-specific tasks, especially because of the peculiarity of the considered deployment environment. Generic reliable predictive models for data correlation or radio propagation are seldom available.

Event is an abstract base class that provides basic functionality for all events. It Contains the time at which an event should work, and provide method to compare events based on their fire times, determine whether event are equal, print themselves to a string, and an abstract method to fire the event.

Medium model is the wireless medium. It allows nodes to broadcast signals, and is responsible for informing nodes if signals that affect it.

The environment model is similar to medium model. The difference is that the implementation of environment has property that relate to the physical phenomenon modelled.

Transceiver models the hardware transceiver on each sensor node. It models the transceiver states that is sleep, standby, receive and transmit and their associated behaviour and power consumption. Components of Sensor Networks are as follows:

- Sensor Node: A sensor node is the core component of a WSN. Sensor nodes can take on multiple roles in a network, such as simple sensing, data storage, routing and data processing.
- Clusters: Clusters are the organizational unit for WSN's. The dense nature of these networks requires the need for them to be broken down into clusters to simplify tasks such a communication.
- Cluster heads: Cluster heads are the organization leader of a cluster. They often are required to organize activities in the cluster.
- Base Station: The base station is at the upper level of the hierarchical WSN. It provides the communication link between the sensor network and the end-user.
- End User: The data in a sensor network can be used for a wide-range of applications. Therefore, a particular application may make use of the network data over the internet, using a PDA, or even a desktop computer. In a queried sensor network query is generated by the end user.

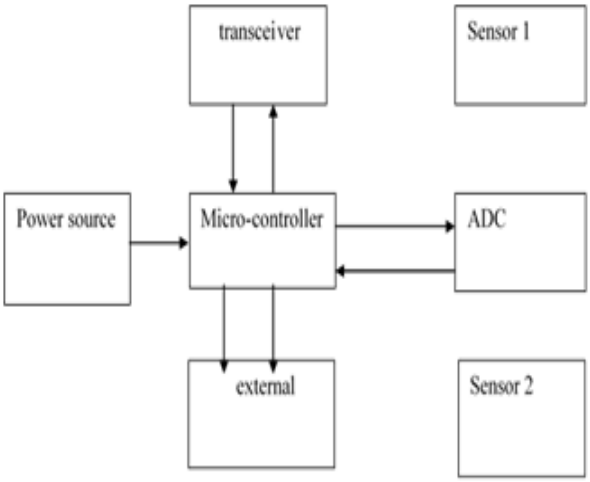

Fig 1: Architecture of Sensor Nodes

III. CHALLENGES OF WSN BASED ON ENERGY

Sensors need power for the collection of data, their processing and data communication. CPU or radios are such node component which requires a large amount of energy. The energy is mainly provided by using batteries. After the consumption of energy it should be changed or recharged [2]. But most of the time it becomes difficult to change or recharge these batteries of its demographic conditions. So some measures should be taken for designing, developing and implementing energy efficient hardware & software protocols for wireless sensor networks as it is the most crucial research challenge to them [5]. Energy conservation is one of the main concerns [3]. Research investigation reveals that wireless sensor network is multidisciplinary field. It demands energy efficient algorithms and protocols to make them practical and feasible [4].

III. IMPROVING ENERGY EFFICIENCY USING MEDIUM ACCESS CONTROL (MAC) PROTOCOLS

Basically the energy waste in wireless sensor networks occurs by collision, overhearing, and idle listening. Here, the time division multiple access (TDMA) based medium access control (MAC) [1] protocols and typical contention based MAC protocols are analysed for the energy efficient sensor nodes. This is viewed as a natural choice for sensor networks, for instance, radio can be turned off during idle times in order to save energy. TDMA based MAC protocols are u-MAC (energy efficient medium access control) and Dee-MAC (dynamic energy efficient medium access control). Typical contention based MAC protocols are s-MAC (sensor medium access control) and t-MAC (timeout medium access control) protocols. The energy efficient medium access control u-MAC protocol is used to obtain high sleep ratio while conserving the energy, preserving the message latency and trustable at an acceptance level. Contention period and contention-free period are the two subclasses. Contention slots are set accurately as the contention period incurs large overhead and has to take place frequently. Switching interval is being set for the contention free period.

A. Dee-MAC

Dynamic energy efficient medium access control (Dee-MAC) protocol is proposed to minimize the energy consumption which lets the idle listening nodes go into sleep using synchronization. TDMA can be combined with clustering solutions as it is a promising distributed technique used in wireless sensor networks to reduce the cost of idle listening. Dee-MAC divided into two rounds and each of the rounds comprises of two phases, cluster formation phase and a transmission phase. in a cluster formation phase the node with the highest power level is elected as the cluster head. After the successful cluster head election, the system enters the transmission phase. This phase consists of a number of sessions and each of which comprises of contention period and a data transmission period. In the contention period nodes are in the listen state and in the data transmission period it is ready to transmit the data.

B. S-MAC

Sensor medium access control protocol is mainly adopted for solving the energy wasting problems by using periodical listening and sleeping. There are two states in a time frame: active state & sleep state. Energy waste caused by idle listening is reduced by sleep schedule. Sensor MAC uses listen and sleep states in order to reduce power consumption.

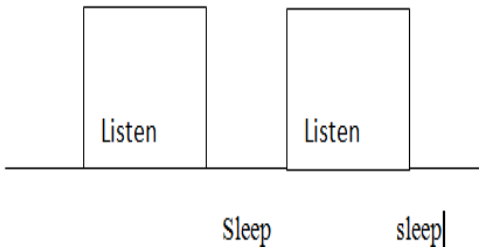

Fig 2: Representing the states in Sensor MAC

C. T-MAC

Timeout medium access control protocol adjusts the sleep and wake periods according to the estimated traffic flow to increase the power savings and reduce the delay. This protocol also minimizes the inactive time of the sensors. This protocol is more efficient than sensor MAC.

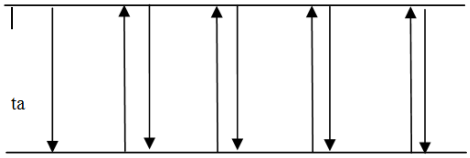

Fig 3: representing the traffic flow in Timeout MAC

D. Leach

Leach stands for low energy adaptive clustering hierarchy. Leach network has two phases: the set-up phase and the steady-phase. It is mainly proposed to increase the life of the network.

E. Security of WSN Using a Secure Topology Maintenance Protocol

The aim of sec-TMP [2] for wireless sensor networks is to enforce event delivery to the base station. It has many features such as it does not need any underlying routing, not required pair-wise node confidentiality and it is highly scalable. Here the node asks for the reply, if the reply is arrived its working state begins otherwise the node goes for the sleeping state.

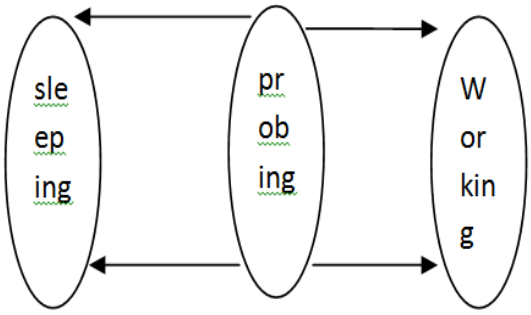

Fig 4: Representing the states in TMP

IV. CONCLUSION

The conservation and efficiency can be improved as the measures proposed are summarized in this paper. Power consumption is totally minimized; maximized throughput & fairness; minimized latency; memory usage is kept low. Energy conservation is emphasized to be an important optimization goal. MAC layer protocol is the protocol that controls access to the physical transmission medium on a local area networks. It tries to ensure that no two nodes are interfering with each other's transmissions and combined with TMP for providing a secure, energy efficient and scalable wireless sensor networks. Scarcity of energy can be reduced as these methods are followed. Energy is conserved for the accurate functioning of wireless sensor networks.

V. FUTURE WORK

In future an acknowledgement state also implemented in order to rectify the problems of insufficiency in power supply and interruptions occurring in between the working state of sensor nodes.

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