Wireless Sensor Network

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Abstract

Wireless Sensor Network (WSN) is a promising technology that has a wide range of potential applications. Such network consists of large number of distributed nodes that organized themselves into multihop WSN. Each node collects information as required and sends it to base stations.Analyze the energy consumption and its effect on data transmission using Sensor Medium Access Control (S-MAC) protocol. Analyzed energy consumption with different duty cycles in S-MAC protocol and its effect on throughput of network. The main objectives is to analyse the duty cycle at which S-MAC protocol is energy efficient.

I. INTRODUCTION

Wireless sensor networking is an emerging technology that has a wide range of potential applications including environment monitoring, smart spaces, medical systems and robotic exploration.

Such networks consist of a large numbers of distributed nodes that organize themselves into a multihop wireless network. Each node has one or more sensors, embedded processors, and low-power radios, and is normally battery operated.

A Wireless Sensor Network consists of group of nodes called sensor nodes. These nodes operate together in the area being monitored and collect physical attributes of the surroundings, say temperature or humidity. Data gathered by these sensor nodes can be utilized by various top level applications such as habitat monitoring,surveillance systems and systems monitoring various natural phenomenons.The sensor nodes are often battery-powered and equipped with an on-board processor carrying out simple computation. Therefore the sensor nodes can only send out the required data to the data gathering sink. Because of the limited power supply on sensor nodes, energy consumption is often an important design consideration.

Small wireless sensor and actuator network is a collection of randomly dispersed devices that provide three essential functions; the ability to monitor physical and environmental conditions, often in real time, such as temperature, pressure, light and humidity; the ability to operate devices such as switches, motors or actuators that control those conditions; and the ability to provide efficient, reliable communications via a wireless network

Currently, the development of electronics, software and telecommunication grows up quickly. Technology has changed from analog to digital, making electronic devices smaller, cheaper and more mobile. A wireless network has been developed to support requirement of mobile communication. In industrial electronics, a sensor system has been used for monitoring and data collecting. The sensors detect environmental event and transmit data to a host for further processing. The data transmission between the sensors and the host is low-traffic rate, because the environmental events rarely happen; thus applying the wireless communication for the sensor systems is suitable. A wireless network of sensor system is called the Wireless Sensors Networks

II. SOLE FEATURES OF WIRELESS SENSOR NETWORKS

Sensor networks do share some commonalities with general ad hoc networks. Thus, protocol design for sensor networks must account for the properties of ad hoc networks, including the following:

- Lifetime constraints imposed by the limited energy supplies of the nodes in the network.
- Unreliable communication due to the wireless medium.
- Need for self-configuration, requiring little or no human intervention.
- While traditional ad hoc networks consist of network sizes on the order of 10s, sensor networks are expected to scale to sizes of 1000s.
- Sensor nodes are typically immobile, meaning that the mechanisms used in traditional ad hoc network protocols to deal with mobility may be unnecessary and overweight.
- Since nodes may be deployed in harsh environmental conditions, unexpected node failure may be common.
- Sensor nodes are smaller (e.g., PDAs, laptop computers), with smaller batteries leading to shorter lifetimes, less computational power, and less memory.
- Additional services, such as location information, may be required in wireless sensor networks.

III. OBJECTIVES

Sensors in wireless sensor network are very small devices which are generally powered by batteries. These devices are placed in remote locations and unattended. The maintenance of these sensors are expensive as they are placed in remote locations. One of the major problem of these sensors is power consumption. As high power consumption is lead to high maintenance of sensors. As battery replacement of these sensors will be very frequent. There is a S-MAC protocol for wireless sensor network which helps in low consumption of power. The S-MAC protocol helps sensor nodes to go in sleep mode when there is no use of particular sensor nodes. Duty cycle in S-MAC protocol decide the duration for which sensor nodes will be in sleep mode. High duty cycle will lead to more sleep time of a sensor node and turned on listen mode when certain event occurred. These nodes are in idle state and do not consume power. Consequently this prolongs the life of battery and save the power. The proposed works in this is to analyze the performance of sensor network using S-MAC protocol with different duty cycles. The effect of different duty cycles on wireless sensor network, different parameters are obtained and tried to find the best duty cycle at which power consumption is less and better network performance.

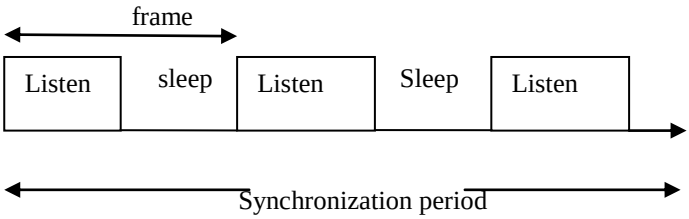
All simulation results are obtained by implementing wireless sensor network in Network Simulator-2. In this work four duty cycles in S-MAC protocol has been taken as 5%, 10%, 20% and 30%. Analyze the simulation result and finding the best duty cycle among them in which energy consumption is less. The effect of this energy consumption on other parameters like throughput and end to end delay in different duty cycles is analyzed.After this analyzing the energy consumption result of MAC protocol with the best result of S-MAC protocol. Similarly others parameters like throughput and end to end delay of MAC protocol is analyzed with the best duty cycle result of S-MAC protocol.

IV. MOTIVATION

As sensor nodes in wireless sensor network are small and inexpensive and they are deployed in ad-hoc fashion. They can be produced in antagonistic environment or over a large geological area. So they cannot be recharged easily. The main issue is to prolong the life time the sensor nodes. Power consumption is the biggest problem in wireless sensor network. This is significantly affected by communication between nodes. The communication protocols between different layers are designed in such a way that power consumption is reduced. Sensor-Medium Access protocol is used to increase the life time of sensor nodes. For this sensor nodes should go to inactive (sleep) mode and there is no energy consumption as all radios of sensor nodes are off. These nodes become active when certain event occurred. In this duration the timer is set that after particular time sensor node become active (listen). In this work the sleeping time is decided as the duty cycle. This is the ratio of listen period to complete listen and sleep period.

Periodic Sleep and Listen Operations

Reducing energy consumption is the main objective of the S-MAC protocol. This can be done by avoiding idle listening. This is achieved by establishing low-duty-cycle operations for sensor nodes.



S-MAC protocol

S-MAC stands for Sensor MAC, is a medium access control (MAC) protocol considered for wireless sensor networks. S-MAC was one of the first MAC protocols to be designed for sensor networks. The basic idea behind S-MAC is very simple - nodes produce a sleep schedule for themselves that determines at what times to make active their receivers and when to set themselves into a sleep mode.

V. APPLICATIONS

- Military Applications:-Because most of the essential knowledge of sensor networks is basic on the defense application at the beginning, especially two important programs the Distributed Sensor Networks (DSN) and the Sensor Information Technology (SenIT) form the Defense Advanced Research Project Agency (DARPA), sensor networks are applied very successfully in the military sensing.

- Environmental Applications:-networks are also widely applied in habitat monitoring, agriculture research, fire detection and traffic control

- Health Applications:- Sensor networks are also widely used in health care area. In some modern hospital sensor networks are constructed to monitor patient physiological data, to control

the drug administration track and monitor patients and doctors and inside a hospital.

- Home Application:- Along with developing commercial application of sensor network it is no so hard to image that Home application will step into our normal life in the future. Many concepts are already designed by researcher and architects, like "Smart Environment: Residential Laboratory" and some are even realized.

- Environmental control in industrial and office buildings
- Inventory control
- Vehicle tracking and detection
- Traffic flow surveillance

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