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A Comparative Performance Analysis of Wireless Sensor Network Protocols

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ABSTRACT

Wireless Sensor networks plays a vital role in the recent technologies.WSN consists of group of sensor nodes and monitors the environment for application without having any central controller. The sensor networks consist of sensed data, which may be depending upon the applications in real time. The networks transfer the large amount of data, broadcast messages from one node to another. These Application required high performance on the network without affecting the resource constraints. Wireless devices are having limited energy because nodes are operated by batteries. The main challenge in the WSN is the durability of the energy in the nodes. By using the protocol the energy of the nodes can be stable and reduce the error prone transmission of sensored data. In this paper, the Analysis of LEACH (Low Energy Adaptive Clustering Hierarchy) Protocol and TEEN (Threshold Sensitive Energy Efficient Sensor Network) protocol to conserve the energy of the nodes in the Wireless sensor networks. Wireless sensing element networks have emerged as a promising tool for observance (and probably actuating) the physical world, utilizing self-organizing networks of powered wireless sensors that can sense, process and communicate. The necessities and limitations of sensing element networks build their design and protocols each challenging and divergent from the wants of ancient Internet design. A sensing element network is a network of many tiny disposable low power devices, known as nodes, which are spatially distributed in order to perform an application-oriented international task.

Keyword: LEACH, Nodes , TEEN, Sensor Network, Wireless Sensor Network.

I. INTRODUCTION

Wireless Sensor Network

A Wireless Sensor Network is surrounded by the network of small sensor nodes communicating among themselves using signals, and deployed to sense and monitor the real world environment. Wireless Sensor nodes are called motes.[1]

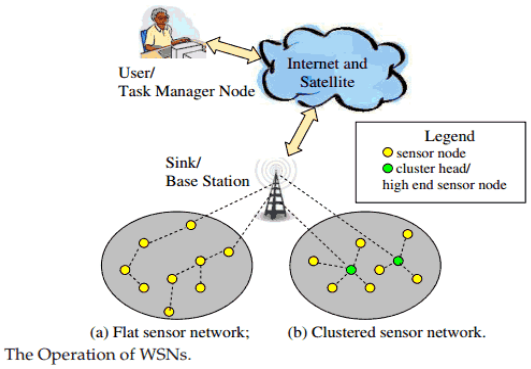

Figure 1. Operations of WSN

A WSN is a network consisting of numerous sensor nodes with sensing, wireless communications and computing capabilities. These sensor nodes are isolated throughout the environment to sense the physical world. The sensed data can be collected by sink nodes which have accesses to infrastructure networks like the Internet. Finally, an end user can remotely fetch the sensed data by accessing infrastructure networks. The sensor nodes either form a flat network topology, multi-hop routing, or a hierarchical network topology where more powerful or mobile relays are used to collect and route the sensor data to a sink.[3]

II. OBJECTIVES

- ✓ Low Node Cost
- ✓ Low Power Consumption
- ✓ Self-configurability
- ✓ Scalability
- ✓ Adaptability

- ✓ Reliability
- ✓ Fault Tolerance
- ✓ QoS Support
- ✓ Communication Channel
- ✓ Utilization
- ✓ Security

III. SENSOR NODE STRUCTURE

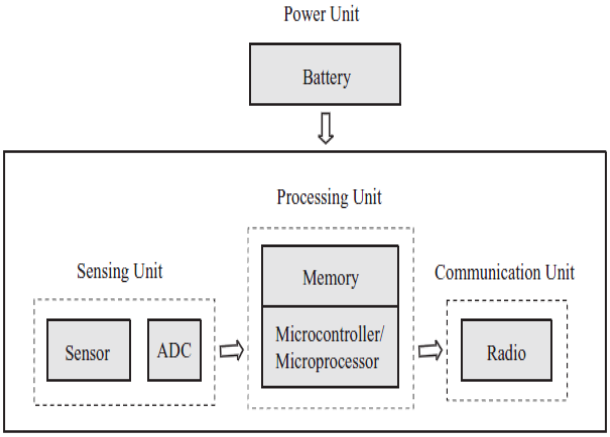

Figure 2. Sensor Node Structure

A sensor node normally consists of four basic components

- ✓ A sensing unit
- ✓ A processing unit
- ✓ A communication unit
- ✓ A power unit

Figure 2.1. Sensirion SHT11

Figure 2.2. Acoustic sensor

Devices are capable of detecting change:

- ✓ Temperature
- ✓ Pressure
- ✓ Humidity
- ✓ Sound

IV. APPLICATIONS

Environmental Monitoring

- ✓ Habitat Monitoring
- ✓ Air or Water Quality Monitoring
- ✓ Hazard Monitoring
- ✓ Disaster Monitoring

Military Applications

- ✓ Battlefield Monitoring
- ✓ Object Protection
- ✓ Intelligent Guiding
- ✓ Remote sensing

Health Care Applications

- ✓ Behavior Monitoring
- ✓ Medical Monitoring

Home Intelligence

- ✓ Smart Home
- ✓ Remote Metering

V. HIERARCHICAL ARCHITECTURE

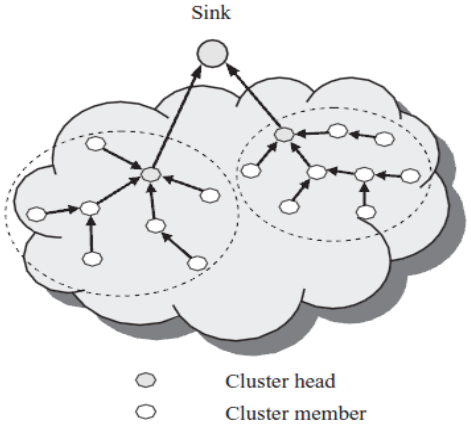

Figure 3. Hierarchical Architecture

The hierarchical Architecture is a tree like structure. The main functionality hierarchical approach is that it

controls the centralized server in the distributed manner. It consists of cluster head and cluster member. The cluster head gathered the information from cluster member and sent the messages to the sink. Each node is considered as cluster member who have a interconnection with the other cluster member. In the Wireless Sensor Network, Hierarchical protocol has the capable to conserve the energy of the cluster head.

VI. LEACH

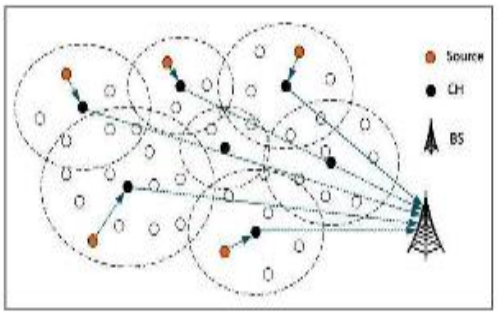

Figure 3.1. Leach

LEACH is the cluster based hierarchical protocol, which includes distributed cluster formation. LEACH randomly selects a few nodes as cluster-heads (CH) and rotates his role to evenly distribute the energy load among the sensor network. In LEACH, the cluster heads comprises data arriving from nodes that belongs to the respective cluster Member and sends the aggregated packet to Base station (BS). [4].This protocol is based upon Multi-hop communication Clustering Algorithm,[6] the energy consumption of cluster heads consists of the energy receiving , aggregating and sending the data from their cluster members, known as intra-cluster energy consumption and the energy for forwarding data for their neighbor cluster heads known as inter-cluster energy consumption. The main Functionality of LEACH protocol is to decrease the number of transmitted messages to the sink and the transmission distance of sensor node.

VII. TEEN

TEEN is an energy efficient hierarchical clustering protocol which is suitable for time critical Applications. The CH sends aggregated data to the next higher level CH until data reaches the sink. TEEN is designed for reactive networks, where the sensor nodes react immediately to sudden changes in the value of the sensed attribute. [5] Sensor nodes sense the environment sequentially, but data transmission is done frequently and this helps in energy efficiency. This protocol sends data if the attribute of the sensor reaches a Hard Threshold and a small change the Soft Threshold.

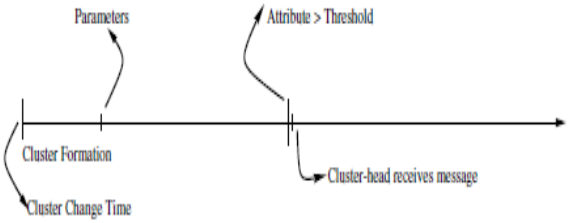

Figure 3. 2

A. Hard Threshold(HT)

A Cluster member only reports the data to cluster head by switching in its transmitter, only if the data values should reach to the threshold value.

B. Soft Threshold(ST)

A Cluster member only reports the data to cluster head by switching in its transmitter, only if the data values should atleast reach to the threshold value

VIII. ANALYTICAL STUDY

In this Section, We compare the performance of two Hierarchical Cluster-based protocol LEACH and TEEN protocol. In this Comparative Study, we analyze the Energy Conservation of this Protocol. LEACH can processes all the data from all the cluster head nodes in sink, which means it does not have a multi-path and Cluster head has to idle when one Information reach the Base Station to send the other information. TEEN Protocol is well suited for time critical applications and quite efficient in terms of energy consumption and response time. This Protocol has the methodology of Throughput which makes the cluster nodes have a time limit to send the data to the base station. It allows the user to control the energy consumption and accuracy to suit the application.

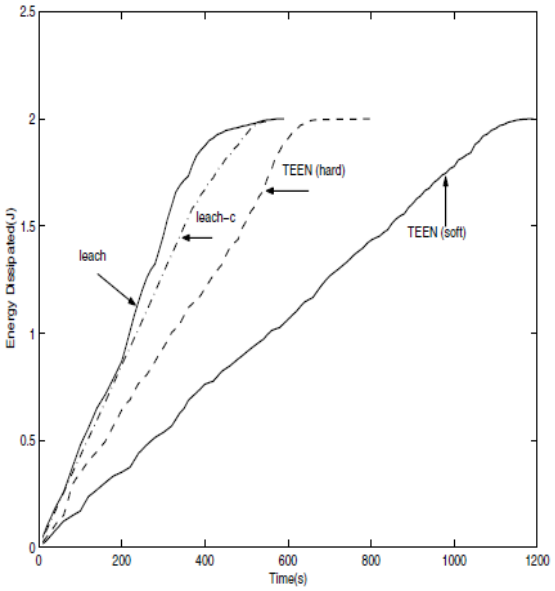

Chart 1. Comparison of AverageEnergyDissipation

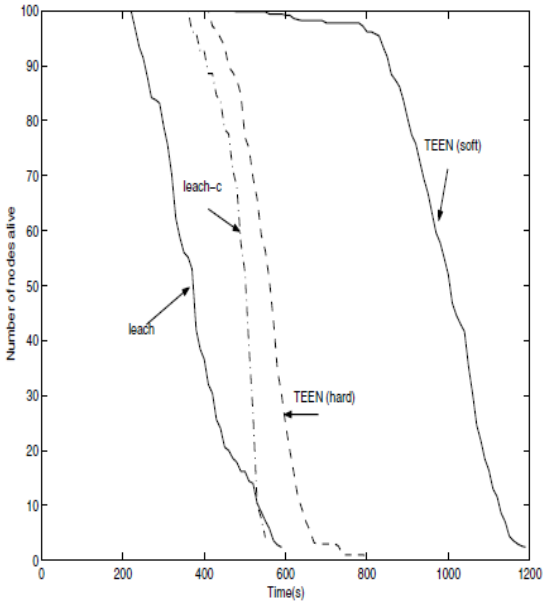

Chart 2. Comparison of nodes alive

By the Analysis of these two Protocols, LEACH protocol has less energy conservation in when compare to TEEN protocol.

IX. CONCLUSION

WSN are a widely applicable, major emerging technology. They bring a whole host of novel research challenges pertaining to energy efficiency, robustness, scalability, and self-configuration. These challenges must be tackled at multiple levels through different protocols and mechanisms. LEACH protocol and TEEN protocol capable to decrease the error prone message to increase the durability of Wireless devices. TEEN protocol is more effective when compare to LEACH protocol.

In future, the emerging Wireless technology may be arise by the effective usage of the Hierarchical cluster-based Protocol

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