

A Review on Various Approaches of Communication in Wireless Sensor Network

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Abstract: WSN is the field on recent technology that is based on sensors. Sensors have been used for sensing information from environment in which human interaction is not possible. In these types of areas sensor network has been deployed so that information can be collected from the environment and used for further processing. Due to non-interaction WSN is energy aware network that must be used in such a manner so that minimum amount energy must be used in data sensing and transmission to base station. In this paper various energy optimization routing protocols have been discussed. Clustering based routing protocols are the best resulted routing protocols that can be used for energy optimization. In this paper LEACH, C-leach, DEEC, HEED, BEC has been discussed, that describe working of these routing protocols and how these can be effective in WSN.

Keywords: LEACH, BEC, DEEC, C-Leach, HEED

I. INTRODUCTION

1.1 Wireless Sensor Network

WSN has been a used for capturing of information from the environment based on the sensor nodes. In WSN sensor nodes have been deployed over the network so that these nodes can be used for collection of information from the region and that can be collected at a particular station so that for valuable purposes information can be used. A sensor node comprises various parts that work together in the process of data collection as well as data transmission. Sensor node is essential part of the network that having sensor, battery source, transmitter, receiver and storage memory.

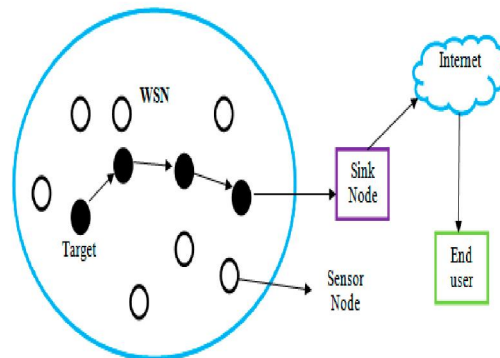


Figure 1. Wireless Sensor Network [13]

WSN achieves a great importance in various real time applications because of self sourcing communication approach. This type of network is utilized in unapproachable areas. For e.g. Line of Control Area for Military Surveillance, Temperature Monitoring, Forest Areas for motion of animal and fire activities sensing. This network consists of various small nodes that have been act as sensor nodes so that information can be collected based on the type of sensor used for communication. The collected information has been stored in the memory unit available to the sensor node and

transmitted using routing approach to the base station. Base station formerly known as sink node collects information and used for further processing.

The drawback of WSN is that due to limited battery life of the sensor nodes energy dissipation is high that increases overall cost of network. Routing is the strategy that can be modified so that energy consumption during network transmission can be reduced and used for communication process.

1.2 Routing protocols in WSNs:

In the process of wireless sensor network various communications have been done based on the some protocols that has been used for communication and transmission of information from sensing nodes to other nodes. In this paper various approaches that are used in communication has been discussed.

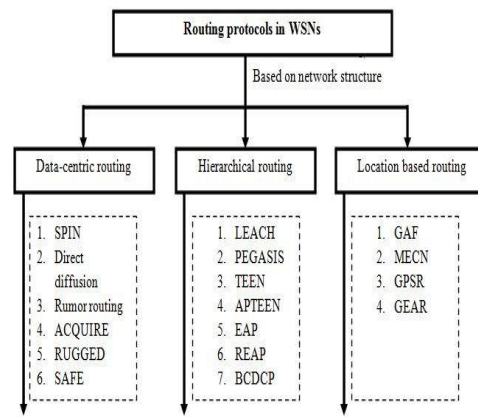


Figure 2 Classification of Routing Protocols [14]

1.2.1 Location-based Protocols: In location-based protocols, sensor nodes are addressed by means of their locations. Location information for sensor nodes is required for sensor networks by most of the routing protocols to calculate the distance between two particular nodes so that energy consumption can be estimated. A sample of location-aware routing protocols proposed for WSNs is presented below:

1.2.2 Geographic Adaptive Fidelity (GAF): Due to its emphasis on energy conservation, GAF is a routing protocol that is designed primarily for MANETs but may also be applied to WSNs. An energy model that takes into account energy usage due to packet receipt and transmission as well as idle (or listening) time when a sensor's radio is on to detect the presence of incoming packets is the foundation for the design of GAF. The foundation of GAF is a technique that disables unused sensors while maintaining a constant level of routing fidelity (or continuous communication between communicating sensors).

1.2.3 Geographic and Energy-Aware Routing (GEAR): For directing inquiries to specific areas in a sensor field, the GEAR routing protocol has been devised. In GEAR, the sensors are expected to be equipped with localization hardware, such as a GPS or a localization system, so they can track their current locations. The sensors are also aware of their own residual energy as well as that of each of their neighbors' positions and leftover energy. GEAR chooses sensors to route a packet toward its destination region using energy-conscious heuristics that are based on geographic information. Then, GEAR distributes the packet inside the target area using a recursive geographic forwarding method.

1.2.4 Coordination of Power Saving with Routing: Span is a routing system that was first designed for MANETs but can also be used in WSNs because it aims to lower node energy consumption. The fact that a device's wireless network interface frequently consumes the most power is what drives Span. Therefore, it would be preferable to switch the radio off when you're not using it. Span functions well with a geographic forwarding protocol even though it is not necessary for sensors to be aware of their position. With the use of Span, sensors can become coordinators in forwarding backbone architecture, sending packets between any source and destination on behalf of other sensors.

1.2.5 Data Centric Protocols: Data-centric protocols send data from source sensors to the sink in a different way than conventional address-centric protocols. According to address-centric protocols, every source sensor that has the necessary data reacts by sending its data to the sink on its own, regardless of the responses from any other sensors. In contrast, in data-centric protocols, when source sensors transmit their data to the sink, intermediate sensors can aggregate the data coming from several source sensors and deliver the combined data in the direction of the sink. Because less transmission is needed to transfer the data from the sources to the sink during this process, energy can be saved. We examine a few of the WSN data-centric routing protocols.

1.3 Applications of Wireless Sensor Network

Wireless Sensor Network has been used in various applications in the real world. WSN has great importance for data collection from non approachable areas. There are some applications of WSN that have been used in real world application.

1.3.1 Process Management

The common application of WSN is area monitoring. In area monitoring, the WSN is deployed upon an area where some phenomenon is to be monitored. The use of sensors detects enemy intrusion in military; a civilian example is the geofencing of gas or oil pipelines. Area monitoring is most important part.

1.3.2 Health care monitoring

The medical application of two types: wearable and implanted. First devices are used on the body surface of a human and also just at close proximity of the user. The implantable medical devices are those which are inserted within the human body. There are also many other applications like body position measurement and location of the person, overall monitoring of ill patients in hospitals and at homes. Body-area networks can collect information about an individual's health, fitness, and energy expenditure.

1.3.3 Environmental/Earth sensing

In monitoring environment there is so much application, examples of which are given below. They share the extra challenges of harsh environments and reduced power supply.

1.3.4 Air pollution monitoring

Wireless sensor networks have been deployed in several cities to monitor the concentration of dangerous gases for citizens. These can take advantage of the ad hoc wireless links rather than wired installations, which also makes them more suitable for testing readings in different areas.

1.3.5 Forest fire detection

A network of Sensor Nodes can be installed in a forest to detect when a fire has started. The nodes can be equipped with sensors to measure temperature, humidity and gases which are produced by fire in the trees or vegetation. The early detection is crucial for a successful action of the firefighters; thanks to Wireless Sensor Networks, the fire brigade will be able to know when a fire is started and how it is spreading.

1.3.6 Landslide detection

A landslide detection system makes use of a wireless sensor network to detect the slight movements of soil and changes in various parameters that may occur before or during a landslide. Through the data gathered it may be possible to know the occurrence of landslides long before it actually happens.

1.3.7 Water quality monitoring

Water quality monitoring involves analyzing water properties in dams, rivers, lakes & oceans, as well as underground water reserves. The use of many wireless distributed sensors enables the creation of a more accurate map of the water status, and allows the permanent deployment of monitoring stations in locations of difficult access, without the need of manual data retrieval.

1.3.7 Natural disaster prevention

Wireless sensor networks can effectively act to prevent the consequences of natural disasters, like floods. Wireless nodes have successfully been deployed in rivers where changes of the water levels have to be monitored in real time.

1.3.8 Machine health monitoring

Wireless sensor networks have been developed for machinery condition-based maintenance (CBM) as they offer significant cost savings and enable new functionality. In wired systems, the installation of enough sensors is often limited by the cost of wiring. Previously inaccessible locations, rotating machinery, hazardous or restricted areas, and mobile assets can now be reached with wireless sensors.

II. REVIEW OF LITERATURE

VXiangwen Zhang et al.(2008) “Key Technologies of Passive Wireless Sensor Networks Based on Surface Acoustic Wave Resonators” In this paper, we presents the passive wireless sensor network based on the surface acoustic wave (SAW) resonators. The sensor node consists of the SAW sensor that is small, light, reliable, stable, sensitive, wireless and passive, so the battery is needless and its life-span is infinite. The sink node gathers data from the sensor nodes and processes the data with intelligent algorithms and transmits the needed data to the exterior network timely. The basic structure and the realization of the passive wireless sensor network are elaborated. The five main characteristics of the passive wireless sensor network, that is passive sensor nodes, simple and small sensor nodes, organized sensor nodes, intelligent sink nodes, high security, good extendibility, are explained concretely.

Yuling Lei et al. (2009) “The Research of Coverage Problems in Wireless Sensor Network” wireless sensor network is composed of many wireless sensor network nodes that have capabilities of perception, computing and communication. Network coverage is the main support technology in wireless sensor network application; that can be achieved by the physical information perception of the target region and the target object through the spatial distribution of sensor nodes in the network. Network coverage fundamentally reflects the network's perception ability for physical world. In addition, it largely affects the cost of the network and the performance of specific application.

Xuhui Chen et al. (2010) “Research on hierarchical mobile wireless sensor network architecture with mobile sensor nodes “In traditional wireless sensor network the nodes like the users, the sink nodes and sensor nodes are considered to be static, in the form of single layer planner the network are organized, which cannot adapt to the application of the sensor nodes with mobility. This article starts from the network architecture that introduces the architecture of traditional wireless sensor network, and takes account of the application scenario of mobile sensor nodes.

Guanglai Chen et al. (2011), “The design of wireless wave height sensor network node based on Zigbee technology” Wireless sensor network is consisted of a large number of sensor nodes, which have advantages, such as small size, lower power consumption, with wireless communication, sensing and data processing capabilities. And the Zigbee is a wireless communication protocols using at the short distance, low rate, low power consumption. It is fit for the wireless sensor network since it supports facile applying feature. Following an introduction of the performance and structural features of CC2420, this paper describes the key points of the wireless sensor network node. So the design has broad application prospects based on CC2420 wireless sensor network with low cost, energy consumption and other characteristics.

Marriwala, N. et al.(2012) “An approach to increase the wireless sensor network lifetime” A wireless sensor network consisting of small devices, called sensor nodes that are equipped with sensors to monitor the physical and environmental conditions such as pressure, temperature, humidity, motion, speed etc. The nodes in the wireless sensor network were battery powered, so one of the important issues in wireless sensor network is the inherent limited battery power within network sensor nodes. Minimizing energy dissipation and maximizing network lifetime are the most important issues in the design of sensornetworks so if the power exhausted node would quit from the network, and it overall affects the network lifetime. Minimizing energy dissipation and maximizing network lifetime are the most important issues in the design of applications and protocols for sensor network.

Ismail Ahmedy et. al [2012] “Using store-forward technique to conserve energy in wireless sensor networks: Initial step for routing mechanism” Wireless sensor network (WSN) is a technology which consists a number of sensor nodes distributed among of an area usually for monitoring purposes. As the emerging of this technology has been rapidly increased nowadays, the successful of the wireless sensor networks application is highly depends on the reliable communication among the sensor nodes. One major problem in wireless sensor networks environment is the limitation

of the physical resource in sensor nodes which energy resource has been identified as a critical constraint for achieving the demanding capabilities in wireless sensor networks application.

III. WSN APPROACHES

LEACH protocol: A TDMA-based MAC technology called Low Energy Adaptive Clustering Hierarchy ("LEACH") is merged with clustering and a straightforward routing algorithm in wireless sensor networks (WSNs). LEACH seeks to extend the lifespan of a wireless sensor network by reducing the amount of energy needed to build and maintain clusters. LEACH is a hierarchical protocol in which the majority of nodes provide data to cluster heads, who then compile and forward the data to the base station (sink). Every round, each node employs a stochastic method to determine whether or not it will become a cluster head. LEACH assumes that every node has a radio that is strong enough to reach

HEED: The HEED (Hybrid Energy- Efficient Distributed Clustering) protocol is another enhanced and well-liked energy-efficient protocol. A single-hop communication pattern is retained within each cluster under the hierarchical, distributed, and clustered (HEED) system, although multi-hop communication is permitted between the CHs and the BS. Two fundamental factors—residual energy and intra-cluster transmission cost—are used to select the CH nodes. The initial set of CHs is selected probabilistically using the residual energy of each node. The nodes employ the intra-cluster communication cost, which takes into account the node degree or closeness to the neighbor, to determine whether or not to join a cluster. As a result, unlike LEACH, the CH nodes in HEED are not chosen at random. It is anticipated that only sensors with a high residual energy will develop into CH nodes. Additionally, there is a low likelihood that two nodes within a node's transmission range of one another will become CHs. This indicates that CH nodes are evenly spread throughout the network, unlike LEACH.

DEEC: (Distributed Energy Efficient Clustering) the initial and residual energy levels are used by all nodes in the DEEC protocol to identify the cluster heads. To calculate the reference energy that each node should use during each round, DEEC estimates the optimum network lifetime. Two kinds of nodes, m advanced nodes with initial energies equal to E_0 or $(1+a)$ and $(1-m)$, make up a two-level heterogeneous network. N normal nodes where E_0 is the starting energy. Where a and m are two variables that regulate the total starting energy as well as the nodes' percentage types (advanced or normal). DEEC does not demand energy-related knowledge at every election, In the DEEC, Round Advanced nodes always suffer a penalty, especially as their residual energy drops and they enter the conventional node range. The more advanced nodes die more quickly than the others in this position.

BEC: the design of Binary Exponential CODE (BEC) back-off MAC protocol is presented and discussed elaborately. The key concept is to dynamically transfer channel contention between random access stations into orthogonal coding space to enable concurrent transmission of the competing messages on the same spectrum. Our suggested BEC protocol allows many parallel transmissions at the same time, although at reduced data rates, as opposed to the conventional IEEE 802.11 MAC technique, which transmits sequentially in the time domain. This would deal with the issues of performance penalty and channel utilization inefficiency brought on by the temporal binary exponential back-off because the frame transmission is significantly impacted by channel contention because they are serialized in time and it is challenging to achieve coordination among random access competing stations to win channel. In order to manage contention and enable parallel transmissions of the competing communications on the same spectrum using code division multiple access (CDMA), the binary exponential code back-off will vary the length of code words, or equivalently the size of code space, based on the available spectrum.

C-Leach: In LEACH-C, clusters forming in the beginning of every period are done, using the centralized algorithm by the base station. The base station uses data from nodes that it has received, such as energy and node status, to determine the predetermined number of cluster heads and to configure the network inside the clusters. To reduce energy consumption and transfer data to the appropriate cluster head, the cluster nodes are then classified. Due to the base station's excellent cluster formation, results demonstrate that LEACH-C performs better overall than LEACH. Additionally, each LEACH-C period's cluster head count is equal to the desired ideal value. While in LEACH there is insufficient global coordination, which causes the number of cluster heads to fluctuate over time.

IV. CONCLUSION

In WSN various approaches have been used for network deployments as well as network establishment for reliable communication between the nodes. In this paper various approaches for communication between the nodes have been illustrates and discussed. Based on these approaches various protocols have been used for transmission route management.

WSN is used for sensing important information's from the regions in that human interaction or other devices can't be reached. In the process of WSN energy is main constraint that has been used for data sensing and transmissions over the network. Clustering is the best way that has been emerged so that energy optimization can be done. In this paper various routing protocols clustering and cluster head selection strategy has been discussed so that efficient results in terms of energy consumption can be achieved. On the basis of review of these routing protocols BEC and C-LEACH provide better energy optimization in WSN.

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