Enhancement of Clustering Techniques Efficiency for WSN using LEACH Algorithm

G.Srividhya¹, R.Nagarajan¹ and S.Kannadhasan²
¹Department of Electrical and Electronics Engineering, Gnanamani College of Technology, Tamil Nadu, India, ²Department of Electronics and Communication Engineering, Cheran College of Engineering, India, E-mail : srvidhyagk1990@gmail.com kannadhasan.ece@gmail.com, krnaga71@yahoo.com

Abstract: The Low Energy Adaptive Hierarchy is perhaps the most popular hierarchical protocol (LEACH). LEACH is a hierarchical structure that implements the creation of a disseminated cluster; nodes select themselves as the head node with any probability at any point in it. In view of the fact that a wireless node may only be configured with a restricted power supply, energy consumption is considered to be the key design target. In many implementations, it is not feasible to substitute energy sources, and therefore the life cycle of the node shows a heavy dependency on the battery life. With the aim of leveraging the network life cycle by applying clustering designs, several algorithms have been published. The paper presents numerous routing protocol definitions to save resources and prolong the existence of the sensor network. WSN applications, such as communication architectures, security and management, still have several problems to be resolved. We will close the distance between technology and implementation by addressing these problems.

Keywords: - Cluster Head, LEACH, LEACH-C, K-Means, PAM, MTE and WSN.

1. INTRODUCTION

Energy use could be attributable to either beneficial or inefficient sources in a sensor node (SN). Useful energy consumption may be attributed to the transfer or reception of data, the handling of query requests, and the transmission to adjacent nodes of queries and data. For such sensor systems, energy is a very limited resource and needs to be handled carefully in order to prolong the existence of the SN for the length of a given mission. One or all of the above evidence may be induced by wasteful energy use [1]-[4]. Idle listening, listening to an idle channel in order to accept potential traffic is one of the key causes of energy waste, and secondly, the cause for energy waste is collision, when a node collects more than one packet at the same moment, these packets are referred to as collided, even though they just partly overlap. Overhearing is the next explanation why electricity waste is a node receives packets that are destined to other nodes. The fourth happens as a consequence of an overhead management packet, a minimal number of control packets should be used to make a data transmission. Lastly, energy loss is over-emitting, which is triggered by a message being sent while the target node is not ready. Taking into consideration the above-mentioned reality, in order to avoid such energy consumption, a correctly built procedure must be considered [5]-[8].

Wireless sensor networks (WSN) have lately received a great deal of scientific interest. Tiny and cheap machines with low and minimal energy usage in multiple application settings, computational
capabilities are being rapidly implemented. Ecological surveillance, goal mapping and biological health monitoring are included. In Node localization is necessarily, one of the device parameters for all such programmers. The process of localization is important for disclosing the origin of incidents, routing and tell concerns regarding the network coverage of assist community sensor inquiries [9]-[12].

Generally, Two wide types are categorized into localization schemes: range-based and range-free. Hybrid options are, however, challenging to define as range-based or range-free. In this one, render this division simple on paper, where range-based structures and range-free schemes. There are two forms of schemes: total schemes and hybrid schemes. Compare the most important algorithms for localization and address potential studies, directions for localization schemes for WSN. Some of the topology network WSNs is their batteries. Easily altered, loaded or recharged whereas others the setup of the topology is complicated due to the existence of the network. Those are the complicated energy setups that are topologies for the network, such as the aquatic network or others implemented in embedded ecosystems such as mining, under soil, forests or other unhealthy areas for people. In reality, the sensor network has several difficulties in compared to conventional networks such as geographic areas, distribution Network, LAN or Local Area Broadband Network, WLAN. There are several physical nodes of the conventional network, Media for transmission, switches, routers and other networks. Compared with gadgets that make things easier to set up WSNs, this is an Ad-hoc network [13]-[15].

In WSN, the primary use of transportation protocol is to solve the reliability and pollution with electricity efficiency. The Energy Efficient Transportation Protocol (REETP), which focuses primarily on reliability, and quality of electricity. A Successful Node Collection is wireless sensor protocol. An algorithm to evaluate a collection of effective nodes called E-Nodes that shape a near-effective node set maximum coverage for the greatest region and the highest amount of residual oil. The central principle of REETP is the movement of encoded packets from the source to the sink block using LT codes. By block, and an E-node is forwarded to each address. After encoded packets have been received, the E-node aims to restore the original data packets and encodes the original data packets. Again, data packets and relays them to the next E-node before the sink is hit. A revival of interest is taking place in the area of WSN, in the science and technological community and a continuing evolution. In several contexts, the basic form of ad hoc network is becoming increasingly relevant, irrespective of the geographical area and so, according to the potential collection of applications. WSN have interesting, low-cost and quickly deployable solutions for real remote results. Monitoring of time, goal detection and physical occurrence identification, through reducing energy usage by implementing MAC protocols for SN, switch in a mechanism for active/sleep. They do not, however, offer energy quality in varying traffic patterns as well as Quality of Service (QoS) problems was not discussed. The MAC protocol H-MAC retains energy quality as well as QoS problems such as latency, throughput, and usage of the channel [16]-[18].

2. EFFICIENT CLUSTERING TECHNIQUES

The new developments in wireless and embedded technology make it possible to use a micro-autonomous framework composed of tiny, compact devices known as sensors. Via sufficient sensor technologies, these sensors will sense, calculate, and interact, resulting in a wireless sensor network (WSN). Fast integration and low-cost sensors allow the WSN ideal for many uses, such as health care, travel, smart development and environmental monitoring, etc. There are several essential considerations that should be taken into consideration with respect to the WSN architecture, such as the size of nodes, hardware sophistication and low energy consumption.

This procedure is carried out sporadically and the probability of being cluster-head (CH) is chosen for each epoch to ensure that each node turns out to be a CH in 1/p rounds at least on one point, wherever 1/p is the proportion of CHs preset. It offers substantial energy savings and prolonged network
existence over conventional routing approaches, such as the minimal transmission energy (MTE) system, for example. LEACH cannot, though, guarantee that the preferred quantity of CHs is selected and that CHs are not uniformly placed on the network.

The most significant downside of LEACH is that it is necessary to classify a sensor node (SN) with extremely low energy as CH and transmit the data to the base station (BS) in a one-hop manner. This scheme therefore improves the CHs’ energy consumption. Various techniques were developed to enhance LEACH, i.e. LEACH-C, PEGASIS, etc. HEED. Because of the required election of CH by BS, LEACH-C acts superiorly relative to LEACH. It takes into account energy as well as distance in the collection of CH. Therefore by taking into account energy expertise, LEACH-C will easily pick the CH and be able to increase the network life cycle. With the goal that each node sends and/or collects the data only from its neighboring nodes, PEGASIS arranges the nodes into chains. A randomly selected node from the chain is chosen as the CH in each round.

Due to its variety of applications and functionality, WSNs collect data in numerous applications such as civilian and battlefield surveillance that minimizes the role of humans and users have increased interest to the research community over the past decade, which offers different challenges in designing energy-efficient protocols for medium entry, routing, deployment, tracking, sensing. Due to the limited capacity of WSN sensor nodes, a creative solution is extremely important to extend the existence of the network. Figure 1 illustrates the restricted capacity of SNs in the WSN, which makes it costly and challenging to install on a wider scale.

Fig 1. SN, CH and BS in WSN

3. NETWORK LIFE TIME IN WSN

The energy-conscious protocol has demonstrated that the self-configuring method plays an important role in the well-controlled use of energy. Therefore in WSN, the most important energy-efficient routing strategy is to extend the life of the overall WSN. The approach to data routing and data transmission to the WSN-BS is quite relevant. Effective routing with optimum energy usage and optimum path selection for WSN data transmission is needed in this situation. A certain degree of throughput is needed to ensure the reliability of the WSN in order to satisfy the standard of services offered by the end user of the network. Interfering concerns arise in WSN when sharing the channel for higher data transmission. In addition to other concerns of WSN interference effects, the simultaneous transfer of data to increase WSN capability is also of considerable significance. In such a situation, it is impossible to obtain high throughput and low latency.

3.1. Energy saving in interference environment

In various environments, the action of WSNs is significantly influenced by the implementation environment of wireless communication. In the WSN, sensors are normally densely deployed. It may suffer considerable interference due to this dense environment, which significantly impairs network efficiency. Therefore it is very important to discover numerous strategies to minimize power usage in the face of disturbance and shadowing conditions.
3.2 Message Delivery
In WSN, the function of SN is to detect the atmosphere and provide data to the BS. Since in WSN there are different sensing nodes to transfer the data to the destination node, for researchers, fairness is an important problem. Multi hop routing worsens the loss of packets in WSN with higher packet distribution nodes close the destination. If have a packet to send to the SN, it must be able to deliver the data to the destination node. Weak data transmission efficiency can impair data transport performance and increase energy consumption. The distribution ratio should then be strong.

3.3 Scalability
Most of the SN installed in WSN owing to less land due to infrastructure. The SN network has a restricted scope of coverage. In order to handle a large number of SN, capable routing protocols are required for such scenarios. WSN consists of the set of vast numbers of tiny nodes; the global network knowledge for each node in the sensor network is not simple to manage.

3.4 Data aggregation
Data consolidation is a method utilised by WSNs to remove unnecessary data transfer. The fundamental method for saving energy is the collection of data. Data aggregation is a process for storing and aggregating data to increase the lifetime of the network. Every SN most frequently duplicates sensed data to its sink node named BS, lead BS redundancy energy efficiency and sophistication of various LEACH (Low Energy Adaptive Clustering Hierarchy) protocols, HEED (Hybrid Energy Efficient Distributed Clustering), EECS (Energy Efficient Clustering Scheme), PEGASIS (Power Efficient Gathering in Sensor Information Systems), UCS (Uneq Efficient Gathering in Sensor Information Systems) and HGMR (Hierarchical Geographic Multicast Routing). In contrast to LEACH, HEED, EECS, PEGASIS, UCS, APTEEN, CCS, and HGMR, the TEEN protocol has very good energy efficiency. The difficulty of LEACH and HGMR is low compared to HEED, EECS, PEGASIS, UCS, TEEN, APTEEN and CCSS.

4. RESULTS AND DISCUSSION
WSN is a series of small strength, multifunctional and communication nodes with circumstances of observation and recording at various places, then translate these data to signals that can be interpreted, such nodes are randomly deployed on a large or small scale, this becomes an essential area of research since these networks are found today in many customers and industries. If the number of sensors is high, this makes for greater tracking with greater precision, but because of the demanding environment, charging or removing batteries may be very expensive or even difficult. These distributed SN are capable of gathering and transmitting data back to an internal BS or other sensors, sending and receiving energy from the information drain node, so the safest approach to boost the existence of the WSN is to choose information transmission paths to reduce the full drainage of energy along the route and to manage the load between the nodes. BS may be either a mobile node or a fixed node linking the sensor network to the existing communications system or the Internet. As the WSN have become an essential feature of the new networking system for the 21st century, the resource usage and maximization of network life have become the crucial parameter characteristic of routing protocols in order to efficiently provide information to their endpoint. One of the basic instruments for interpreting the data set form is data clustering. In machine learning, data processing, knowledge retrieval, and pattern recognition, it plays a key, fundamental function.
The goal of clustering is to categories data into classes or clusters in such a manner that the data in the same cluster is more identical to each other than in the identification of separate clusters. Several well-established clustering algorithms have been designed for numerical data, such as LEACH, LEACH-C, k-means and PAM, whose inherent properties will naturally be used to quantify the distance (e.g. Euclidean) between feature vectors, as seen in Figure 2. These cannot however be used explicitly for categorical data clustering, where domain values are discrete and no ordering is specified.

These nodes integrate the potential of transmitting and receiving signals from/to several nodes jointly by beam construction, with a large range of possibilities to route and monitor the various nodes. With the use of a frequency shift key direct sequence spread spectrum modulation system, data from each node may be de-multiplexed at the receiver, enabling multiple accesses without destroying the beam forming characteristics of the network. Figure 3 demonstrates energy consumption in WSN. The transmission scheme suffers from accidents and retransmissions that result in high energy use. New battery technology and energy-efficient networks are planned to keep nodes from dying out with simplified traffic conditions for event-tracking applications. To maximize and conserve energy between SN, the principle of optimized opportunistic routing utilizing sleep mode is implemented, resulting in improved efficiency of the linear framework. Sleep mode means that nodes are only involved during processing during the transmission of data packets, which helps to conserve their energy in turn. However the concern with new wireless ad-hoc methods is that they cannot exploit the nodes' cooperative capacity inside the network. In Figure 4, one convenient solution is to minimise the power expended to send a packet to the destination. The standard approach is to use the shortest route with communication costs equal to the energy needed for transmitting a packet on each pass.
The Figure 5 indicates the end-to-end delay, the efficiency of the energy savings to be gained at the receiver in terms of direct beam creation and direct single connection transmission with the same source-receiver pair. Another strategy is to optimize the network's lifespan. In Figure 6, there are several ways to describe the lifespan of WSN. The specific function of the BS renders it a natural goal for an opponent who wants to accomplish with the least amount of effort the most impactful assault possible on WSN. It represents a strategy utilizing coordination between nodes to produce MIMO, variability and beam-formed antennas from the dispersed sensor elements collaboratively. The benefits of wireless linked sensor arrays creating self-organizing ad hoc networks in the sensor domain have the important advantage of growing the infrastructure required for implementation.

5. CONCLUSION

An energy-efficient routing protocol focused on clustering and finds an acceptable fixed packet size according to the transceiver’s radio parameters and channel requirements, conscious energy clustering about network lifespan and increasing the network's total throughput. With optimum energy and throughput, WSN is applied, and in the case of the void route or node failures, a path recovery algorithm is then implemented. In this technique, a sink's versatility pattern takes a distinct shape that allows each era to be much longer than the moving period levied by these anchor points, simplifying the mobile sink's architecture and limiting the extra overhead. Taking into consideration the use of battery capacity, it is shown that the transmitting mechanism is capable of growing the existence of SN that need to connect over long distances.

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