

process also produces a near uniform distribution of cluster heads. Moreover in the cluster formation phase, a unique approach is introduced to balance the load among cluster heads. However, on the other hand, it will increase the necessity of global knowledge regarding the distances between the cluster-heads and the base station.

2.8 DEEC

In 2006, Q. Li, Z. Qingxin and W. Mingwen [10] projected Distributed Energy Efficient Clustering Protocol (DEEC) protocol. DEEC protocol is a cluster based method for multi level and 2 level energy heterogeneous wireless sensor networks. In this scheme, the cluster heads are chosen using the probability based on the ratio between residual energy of every node and the average energy of the network. The era of being cluster-heads for nodes are entirely different according to their initial and residual energy. The nodes with more initial and remaining energy have greater chances of the becoming cluster heads compared to nodes with low energy.

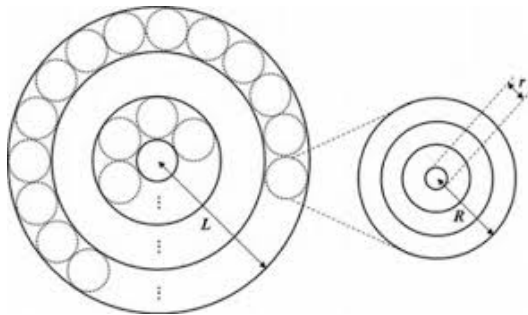


Figure 7: Distributed energy efficient clustering protocol for multilevel wireless sensor networks.

2.9 HEED

O. Younis and S. Fahmy projected [11] Hybrid Energy Efficient Distributed clustering Protocol (HEED) protocol in 2004. It extends the fundamental or the basic scheme of LEACH by using residual energy as primary parameter and network topology features such as node degree, distances to neighbors are only used as secondary parameters to shatter the tie between the candidate cluster heads, as a metric for cluster choice to attain power balancing. The clustering process is split into a number of iterations, and in every iteration nodes that are not covered by any cluster head doubles their probability of becoming a cluster head. As these energy-efficient clustering protocols further enables each node to probabilistically and independently decide its role in the clustered network. Moreover they cannot guarantee optimal elected set of cluster heads

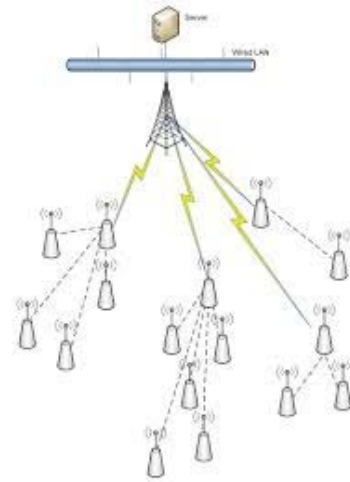


Figure 8: Hybrid energy efficient distributed clustering protocol.

2.10 H-HEED

Harneet Kour and Ajay K. Sharma, 2010 discuss about the H-HEED protocol. This protocol is basically used in heterogeneous wireless sensor network. H-HEED protocol is employed to extend the network life [12]. The impact of heterogeneity in terms of node energy in wireless sensor network has been stated. H-HEED (Heterogeneous Hybrid Energy Efficient Distributed) is the revised version of the HEED protocol in terms of non-homogeneity. Here the cluster head is chosen based on the fraction of residual energy to the utmost energy possessed by the sensor nodes. Head to head communication takes place and unlike energy leveled networks have been formed. The energy efficiency has been verified in terms of the energy needed for the transmission and reception of the data. Here the node substitution takes place in order to reenergize the network and to enhance the network life.

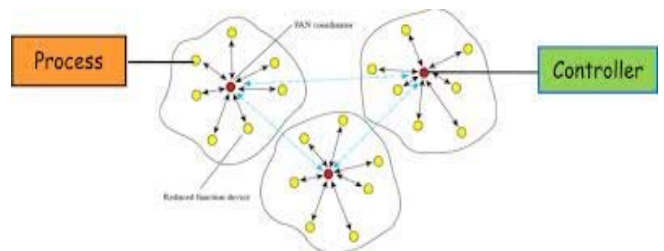


Figure 9: Clustering structure of H-HEED

2.11 Sleep/Wake Scheduling Protocol

This protocol is used to minimize end-to-end delay for event driven multi-hop wireless sensor network. This protocol is used to extend the energy and life time of network. It consists of two main phases. 1. Setup phase 2. Operation phase. Setup phase is divided into two sub-phases a. Initialization b. Route update Initialization: Energy level and position in the network [13] are computed by each node. This information is used in sleep/wake scheduling, route update [14] and event reporting. Therefore, base station divides the network into three different regions. BS transmit message to all the nodes in the network three different transmission power (TP).Therefore, $TP1 < TP2 < TP3$. $TP1$

define region 1, TP2 define region 2, TP3 define region 3 as describe in Figure 10.

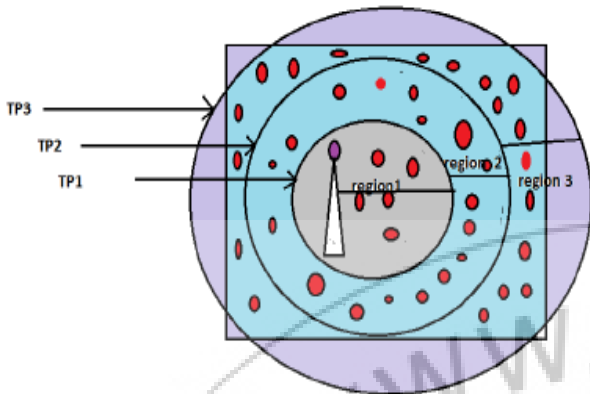


Figure 10: Clustering structure of sleep/wake scheduling protocol

Base station propagates beacon message with transmission power TP1. When node receives this message then it mark its region status as region 1 and will go to sleep state. Next, control messages are propagated by BS with transmission [15] power TP2. As we know region 1 is in sleep state and will not receive this message. All other nodes after getting this message will mark their region status as region 2 and will go to sleep state. Therefore, rest of the nodes will mark their region status as region 3 when message is received as TP3. Each node transmit control message to maintain first hop neighbour information. Once a node gets information of its neighbor it may decides whether it is connectivity critical nodes or normal nodes. Route update, Base station generates a route discovery [12] message with hop count 0 and messages are broadcasted throughout the network. A node that receives this broadcast message update its hop count value, that is, if received hop count is less than the previous hop count value then values changes to new value otherwise, it retains the previous value. Before forwarding the route discovery message, hop count is incremented by each node and then broadcasts the message to nodes in its communication range.

2.12 Virtual Grid Architecture

It is a hierarchical routing protocol that utilizes the data aggregation and processing in the network in order to extending the life time of network. Nodes in WSNs are fixed topology. It works without GPS and data are organized in grid of symmetric shapes. Inside each cluster a cluster head known as Local Aggregator [16] and aggregation is performed. Moreover, VGA uses a two-level data aggregation model: - Local Aggregator (LR) each grid square has a cluster head and subset of the local aggregator also perform global aggregation. Global Aggregators are called Master aggregators (MA). Therefore, optimal selection of Master Aggregators is difficult problem and many algorithms are existing for that, all aiming at extending the life time of network. In the data aggregation phase, some heuristic are proposed which may give efficient, sample and near optimal solution. An example of virtual grid architecture is depicted in Figure 11.

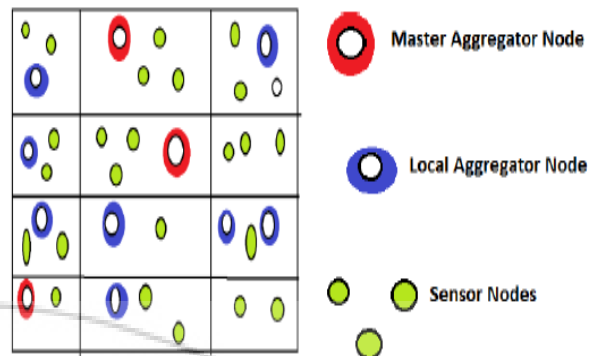


Figure 11: Virtual grid architecture.

Table I shows Schematic overview of comparative study of hierarchical routing protocols

Table 1: Hierarchical routing protocols comparison

Protocols	Mobility	Scalability	Route Metric	Power usage	Overhead	Robust
LEACH	Fixed Base Station	Good	Shortest path	Low	Yes	Limited
PEGASIS	Fixed Base Station	Good	Greedy approach	Max	No	Good
TEEN	Fixed Base Station	Good	Best route	Low	Yes	Limited
APTEEN	Fixed Base Station	Good	Best Route	Low	Yes	Limited
BCDCP	No	Limited	Best route	Low	No	Limited
SEP	No	Good	Best route	Low	No	Good
EECS	Fixed Base Station	Good	Best route	Low	Yes	Good
DEEC	No	Good	Best route	Low	No	Good
HEED	Fixed Base Station	Good	Shortest Path	Low	Yes	Good
H-HEED	Fixed Base Station	Good	Shortest Path	Low	Yes	Good
VGA	No	Good	Greedy route approach	N/A	No	Good
Sleep/wake scheduling	No	Good	Best route	Low	No	Limited

3. Research Issues In Wireless Sensor Networks

The limited capabilities of sensor node and the deployment of sensor networks raise several research issues. A sensor node is designed with limited processing capabilities and equipped with limited amount of energy. The limited processing capabilities of node emphasis researchers to develop algorithms which involve minimum possible computation and data storage. The sensors implanted into the body are of small size and cannot accommodate huge processing power. In this section, we address some of the limitations of WSN when implemented for medical healthcare.

3.1 Energy Consumption

Typically sensor nodes are equipped with small batteries which cannot be changed or recharged and a node destroys when its battery exhausts. The experimental evaluations highlights that data communication consumes more energy as compare to data processing. The energy cost of receiving or transmitting a single bit of information is approximately the same as that required by processing executing a thousand operations [12] [13]. The continual operation of sensors is vital for healthcare applications.

Two major techniques, duty cycling and in-network processing are used in WSN to reduce power consumption. The power reservation algorithms in medical healthcare must be able to reduce power consumption without compromising on system reliability.

3.2 Security

Security is an important part of any system and it is a major area of research in general WSN. Wireless media is always more vulnerable than wired media for attackers [14]. This is more important in healthcare applications since a security breach can result in life threatening situations.

Security can be defined at several levels in healthcare applications. The security threats can occur during routing the data where intruders may change the destination, can make routing inconsistent or even steal the data by eavesdropping the wireless communication media [14]. The attackers can steal or modify the data routing through GPRS or similar networks [14]. The criminal-minded attackers can track the user location or can keep an eye on user's activity. The attackers can fiddle with the data by forging alarms [15]. They can also wage the Denial of Service (DoS) and Jamming attacks on the networks.

Data Encryption and Authentication are major security techniques used for security provision. Data encryption techniques must be used for secured data transfer and legitimate devices must be allowed to create or inject data into the system [15]. One of the solutions against security threats is to implement different encryption techniques

3.3 Power Sources

No matter how intelligent the routing mechanism or how adaptive the network, if the sensor loses power the sensor is simply non functional. Significantly more work is needed on alternative low cost power techniques such as solar, fuel cells and RF coupling.

3.4 Usability and Durability

Much of the work in this space has stopped at lab type 'prototype' solutions. More commercial devices are needed and more studies needed on performance in real world applications

3.5 Autonomic Networks

Substantive effort is needed in the self-organizing properties of sensor networks. Also end-to-end pilots are needed that demonstrate the autonomic properties of sensor networks. In Healthcare the Reliability Dilemma is particularly important, i.e. data needs to be secure and reliable, but this brings high overheads in terms of data size, power consumption and scalability. This dilemma needs attention through appropriate studies. Body Sensor Networks need to be recognized as a special category of sensor networks as the requirements can be quite different from general wireless sensor networks.

3.6 Biocompatibility and RF Effects

Given the amount of information on aspects of sensor network design, there is very little information on biocompatibility of sensor materials. Much of the efforts here are at the basic research level (materials science, garment fabrication etc) and this is appropriate as the promise of wearable devices is quite considerable. However more initiatives aimed at investigating the long term relationship between the sensor interface and the human body/skin are required. For example RF produces a heating effect which could possibly damage human cells. Even with low emitted and radiated power levels, it remains to be proven what the effect on human tissue over time (and with many sensors on the body) would actually be

3.7 Privacy and Data Ownership

In parallel with the technical research, research in to the societal, ethnographic and demographic effects of wireless sensor networks need to be performed. This encompasses the privacy debate also. Concerns such as profiling, 'big brother', 'one big database' etc need to be addressed up front and policies developed and agreed ahead of the technology becoming mature. Issues around data ownership when data travel across multiples boundaries arise. Also the legal aspects need to be reviewed, who is liable etc.

3.8 Development Environment

Sensor network operating systems have long been the domain of programmers and technical architects. Development environments where programming detail is abstracted to a high level are needed. These can be used by non-technical people (example nurses, doctors) to quickly set up and test prototype networks. These environments need to be user friendly, intuitive, support high level user interfaces with extensive support and training available.

3.9 Programming Challenge

Also one should accept that Wireless devices are slower than wired because of traffic congestion and hence increases the challenge to create the devices that could reach to better performance. This creates a big challenge for developers in programming and designing a secure sensor network. Ensuring patients information security can be a major issue when deploying these applications. Privacy of user data over

wireless channels can be another major issue. Wireless network based medical devices can be very limited in terms of power availability and processing strength. Thus ensuring privacy without using complex encryption algorithms can be a big issue for developers of medical devices [11].

4. Conclusion

From the survey considering the existing drawbacks and issues in wireless body sensor network it is planned to propose a novel approach on increasing efficiently the lifetime of sensor nodes, energy consumption and routing design issues must be accounted for. Energy saving becomes one of the most important features for the sensor nodes to prolong their lifetime. In the wireless body sensor networks, the main power supply of a sensor node is a battery, and a sensor node consumes most of its energy in transmitting and receiving packets. However, the battery energy is finite in a sensor node, and a sensor node that has its battery drained could make the sensing area uncovered. Hence, energy conservation becomes a critical concern in wireless body sensor networks. To reduce the energy consumption and to prolong the network lifetime, new and efficient energy saving routing architectures must be developed.

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