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Performance of SEP with Three Level of Heterogeneity over LEACH and SEP of WSN: A Review

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Abstract - Wireless Sensor Network plays an important role in our daily life. In real life applications we have to send data from one location to another location via mobile nodes and sensor nodes. In wireless sensor network one base station is required and one controlling station is required which controls sink node for transferring data from base station to destination station. In this paper, three protocols are used for transferring data from base station to destination station which are given: LEACH (Low energy adaptive clustering Protocol), SEP(Stable Election Protocol and SEP with three level of heterogeneity ie. three types of nodes are used which are normal nodes, advanced nodes and intermediate nodes. Energy is totally distributed equally in nodes.

In this paper we have to increase energy and increase number of advanced nodes and intermediate nodes then more stable protocol is achieved ie. SEP with three level of heterogeneity. We have changed the energy factor α = 4 and μ = 2 and μ= α/2. In future, the level of heterogeneity is increased and changing the value of α and μ, more stable protocol is developed.

1. INTRODUCTION

Wireless Sensor networks(WSN) have emerged as a promising tool for monitoring (and possibly actuating) the physical world, utilizing self-organizing networks of battery powered wireless sensors that can sense, process and communicate. A WSN typically consists of a large number of low-cost, low power, and multifunctional wireless sensor nodes, with sensing, wireless communications and computation capabilities. These small sensing devices are called nodes and consist of CPU (for data processing), memory (for data storage), battery (for energy) and transceiver (for receiving and sending signals or data from one node to another)

Characteristics of Wireless Sensor Networks

- A WSN typically consists of a large number of low-cost, low power, and multifunctional nodes
- Wireless sensor nodes, with sensing, wireless communications and computation capabilities.
- The nodes have very limited resources such as memory, computational power, communication range and most importantly battery power
- Sensor nodes are usually randomly deployed and autonomously configure themselves into a communication network.
- The deployment of sensor nodes is totally distributive in nature. The node density is thus varying at different places. Due to this reason one can find dense as well as sparse region in the same topology.
- Sensor nodes are prone to physical damages or failures due to its deployment in harsh or hostile environment.
- In most sensor network application, sensor nodes are densely deployed in a region of interest and collaborate to accomplish a common sensing task. Thus, the data sensed by multiple sensor nodes typically have a certain level of correlation or redundancy.
- A sensor network is usually designed and deployed for a specific application. The design requirements of a sensor network change with its application.
- The primary component of the network is the sensor, essential for monitoring real world physical conditions such as sound, temperature, humidity, intensity, vibration, pressure, motion, pollutants etc. at different locations.
- There is a Bounded Directed Stream (from /to Sink).
- The nodes are disposable and inexpensive.

Application of WSN

- Military applications
- Health applications
- Home Applications.
- Environment applications.

2. Literature Survey

1.“Extended Stable Election Protocol (SEP) for three-level hierarchical clustered heterogeneous WSN”

In heterogeneous sensor networks, some nodes become cluster heads which aggregate the data of their cluster nodes and transmit it to the sink. Here, the authors present an extended Stable Election Protocol (SEP) algorithm for cluster head selection in a hierarchically clustered heterogeneous network to reorganize the network topology efficiently. The presented algorithm considers the sensor nodes are static and randomly distributed in the heterogeneous network, the coordinates of the sink and the dimensions of the sensor field are known. Our simulation result shows that the extended SEP algorithm achieves better performance than the existing SEP algorithm in terms of network lifetime and throughput**. (M.M. ISLAM et al. 2012)**.

2. **“Analysis of LEACH Protocol in Wireless Sensor Networks”**

Wireless Sensor Network is a network of sensor nodes without having any central controller. Its growth is expeditiously increasing and that’s why there is an immense field for research in this area. Sensors depend entirely on the trust of their battery for power, which cannot be revitalized or substituted. So the design of energy aware protocol is essential in respect to enhance the network lifetime. LEACH is energy-efficient hierarchical based protocol that balances the energy expense, saves the node energy and hence prolongs the lifetime of the network. So this paper presents a detailed review and analysis of LEACH protocol. Comparison of various network parameters is done in the form of tables and graphs. The simulation work has been carried out by using own set of parameters and in the last of the paper conclusions is drawn. **(Meena Malik et al. 2013).**

3.**"Performance Analysis of SEP and LEACH for Heterogeneous Wireless Sensor Networks"**

While wireless sensor networks are increasingly equipped to handle more complicated functions, these battery powered sensors which used in network processing, use their constrained energy to

enhance the lifetime of the network especially in a heterogeneous settings. Clustered techniques have since been employed to optimize energy consumption in this energy constrained wireless sensor networks. In Classical clustering protocols, equal energy is assigned to all nodes and they cannot take full benefit of the presence of node heterogeneity. SEP, a heterogeneous-aware protocol is used to prolong the time interval before the death of the first node which is crucial for many applications where the feedback from the sensor network must be reliable. The performance of SEP in comparison to LEACH Protocol is analyzed in this paper in which the relation between number of alive node and number of rounds for different base stations and terrain area is analyzed. If the base station is closer to the network nodes die out after more number of rounds when compared to the base station far from the network. For larger terrain area nodes die out after more number of rounds when compared to the smaller terrain area.

(Sunil Tiwari et al. 2014).

4. "Performance Evaluation of Variants of Stable Election Based WSN protocols"

Wireless Sensor Networks (WSNs) contain a large number of sensor nodes that sense the environment they are employed in; and gather the data and forward it to the Base Station (BS). The sensing and transmission of data involves a huge amount of energy. While WSNs are equipped to handle complex functionalities, the network processing may require the sensors to use the constrained energy level to enhance the network lifetime. Many protocols have been proposed for achieving energy efficiency in heterogeneous structure of the network. In this paper, the performance of SEP, ECRSEP and ESEP have been evaluated for different WSNs scenarios. The outcomes of the same have been then analyzed for stability, network lifetime and throughput. It has been shown that the ESEP and ECRSEP performs well in differing heterogeneous scenarios, however ESEP has best results in stability period among others. This study has shown that the ESEP is quite effective over the available protocols**.(Shobti Saini et al. 2014).**

5. "Comparative Study of Hierarchical Routing Protocols in Wireless Sensor Networks"

WSN (Wireless sensor network) is composed of a large number of small, inexpensive, energy constrained nodes that are used to sense data for various civil and military applications. The sensed data from the environment is then propagated using various routing techniques to the base station. A sensor node becomes useless once its energy source i.e. the battery gets used up. To increase network lifetime, the main issue in wireless sensor networks is of energy conservation due to the fact that sensor nodes are kept in conditions and places that are inaccessible and left unattended. Network lifetime and energy conservation depends on using efficient routing techniques in wireless sensor networks, since energy is mostly used in transmission and reception of radio signals. Researchers have proposed many efficient routing protocols that can lower the energy consumption and thus increase the network lifetime. In this paper, we provide a comparative study of some popular cluster based hierarchal routing protocols using analytical simulation in MATLAB. **(Rajat Kandpal et al. 2015).**

6. "A Modified LEACH Protocol for Network Lifetime Enhancement in Wireless Sensor Networks"

Wireless sensor network consists of one or more base station and lots of sensor nodes. These sensor nodes are scattered in a specific area and these are battery operated. Since, the energy of battery is limited alternative to this problem is either to recharge the battery or to replace it with other one .In wireless sensor networks (WSNs), due to the limitation of nodes' energy, energy efficiency is an important factor should be considered when the protocols are designing. As a typical representative of hierarchical routing protocols, LEACH Protocol plays an important role. In this paper we proposed a modified LEACH which extends the LEACH clustering routing algorithm protocol in which cluster head chosen criteria is on the basis of minimum distance, maximum residual energy, minimum energy transmission. The result of simulations conducted indicates that the proposed clustering approach is more energy efficient and hence there is enhancement in the sensor network lifetime. **(Prerna et al. 2015).**

3. Objective

A stable and reliable routing protocol, it can increase the lifetime of the network by minimizing the energy consumption of each sensor nodes resource constraints, including storage, computation and communication's. The first routing protocol is based on sending and receiving message to the nodes. The solution is:

1. Comparison of LEACH, SEP and SEP with three level of heterogeneity over WSN.
2. Propose stable and energy efficient Routing protocol SEP with three level of heterogeneity over WSN.
3. Implementation of SEP with three level of heterogeneity over WSN.
4. Evaluate the result.

4. Research Methodology

SEP (Stable Election Protocol) works with three tier of heterogeneity such as three nodes which are given below: Normal Node, Advanced Node and Intermediate Nodes. The intermediate node is kept between normal node and advanced node at equal distance having extra energy. The cluster is formed with these nodes. The cluster head is chosen on the probabilistic method of energy having nodes. The cluster head changed with respect to time and energy. The cluster head is kept on and intermediate nodes are kept on and other nodes are kept off. So energy is saved for future use. The process takes place into rounds.

For ″SEP with three levels of heterogeneity″ also, we are using a 100 × 100 network of 100 sensor nodes for simulation using MATLAB. Let 20% nodes be the advanced nodes with additional energy level $\alpha = 4$ and 30% nodes be the intermediate nodes with additional energy level $\mu = \alpha/2$ i.e. $\mu = 2$.

Let $P_{opt} = 0.1$, this means that on an average, 10 nodes will become cluster heads per round. Initial energy Eo = 0.5J. After this performance, the protocol becomes stable and energy efficient. Less no. of nodes is died and more no. of nodes is alive.

5. Conclusion

Sensor nodes having less energy provided by battery is no longer survive their life because of consuming energy. So Energy is required to consume less energy in transferring data from base station to destination station. So we have to increase energy factor and level of heterogeneity then nodes becomes more stable.

In wireless sensor network, mac protocols are used for transferring data from base station to destination station. If the life of sensor node is maximized then the network becomes stable. SEP with three level of heterogeneity is more stable than LEACH (Low Energy Adaptive Clustering Protocol) and SEP (Stable Election Protocol). All these protocols are cluster dependent protocol so election of cluster is necessary. The probability of cluster formation is good in SEP with three level of heterogeneity. After increasing initial energy of the battery of the sensor node, then the life of sensor nodes persists longer and less number of nodes died.

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