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A Review on Heterogeneous Protocols for Wireless Sensor Networks

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Abstract: ***In this review paper we overview wireless sensing networks (WSN), types of WSN networks. This blueprint analyse the criteria used to make WSN efficient and effective to be deployed in various applicable areas. Further we overview various protocols that are employed in heterogeneous WSNs. These have bounded power available so making these network energy efficient is a key requirement for increasing the overall performance and lifetime of WSN deployed at remote locations .In this second thought work we analyse heterogeneous WSN protocols including DEEC, DDEEC, EDEEC and TDEEC. Conclusion strengthened on our research and overview portrays that TDEEC and EDEEC protocols work dexterously in all heterogeneous plots varying in terms of lifetime of the nodes .***
Index Terms: Cluster head, Base Station, Residual energy, Heterogeneous efficiency, Sensor nodes

I. INTRODUCTION

A wireless sensor network (WSN) is a network without wires consisting of spatially distributed autonomous devices using sensors to monitor physical or environmental conditions. A WSN system incorporates a gateway that provides wireless connectivity back to the wired world and distributed nodes.

The wireless protocol we select depends on our application area. Some of the available standards include 2.4 GHz radios based on either IEEE 802.15.4 or IEEE 802.11 (Wi-Fi) standards or proprietary radios, which are usually 900 MHz.

A WSN node contains several technical components. These include the radio, battery, micro-controller, analog circuit, and sensor interface. When using WSN radio technology, we must make important trade-offs. In battery-powered systems, higher radio data rates and more frequent radio use consume more power. To make these networks more energy efficient we employ Clustering technique, according to which nodes form clusters and these clusters empower cluster head. All nodes in the cluster, report their data from sensors to the cluster head, which further report the data to the Base Station(BS)[5].Thus only active nodes are supplied power which report data to the base station, are supplied power which report data to the base station, saving the energy on the part of passive nodes .Thus further the data is segregated and only useful data is sent further for processing. Nodes are classified on the grounds of energy level. Nodes with same energy level are crowned under homogeneous network and nodes with varying energy levels are coined under heterogeneous network. Homogeneous networks employ protocols such as LEACH,PEGASIS and HEED whereas heterogeneous networks employ protocols like DEEC, DDEEC, EDEEC, TDEEC. Further each protocol is analysed as under.

II. DEEC(DISTRIBUTED ENERGY EFFICIENT CLUSTERING)

Li Qing, Qingxin Zhu and Mingwen Wang [1] proposed this protocol which also works at two levels of energy as in case of SEP protocol and has better stability period than SEP protocol. In DEEC, the cluster heads are elected by a probability based on the ratio between residual energy of each node and the average energy of the network. The epochs of being cluster heads for nodes are different according to their initial and residual energy. The nodes with high initial and residual energy will have more chances to be the cluster heads than the nodes with low energy. So, the advance nodes have more chances to be cluster heads than the normal nodes. The probabilities of normal, advance and super nodes are given by equation :

$$\begin{cases} \dfrac{P_{opt}\, E_i(r)}{(1+am)\, \bar{E}(r)} & \text{for normal nodes;} \\ \dfrac{P_{opt}\,(1+a)\, E_i(r)}{(1+am)\, \bar{E}(r)} & \text{for advance nodes;} \end{cases}$$

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where $E_i(r)$ is the residual energy of the node 's_i' at round 'r', $\bar{E}(r)$ is the average energy at round 'r' of the network which is determined a priori before the deployment of the nodes in the network.

III. DDEEC (DEVELOPED DISTRIBUTED ENERGY EFFICIENT CLUSTERING)

Brahim Elbhiri, Saadane Rachid, Sanaa El fkihi and Driss Aboutajdine [2] proposed this protocol which was 30% better than SEP and 15% better than DEEC in terms of Network lifetime and Stability period. This protocol also works at two levels of energy and overcomes the drawbacks of the DEEC protocol. DEEC is based on clustering, when the cluster heads are elected by a probability based on the ratio between residual energy of each node and the average energy of the network. The round number of the rotating epoch for each node is different according to its initial and residual energy. DEEC adapt the rotating epoch of each node to its energy. The nodes with high initial and residual energy will have more chances to be cluster heads than the nodes with low energy. Thus DEEC can prolong the network lifetime, especially the stability period. This choice penalizes always the advanced nodes, specially when their residual energy deplete and become in the range of the normal nodes. In this situation, the advanced nodes die quickly than the others. The DDEEC, thus balances the cluster head selection over all network nodes following their residual energy. So, the advanced nodes are likely to be cluster heads during initial period but as the energy of the advance nodes depletes and become comparable with the normal nodes, the advance nodes will have the cluster head election probability like the normal nodes. The probabilities are given by equation below:

$$\begin{cases} \dfrac{p_{opt}\,E_i(r)}{(1+am)\,\bar{E}(r)} & \text{for normal nodes if } E_i(r) > Th_{rev}; \\ \dfrac{p_{opt}(1+a)E_i(r)}{(1+am)\bar{E}(r)} & \text{for advance nodes if } E_i(r) > Th_{rev}; \\ c\,\dfrac{p_{opt}(1+a)E_i(r)}{(1+am)\bar{E}(r)} & \text{for normal, advance nodes if } E_i(r) \le Th_{rev} \end{cases}$$

IV. DEEC(ENHANCED DISTRIBUTED ENERGY EFFICIENT CLUSTERING)

Parul Saini and Ajay K. Sharma [3] proposed EDEEC protocol which works on the same principle of DEEC but adds a third type of node called super node which has (1+b) times more energy than normal node. Advance nodes have (1+a) times more energy than normal nodes. Due to this third node, the heterogeneity of the network increases from two to three. Traditionally as per previous protocols, in this protocol too, cluster head selection uses the same threshold technique and the advance and normal nodes have same probabilities. Difference is just that this protocol has a probability formula for super nodes too.This protocol is explained using following equation:

$$\begin{cases} \dfrac{p_{opt}\,E_i(r)}{1+m(a+m_o b)\bar{E}(r)} & \text{for normal nodes;} \\ \dfrac{p_{opt}\,(1+a)\,E_i(r)}{1+m(a+m_o b)\bar{E}(r)} & \text{for advanced nodes;} \\ \dfrac{p_{opt}\,(1+b)\,E_i(r)}{1+m(a+m_o b)\bar{E}(r)} & \text{for Super nodes;} \end{cases}$$

The simulations show that this protocol is better than SEP, which is also extended to three levels but based on its own principle, in terms of network lifetime and stability period.

V. TDEEC(THRESHHOLD DISTRIBUTED ENERGY EFFICIENT CLUSTERING)

TDEEC [4] uses the same process of CH selection and estimation of average energy as in DEEC. At start of each round, the nodes decide whether or not to become a CH by selecting a random number within 0 and 1. If this selected number is lower than a threshold, then the node becomes a CH for this round. In TDEEC approach we have adjusted the value of the threshold, according to which a node decides to be a cluster head or not, based on ratio of residual energy and average energy of that round in respect to the optimum number of cluster heads. So that only nodes having a more energy becomes the cluster head. TDEEC protocol is the one which improves stability and energy efficient property of the heterogeneous wireless sensor network and hence increases the lifetime. Results show that TDEEC performs better as compared to SEP and DEEC in heterogeneous environment for wireless sensor networks.

T(s)=[{ p/1— p(rmod 1/p) }* {residual energy a node*k(opt)/average energy of the network}]

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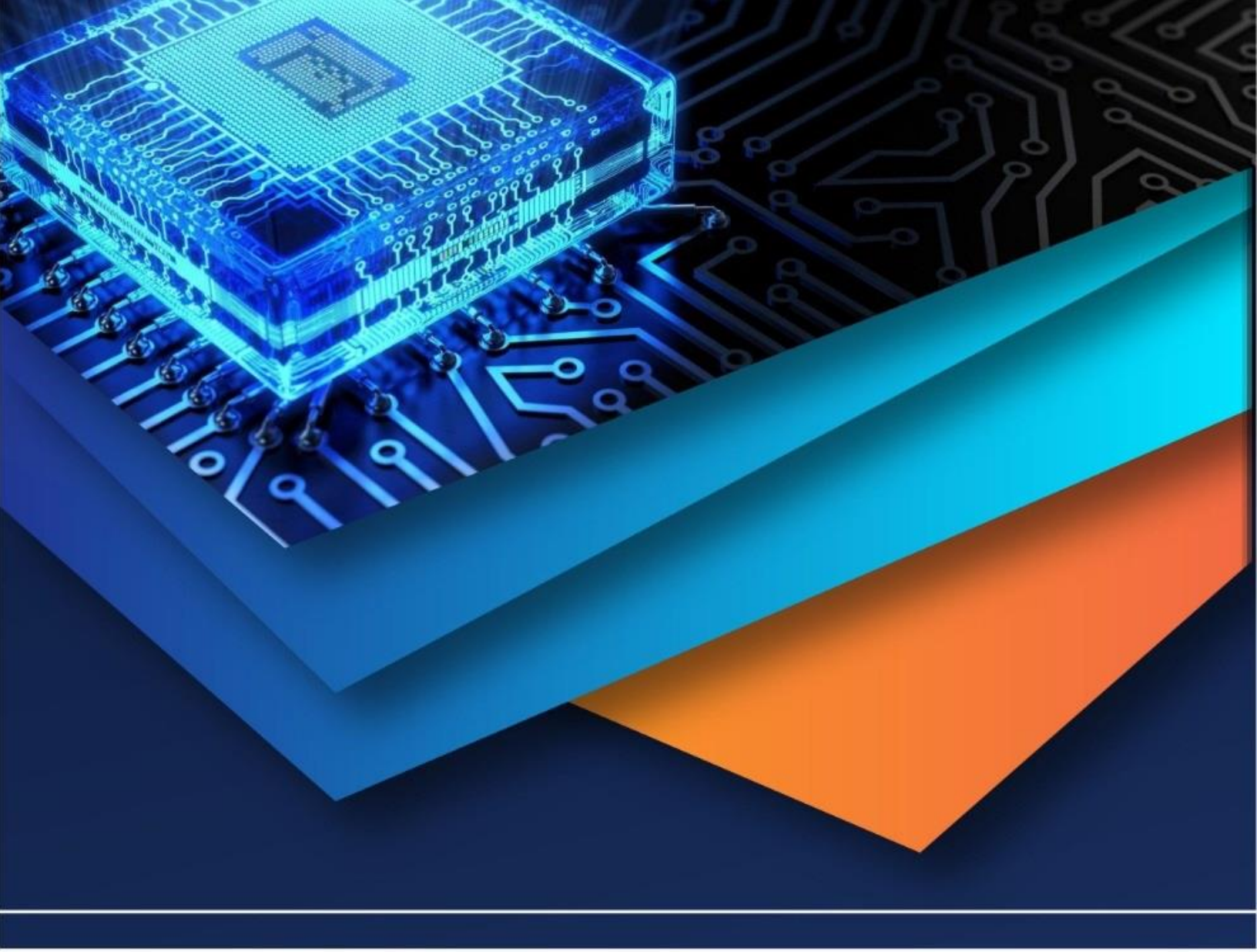
VI. CONCLUSION

In this review paper we come to know about various protocols being deployed in WSN system in heterogeneous nodes . Thus we conclude that DEEC protocol is the basic and simplest protocol which is used in heterogeneous nodes then its improved version is DDEEC .Above DDEEC we have EDEEC protocol and above EDEEC we have TDEEC protocol . Thus EDEEC and TDEEC work very well in all types of sensing nodes system of heterogeneous class .

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