Formation of Balanced Clusters through a in Clustering Algorithm Wireless Sensor Network

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Abstract

Clustering of wireless sensor network nodes, a fundamental operation, is aimed at achieving load balancing and prolonged network lifetime. Low-energy adaptive clustering hierarchy protocol, the prominent standard, achieves these. An improved protocol, balance cluster formation, provides the additional advantage of equal size clusters, but at the cost of overlapping of clusters. This project presents a node overhaul scheme that achieves load balancing and energy efficiency while also maintaining uniform size clusters without any overlapping. The proposed solution first forms initial clusters and later refurbishes the initial clusters based on a second best choice cluster head, wherever applicable. The results so obtained show a substantial improvement in network lifetime and node death rate as compared to other simulated methods.

Index Terms - Sensor networks, energy efficiency, load balancing, network lifetime, uniform size clusters (USCs).

I. INTRODUCTION

A wireless sensor network (WSN) is a group of interconnected small electronic devices or sensors that are capable of gathering and transmitting data wirelessly. The sensors are designed to monitor and collect information about their surrounding environment, such as temperature, humidity, pressure, light, sound, and motion. They are equipped with wireless communication modules that allow them to send the collected data to a central location or server, which can then be processed and analyzed. WSNs typically consist of three main components: sensors, a gateway or base station, and a network infrastructure. The sensors gather data and transmit it to the gateway or base station, which acts as a bridge between the sensors and the network infrastructure. One of the biggest advantages of WSNs is their ability to be deployed in remote or hard-to-reach locations without the need for physical connections such as cables or wires. This makes them ideal for applications such as monitoring wildlife, tracking vehicles, and monitoring weather conditions. Wireless sensor networks are often used in various applications, such as environmental monitoring, industrial automation, home automation, healthcare, and military surveillance. They offer several advantages, such as low cost, low power consumption, ease of deployment, and flexibility. However, they also face several challenges, such as limited energy and memory resources, communication range, and security issues. Wireless Sensor Networks (WSNs) can be organized into various network topologies depending on the arrangement of the sensors and the communication links between them.

II. LITERATURE SURVEY

Wireless sensor[1] nodes are the main components in wireless sensor networks. Such devices affect the performance and the accuracy of the network. Countless commercial and research nodes exist and their comparison is critical. Literature surveys do not provide a comprehensive overview about all the existing nodes' technologies. Wireless Sensor Networks (WSNs)[2] typically include thousands of resource-constrained sensors to monitor their surroundings, collect data, and transfer it to remote servers for further processing. Although WSNs are considered highly flexible ad-hoc networks, network management has been a fundamental challenge in these types of networks given the deployment size and the associated quality concerns such as resource management, scalability, and reliability. Networking[3] together hundreds or thousands of cheap microsensor nodes allows users to accurately monitor a remote environment by intelligently combining the data from the individual nodes. These networks require robust wireless communication protocols that are energy efficient and provide low latency. We develop and analyze low-energy adaptive clustering hierarchy (LEACH)[4], a protocol architecture for micro sensor networks that combines the ideas of energy-efficient cluster-based routing and media access together with application-specific data aggregation to achieve good performance in terms of system lifetime, latency, and application-perceived quality. This paper describes the concept of sensor networks which has been made viable by the convergence of micro-electro-mechanical systems technology, wireless communications and digital electronics. First, the sensing tasks and the potential sensor networks applications are explored, and a review of factors influencing the design of sensor networks is provided. Then, the communication architecture for sensor networks is outlined, and the algorithms and protocols developed for each

layer in the literature are explored. Open research issues for the realization of sensor networks are also discussed. This study[5] examines the problem that sensors are irregularly deployed in a wireless sensor network (WSN). Such irregularity makes clustering protocols less efficient. This paper proposes a new clustering algorithm, called balanced clustering algorithm (BCA), for irregularly deployed WSNs. In BCA, each node determines the probability that the node itself becomes the cluster head (CH) by considering the sensing population, which is defined as the number of nodes within the sensing range of a node.

III. EXISTING METHOD

Low Energy Adaptive Clustering Hierarchy (LEACH) protocol is a TDMA based MAC protocol. The principal aim of this protocol is to improve the lifespan of wireless sensor networks by lowering the energy consumption required to create and maintain Cluster Heads. LEACH is a hierarchical protocol in which most nodes transmit to cluster heads, and the cluster heads aggregate and compress the data and forward it to the base station (sink). Each node uses a stochastic algorithm at each round to determine whether it will become a cluster head in this round. LEACH assumes that each node has a radio powerful enough to directly reach the base station or the nearest cluster head, but that using this radio at full power all the time would waste energy. LEACH also uses CDMA so that each cluster uses a different set of CDMA codes, to minimize interference between cluster . The operation of LEACH protocol consists of several rounds with two phases: Set-up Phase and Steady Phase.

The Set-Up Phase where Cluster Heads are chosen and Cluster Formation are done and steady state Phase in which the data transmission takes place between nodes to Cluster Head and Cluster Head to Base Station**.** A cluster head in the LEACH protocol is not stabilized. Therefore, this protocol can not only reduce the energy loss, but also can extend the network lifetime. In addition, the CH uses the method of data aggregation, which can reduce correlated data locally. This method can also optimize the amount of data in the network and reduce energy consumption. Moreover, the time division multiple access (TDMA) schedule used by LEACH allows the member nodes to go into sleep mode, and this mechanism holds back the collision between clusters and extends the sensors' battery life.

IV.PROPOSED METHOD

Uniform size clustering refers to the concept of dividing the network into clusters of equal size. In LEACH, the network is divided into clusters, and each cluster contains approximately the same number of nodes. This is done to ensure that the energy consumption is balanced among the nodes and to prevent some nodes from draining their energy more quickly than others.

By using uniform size clustering, the energy consumption is distributed equally among the nodes, which helps to increase the network lifetime. Additionally, the randomized CH selection approach ensures that the workload is evenly distributed among the nodes, which helps to prevent hotspots and improve the network's stability.

Finally, the CH rotation mechanism helps to evenly distribute the energy consumption among the nodes, preventing some nodes from running out of energy too quickly. In summary, LEACH-USC is a more energy-efficient, scalable, and stable protocol than the original LEACH, making it a better choice for wireless sensor network applications.

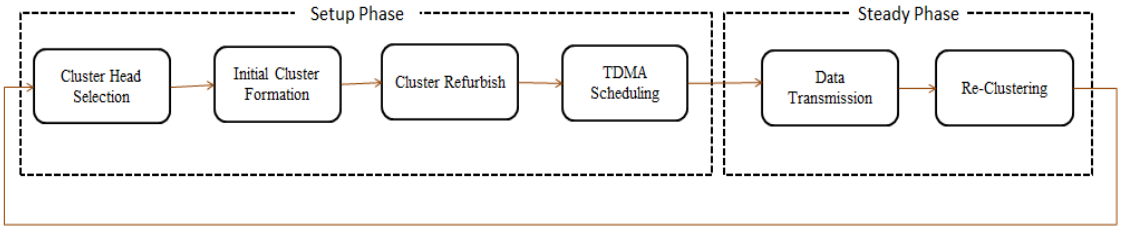

Fig.1. Sequence of operations in the proposed LEACH-USC

In conclusion, although LEACH-USC is an improvement over the original LEACH protocol, there are still some challenges that can be addressed through further modifications to enhance its performance and address some of its limitations**.**In the proposed solution, all the nodes are assigned with a cluster head as it happens in case of LEACH protocol, but there will be a few un clustered nodes because of threshold Thcluster. The idea of the cluster refurbish phase of the proposed solution is to allow extra nodes (MNs—Thcluster) of large clusters to join other clusters according to the second best choice of cluster heads.

The proposed solution has uniform size clusters (USCs).Thus, The approach is named as LEACH-USC, along with reduced intra cluster communication .The operation of the proposed strategy has been depicted in Fig. Cluster head selection depends on the probabilistic approach as also performed by LEACH.

V.RESULTS

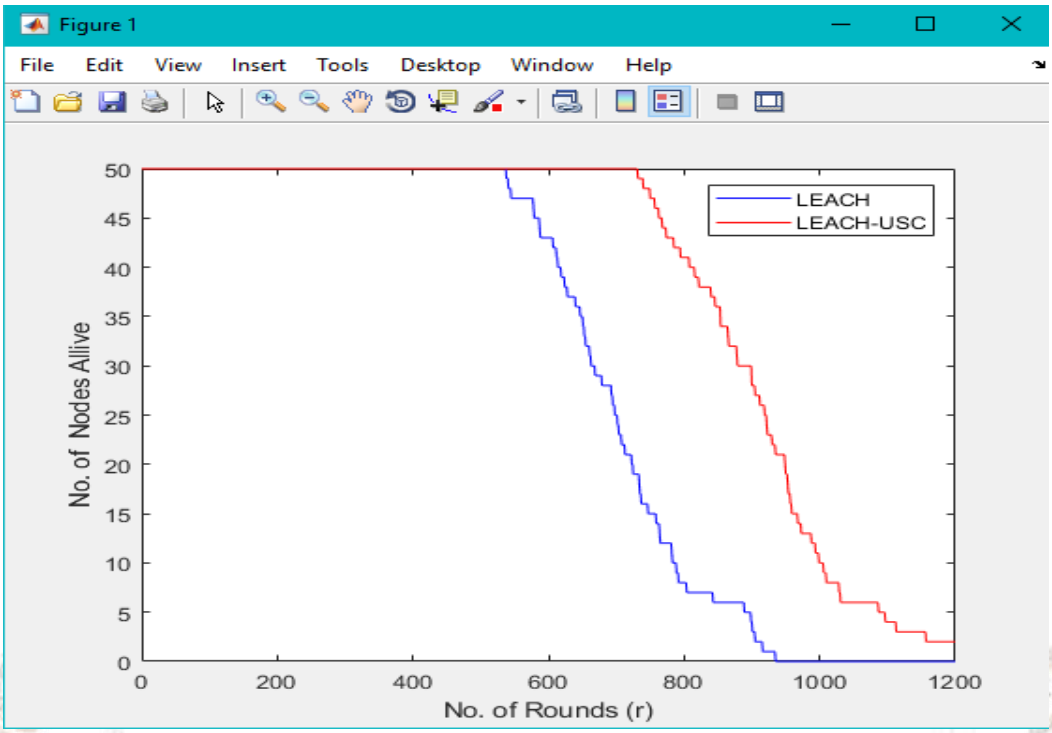

Fig.2: Node death rate comparison for LEACH and LEACH-USC.

The wireless sensor networks are widely used in different areas. LEACH protocol is one of the most popular approaches in WSN. In this paper, The clustering approach, LEACH-USC, proposed in this article focuses on the balancing the load of the network by creating clusters of uniform size. The proposed LEACH-USC has established good quality clusters, in terms of cluster size and total intra-cluster communication distance. Simulation results show that LEACH-USC in comparison to LEACH.

VI.CONCLUSIONS

The wireless sensor networks are widely used in different areas. LEACH protocol is one of the most popular approaches in WSN. In this paper, The clustering approach, LEACH-USC, proposed in this article focuses on the balancing the load of the network by creating clusters of uniform size. The proposed LEACH-USC has established good quality clusters, in terms of cluster size and total intra-cluster communication distance. Simulation results show that LEACH-USC in comparison to LEACH.

VII.REFERENCES

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