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Mobile Sink Based Energy Efficient Adaptive Clustering Hierarchy Protocol for WSN

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Abstract: In wireless sensor networks, the restriction of vitality and reserve space of hubs and the multi-jump transmission flimsiness will truly meddle the execution of customary information accumulation conventions. Fundamentally directing conventions are intended for effective usage of vitality assets. WSNs form battery-fueled hubs, which are connected to the beds base station to for some activities or errand. As sensor hubs are battery-controlled i.e. can be dead after the utilization of the battery that is additionally called span of WSNs. In this paper, an Energy Adaptive Clustering Hierarchy, which utilizes a portable sink, has been proposed for WSNs with non-uniform hub appropriation. The recreation comes about demonstrate that: contrasted and customary information accumulation conspires, the technique abbreviates the moving separation of the versatile base station, amplifies the network life cycle lessens the vitality utilization, and has the shorter postponement of the information.

***keywords*:**wireless sensor networks, topologies, mobile sink

I. INTRODUCTION

A wireless sensor network (WSN) consists of sensor nodes capable of collecting information from the environment and communicating with each other via wireless transceivers. The collected data will be delivered to one or more sinks, generally via multi-hop communication. The sensor nodes are typically expected to operate with batteries and are often deployed to not-easily-accessible or hostile environment, sometimes in large quantities. It can be difficult or impossible to replace the batteries of the sensor nodes. On the other hand, the sink is typically rich in energy. Since the sensor energy is the most precious resource in the WSN, efficient utilization of the energy to prolong the network lifetime has been the focus of much of the research on the WSN.

A wireless sensor network (WSN) is a wireless network 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.

WSN Network Topologies:

WSN nodes are typically organized in one of three types of network topologies. In a star topology, each node connects directly to a gateway. In a cluster tree network, each node connects to a node higher in the tree and then to the gateway, and data is routed from the lowest node on the tree to the gateway. Finally, to offer increased reliability, mesh networks feature nodes that can connect to multiple nodes in the system and pass data through the most reliable path available. This mesh link is often referred to as a router.

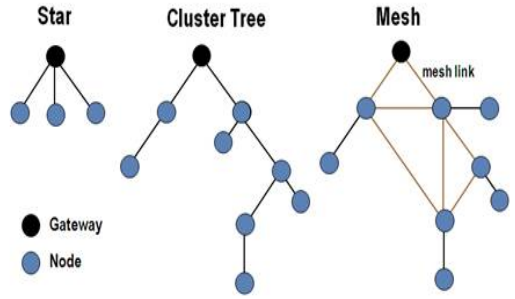

Figure: Common WSN Network Topology

Components of a WSN Node:

A WSN node contains several technical components. These include the radio, battery, microcontroller, analog circuit, and sensor interface. When using WSN radio technology, you must make important trade-offs. In battery-powered systems, higher radio data rates and more frequent radio use consume more power. Often three years of battery life is a requirement, so many of the WSN systems today are based on ZigBee due to its low-power consumption. Because battery life and power management technology are constantly evolving and because of the available IEEE 802.11 bandwidth, Wi-Fi is an interesting technology.

The second technology consideration for WSN systems is the battery. In addition to long life requirements, you must consider the size and weight of batteries as well as international standards for shipping batteries and battery availability. The low cost and wide availability of carbon zinc and alkaline batteries make them a common choice.

To extend battery life, a WSN node periodically wakes up and transmits data by powering on the radio and then powering it back off to conserve energy. WSN radio technology must efficiently transmit a signal and allow the system to go back to sleep with minimal power use. This means the processor involved must also be able to wake power up, and return to sleep mode efficiently. Microprocessor trends for WSNs include reducing power

consumption while maintaining or increasing processor speed. Much like your radio choice, the power consumption and processing speed trade-off is a key concern when selecting a processor for WSNs. This makes the x86 architecture a difficult option for battery-powered devices.

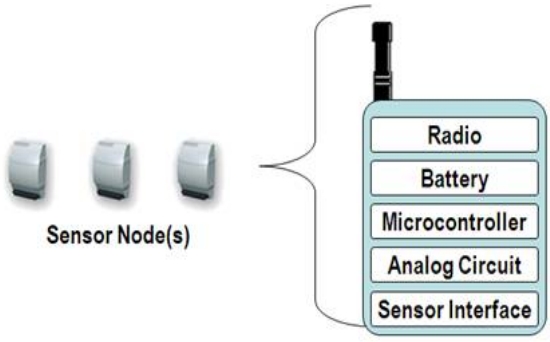

Figure: WSN Sensor Node Components

Mobile Sink:

In a sensor network with mobile sink, sinks are capable of movement and sensor nodes relay data to the mobile sinks with little or no buffering.

LOW-ENERGY ADAPTIVE CLUSTERING HIERARCHY

Low-energy adaptive clustering hierarchy ("LEACH") is a TDMA-based MAC protocol which is integrated with clustering and a simple routing protocol in wireless sensor networks (WSNs). The goal of LEACH is to lower the energy consumption required to create and maintain clusters in order to improve the life time of a wireless sensor network.

Protocol explanation

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.

Nodes that have been cluster heads cannot become cluster heads again for P rounds, where P is the desired percentage of cluster heads. Thereafter, each node has a 1/P probability of becoming a cluster head again. At the end of each round, each node that is not a cluster head selects the closest cluster head and joins that cluster. The cluster head then creates a schedule for each node in its cluster to transmit its data.

All nodes that are not cluster heads only communicate with the cluster head in a TDMA fashion, according to the schedule created by the cluster head. They do so using the minimum energy needed to reach the cluster head, and only need to keep their radios on during their time slot.

LEACH also uses CDMA so that each cluster uses a different set of CDMA codes, to minimize interference between clusters.

II. RELATED WORK

Jin Wang, Menglin Wu and Jeong-Uk Kim [01], Wireless sensor networks commonly consist of a large number of tiny sensor nodes that are deployed either inside the target area or very close to it to cooperatively monitor the target area. Energy efficiency and network lifetime are two challenges that most of researchers deal with. In this paper, to improve the performance of sensor networks, we propose an energy-efficient competitive clustering algorithm for wireless sensor networks using a controlled mobile sink. Clustering algorithm can effectively organize sensor nodes and the use of a controlled mobile sink node can mitigate hot spot problem or energy holes. The selection of optimal moving trajectory for sink nodes is an NP-hard problem. In our algorithm, we firstly study an competitive clustering algorithm in which cluster heads are rotated in each round and selected mainly based on their competition range and their residual energy. Besides, we use mobile sink node instead of fixed sink node. The mobile sink node moves at a certain speed along a predefined path and sojourn at some park position to collect data packets. Simulation results validate that competitive clustering algorithm outperforms LEACH and the use of mobile sink node significantly improve the performance of the sensor network.

S.Suganyadevi and N.Subhashini [02], Energy hole problem is a critical issue for data gathering in wireless sensor networks. Sensors near the static sink act as relays for far sensors and thus will deplete their energy very quickly, resulting energy holes in the sensor field. This project proposed a mobile sink-based adaptive immune energy-efficient clustering protocol (MSIEEP) to alleviate the energy holes. A MSIEEP uses the adaptive immune algorithm (AIA) to find the optimum number of cluster heads (CHs) to improve the lifetime and stability period of the network. The performance of MSIEEP is compared with the previous protocols; namely, low-energy adaptive clustering hierarchy (LEACH), rendezvous, and mobile sink improved energy-efficient PEGASIS-based routing protocol using Network Simulator (NS2). Simulation results show that MSIEEP is more reliable and eliminates the energy hole problem and improves the lifetime and the stability of the wireless sensor network.

Archana B Biradar, V.V.Ayyannavar [03], Wireless Sensor Networks consist of hundreds of tiny, inexpensive, resource constrained sensor nodes. Routing is a challenging task in such environment mainly due to the unique constraints the wireless sensor networks suffer from. Wireless sensor network consisting of a large number of sensors is effective for gathering data in a variety of environments. Since the sensors operate on

battery of limited power, it is a challenging task to design an efficient routing scheme which can minimize the delay while offering high energy efficiency and long network lifetime. In this paper we propose an energy efficient routing protocol. The proposed protocol is hierarchical and cluster based. The selection procedure is carried out in two stages. In the first stage, all candidate nodes for becoming CH are listed, based on the parameters like relative distance of the candidate node from the Base Station, remaining energy level, probable number of neighbouring sensor nodes the candidate node can have, and the number of times the candidate node has already become the Cluster Head. Simulation results show that the proposed routing scheme significantly reduces energy consumption and increases the lifetime of sensor network compared to other hierarchical routing schemes such as Low-Energy Adaptive Clustering Hierarchy (LEACH).

Gurpreet Kaur, Dr. Sandeep Sharma [04], The quick escalations in network multimedia devices have permitted extra concurrent digital services: video conferencing, online playoffs as well as remote learning to nurture for conform e-net jobs. WSNs have become major area of research in computational theory due to its wide-ranging applications. But due to limited battery power the energy expenditure has become key drawback of WSNs protocols. Although several protocols has been proposed so far to improve the energy efficiency more however still a lot enhancement can be done. GSTEB has shown fairly significant results over the on hand WSN protocols. The general purpose of this work is to find the problems of the former techniques for WSNs. At the end of this paper appropriate future guidelines are given to further improve this work.

Harleen kaur, Dr.Tanupreet singh [05], Wireless sensor networks (WSNs) are becoming popular in real life applications. Because of the top features of the resource-constrained and battery-aware sensors, in WSNs energy utilization has found to be always a major interesting subject of research. WSNs compose battery-powered nodes, which are linked to the beds base station to for many actions or task. As sensor nodes are battery-powered i.e. can be dead after the consumption of the battery that is also called duration of WSNs. So utilizing the energy in well-organized way, may end in prolonging the duration of the WSNs. Sensor nodes possess a negative characteristic of limited energy, which pulls back the network from exploiting its peak capabilities. Hence, it is essential to gather and transfer the data in a optimized way which reduces the vitality dissipation. In this paper, a survey on various mobile sink based clustering protocols is presented. From the survey, it has been concluded that none of the technique performs effectively in all fields.

Gurpreet Kaur, Dr. Sandeep Sharma [06], Although GSTEB has given away relatively considerable outcome in wireless sensor network(s) but still it has not given the idea of three major objectives: mostly, current research has not been considered the consequence of the movable sink, can proffer stage wise clustering to supplementary improve the outcomes, the pretty upshot of the reactivity has been ignored too since GSTEB has seen as proactive one. To triumph over the restriction of the former exertion, a new-fangled superior technique is projected in this research. The proposed technique has cross over these restrictions. This proposed protocol with mobile sink evaluates the effectiveness of the propose GSTEB for mobile sink based environment. Also, evaluates the effect of network range and nodes scalability on the proposed GSTEB according to the specific parameters: stability phase, network lifespan, throughput, standard residual energy. Simulation results conclude the better outcomes given by the proposed protocol. Future scope is also given.

Shipra Sharma, Kanika Sharma [07], WSN is the emerging and fast growing field which consist of low cost, battery operated and multi-functional sensor nodes. In wireless sensor network improving lifetime of the network is the main challenge. With static sink energy whole problem or hot spot is a major problem in WSN. The sensor nodes which are located near to the sink, act as relay for those of the nodes which are far apart from the sink. This causes the lifetime of the network reduced. The concept of mobile sink solves the problem of energy hole problem and also does the load balancing in the wireless sensor network. In this paper we propose to improve the lifetime of the wireless sensor network by using mobile sink based energy efficient adaptive threshold clustering hierarchy algorithm. Here we use hybrid routing protocol APTEEN which gives overall snapshot of the network at periodic intervals and also react to time critical situations. The results obtained from the proposed algorithm have been compared with that obtained from MSIEEP protocol. It can be accessed from results that the proposed algorithm works better than MSIEEP. The simulation result is performed in MATLAB.

Kalyani Khanke, Mamta Sarde [08], A wireless sensor network (WSN) is a collection of nodes organized into a cooperative network, which are small energy constrained devices The efficient use of energy source in a sensor node is most desirable criteria for prolong the life time of wireless sensor network. In WSN, sensors near the static sink have to relay the data of the nodes away from the sink and as a result they drain their energy very quickly. It result in network partitioning and can significantly limit the network lifetime, problem is termed as hotspot problem. So designing efficient routing for reducing energy consumption is the important factor. Recently, mobile sink approach has been used to address the hotspot problem but it increase end to end delay which is not acceptable for delay sensitive application. In this paper, to solve the above problem the consumption of energy during the transmission of data from sensor nodes to the sink has been calculated. Routing protocols in WSNs along with the most energy efficient protocol

named LEACH (low energy adaptive clustering hierarchy) and AODV protocol is used. the proposed protocol incurs less end to end delay and is energy efficient. Intensive Simulations are carried out to evaluate the performance of the proposed strategy.

K. Padmanabhan, Dr. P. Kamalakkannan [09], Wireless Sensor Networks (WSNs) is a network of an inexpensive low coverage, sensing, and computation nodes. The foremost difference between the WSN and the traditional wireless networks is that sensors are extremely sensitive to energy consumption. Energy saving is the crucial issue in designing the wireless sensor networks. Many researchers have focused only on developing energy efficient protocols for continuous-driven clustered sensor networks. In this paper, we propose a modified algorithm for Low Energy Adaptive Clustering Hierarchy (LEACH) protocol. Our modified protocol called "Energy-Efficient Adaptive Protocol for Clustered Wireless Sensor Networks (EEAP)" is aimed at prolonging the lifetime of the sensor networks by balancing the energy consumption of the nodes. EEAP makes the high residual energy node to become a cluster-head. The elector nodes are used to collect the energy information of the nearest sensor nodes and select the cluster-heads. We compare the performance of our EEAP algorithm with the LEACH protocol using simulations.

Deepak Kumar, Deepali [10], Wireless sensor network (WSN) is collection of large number of sensor nodes which senses the physical conditions of environment and send the data to sink. WSN can be classified as static and mobile WSN. In static routing protocol, energy consumption is not uniformly distributed. To avoid this problem, wireless sensor network with mobile sink can be used, where mobile sink gathers data from other nodes using 1-hop communication. In this paper, we presented the various types of WSN. At last, we compared the various routing protocol of WSN with mobile sink based on parameter no. of sinks, mobility of CH and mobility pattern.

III. PROPOSED METHOD

In the network model described in previous section some assumptions have been made for the sensor nodes as well as for the network. Hence the assumptions and properties of the network and sensor nodes are:

• Sensor Nodes are uniformly randomly deployed in the network.

• There is one Base Station which is located at the center of the sensing field.

• Nodes always have the data to send to the base station.

• Nodes are location-unaware, i.e. not equipped with GPS-capable antennae.

• All nodes have similar capabilities in terms of processing and communication and of equal significance. This motivates the need for extending the lifetime of every sensor. Sensor nodes have heterogeneity in terms of energy i.e., different energy levels. All nodes have different initial energy; some nodes are equipped with more energy than the normal nodes.

We proposed an Adaptive threshold algorithm based on a query system which allows three types of queries: historical, on-time, and constant which can be used in a hybrid network.

In adaptive threshold algorithm the cluster head first broadcasts the following parameters:

• Attributes -interested physical parameters.

• Thresholds -hard threshold value and soft threshold value.

• Schedule -time slot using TDMA.

• Count time -Maximum time period between two successive reports sent by a node.

In our proposed we will concern with following performance criteria and compare with previous protocols

1. Stability
2. Throughput
3. Lifetime of network
4. Network Remaining Energy

Our proposed system has three phases first one is Initial phase, Processing phase, and termination phase. In initial phase sink and sensor nods will be initialized and region will be divided. All information about sensor nodes like energy, id, and position will be transferred to sink node. Second Phase is processing phase in this phase cluster node will be decided by Energy efficient adaptive algorithm and information broadcast to the sensor node and its contain iteration process to cover up all nodes according to TDMA sheduling.In termination process check about whole network by cluster head for dead and alive node and iteration continuously take place.

IV. IMPORTANT ALGORITHMS

TDMA Scheduling

TDMA is one of schedule-based MAC protocol which is a subject of an active and broad research. TDMA provides collision-free transmission from nodes or links since a set of time slots are prearranged. Thus, TDMA can adapt well to various network densities and offered loads. An efficient TDMA schedule can save energy by allowing nodes to turn on the radio only during the scheduled transmission times of their neighbors, without wasting energy due to idle listening and overhearing unlike contention-based schemes. It is well-known that idle listening consumes as much as energy as receiving. Furthermore, as TDMA does not require any control message exchanges for communication (e.g., RTS/CTS), it limits overhead in communication.

V. CONCLUSION

This paper proposes a Mobile Sink based Energy Adaptive Clustering Hierarchy to limit the vitality utilization of sensor hubs. Vitality Adaptive Clustering

Hierarchy presents the idea of mobile sink which gathers the information from the cluster heads by taking after the pre-characterized ways. With limiting the vitality entire issue, Energy Adaptive Clustering Hierarchy calculation gives better soundness period and system lifetime than unique Energy Adaptive Clustering Hierarchy. The simulation result comes about have demonstrated that versatile sink based Energy Adaptive Clustering Hierarchy performs all around contrasted with comparable methodologies. Moreover, the proposition has less moving separation of MS than that in the other two calculations and has points of interest on the system life cycle and normal vitality utilization.

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