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Improving the performance of Mobile Wireless Sensor Networks using modified DBSCAN

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***Abstract*—** In wireless sensor networks the nodes are most of times static in nature. But in Mobile wireless sensor networks the nodes are mobile in nature, in such kind of networks if the emphasis is given on the clustering then the cluster head sometimes tend to move out of the cluster. The paper analyzes ECBR-MWSN which takes into account mobility, remaining energy and distance to the base station while making selection for the cluster head nodes. The proposed work however has tried to reduce the time taken in rotation of cluster heads. The performance of network was analyzed using throughput, delay and packet delivery ratio which showed a significant improvement.

***Keywords* -** ECBR-MWSN, Cluster head, Throughput of Network, delay, Packet Delivery Ratio, Routing Protocol, Sensor Nodes, Mobile Sink.)

I. INTRODUCTION

Recent years have witnessed an increasing interest in using wireless sensor networks (WSNs) in many applications, including environmental monitoring and military field surveillance. In these applications, tiny sensors are deployed and left unattended to continuously report parameters such as temperature, pressure, humidity, light, and chemical activity. Reports transmitted by these sensors are collected by observers (e.g., base stations). The dense deployment and unattended nature of WSNs make it quite difficult to recharge node batteries. Therefore, energy efficiency is a major design goal in these networks.

A wireless sensor network is an infrastructure comprised of sensing (measuring), computing, and communication elements that gives an administrator the ability to instrument, observe, and react to events and phenomena in a specified environment. WSN is a very large array of diverse sensor nodes that are interconnected by a communication network. The sensing data are shared between the sensor nodes and are used as input for a distributed estimation system. The fundamental objectives for WSN are reliability, accuracy, flexibility, cost effectiveness, and ease of deployment. WSN is made up of individual multifunctional sensor nodes.

II. RELATED WORKS

In[1] The authors have talked about hotspot problem. In WSN, sensors close to the sink need to hand-off the information of the nodes far from the sink and subsequently they deplete their energy rapidly. It consequences in network partitioning and hence decreases the lifetime of network. This problem is termed as hotspot problem. Recently, formation of hotspot or energy hole close to the sink has risen as a critical issue for data gathering in WSN. In this paper, authors discussed about the hotspot problem and proposed a Mobile Sink based Routing Protocol (MSRP) for Prolonging Network Lifetime in Clustered Wireless Sensor Networks. *In MSRP,* mobile sink moves in the clustered WSN to gather sensed data from the CHs inside its region. Mobile sink has to maintain the information data about the residual energy of the CHs while gathering the data. Mobile sink, considering the residual energy of CHs move to the CHs having higher energy. Therefore, the hotspot problem is minimized as the next neighbor of the sink is high energy node and it changes as a result of regular sink movement. This protocol is effective in the efficient utilization of WSN energy and enhances the network life time.

In [2] authors propose a new strategy in which nodes send their data to the sink via multi-hop path of reduced length and all nodes maintain a buffer in which they store their data before sink comes closer to them. This exempts the different sensors to relay the data. This strategy is effective in saving the energy along with a check that no data has been lost due to buffer overflow. WSN lifetime is optimized through controlled sink mobility and limited buffer capacity using Linear Program (LP). LP determines the time a sink stays at a particular location, data transfer rate between the nodes and the quantity of buffered packets. The proposed solution claims to achieve better lifetime, generate and transmit more data to the mobile sink and more load balancing among the nodes. A distributed algorithm is derived from the numerical results of data collection in WSN. In [3] authors proposed an efficient routing protocol for single mobile sink and multiple mobile sinks for gathering of the data in WSNs. In this scheme, the next position of the sink is determined by using biased random walk method. After this the optimal data transmission path is found using rendezvous point selection with splitting tree technique. If the sink moves within the range of the

rendezvous point, it receives the gathered data and if it moves out of the range, it chooses a relay node from its neighbours to pass the packets from meeting point to the sink. The scheme suggested here is effective in reducing the signal overhead and improving the triangular routing problem. The sink behaves like a vehicle and collects the data from the sensor. The proposed model effectively supports sink mobility with low overhead and delay when compared with Intelligent Agent-based Routing protocol (IAR) and also increases the reliability and delivery ratio when the number of sources increases.

In [4] authors propose a novel clustering scheme EECS for wireless sensor networks, which are suitable for data gathering applications at regular intervals. Clustering is an effective topology control approach in wireless sensor networks which can increase network scalability and lifetime. In this approach cluster heads are elected among the nodes having more residual energy through local radio communication by having well cluster head distribution. This novel method is used to balance the load between the cluster heads and proves that EECS surpass LEACH significantly with increasing the network lifetime over 35%.

In [5], authors propose a novel network construction and routing method by defining three different duties for sensor nodes i.e. node gateways, cluster heads and cluster members and then by applying a hierarchical structure from sink to the normal sensor nodes. The proposed method provides an efficient rationale to support the maximum coverage to recover the missing data with node mobility and to reduce the energy wastage. In this way the lifetime of the network improves significantly.

In [6] author uses optimum approach i.e. Leach-C to increase the lifetime of a wireless sensor networks. In this approach, cluster heads are distributed all over the network for better performance. Sink collects the data from each cluster heads by finding the optimum path with the help of travelling salesman problem. Here energy consumption is reduced by using Leach-C and travelling sales problem. Mobile sink gathers data, hence, reducing the energy consumption and so extends the network lifetime.

The authors in [7] talks about maximizing lifetime of the network. The major problem WSNs facing today is the limited energy availability of nodes. This paper discusses the controlled sink mobility in clustered sensor networks where all cluster heads send buffered data to the sink in a specified period of time called data reporting time (drt). In the proposed scheme, cluster heads data is collected by sink in drt time span, thus, maximizing the lifetime of the network with the help of MILP(Mixed Integer linear Programming) model. The scheme is then compared with the other related schemes by using other means of simulation scenarios.

In [8] the authors focused upon sleep and wake approach to increase the lifetime of the network. These days energy efficient routing protocols are considered as best solution to the WSNs routing. In this paper, mobile sink collects the data from all sensor nodes and transmit it through the network. There are different methods to utilize the transmission energy of the sensor node. The distance between transmitter and receiver is calculated before available transmission and then lowest transmission power is calculated and determined. Lowest transmission power is used to transmit the measurement data. During normal operating condition, sensor nodes are set to sleep/wake up mode for saving the energy.

III. EXISTING WORK

Group communication in wireless sensor networks (WSNs) is emerging as an important communication paradigm. A WSN is typically organized as a hierarchical tree network, with leaf sensor nodes sending data to a root base station collection point via a multi-hop wireless routing network. Each micro sensor node is resource-constrained, with severe limitations on its energy lifetime, memory, CPU, and radio bandwidth. It is often important for the base station to communicate to groups of resource-constrained sensor nodes.

One of the most important challenges of WSNs design is develop a method or protocol so that the randomly deployed numerous sensor nodes behave in a collaborative and organized way. Each sensor node wants to maximize its own utility function. In addition, the entire network needs balance in resource assignments to perform in a way that is useful and efficient. So it becomes extremely important to design a method which can save energy of the nodes so that nodes in the network may work for long duration and the lifetime of the network can be increased.

In the study done by RU Anitha in [9] the authors have put forward concept of enhanced clustering in the wireless sensor network where the nodes are also mobile. In this concept the clustering is done by sink node using DBSCAN algorithm [10]. The algorithm starts with nodes broadcasting the information about their residual energy, distance to the base station and mobility factor to the base station node. The cluster head selection is done taking primary factors into consideration - residual energy of the nodes and the mobility factor, the secondary factor which

is taken into consideration is distance to the base station. However, this approach causes delay as the nodes have to broadcast their information to the base station at the start of every round. There arises a need where the cluster head selection between the rounds is one as fast as possible to reduce the delay.

IV. Proposed Work

We first divide the networks into group of nodes called clusters. We use the concept of the initiator node, initiator node will be one that will start the clustering process. Initially a random node from the cluster will be chosen as initiator. Initiator will send hello message to the nodes. Each node will reply to initiator node along with their remaining energy levels and mobility information. The initiator will chose the one with lowest mobility and highest energy as the cluster head. After that it will decide the schedule after which next node will become the cluster head and broadcast the schedule to the nodes in the clusters. In this we will modify the cluster head rotation phase to reduce the delay between the rounds.

V. Results and Discussion

The concept of prevention of black hole attack by using secure clustering was implemented in NS2.35. The performance of the network was analyzed using three parameters which are crucial to performance of the network namely packet delivery ratio, throughput and delay. The parameters which were used for simulation are described in the table below.

Simulation Parameters Table:

Channel	Wireless Channel
Propagation Model	Two Ray Ground
Antenna	Omni-Directional
Queue	Drop Tail
Number of nodes	50
Initial Energy	100 Joules

The results were analyzed using three parameters- throughput, packet delivery ratio and delay.

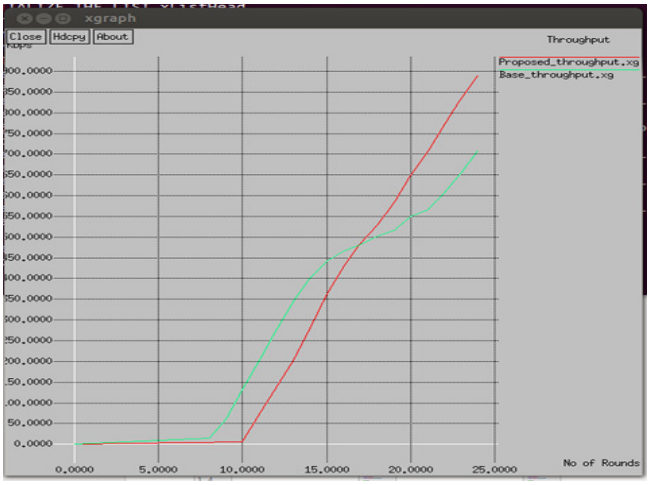
Throughput - It is defined as amount of data received at the base station in the network. For better performance of the network, the throughput must be more.

Packet Delivery Ratio - It is defined as ratio of number of packets received to the number of packets sent. If the dropping in any network is more the packer delivery ratio tends to be less and vice versa. The value for PDR must be more.

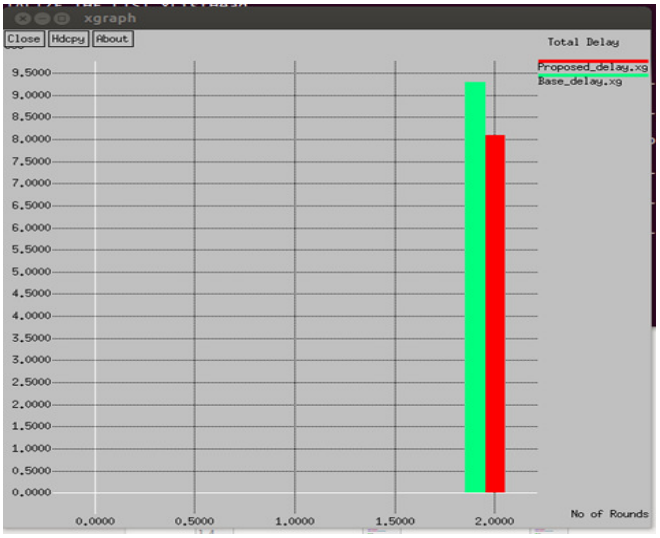
Delay - It is time taken for data packets to reach the base station in the network. A major part of the delay is caused due to cluster formation and rotation of cluster heads in the network.

The values obtained are shown in the table:

Parameters	Existing Scheme	Proposed Scheme
Throughput	707 Kbps	889 Kbps
Packet Delivery Ratio	0.82	0.91
Delay	9.3 sec	8.1 sec

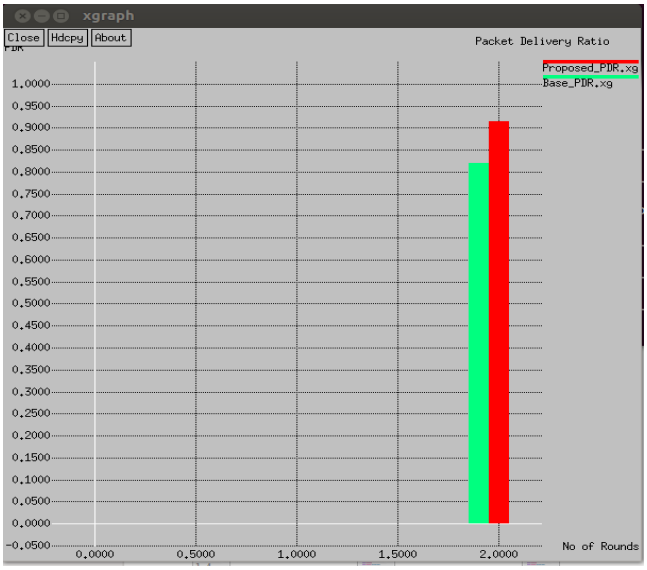


The first parameter analyzed was throughput of the network. The throughput obtained by simulating the existing scheme is less than that obtained by proposed scheme.



Delay is another factor computed in the network. It primarily includes the time taken initially to set up the

clusters in the network and the time taken in between the rounds to select the cluster heads in the network



The third factor computed is packet delivery ratio. It is one of the main factors which is important to analyze while checking on the performance of the network. The packet delivery ratio obtained using proposed scheme is more than that obtained using existing scheme.

VI. Conclusion and Future Work

The present work has worked upon the existing clustering algorithm ECBR-MWSN (enhanced cluster based routing for mobile wireless sensor networks). It considered three parameters while selecting the cluster heads for the clusters formed in the network. Remaining energy of the nodes and mobility of the nodes has been considered as the primary factor while distance to the base station was considered as the secondary factor while selecting cluster heads. However the proposed scheme required broadcasting on the part of nodes every time round starts. In the proposed work we have tried to select the cluster heads using the concept of initiator nodes but not by base station. The initiator node selects the cluster head for subsequent rounds at the start of the first round only. The existing and proposed scheme were analyzed using the three parameters namely throughput, packet delivery ratio and delay of the network. All the three factors showed better performance using proposed scheme as compared to existing scheme.

In future the proposed scheme can be used to analyze various other parameters such as energy consumption and various parameters such as number of nodes and mobility of the nodes can also varied to analyze the performance of the network. Also genetic optimization can be used while selecting the cluster heads and as far as routing of the data from cluster heads to the base station is concerned the data can be sent using ant colony optimization instead of simple multi hop scenario.

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