Comparative Analysis Of Eecpk-Means And Modified Eecpk-Means Mid-Point Algorithm For Enhancing Network Lifetime In Wsn

Lovepreet Kaur, Sandeep Kad

Abstract: In previous decades, the utilization of wireless sensor networks (WSN) have grown to a great degree. The nodes in wireless sensor systems are worked by batteries. How the restricted vitality utilized adequately is an essential and vital thought about factor, and the plan objective of most WSN protocols. In wireless sensor networks there is one method utilized for the augmentation of the lifecycle of the system and transfer extra efficient operative technique called as clustering to upgrade the power utilization of the sinks, clustering is one among the well-known approaches used by the researchers. The researchers also proposed many different clustering protocols to achieve the desired network operations. In this paper there is an attempt to give a wide comparison of EECPK-means mid-point and Modified EECPK-means mid-point algorithms to enhance network lifetime. Moreover, extracting the strengths and weaknesses of both techniques, providing a comparison among them, including some metrics like throughput, packet delivery ratio and remaining energy.

Index Terms: clustering, wireless sensor networks, sensor nodes, remaining energy, EECPK-means, throughput, PDR (packet delivery ratio).

1 Introduction

A Wireless sensor network is made out of vast number of remote information gatherers and a substantial number of sensors represents the network system{1]. They have sensing, computation, and wireless communications capacities. Principle obligation of these sensor hubs is observing the area, gather data and transfer to a base station. The base station makes accessible the connection between the network and the client[2]. It comprise of enormous number of minimal price, minimal power and multifunctional sensors inserted with short range wireless communication capacity that are established for observing the physical world. Sensor nodes are often called as motes [3]. Every sensor mote generally consists a small CPU, memory, receiver/transmitter radio and a power supply unit. These minute devices have the ability to form a network with a enormous number of hubs in a self-configured arrangement and without a specific infrastructure. Wireless sensor networks (WSNs) are made out of enormous number of sensor hubs [4]. New advancements in sensor technology and wireless transmission generate the nodes sensible. Various advantageous and diverse uses of wireless sensor networks contain applications requesting information gathering in intense, unfriendly atmospheres, climate, and temperature observing recognition of natural or organic agent fears, and healthcare observing [5]. Wireless sensor networks are typically scattered in harsh environments with restricted access to human beings, area like battlefields, forests, and special industrial and clinical fields. Thusly, it is necessary that wireless sensor networks operate in a self-arranged and self governing mode with the ability to form a network in ad hoc scheme [4].

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Wireless sensor network is dynamic which can comprise of different kinds of sensor hubs. The environment is heterogeneous as far as both hardware as well as software. The sensor node creation focuses to minimize cost, increase flexibility, provide fault tolerance. Upgrade development process and preserve power. The structure of sensor node comprises of sensing fault tolerance. unit (sensor and analog digital converter), processing unit (processor and storage), communication unit (transceiver), and power supply unit [4]. The major blocks shown in Fig.2 a brief description of various units is as per following:

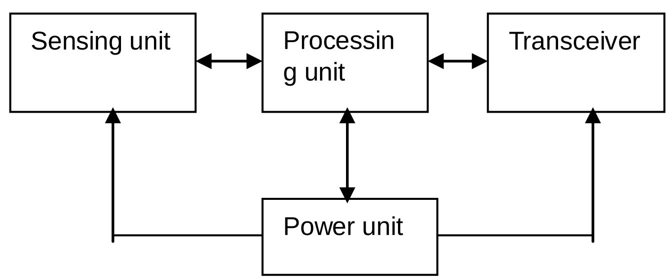

Fig.1.*Basic Building Block of Sensor Node*

Sensing unit: it is made out of gathering of various sorts of sensor which is required for estimation of various occurrence of the physical environment. Sensors are chosen in view of its use. Sensor out is electric signal which is analog. Along these lines, analog-to-digital converter (ADC) is used to convert the signal to digital to communicate with the microcontroller. Processing unit: it comprises of a processor (microcontroller) and storage (RAM). Furthermore it has operating systems as well as timer. The role of the processing unit incorporates gathering information from various sources than processing and storing. Timer is used to do the sequencing for the sequence Communication unit: it utilizes a transceiver which comprises of a transmitter and a receiver. The communication is performed through the communication channels by utilizing the network protocol. In view of the application prerequisites and pertinence in order to communicate it typically utilizes reasonable strategy, for example radio, infrared or optical communication. Power unit: the function of the power unit is to give the power to the sensor hubs for observing the environment at a minimal price and less time. The life of the sensor relies upon the battery or power generator which is associated with power unit. Power unit is needed for the effective utilization of the battery. Since the location of the hubs arranged are typically difficult to reach. Under the constrained energy state of the hub, how the network protocol successfully expands the life of the whole network will be a critical matter while designing a WSN protocol [1]. A sensor node has certain asset resource constraints such as [mite on board battery and a limited communication bandwidth. Rather than the traditional networks, so as to achieve its responsibilities, the sensor networks rely upon dense deployment and appropriate co-ordination .The three fundamental purpose of a sensor network are sensing, communicating and computation. All the three functions require energy, in which communication needs more energy when compared to the other two functions. The energy consumed for transmission is much higher than that for data processing .Hence; there is a requirement for designing appropriate energy efficient communication protocols to increase the lifetime of the network greatly [6].

2 Literature Survey

Chih-Hsien Chien, Ming-Shi Wang[1] proposes a way to improve the energy utilization of the network nodes by adjusting the cluster size while considers the load balancing factor of the network. The main idea is to adjust the cluster size based on the distance between the groups and the base stations.

Gupta.S.,M. Nikhil[5] recommends a different collecting procedure named as Improved Distance Energy based LEACH (IDELEACH) protocol based on energy and distance for homogeneous and heterogeneous WSN. IDE LEACH confirms that nodes which are distant from the sink node will become cluster head only when they have a satisfactory energy for accomplishment this duty. It improves the network lifetime, stable region and quantity of WSN. To make the best use of the network energy, it uses the enduring energy and an expanse built cluster head election scheme.

Ducrocq.T., Mitton.N., Hauspie.M[7]BLAC, a novel Battery-Level Aware Clustering family of schemes. BLAC considers the battery-level combined with another metric to elect the cluster-head. It comes in four variants. The cluster-head role is taken alternately by each node to balance energy consumption. Due to the local nature of the algorithms, keeping the network stable is easier. BLAC aims to maximize the time with all nodes live to satisfy application requirements.

Liu.Q., Zhang.K., Shen.J., Fu.Z., Linge.N[8] a grid-based load-balanced routing method (GLRM) that aims to use a controlled sink to achieve load-balance in a non-uniform distributed network. Cell-header election of each cell is based on three parameters, i.e. the number of data packets that nodes need to relay, the Euclidean distance to the mid-point of cells and residual energy of each node, respectively.

Gong.Y.,Chen.G.,Tan.L [9] balanced serial K-means based clustering protocol (BSK-means) for clustering the sensor nodes. The protocol based on K-means algorithm minimizes the amount of energy for the non-cluster head nodes to transmit their data to the cluster head, by minimizing the total sum of squared distances between all the non-cluster head nodes and the closest cluster centers. BSK means balances each cluster to help in balancing the whole system load on each cluster head. Furthermore, the cluster-heads are selected in terms of two factors, the distance and residual energy.

3 EECPK-Means Mid-Point Algorithm

The size of clusters formed by traditional clustering protocols such as LEACH is unbalanced which means some of clusters will be large and some of them will be small. This usually is result of the random cluster head selection from the eligible sensor nodes. The proposed approach aims at forming the balanced clusters for the sensor network such that load over each of the CH remains balanced. This paper proposes the use of Mid-point algorithm supported by k-means approach to form the clusters in the network. The working principle of our proposed EECPK-means protocol is divided into three phases as follows: Phase 1 will be responsible for initial cluster head selection and will be executed using mid-point algorithm. In this, the distance of each node from the base station will be computed and will be sorted in ascending order. Then, w H9Ohole of the network will be sorted into equal sets where middle point for each set will be taken as centroid. Here the centroid of a cluster is a virtual node locating at the center position of the cluster. Any node, which is nearest to the computed mid-point, will be the cluster head for the cluster. Phase 2 is used for forming the balanced clusters. Every node will join the nearest cluster head selected in the former phase. Once the cluster is formed, the members of the respective clusters are assigned IDs based on their distances from the centroid of the formed cluster. Smaller ID is assigned to one, which is closest to centroid. Phase 3 deals with data transmission from the member nodes to the base station. All the member nodes aggregate their data at the CHs. If distance of any CH is less than threshold value then it will communicate with base station using single hop else it will choose nearest CH to forward data to the sink node. For the CH rotation for the subsequent rounds, the IDs assigned in the phase 2 are used. If energy of any current cluster head goes below threshold value, then the node with subsequent Id will be selected as CH[10]

4 Proposed Approach

The proposed approach aims to optimize the clustering process using modified mid-point algorithm which initially decides the points around which the cluster heads needs to be selected. Suppose the area of the network is M*M sq. units. The modified mid-point algorithm would start with finding the mid-points along the horizontal direction i.e. along the breadth of the network.

$$\text{Mid Point} = (R - 0) / 2.$$

Once the first mid-point is calculated, the second mid-point would extend from R to 2R. The same procedure would be followed along the vertical dimension of the sensing region. Once the mid-points are formulated in the entire network, this will be equivalent to the optimum number of desired clusters required in the network. In the next step, the distance of the nodes from these points would be calculated followed by sorting of these points in accordance with the calculated distances. Once the clusters have been formed, then the ID will be allocated to each node in the cluster according to remaining energy and distance both. So once the clusters are formed and the cluster heads are selected, the process of the data transmission starts from the cluster members sensing the data and aggregating it at the respective cluster heads. The process of cluster head rotation will consider the cluster heads' residual energy. If the residual energy is greater than the threshold value, then the current node will remain as cluster head only else the node with next ID will be selected as cluster head[11].

5 Result And Analysis

For experimentation and implementation the proposed technique is evaluated using NS2.35 tool the evaluation of proposed technique is done on the origin of following parameters such as throughput, packet delivery ratio and remaining energy comparison of existing results and proposed results of modified EECPK-means results i.e. sees Fig.2-6. Also, quantitatively modified EECPK-means approach performs better in terms of almost all the measures as indicated in Table 1.

1. **Packet Delivery Ratio:** This is ratio of number of packets received by the nodes to the number of packets sent by them.

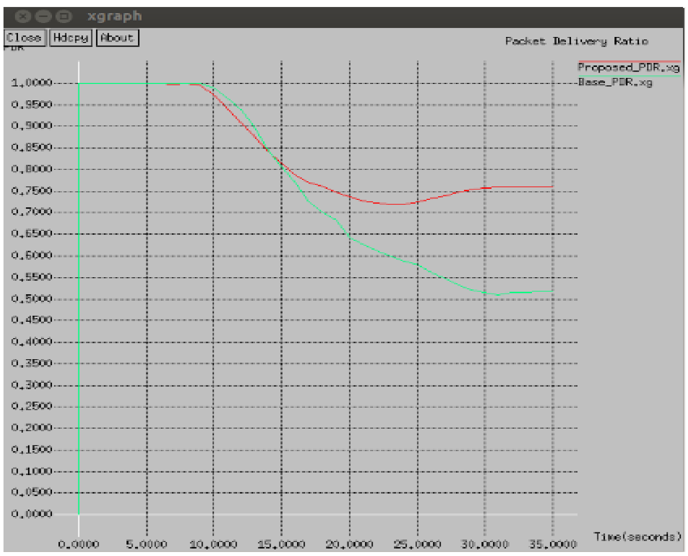

Fig.2. *Comparison of packet delivery ratio (PDR) of modified EECPK-means approach – red to existing EECPK-means technique – green*

Figure.2 represents the percentage of packets received by the nodes in the network. The value of PDR was around 0.75 which illustrates that proposed scheme is more effective than the existing

2. **Remaining energy:** This parameter indicates the lifetime of the network. More is the remaining energy, better is the network's lifetime.

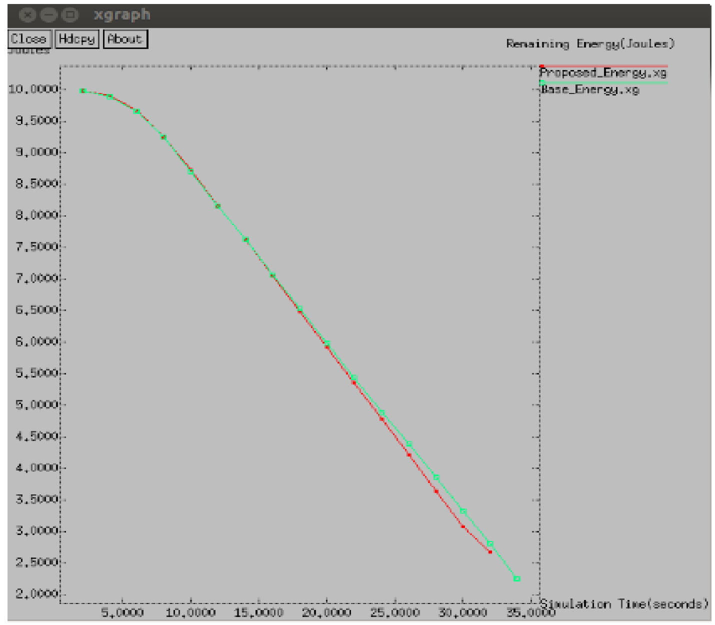

Fig.3. *Comparison of remaining energy of proposed strategy – red to existing EECPK-means technique – green*

Figure 3 shows the variation of remaining energy in the network versus simulation time. Initially, the network was supplied with the initial average energy of 10 Joules and remaining energy at the end of simulation was around 2.78 Joules. Fig.3 illustrates that the energy consumption of existing EECPK-means method is slightly higher than the proposed method. Hence proposed method is performing better than the existing method in case of energy conservation of the system and improving the lifetime of system.

3. **Throughput:** It is defined as amount of data received at the base station from the cluster heads. It is measured in Kbps. Figure 4 illustrates the value of throughput. The amount of data received is approx. 16875 Kbps.

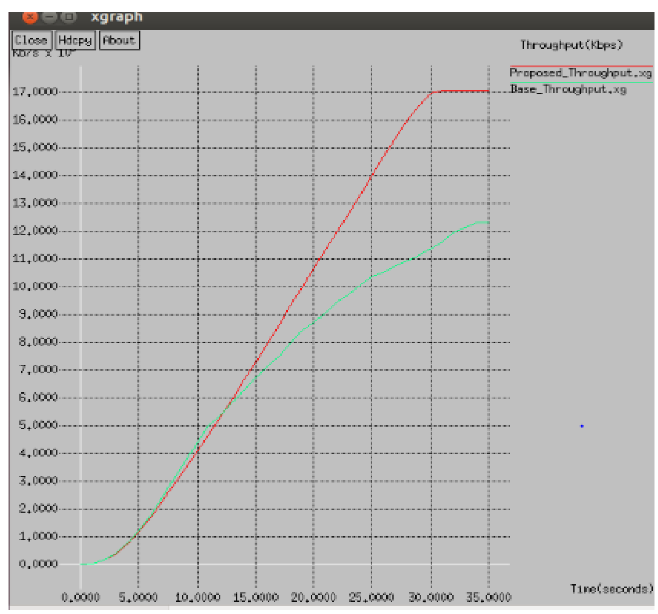

Fig.4. *Comparison of throughput of proposed strategy – red to Existing EECPK-means technique – green*

4. **Number of packets lost:**

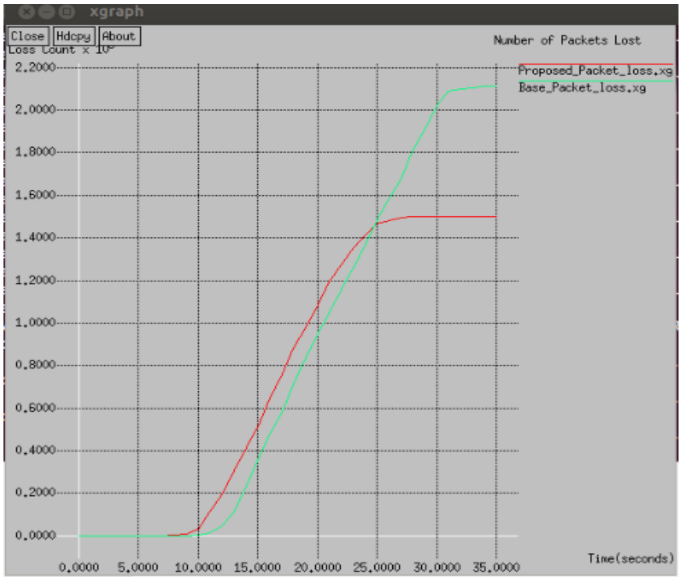

***Fig.5.**Comparison of number of packets lost of proposed strategy – red to existing EECPK-means technique - green*

4 Conclusion

Clustering is one the very effective technique that is been used for enhancing the network life time. The main focus this comparative study is to look at the EECPK-means and Modified EECPK-means and to extract out the cons and pros of both techniques so as to identify that which technique is more efficiently used according to the situation. The proposed scheme form the clusters considering the communication range of the nodes resulted in formation of more number of clusters eventually led to reduction of the cluster size. This furthermore led to reduced load over the cluster head. The graph of Packet Delivery Ratio however, showed a bit downfall. This value can be improved in future by taking into account multi-hop communication between cluster heads and base station

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