

Improved LEACH Protocol using vice Cluster in Wireless Sensor Networks

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ABSTRACT

A sensor network consists of hundreds of sensor node which has similar energy, memory and process capacity. Wireless sensor network is one of the major emerging field comes under the sensor network. These kind of network is having the more challenges because of GPS (Global Positioning System). Clustering mechanism in sensor network under the restrictions of floating nodes, localization and lesser transmission speed. LEACH protocols are considered as the most popular routing protocol, which has better performance and saving the energy consumption. A lot of research on protocol to improve the network lifetime. Each node will alive neighbor node as well as the base station will communication to cluster head. We have defined the cluster head selection base on condition of distance, energy and maximum connectivity level between the nodes. Simulated of the improved LEACH is carried out on MATLAB. By analysis and comparison simulation result. The main objective of the work is to provide the highest throughput and to improve the network lifetime.

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INTRODUCTION

A wireless sensor network is a large network with hundred of thousand nodes. The network consists of several numbers of mobile nodes that communicate with one another without any required infrastructure or central management. The number of sensor node in WSN inn numerous limited resources, so important aim to designing routing protocols of wireless sensor network is to reduce energy dissipated and maximize the lifetime of the network. To control the network, the complete network is divided into sub networks, called clusters and each cluster controlled by centralized cluster head. Wireless sensor network is used for home automation, environmental monitoring, flood detection, forest and fire detection, etc. sensor nodes are collected. All data and send to the sink node that node is known as Base station. The base station sends data to the end user for further processing through interest facility. Increasing lifetime is very important various data aggregation techniques that based on the routing and clustering are proposed to increase the lifetime of the sensor network. The hierarchical routing protocol is more energy efficient routing protocol. Every cluster, single node is considered as cluster head and

non-cluster head, which is treated as a cluster member. Every cluster head, gather data from cluster member and aggregate that data and broadcast this data to the base station through single hop or multi hop. Cluster head has more energy than a cluster member. Numbers of routing protocol have been protocol for wireless sensor network. Few of them are cluster based. There are two most well known hierarchical protocol is LEACH and PEGAGIS. A hierarchical routing protocol designed to reduce energy consumption and aggregate data to reduce transmission to the base station. The Leach protocol is low energy adaptive clustering routing is the first hierarchical cluster based routing protocol. Each node which is partitioned into a cluster, which is called the cluster head. Cluster head is responsible for creating and manipulation a Time division multiple access. Leach protocol provides a significant reduction of overall energy over the other non-clustering protocols. Benefits of clustering architecture include the low power consumption, improved fault tolerance, reduction of congestion. To resolve the problem number of modifications is already done in Leach protocol and numbers of improved leach protocols are present such as the vice cluster leach etc.

The presented work is provided the solution to improve the network lifetime in a cluster network by performing the effective cluster head selection.

This protocol is divided into round and each round consists two phases.

1.1 Setup phase

In this phase, each node will be decide that node will be become the cluster head or not. There are two phases in setup phase. Advertisement phase and cluster setup phase. In advertisement phases, the CHs inform their neighbor node with advertisement packet they become

the cluster head. Non cluster head takes advertisement packet, which is the strongest received signal. The next phase is setup phase the number of member node informs that the CHs become a member to these clusters with 'joint packet'. After cluster setup, the CH knows the number of member node and their IDs. Cluster head received the message through TDMA schedule and pick CSMA code randomly and broadcast the TDMA table to a cluster member after these Steady phases begin.

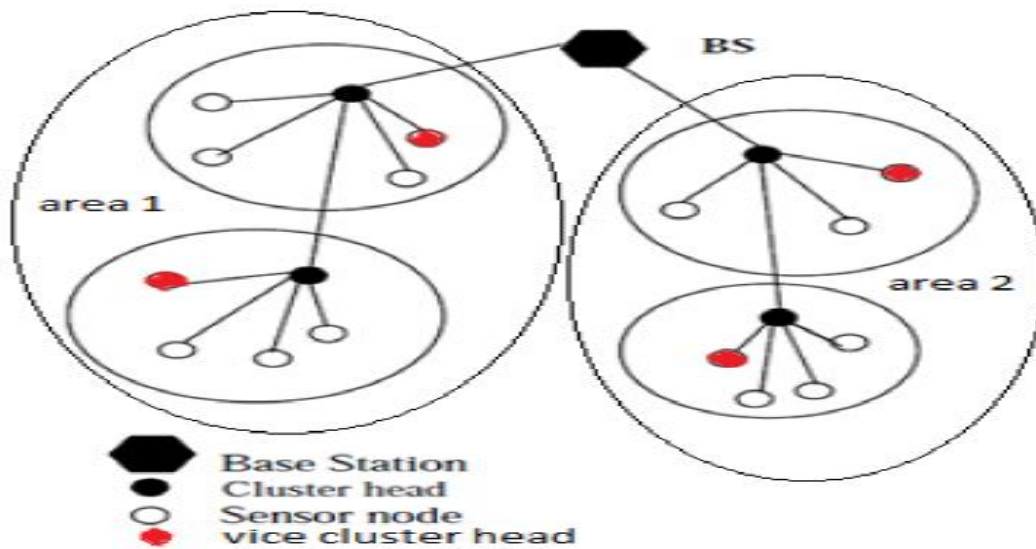


Fig. 1: Node communicate to base station using cluster head and vice cluster

1.2 Steady phase

In these phase sensors nodes can perceptual data and send the data to the cluster head. All non- cluster head nodes can turn off the wireless witch to save emerge before the arrival of the allocation of transmission time. Each cluster head uses different CDMA encodes made to communicate, so as to avoid conflicting with other cluster head.

2. Literature review

M.Bani Yassein performed a work, "Improvement on LEACH Protocol of Wireless Sensor Network" in this paper present new version of leach protocol, which is called VLEACH and aim to reduce energy consumption within the wireless sensor network. In the new version of leach protocol is less energy remaining using V-LEACH is more than remaining network energy using the original LEACH.

Rajashree V.Birdal performed a work, "Classification and Comparing of Routing Protocol in Wireless Sensor Network" this paper tells about sensor network nodes are limited energy supply, communication bandwidth and restricted computational capacity. The sensor node primary designed for monitoring and reporting network events, since they are application dependent, the single routing protocol cannot be efficient for sensor network.

Sensor network holds a lot of promise in applications where gathering sensing information in a remote location is required. A routing protocol for sensor network and also compare and constructed the existing routing protocol.

Razieh Sheikhpous performed a works, "A Cluster chain based Routing Protocol for Balancing Energy Consumption in Wireless Sensor Network" these papers present about energy conservation and maximization of network lifetime are commonly recognized as a key challenge in the design and implemented wireless sensor network. We proposed an Energy Efficiency cluster chain based protocol for wireless sensor network. The ECCP based protocol for wireless sensor network that aim at maximizing the network lifetime and balancing energy consumption among sensor nodes. ECCP improves the data transmission mechanism from the cluster heads to the base station via constructing a chain among the cluster head.

B.JayaLakshmi performed a work, "Maximizing Wireless Sensor Network lifetime through Cluster head selection using hit sets", this paper tells about the network lifetime of WSN as improved through optimizing communication and minimizing energy usage. An initial set of active nodes is identified based on the residual

energy; the list of active nodes is reduced using the hit set.

Asfandyas khan performed a work, 'Maximizing the lifetime of homogeneous Wireless Sensor Network through Energy Efficient Clustering method', in this paper a mechanism to increase the lifetime of homogeneous sensor nodes by controlling long communication, energy balancing and maximizing network lifetime. We divided the whole network into different clusters. Introduce a candidate cluster head node on the basis of node density proposed algorithm for cluster head selection based on residual energy distance reliability and degree of mobility.

Problem formulation and research methodology

3.1 Problem statement

Wireless sensor network is a powered constrained system; node run on limited power batteries which is shortened is lifetime. Cluster head and vice cluster both are similar role such as collect data from member nodes and data aggregation to the BS, but different between CHs and vice-CHs is the CH take responsibility within the earlier stage of the Steady phase, while vice-CHs replace the CHs and work in the later stage of the steady phase. The energy consumption is one of the most crucial design issues in wireless sensor network. By using a clustering technique minimize energy consumed in collecting and disseminating data. Minimizing energy dissipation and maximizing network lifetime are an important issue in the design of work lifetime. When the cluster head dies, that cluster will be become useless because the data will gather by cluster node now that never reach the base station because the cluster head to die.

3.2 Research methodology

The proposed work is about to improve the network lifetime as never the cluster head will dies (cluster head will die and that will be replaced by vice cluster head). Importance of network lifetime under two main factors- maintenance of tracking table for node and selection of cluster head over network.

3.2.1 Algorithm for improving the LEACH protocol

Step 1: Deployed of all initial node in the wireless sensor network will be complete by setting up variety of constant and variable.

Step 2: Periodically the base station will be started as a new round by an incrementing round number.

Step 3: if a node has 0 or negative, then sensor node will be set as lifeless.

Select for sensor node as cluster head

$$T(n) = \begin{cases} \frac{P}{1 - P[r * \text{mod}(1/P)]} & \text{if } n \in G \\ 0 & \text{otherwise,} \end{cases}$$

Step 4: when a node detects a new round it reset its neighbor table and decide whether to become a cluster head, vice cluster head are leaf node.

Step 5: node will be chosen at a present node on based on neighbor node and also choose vice cluster head.

Step 6: cluster head and vice cluster (in case the cluster head node is die) can forward packets for other cluster nodes.

Cluster head and vice cluster head are chosen randomly. When cluster head will be die cluster head will replace by vice cluster head. Therefore increase network time of that network.

Experimental and simulation Result

Improved protocol in term of network lifetime. On basis of Number of dead nodes and number of live nodes comparison with existing protocol and proposed protocol. The result of modification we have done is LEACH is also compared with existing protocol.

Lifetime of network is related to the number of live nodes, the number of dead nodes, and the rate of packet transmission and how long time cluster of nodes is formed in the network. We have taken all these values and find that there are less dead nodes and more alive nodes in the proposed system. Rate of packet transmission is enhanced and due to more alive nodes cluster formation process for a long time, which tends to increase the lifetime of wireless sensor network.

4.1 Simulation tool

MATLAB is a software program that allows you to do data manipulation and visualization, calculation, math and programming. MATLAB is a high level computing language and interactive environment for algorithm development. You can solve technical computing problem faster than traditional programming languages, such as C, C++ and FORTRAN. MATLAB is widely used in application, including signal and image processing, test and measurement, communications, financial modeling and analysis and computational biology. MATLAB is a high performance language for technical computing. Matlab makes use of highly respected algorithm and hence you can be confident about your results. You can build up your own set of function for a particular application.

4.2 Results

The result refers to the measurement of network lifetime. The Figure shows the output existing protocol and modified LEACH protocol.

Table 4.1: Simulation Parameters for LEACH Network in Homogeneous Model

Parameter	Value
Number of Nodes	100
Number of Nodes in deployed in the network	50
Probability of Selection	0.1
Probability for a node to be CH	0.1
Energy Value of Each node (Initial)	0.50 Joules
Transmission Energy	100×10^{-12} Joules
Path Loss Energy	10×0.000000000001 to $0.0013 \times 0.000000000001$ Joules
Packet Size	4000
Control Message Size	32
Data Aggregation or Fusion Energy	5×0.000000001
Topology	Random

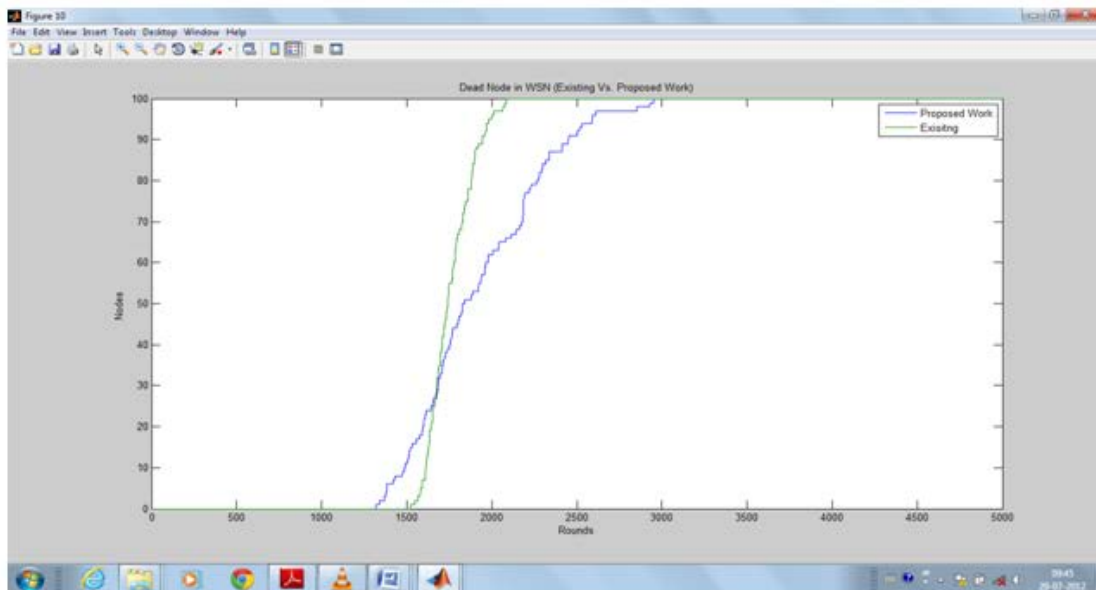


Fig. 2: Dead Nodes in WSN (Existing vs. Proposed work)

We can see after implementing the proposed approach the no. of dead node are less, so network lifetime is increased.

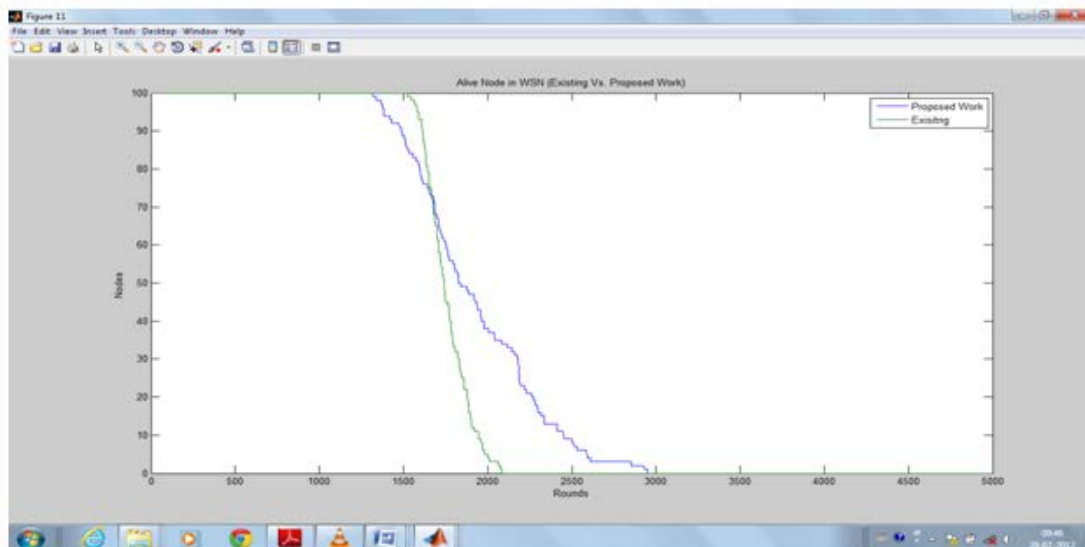


Fig. 3: Alive nodes in WSN (Existing vs proposed work)

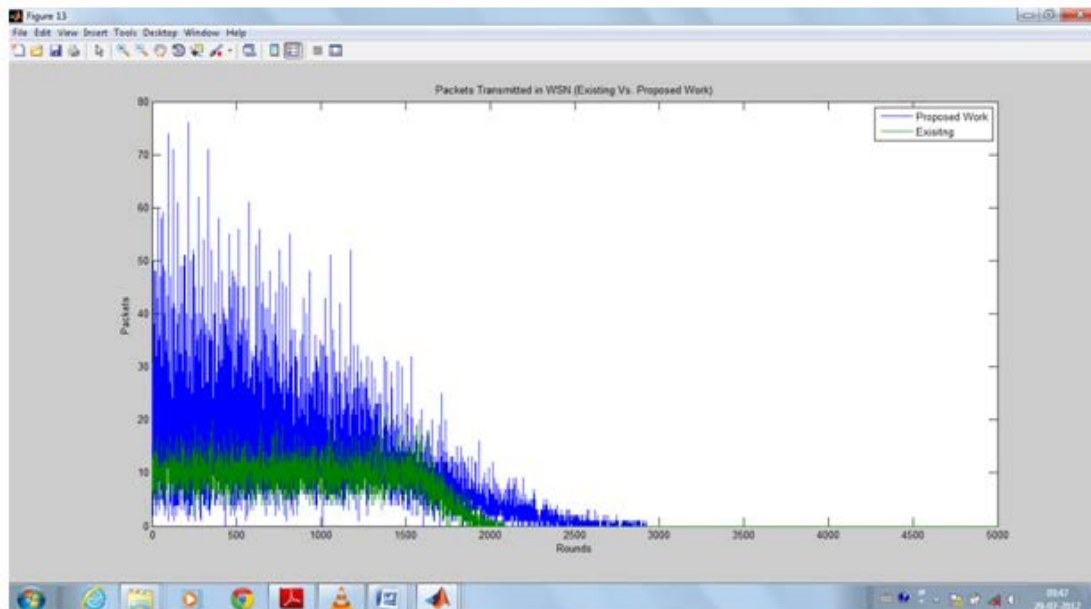


Fig. 5: Packets transmitted in WSN(existing vs Proposed work)

Conclusion

The overall conclusion is that improve LEACH protocol is the best move towards a network with less energy consumption as it involves energy minimizing techniques like multi hop, clustering and data aggregation. This research work has focused to locate the ways to reduce the problem of power utilization. Improved the network lifetime as well as improve the network communication. It is expected that the network will be more reliable and provide the high communication.

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