



S-Node Inclusion in Leach for Energy Conservation in Wireless Sensor Network

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Abstract:

Wireless Sensor Network consists of number of sensors which senses the data or information and forwards it to the base station. So while performing the task of sensing, aggregation and transmission sensors consumes more energy as it assumes to communicate with higher frequency bandwidth. That's why one of the challenging factors is to maximize the network lifetime. To solve this problem we will use the concept of clustering protocol such as LEACH and by controlling the transmission power range and also introducing one special node called as s-node. S-node will act as a transmitter for the cluster and sending the aggregated data to the sink likewise energy will be saved. And the Intra Cluster Energy which is the average energy consumption is reduced.

Keywords: Wireless Sensor Network (WSN), Low-energy adaptive clustering hierarchy (LEACH), Special Node (S-node).

I. INTRODUCTION

Wireless Sensor Network consist of number of sensor nodes connected to each other by wireless network. The main components of each sensor node are sensors, controllers, batteries and radio modem etc. The sensor nodes consist of sensing, data processing and communicating components. These nodes are capable of monitoring physical or environmental conditions, such as temperature, lighting, sound, vibration, pressure, motion or pollutants at different locations. Entire WSN consist of one base station and number of sensor nodes connected to it. Each sensor node senses the data or information, processes on it means it takes the relevant information from it and send that data to the base station. Each sensor node is consisting of five main components; a micro-controller unit, a transceiver unit, a memory unit, a power unit and a sensor unit. Each one of these components is determinant in designing a WSN for deployment.

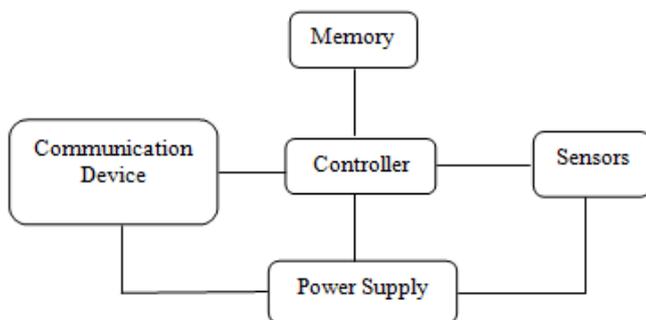


Figure.1. Components in WSN

1. Source function: Each sensor nodes primary role is to gather data from the environment through the various sensors. The data generated from sensing the environment need to be processed and transmitted to nearby sensor nodes for multi-hop delivery to the sink.
2. Router function: In addition to originating data, each sensor node is responsible for relaying the information transmitted by

its neighbors. The low-power communication techniques in WSNs limit the communication range of a node. In a large network, multi-hop communication is required so that nodes relay the information sent by their neighbors to the data collector, i.e., the sink. Accordingly, the sensor node is responsible for receiving the data sent by its neighbors and forwarding these data to one of its neighbors according to the routing decisions. As sensor nodes are all powered by limited capacity battery sources which are difficult to replace or recharge due to inherent nature and types of applications WSN is used for. Therefore energy efficient design of WSN is the challenging factor of it. Energy Efficient Routing protocols is the thing by which we can achieve the energy conservation. Energy Dissipation: Sensors dissipate energy mainly for transmitting and receiving data as compared to data sensing and processing. Energy Waste: Significant energy is wasted with regard to data communications as listed below.

1. Data Collision
2. Data Overhearing
3. Idle Listening
4. Interference
4. Control Packet Overhead

II. RELATED WORK

LEACH is mostly used protocol for clustering algorithm which increases network lifetime. We will see the various clustering protocols along with modification in LEACH. The paper titled "Wireless sensor networks: a survey" by I.F. Akyildiz, W. Su*, Y. Sankarasubramaniam, E. Cayirci. In this paper they describe the concept of sensor network and its applications also the review factors influencing the design and architecture of wireless sensor network algorithm and protocols [1]. The paper titled "Wireless Sensor Networks: A Profound Technology "by Namarta Kapoor, Nitin Bhatia, Sangeet Kumar, Simranjeet Kaur. In this paper they study about various application of wireless sensor network and its routing protocol along with knowledge of simulators available for experimental work of wireless sensor network [2].

The paper titled "Wireless Sensor Networks Issues and Applications" by Rajkumar, Vani B A, Kiran Jadhav, Vidya S. In this paper they provide a survey of wireless sensor networks issues and application wherethe use of such sensor networks has been proposed [3]. The paper titled "Energy Saving in Wireless Sensor Networks" byZahra Rezaei, Shima Mobininejad. In this paper major sources of energy waste such as idle listening, collision, overhearing and control packet overhead are explained. Also it describes the general approaches to energy saving such as duty cycling and Energy E_cient MAC protocols [4]. The paper titled "Low Energy Adaptive Clustering Hierarchy with Deterministic Cluster Head Selection" by M. J. Handy, M. Haase, and D.Timmermann. In this paper it explains about the modifications of LEACH's cluster head selection. That is deterministic CH selection for which only local information is necessary. So that nodes themselves determine whether they become CH or not [5]. The paper titled "The number of neighbors needed for connectivity of wireless networks." by Xue, Feng, and Panganamala R. Kumar. This paper states that large network of nodes will be connected only if each node connects at least $5.1774 \log n$ closest neighbors. So that it will preserve network connectivity after adjusting the transmission power level [6]. The book titled "An Introduction to Wireless Sensor Networks Version 1.8" by Carlo Fischione. This book is explained all the basic and the advanced related concepts about wireless sensor network suchas Architecture, Applications, Challenges, Wireless channels, Routing Protocols and MAC techniques [7]. The paper titled "EMEEDP: Enhanced Multi-hop Energy Efficient Distributed Protocol for Heterogeneous Wireless Sensor Network" by Sunil Kumar¹, Dr. Priya Ranjan². This paper explains about a multi-hop energy efficient clustering algorithm for heterogeneous WSN. The proposed EMEEDP takes the full advantage of computation and power heterogeneity. It improves the CH lifetime resulting increased network lifetime, stability period, throughput and reduce delay of WSN network. Clearly if CH select AN as an intermediary node then CH will save the transmission energy because transmission energy proportional to the distance. If near to BS or CH then only delay will increase. Implemented aWSN to show the working protocols and multi-path communication using Wi-Fi technology. In future work we try to implement WSN using ZigBee stack and WiMAX technology to provide heterogeneity in communication [8]. The paper titled "Energy Conservation Clustering in Wireless Sensor Networks for Increased Life Time" by Madhu Sudan Tinker, Suchismita Chinara. This paper explains about the improvement in LEACH algorithm and proposed a Technique in which they introduced a new special node (S-node) which will reduce the task of cluster head. So the energy will be saved[9].

OUTLOOK

Some Assumptions

1. Base Station is far away from the environment and also sensor nodes and base station are stationary after installation.
2. Data by all nodes are gathered, aggregated and sent to BS.
3. Each sensor node having unique ID and equal energy and processing abilities.
4. Nodes can control their transmission power according to distance to the destination point.

5. One node can find distance between other node based on signal strength and transmitting power of other node.

III. METHODOLOGY

There are 3 phases in this technique as follows:

1. Tune Up phase - Controlling of the node's transmission power levels may result in the loss of network connectivity. So for becoming sure about the network connectivity throughout its life time we have used the result that is proposed by Xue and Kumar in.

They proved that the result given in is not valid for large networks. They state that a large network of n nodes will be asymptotically connected if each node connects to at least $5.1774 \log$ closest neighbors. So we define a degree threshold as $= 5.1774 \log$ that will preserve network connectivity.

App nodes to set their transmission power level to required degree D by method the app-node will send update-msg. Receiving nodes will ack. If count of ack= required degree D then set transmission power level as base power level Else increase power level until required degree D is achieved and will set this as base power level.

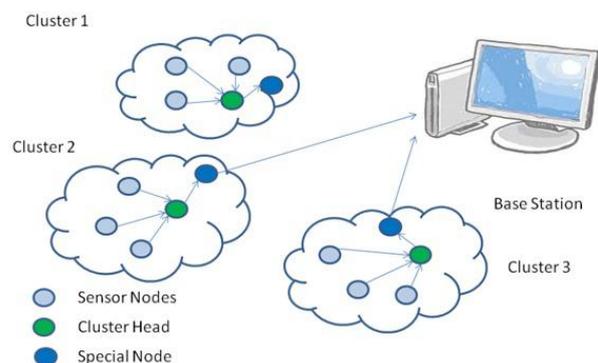


Figure.3. Phases in Proposed Technique

1. Tune Up phase

App nodes to set their transmission power level to required degree D by method –

- The app-node will send update msg.
- Receiving nodes will ack.
- If count of ack= required degree D then set transmission power level as base power level
- Else increase power level until required degree D is achieved & will set this as base power level.

2. Cluster Head & S-node election phase

The app-node will broadcast contention message which consist of their residual energy at their set transmission power.

- Each candidate will compare its residual energy with other app nodes.
- If Candidate energy level is highest then it will elect itself as CH. Candidate with second highest energy will elect itself as s-node.
- The remaining nodes with lower energy will back-off and they will act as normal nodes.

3. Cluster Formation

- Non cluster head nodes will assigned to CHs for cluster formation.
- After electing CH they send CLHD-MSG.
- Normal nodes will acknowledge a CLHD-MSG by NORM-MSG containing its ID to CH.

IV. FLOW MODEL

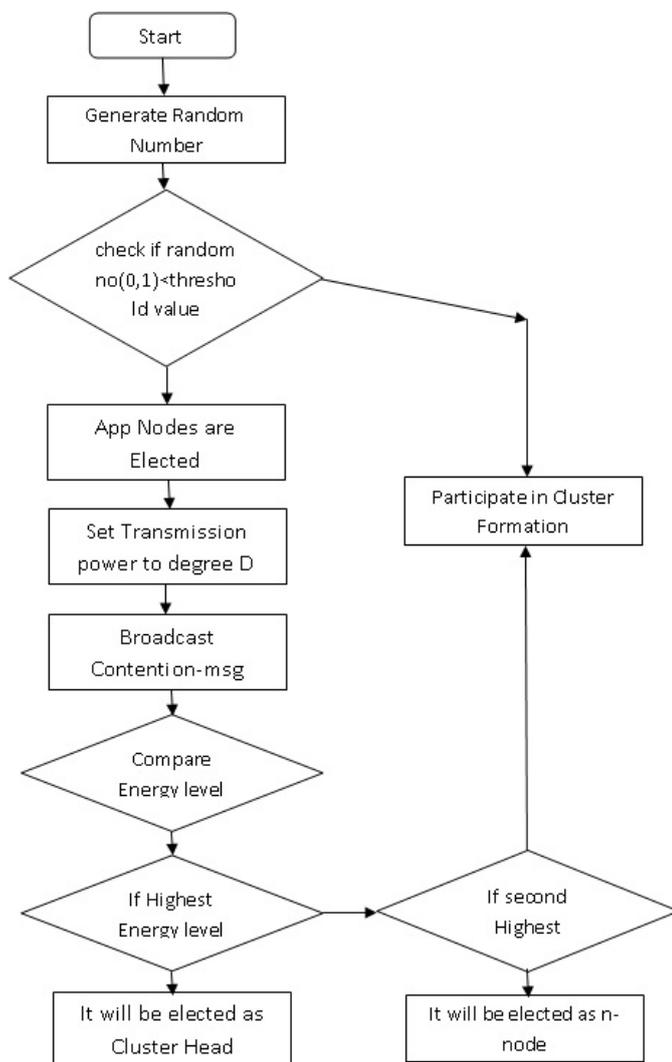


Figure. 2. Flow-Chart Of Algorithm

V. CONCLUSION AND FUTURE SCOPE

A new technique to the improvement of clustering algorithm LEACH is introduced. By controlling the nodes transmission power level. The new concept of s-node is also introduced which is nothing but the special node .This s-node will reduce the task of cluster head by sending the aggregated data to the sink. So in this way the intra cluster energy is saved which will improve the lifetime of network.

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