



Twelfth International Multi-Conference on Information Processing-2016 (IMCIP-2016)

## A Novel Energy Efficient Clustering Mechanism in Wireless Sensor Network

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### Abstract

The area of wireless sensor networks (WSNs) is one of the emerging and fast growing fields in the scientific world. This has brought about developing low cost, low-power and multi-function sensor nodes. However, the major fact that sensor nodes run out of energy quickly has been an issue and many energy efficient routing protocols have been proposed to solve this problem and preserve the longevity of the network. This is the reason why routing techniques in wireless sensor network focus mainly on the accomplishment of power conservation. Most of the recent publications have shown so many protocols mainly designed to minimize energy consumption in sensor networks. This paper proposes a hierarchical routing technique which shows energy efficiency. Our technique selects cluster head with highest residual energy in each communication round of transmission and also takes into account, the shortest distance to the base station from the cluster heads. Simulation results show that hierarchical routing technique with different level of hierarchy prolongs the lifetime of the network compared to other clustering scheme and the energy residual mean value after some communication rounds of simulation increases significantly.

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Peer-review under responsibility of organizing committee of the Organizing Committee of IMCIP-2016

**Keywords:** Clustering; Energy Efficiency; Hierarchical Routing; Network Lifetime; Wireless Sensor Network.

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### 1. Introduction

Wireless Sensor Network (WSN) is an upcoming technology which has a wide range of application including infrastructure protection, industrial sensing and diagnostics, environment monitoring, context-aware computing (for example intelligent home and responsive environment) and so on. This kind of network usually consists of a large number of nodes that bring themselves together to form a wireless network. The components of a WSN are sensor nodes, BS and monitored events (that is, an event that is required to be sensed in the environment)<sup>1</sup>. A typical sensor node is made of four building blocks: power unit, communication unit, processing unit and sensing unit. The sensing component in a node measures certain physical characteristic like temperature or detects soil moisture of a location in which it is placed. The processing component<sup>2</sup> is responsible for collection and processing captured data from its surrounding. The wireless communication component of a sensor node is responsible for transmission or reception of captured data from one sensor node to another node or to an end user through the cluster head to the base station (BS). The sensor node, its processing and communication component requires energy to function as expected, and the power

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component, which is of limited amount, is solely responsible for provision of energy to the three other components<sup>3</sup>. Based on application, the monitored event can either be dynamic or static in its operation.

WSNs<sup>4</sup> are usually deployed in an environment to monitor static or dynamic events. The measurement of static events (such as temperature, humidity etc) is very easy to carry out. On the other hand, dynamic events are typically non-cooperative event is the movement of an unwanted vehicle in a battle field and the movement of whales in the ocean. They are not easy to monitor and they are not stable as they go up and down. Therefore, it is highly difficult to study energy saving schemes for sensing of dynamic event. For example, a forest monitoring application involves static monitoring approach whereas a target tracking application involves a dynamic monitoring approach<sup>5</sup>.

Sensor network requires certain protocol for efficient performance. For instance, protocol can come in form of a specific application with a defined order to aggregate data and optimizing energy consumption. This kind of protocol is referred to as hierarchical routing. Moreover, we have also a data centric routing protocol which describes a network environment whereby a sensor node also relies on data centric approach which performs sensing application to locate route path from multiple sources to a single destination. With this in mind, data from every node in a network can be describe by a list of attribute value pairs called attribute-based addresses, such that a node can expose its availability to the entire sensor network<sup>6</sup> protocols and introduces the energy model employed and analyzes the algorithm of the protocol both in cluster formation and cluster head election. Section 4 shows the validation of the proposed technique and how it is being implemented in MATLAB by showing the simulation result of the protocol both in cluster formation and cluster head election. We also went ahead to simulate the mean and variance residual energy of the proposed protocol and see how it have effect on the energy efficient of the WSN. Section 5 conclude the report and also defines scope of future enhancements is also emphasized. Appendix-shows the mat lab code for the simulation.

## 2. Overview of Routing Techniques

Challenges encountered as a result of constrained energy supply and bandwidth in WSN when managing the network necessitates the need for development of energy awareness protocol at all levels of networking protocol stack. To offer efficient power management in WSN, researches have been focus on areas such as system-level power awareness like radio communication hardware, low duty cycle issues and energy-aware MAC protocols<sup>7,15</sup>. Also, it was observed that the network layer offers a better means through which reliable relaying of data and energy-efficient route setup within a network can help to maximize the network lifetime.

Due to these differences, new protocols are being researched and fashioned to eliminate the problem faced in WSN. These routing protocols have been fashion on sensor nodes characteristics alongside it application and architectural requirement. The various protocols can be classified as location-based, data-centric or hierarchical. Although there are other ones developed based on flow quality.

## 3. Clustering in Wireless Sensor Network

Clustering is a method by which sensor nodes are hierarchically organized on the basis of their relative proximity to each other. Hierarchical (sensor nodes clustering) energy consumption creates an effective and reliable means of routing collected data from the physical environment, through the sensor nodes to the BS. Clustering of sensor nodes helps to compress the routing table such that the discovery mode between sensor nodes is done more easily. Clustering can also conserve communication bandwidth because it limits the scope of inter-cluster interactions to CHs and avoids redundant exchange of messages among sensor nodes. Each sensor node performs a route table look up for the CH in its region and then routes its collected data to the CH. The CH performs a route discovery.

## 4. Energy Saving Schemes in Clustering Technology

### 4.1 Cluster formation and rotation

With the evolving trend in application and management of WSN, clustering provides an efficient means of managing sensor nodes in order to prolong its lifetime. Several clustering formation technique have been develop in the past such

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