Chapter 9
Performance Analysis of Multi-Hop Routing Protocol With Optimized Grid-Based Clustering for Wireless Sensor Network

Saloni Dhiman
Dr. B. R. Ambedkar National Institute of Technology, Jalandhar, India

Deepti Kakkar
https://orcid.org/0000-0002-9681-1291
Dr. B. R. Ambedkar National Institute of Technology, Jalandhar, India

Gurjot Kaur
Dr. B. R. Ambedkar National Institute of Technology, Jalandhar, India

ABSTRACT

Wireless sensor networks (WSNs) consist of several sensor nodes (SNs) that are powered by battery, so their lifetime is limited, which ultimately affects the lifespan and hence performance of the overall networks. Till now many techniques have been developed to solve this problem of WSN. Clustering is among the effective technique used for increasing the network lifespan. In this chapter, analysis of multi-hop routing protocol based on grid clustering with different selection criteria is presented. For analysis, the network is divided into equal-sized grids where each grid corresponds to a cluster and is assigned with a grid head (GH) responsible for collecting data from each SN belonging to respective grid and transferring it to the base station (BS) using multi-hop routing. The performance of the network has been analyzed for different position of BS, different number of grids, and different number of SNs.

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WIRELESS SENSOR NETWORKS

Wireless Sensor Networks (WSNs) have become popular recently, mainly due to the advancements in the Micro-Electro-Mechanical Systems (MEMS) technology that has prompted the improvement in smart sensors. This type of network consists of tiny sensors which are equipped with limited computing and processing resources. Typically, WSNs comprise of huge number of Sensor Nodes (SNs). These SNs are able to communicate with each other or with the Base Station (BS) depending upon the structure and functionality of network. Each SN performs the function of sensing, processing and communication within the network. Information is gathered by SN and transmitted periodically to other SNs or BS. The sensed collected data is transmitted to the BS via intermediate nodes using wireless transmission techniques (S.K. Singh et al. 2017).

Architecture of a Sensor Node

SNs have four basic components: a sensing unit, a processing unit, a transceiver unit and a power unit. Location finding system, a power generator and a mobilizer are its additional components that are application dependent (Akyildiz et al. 2002).

- **Sensing Unit:** Sensing unit usually has two sub-units: Sensors and Analog to Digital Converters (ADCs). Analog signals are obtained by the sensors which are then converted to digital signals by ADC and then given to the processing unit.
- **Processing Unit:** It also has two sub-units: processor and storage unit. It manages the procedures needed for collaboration of SNs with each other to perform required sensing operations.
- **Transceiver:** It is responsible for connecting the SN with each other and to the other parts of the network.
- **Power Unit:** Power unit supplies the energy required by all the board components. The power unit determines the lifetime of the entire network. Energy efficiency is the primary challenge since the battery of the SNs cannot be easily re-charged after the deployment of the SNs.

Other application dependent components of an SN are:

- **Location Finding System:** Position finding system like Global Positioning System (GPS) device helps the nodes to locate other nodes. It is useful in obtaining the location accurately as is required by various routing techniques in sensor networks.
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