

An Intelligent Opportunistic Routing Protocol for Big Data in WSNs

Deep Kumar Bangotra, Department of Higher Education, J&K Govt. Srinagar, India

Yashwant Singh, Central University of Jammu, J&K, Srinagar, India

Arvind Kumar Selwal, Central University of Jammu, J&K, Srinagar, India

ABSTRACT

Opportunistic routing (OR) is an emerging and promising data communication protocol in wireless sensor networks (WSNs). The OR becomes more important when the routing of data is Big Data (BD) generated from multidimensional distributed sensors nodes. The central idea behind OR is overhearing and coordination between relay nodes in the forwarders list and management of multidimensional BD. It uses the salient broadcast feature of the wireless medium for achieving advanced reliability and maximizing the communication range. This article presents the basic concepts of WSN, reviews different OR protocols, and describes the use of different machine learning (ML) techniques in routing BD. Current issues and challenges associated with WSN in general and OR in particular are also presented in this article.

KEYWORDS

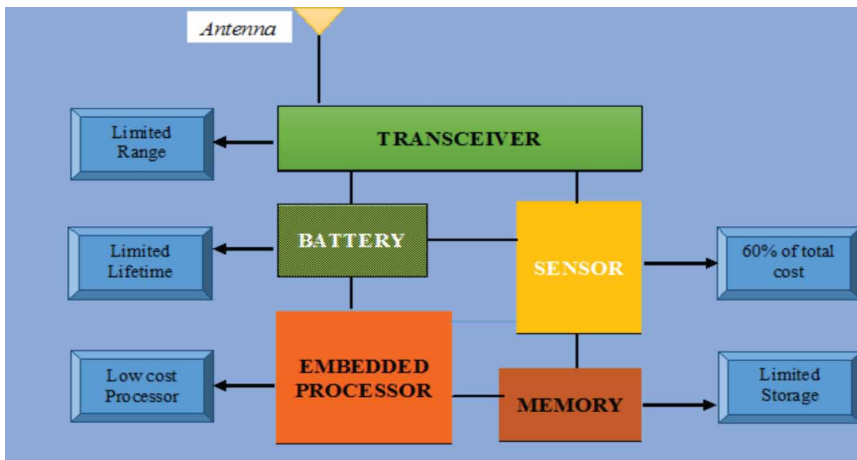
Big Data, Cluster Heads (CH), Coordination Protocol, Machine Learning, Opportunistic Routing, Relay Node, Routing, Wireless Sensor Networks

INTRODUCTION

The WSN are the networks where the necessity of low information rate and low power advancements for a sensor node play a very pivotal role. The WSN are initially spurred by the battlefield surveillance but with the steady progression of technologies in the domain of WSN, their extension and utilization have been cutting-edge in the field of Monitoring of Industrial Processes, Structural Health Monitoring, etc. (Alsheikh, Lin, Niyato, & Tan, 2014). A WSN characteristically comprised of four basic constituents i.e. i) an arrangement of distributed or localized sensors (nodes), ii) a communicating network, iii) a principal point of information gathering and iv) a set of computing resources at the central point (Sohraby, Minoli, & Znati, 2007). Being application focussed is one of the highlights of WSN. Figure 1 represents different components of a sensor node along with unique characteristics of each component. WSN nodes send data from one node to another so that the observed data reaches its destination. The sensor nodes deployed over large area generates the multidimensional huge data continuously that ultimately takes the shape of Big Data. The process of finding suitable path for sending big data from source node to destination node is called routing.

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Figure 1. Sensor node and its components (Devi, Shivaraj, & Manjula, 2014)



Routing of big data in constrained WSN is very challenging due to the inherent characteristics that distinguish these networks from traditional networks like mobile Adhoc networks or cellular networks. All the operations performed by the sensor nodes in the network i.e. acquisition of multidimensional data, communication (routing) and processing have its toll on the energy. The maximum battery power is exhausted during the transmission or communication operation of big data. In WSN, it is the routing operation which demands maximum consumption of resources (Ben, Rajoua, & Ridha, 2018).

The problem of energy consumption in routing big data from source to destination is managed with the use of a special type of routing protocol known as the Opportunistic Routing Protocol. The Opportunistic Routing (OR) is also known as *anypath* routing. It has gained huge importance in the recent years of research in WSN (Hsu, Liu, & Seah, 2011). In OR, best opportunities will be searched to communicate the data packets from source to target (Shruti Pandey, 2017) by taking broadcast feature of the wireless medium into account. The OR protocols proposed recently are still struggling with issues pertaining to energy efficiency and reliable delivery of data packets.

The development of models and algorithms is possible with one of the applications of Artificial Intelligence so that systems learn different rules (Jesus, Casimiro, & Oliveira, 2017). In the recent past, machine learning techniques have seen significant application in resolving network-based challenges (i.e. routing, security, etc.) and application-oriented problems (QoS).

BACKGROUND

WSN offers various solutions to different applications in real life. The use of WSN and design are application specific. This section outlines the routing protocol in WSN and comparative study of opportunistic routing protocol in WSN, specifically machine learning based routing protocols for WSN. As we know that the WSN is energy constraint network, there are some methods (Yan, Zhou, & Ding, 2016) which can be applied in order to save the energy of the sensor network. Energy-efficient routing which deals with finding the routes for data communication from source to destination the most important method for energy is saving. Therefore, it becomes pertinent that an energy-efficient opportunistic routing protocol may be designed that can help in balancing the energy consumption among different nodes in the WSN. Consequently, the protocol which is used for routing packets containing the multidimensional data from the source node to the destination node must be dynamic in nature, so that it can accommodate the changing or versatile nature of the WSN.

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