An Evolutionary Mobility Aware Multi-Objective Hybrid Routing Algorithm for Heterogeneous WSNs

Nandkumar Prabhakar Kulkarni, CTIF, Aalborg University, Aalborg, Denmark
Neeli Rashmi Prasad, CTIF, Aalborg University, Aalborg, Denmark
Ramjee Prasad, CTIF, Aalborg University, Aalborg, Denmark

ABSTRACT

Researchers have faced numerous challenges while designing WSNs and protocols in numerous applications. Amongst all sustaining connectivity and capitalizing on the network lifetime is a serious deliberation. To tackle these two problems, the authors have considered Mobile Wireless Sensor Networks (MWSNs). In this paper, the authors put forward an Evolutionary Mobility aware multi-objective hybrid Routing Protocol for heterogeneous wireless sensor networks (EMRP). EMRP selects the optimal path from source node to sink by means of various metrics such as Average Energy consumption, Control Overhead, Reaction Time, LQI, and HOP Count. The Performance of EMRP when equated with Simple Hybrid Routing Protocol (SHRP) and Dynamic Multi-Objective Routing Algorithm (DyMORA) using parameters such as Average Residual Energy (ARE), Delay and Normalized Routing Load. EMRP improves AES by a factor of 4.93% as related to SHRP and 5.15% as related to DyMORA. EMRP has a 6% lesser delay as compared with DyMORA.

KEYWORDS
Cluster, Control Overhead, DyMORA, Green Routing, Hybrid Routing, LQI, Mobility, MWSN, Reaction Time, SHRP, Wireless Sensor Network

1. INTRODUCTION

A Wireless Sensor Networks (WSNs) consists of a vast quantity of sensors communicating across small distances to achieve a predefined job. The rise of very dense, power constrained, cost-effective and tiny wireless communication sensors have made it possible to spread use of WSNs in a variety of applications. The applications are not limited to sensing, recognizing, and tracking critical information from chemical plants, living plants, nuclear power stations, home automation, health monitoring, Medical Image Fusion and asset tracking system, etc. (Bhateja et al., 2015; Cinque et al., 2012; Kumar and Nagarajan, 2013; Nizar Banu and Andrews, 2015; Pantazis et al., 2013; Yessad et al., 2014). In most of the situations, these sensors are distributed and deployed in hostile environments where the topography, environmental and additional restrictions may obstruct in the placement of wired/conventional networks. Energy efficiency is the utmost significant concern for WSNs as sensor nodes have inadequate batteries. Foremost important design step in any WSN application is to maximize coverage range of embattled province and network life (Pantazis et al., 2013; Sara and Sridharan, 2014; Yessad et al., 2014).

DOI: 10.4018/IJRSDA.2017070102

Copyright © 2017, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.
In many applications, the investigators have presumed that the sensor nodes are immobile and identical. To lengthen the lifetime of the network and to increase consistency, the authors have thought wireless sensor networks of mobile and diverse nodes known as MWSN. Here, mobility means the ability of a sensor node to move liberally to a target region deprived of the need for any unusual arrangement. A mobility of the sensor nodes could be either due to environmental conditions (marine or wind) or due to some transportation means (vehicles, animal, robots). Sometimes the sensor nodes can have self-propelling property (sensor nodes mounted on spring, wheels). Due to movement, the routing process in MWSN has turn out to be more complex as connections in the network can change apathetically. Introducing Mobile Wireless Sensor Networks (MWSNs) has particular advantageous (Sara and Sridharan, 2014)

- MWSN has a dynamic topology that is the requirement of many routing and MAC layer protocol for different applications.
- Routing protocols for MWSNs will not require load balancing.
- Due to hardware failure or energy depletion, WSNs might be partitioned into disjoint sets. Mobile nodes can better control such scarce and disengaged networks.
- A mobility of nodes can reduce energy consumption during communication. Hence, a lifetime of WSNs can be improved using moveable sensor nodes.
- As per the need of the application, desired density of the nodes can be maintained to condense energy holes in the system.
- Node mobility reduces the number of hops on data routes. Shorter data routes lead to increase in throughput and reliability together with decreased energy consumption.

In WSN, many scientists have anticipated numerous routing protocols based on path selection criteria, network formation and a set of guidelines laid for communication. The routing protocols will pick the paths for dispatching data up to target in the “paramount effort delivery” fashion. Here paramount is connected with metrics such as lowermost delay, uppermost throughput, lesser hop count, finest link quality, lowest energy depletion, or capitalize on the lifetime of the system (Pantazis et al., 2013). In these traditional routing algorithms, only limited numbers of nodes are involved in sending data packets from source to the destination while other nodes stay practically idle. Traditional routing algorithms use few parameters and put some conditions or threshold value for routing procedure. Here, the energy of the nodes those engage in the communication process depleted at a very fast rate. These nodes will quickly die out when the energy is completely drained. The dead nodes may cause partition of the network or disconnection of the link. Another drawback of the traditional routing algorithm is that they find the “best” route from source to destination that resembles the minimum or maximum price of a single objective function, which blends all different objectives into one. This type of route optimization is responsible for decision making and gives the perception of the nature of the problem, but typically cannot offer a set of alternative solutions that barter different objectives in contradiction with each other. Through this paper, the authors have made an effort to evade this.

In this paper, the authors have proposed a unique energy competent Heterogeneous multi-objective (O’zdemir, 2013) hybrid routing protocol named EMRP. The prime goal of this research is to achieve energy efficiency and to increase the network lifetime. By multi-objective parameters as (1) Average Energy Consumption (2) Control Overhead (3) Reaction Time (4) LQI (5) HOP Count, EMRP opts for the best route to the sink (Kulkarni et al., 2013, Kulkarni et al., 2014). EMRP uses two-level hierarchical clustering. The authors investigate the impact of energy heterogeneity and movement of nodes on the performance of EMRP. EMRP is energy efficient, and it is comparable with the existing solutions regarding delay and normalized routing load. The paper arranged as below: Section 2 offers a summary of the present routing protocols for heterogeneous WSN. Section 3 describes EMRP. Section 4 contributes with the particulars about the network model. Section 5 explains the routing procedure in EMRP. Section 6 describes the imitation details and results obtained. Section 7 gives details about the summary of the work.
Community Broadband Networks and the Opportunity for E-Government Services

www.igi-global.com/chapter/community-broadband-networks-and-the-opportunity-for-e-government-services/184065?camid=4v1a

Twitter Intention Classification Using Bayes Approach for Cricket Test Match Played Between India and South Africa 2015

www.igi-global.com/article/twitter-intention-classification-using-bayes-approach-for-cricket-test-match-played-between-india-and-south-africa-2015/178162?camid=4v1a