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ScienceDirect

Procedia Computer Science 78 (2016) 431 – 438

Procedia Computer Science

International Conference on Information Security & Privacy (ICISP2015), 11-12 December 2015, Nagpur, INDIA

A Review over Genetic Algorithm and Application of Wireless Network Systems

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Abstract

Tele-communication and network industry are becoming extremely fascinated by the use of evolutionary smart sensor nodes in wireless sensor networks. This technology promises to overcome several challenges within WSNs needed for real time data protection via optimization technique: Genetic Algorithm. This paper reviewedthe use of Genetic Algorithms (GAs) to solve certain limitation of wireless sensor networks. It further presents major application areas of wireless sensors networks. Longerdistance gap between a sensor and destination in a sensor network can remarkably reduce the energy of sensors and can degrade the life of a network. GA can prolong the network lifetime by minimizing the total communication distance.

Peer-review under responsibility of organizing committee of the ICISP2015

*Keywords:*Wireless sensor network, Genetic algorithm, Sensor nodes, Internet

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Peer-review under responsibility of organizing committee of the ICISP2015
doi:10.1016/j.procs.2016.02.085

1. Introduction

Variation of applications from small home environment to large habitat monitoring has made Wireless Sensors Networks (WSNs) more popular nowadays. With the recent advancement in micro-electro-mechanical systems (MEMS), wireless communication and digital electronics, Wireless Sensors Networks (WSNs) is becoming more popular and give rise to development of smart sensors nodes.Node placement, network coverage, clustering, data aggregation and routing are general operational stages of Wireless Sensor Networks. Node placement is a compulsory stage before establishment of Wireless Sensor Networks. Types of nodes layout depends upon the application. Depending upon the coverage area, layout and connection of sensors within the network must be done in an effective manner to achieve optimum utilization of energy and financial resources. In optimization of WSNs, clustering is another important stage. By clustering, division cluster each having cluster head is formed. Cluster head collects data from the nodes and forward data either to the other clusters for further operations or directly to the sink to reduce communication heading. There may be one or more sink nodes (Base stations) too in a wireless sensors network to accumulate information and pass it to a central processing unit and storage system. Multiple sinks help in minimizing worse case delay for message transfer. Thus, clustering is better approach for load attenuation within the networks. Moreover, it is better approach to save energy and increase sensor's lifetime in network. This also provides improved data security, less unused data and better scalability. While aggregating valuable data are collected from the sensors and those data are forwarded to the base stations. Data latency and residual energy balance among the nodes are two important factors to be considered in this period.

In Wireless Sensor Networks, smart nodes collaborate with each other and perform specific sensing task in an existing environment. The smart nodes have one or more sensors depending upon circumstances to sense the data within the application area. Nodes of Wireless Sensors Networks are smaller in size, cheap, robust and consume low power as compared to traditional sensors. Since the sensors are deployed in difficult location a radio can be used to transfer data to the base station. In a sensor node a rechargeable battery is used for power supply. Solar cell can be another option for chargeable power source. So, optimum energy utilization is one of the factors to be considered during WSNs design. To complete certain tasks right and reliable sensors, computational unit, adequate memory and optimum communication prerequisites are mandatory in a sensor node. Generally, a smart sensor node consists of one or more sensor elements, a battery, a memory and embedded processor unit and transceiver. A node might comprise of secondary application dependent components like a mobilizer, a power generator or a position detecting system. Sensors and analog to digital converter (ADC) are main components of sensing units. Signals converted by ADC are received by the processing units. Then the processor manages and executes further sensing tasks. For storing data flash memories can be used to reduce cost factor. Transceiver is used to transmit and receive data. Deployment of sensor nodes is shown in fig [1]. The information is sensed, measured and collected from the environment by the smart sensor node and finally through internet passed to the user. Depending on the architecture and complexityof WSNs, many protocols are proposed to meet different application requirement. Since there are relatively small numbers of sensor nodes, global addressing into WSNs is not needed. So, conventional IP-based protocols will not be applicable to WSNs. Similarly self-organization, lifetime, energy limitation, processing, storage and limited bandwidth are other challenging factors to be considered during the deployment of WSNs. Many algorithms have been proposed to address above mentioned problems.In [7], based on technical survey of the operational stages of WSNs limitations were pointed out. Ideal parameters of the networks with optimum efficiency were achieved based on result of simulation in NS, MATLAB and JPAC using Genetic Algorithm. In [20],Heinzelman proposed adaptive protocols called Sensor Protocols for Information via Negotiation (SPIN) that circulates all the information at each node to every node in the network assuming all other nodes within the network are capable base-stations. Though wireless Sensor Networks are very promising technology for various futuristic applications these are not devoid of security threats. Data security is one of the main challenges in WSNs. Techniques like data encryption-decryption (cryptography), steganography (image protection), and physical layer secure access by means of frequency hopping are some of the approaches for secure transmission in WSNs [25].In [31], Babamir and Norouzi presented signcryption method to maximize data security in a type of wireless medical network. Similarly in their next paper they proposed new secure process to provide confidentiality, authentication and integrity. This technique efficiently improves data protection, verification and recovery within the networks.