A dynamic routing algorithm for software defined wireless sensor network

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Abstract:

wireless sensor networks is a network that is collection of many sensors nodes, there are many types of significant research going on WSN in which there is very important role of this algorithm that is software defined wireless sensor network which can be reconfigured even after deployment. In this research paper we will discuss about the very important routing protocol that is energy efficient and known as software defined wireless sensor network. In this algorithm the main aim is to make the network to be functional and control nodes are used to assign the different tasks dynamically. To provide the control in selected nodes a NP hard problem is formulated in this algorithm.

Index terms: *coverage problem, detecting holes, wireless sensor network, patching holes*

Introduction:

The emergence of big data and cloud technology has drive a fast development of wireless sensor networks (WSNs) [1– 4]. A sensor node is normally comprised of one or more sensor units, a power supply unit, a data processing unit, data storage, and a data transmission unit [5]. A wireless sensor network is a collection of wireless nodes with limited energy that may be mobile or stationary and are located randomly in a dynamically changing environment. The characteristics of low-cost, low-power, and multifunctional sensor have attracted a great deal of research attention, in that sensor nodes can perform intelligent cooperative tasks under stringent constrains in terms of energy and computational resources. However, most previous research work only considers the scenario where a WSN is dedicated to a single sensing task, and such application-specific WSN is prone to high deployment costs, low service reutilization and difficult hardware recycling [7]. SDWSNs are emerging as a compelling solution to tackle the above issues. A software-defined sensor node equipped with several different types of sensors is able to undertake a variety of sensing tasks according to deployed and activated programs. In recent years, especially due to the advent of forthcoming 5G networks [8–11], a number of prototypes have been practically implemented. SDWSNs enable programmable control in network and virtualization of network equipment by decoupling the control plane and data plane [12]. In SDWSNs, control intelligence is taken out from data plane devices and implemented in a logically centralized controller (network operating system, however can be formed by distributed clusters), which interacts with data plane devices through standard interfaces. Network operators run software programs on the controller to automatically manage data plane devices and optimize network resource usage [13]. This architecture enables up-to-date control schemes to be developed and deployed so as to enable new smart sensing services, making simplified network management in WSNs, which makes the future of SDWSNs bright [14]. However, to realize the aforementioned advantages of SDWSNs is not without challenges [15]. In a sensor network, each node acts as both a sensor and router, with limited computing and communications capabilities, and storage capacity. However, in many WSN applications, the deployment of sensor nodes is performed in harsh environments, which makes sensor replacement difficult and expensive [16–18]. Thus we can say that in many schemes the wireless nodes must operate without battery replacement for a long period of time. Therefore, the energy constraint is vital for the design of WSNs [19] and SDWSNs. In an SDWSN, although different virtual networks can work together on top of the same physical infrastructure, the centralized control plane may lead to high energy costs due to this phenomenon an information collection to reach a global view and multiple virtual networks may compete for common physical network resources. Consequently, source utilization of the SDWSN also needs to be carefully designed. In this research work we propose SDWSN as illustrated in Fig. 1, which consists a server that is control the sensor of a sensor and a set of software-defined sensor nodes. The large scale of deployed nodes that are equipped with multi-functions are able to execute multi-tasks simultaneously.

WSN routing algorithm

Routing is important in the WSN in determining the optimum routing paths of data packets, and there have been a great number of popular routing algorithms for the WSN. Ad hoc On-demand Distant Vector (AODV) [25] was proposed in 1999, and became an IETE standard. It is a routing algorithm in consideration of the distance between the nodes. Its quick adaption to link conditions, low memory usage and low network utilization make the ADOV algorithm popular. However, the number of flooding messages increases significantly thanks to the increasing routing request messages. Clustering protocols can provide the benefit in data collection through efficient network organization. Low-energy adaptive clustering hierarchy (LEACH) [26] is one of the most well-known WSN hierarchical routing algorithms, which selects the cluster headers (CHs) based on a predetermined probability in order to rotate the CH role among the sensor nodes and to avoid fast depletion of the CH's energy. LEACH operates in two phases, i.e., the cluster setup phase and the steady phase. In the cluster setup phase, the cluster heads are selected and then broadcast to other nodes.

We define the energy information as the fitness function f1, which is the ratio of the control nodes' average residual energy to the common nodes' average residual energy in the current round. As a result, maximizing f1 means that the nodes with higher energy should be selected as control nodes. The average node residual energy can be expressed as

$$E_{\substack{\text{Sensor}\\ \text{node}}} = \sum_{i=1}^{N} E_i^{res} / |N|$$

Where Eres i is the node residual energy, and N is the number of nodes. We define Eres i as the average residual energy of common nodes, and Eres j as the average residual energy of control nodes.

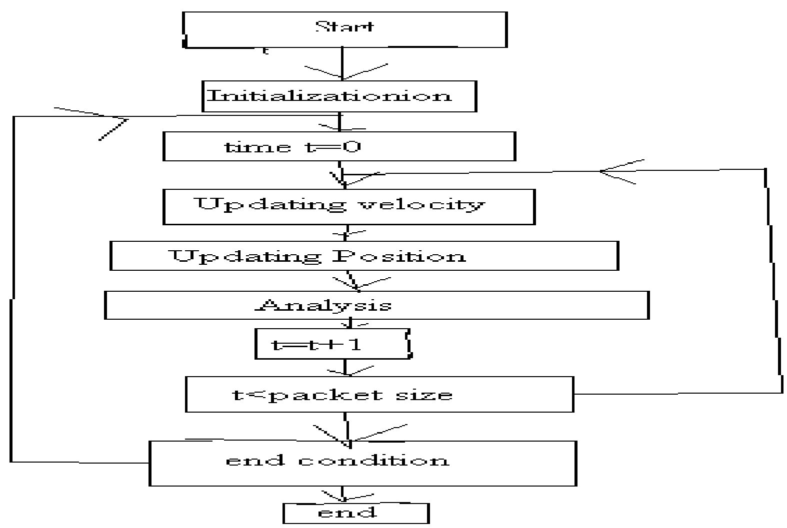

Fig. 1. Flowchart of the PSO algorithms

Result:

A dynamic algorithm for software defined in wireless sensor network we have used the MATLAB software to define the fitness value of sensing nodes, alive nodes and deployment of nodes in the network. Here we have used the 1500 iteration to analyse the result.

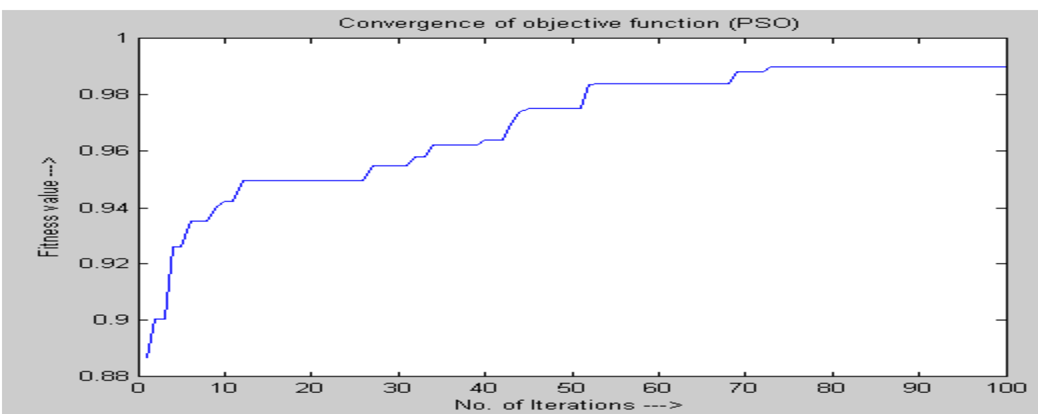

Fig.2 Deployment of nodes on the network

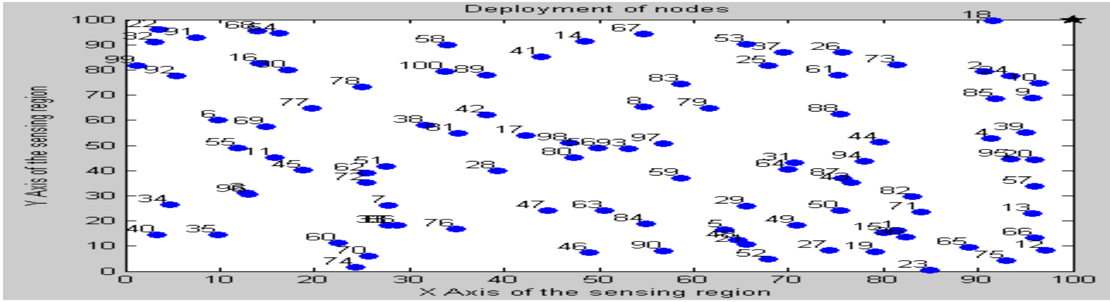

Fig.3 Alive nodes in the network

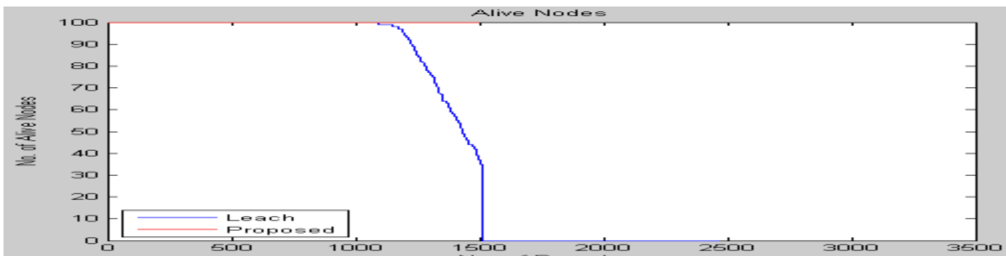

Fig.4 Convergence of objective function

Conclusion:

In this paper, we presented a new energy-efficient routing algorithm for the software-defined wireless sensor networks. In our routing algorithm, the control nodes are assigned different tasks dynamically. Meanwhile, we utilize non-linear weight particle swarm optimization algorithm to create a cluster structure so as to minimize the transmission distance and tooptimize the energy consumption of the network. Simulation results suggest that the proposed protocol is capable of prolonging the network lifetime.

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