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Intelligent Wireless Sensor Network Management Based on a Multi-Agent System

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***Abstract*—The main goal of wireless sensor networks (WSN) is to gather data from their environment. This gathering should take into consideration the life of the battery of each sensor node to maintain the continuity of the network. The technology of multi-agent system (MAS) can be adopted in large scale WSN for reliable wireless communication with high energy efficiency. In this paper, we propose a scheme for data collection based MAS for sensor networks based on clustering with the use of a mobile agent to collect data according to a routing scheme. The main idea is to assign nodes to the data processing function rather than providing data to the base station (Sink). For this, an agent is introduced into each node of the network to process data locally and to judge their importance to remove any irrelevant redundant data. Then, the nodes are clustered together, each consisting of a Cluster-Head. The latter will then determine a scheme for the nodes belonging to the same group, using the Local Closest First (LCF) algorithm. In addition, for the agents (nodes) in a cluster cooperate to eliminate inter-node data, we propose a mobile agent (MA) sent by the Sink to collect data between the cluster nodes according to the LCF itinerary. Successive simulations in large-scale WSN with different densities show the capacity of the proposed collecting regime to extend the lifetime of the network in terms of energy consumption and the rate of packet delivery.**

***Index Terms*—Wireless Sensor Network, Data Aggregation, Multi-Agent Systems, Energy and Communication**

I. INTRODUCTION

ADVANCED and integrated technologies in the field of wireless networks, micro-fabrication and integration of microprocessors have created a new generation of wireless sensor networks (WSN) adapted to a varied range of applications.

A WSN consists of a set of nodes that can collect data from a monitored environment and transmit it to a base station (Sink) via a wireless medium. The WSN are often characterized by a dense and large-scale deployment in environments with limited resources. The constraints are the limited processing, storage and energy capacity especially that they are usually powered by batteries. The size constraint of a sensor node requires designers to limit the size of the battery and therefore the amount of energy available. Replacing a battery is rarely possible, for reasons of cost or constraints due to the environment. Therefore, management of energy consumption during operation of the nodes is vital for the network.

Hence, unlike traditional networks concerned with ensuring a good quality of service, the WSN should give importance to the energy conservation. It is widely recognized that energy limitation is an unavoidable issue in the design of WSN because it imposes strict constraints on network operations. In fact, energy consumption of sensor nodes is determinant in the lifetime of the network, which has become the dominant performance criterion in this area. If we want the network to operate satisfactorily, and as long as possible, the energy constraints require a compromise between different activities at both the node and network levels.

Several research studies have emerged with one objective: to optimize the energy consumption of nodes using innovative conservation techniques to improve network performance, including the maximization of its life. In general, energy conservation is ultimately to find the best compromise between the various energy-consuming activities. The field-related literature recognizes that the WSN data transmission is a prominent consumer of energy, because the majority of works stretched to techniques for the reduction of energy consumption due to data transmission.

One method for minimizing energy consumption is the Cluster technique; it is used to partition the network into groups with a Cluster-Head (CH) for each. It supports data exchange with the base station, by receiving the data collected from all nodes in their cluster and sending them to the Sink.

During the last decade, the multi-agent systems (MAS) have blossomed and are applied to various fields such as simulation and artificial life, robotics, image processing. MASs are integrated into the WSN, because of their intelligence and adaptation to the field. Ant colonies,