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Energy Efficient Data Routing Protocol Design And Lossless Data Aggregation in Wireless Sensor Networks

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Abstract: Wireless Sensor Networks are becoming more and more popular as cost of sensor gets cheaper. A wireless sensor device is a battery-operated device, capable of sensing physical quantities or environmental conditions. They become more and more important for applications like security, traffic monitoring, agriculture, battlefield surveillance, and also used to measure air pressure, temperature, acceleration, etc. Sensors in networks are responsible for four major tasks: data aggregation, sending and receiving data, and in-network data processing. The sensor nodes communicate together by routing protocols. Many routing protocols, data dissemination protocols and power management protocols have been specifically designed for WSNs where energy conservation is an important design issue to increase the lifetime of networks. The reliable routing of packets from sensor node to base station is the important task for the network. Redundant data can increase the size of message. This Increase communication cost, energy consumption and decrease the lifetime. In response to this challenge, over the last few years there have been increasing efforts to minimize energy consumption via new algorithms and techniques in different layers of the WSN, including the hardware layer (i.e. sensing, processing, and transmission), network layer (i.e. Protocols, routing) and application layer. Data aggregation by clustering is an important method to reduce the energy consumption of sensor nodes and improve the bandwidth utilization. The selection of particular routing protocols in network layer depends on the application and network architecture. Much research focuses on a single aspect of WSNs, In this project an energy driven architecture is designed for minimizing the total energy consumption and lossless data aggregation by clustering using Particle swarm optimization and results are compared with existing algorithms.

Index Terms - WSNs, Data Routing, Routing Protocol , Fuzzy Clustering, PSO.

I. INTRODUCTION

Wireless Sensor Networks (WSNs) are becoming more popular as cost of sensor gets cheaper. WSNs consists of a large number of nodes called as sensors or motes. A sensor device is one type of transducer which uses energy, a signal of some sort, and converts it into a reading for the purpose of information transfer. A wireless sensor device is a battery-operated device, which is capable of sensing physical and environmental, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a Base Station(BS). In addition to sensing, sensor nodes are capable of data storage, limited amount of computation, wireless communication and signal processing. Advances in integrated circuit design are continually shrinking the size, weight and cost of sensor devices, improving their resolution and accuracy. Most of those sensors are battery operated device so the lifespan sensor is determined by how fast the sensor consumes energy and distance between node and base station . Sensors use energy to run circuitry and sending and receiving radio signals. The more modern networks are bi-directional and they control the sensor activity. The development of WSNs was motivated by military applications such as battlefield surveillance. Today such networks are used in many applications, such as industrial process monitoring and control, machine health monitoring, area monitoring, volcano monitoring, health care monitoring, air pollution monitoring, forest fire detection, landslide detection, water quality monitoring, agriculture and so on. WSNs are data driven networks in which data is process using different routing techniques. The data transformation consume energy. Sensor nodes may generate redundant data which increase the size of message. This Increase communication cost, energy consumption and decrease the lifetime of sensor

networks. The energy consumption is reduced by aggregating redundant data at some specific node and routing data using energy efficient routing protocols. Figure shows the diagram of communication architecture of wireless sensor network.

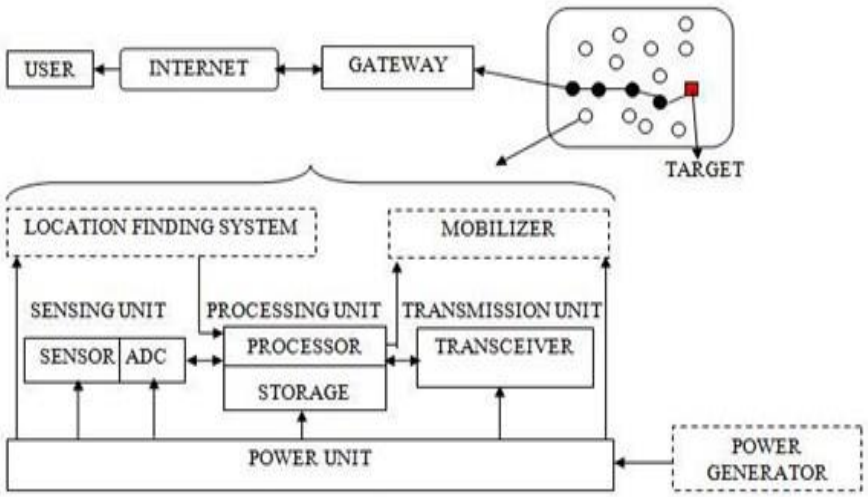

Figure : Communication architecture of a WSN

Sensing Unit: It is made up of two parts Sensor and Analog to Digital Convertor. The sensor sense data in analog signal form , ADC convert this data into digital signal and forward to Processing Unit.

Processing Unit: Processing Unit have two parts Processor and Storage (Memory) . Processor is an electronic circuit for interfacing with the sensors and power unit (energy source), usually a battery or an embedded form of energy harvesting. Storage is used for storing processed or un- processed data.

Transceiver: It connects the node to the network using radio frequency. A transceiver uses an internal antenna or an external antenna to communicate with other nodes.

Power Unit: Include battery or solar cell. A sensor node have limited power source.

Location finding system: It is application dependent and required because most of the sensor network routing techniques and sensing tasks require location for high accuracy. i.e. GPS.

Mobilizer: It is needed to move sensor nodes depending on network requirement.

II. LITERATURE REVIEW

1. HISTORY

Wireless Sensor networks are used in non-accessible as well as accessible environments. WSNs are used in many accessible environment such as industrial and consumer applications for industrial process monitoring and control, machine health monitoring, Hospital health care system and so on. Large WSNs are created to cover large geographical area , as the number of nodes increases the number of messages also increased causing increase in communication cost and energy consumption due to redundant data collection by sensor nodes. The main problem in WSNs is that sensor is battery oriented device and need some energy for sensing , computing and transforming message. Changing, charging or replacing battery is impossible in some application. so saving energy utilization by sensor and network is the only solution . If node failure occurs then the information may lost. So it is necessary to find optimal route for data transfer from sensor node to BS without loss of information. Therefore, need of developing energy efficient routing protocols which provide optimal path from source to destination and consume less power so that the lifetime of network increase and reduce data loss.

Traditional analytical optimization techniques require many computational efforts, which grow exponentially as the problem size increases. Bio-inspired optimization methods are alternatives to analytical methods. Bio-inspired optimization approaches are based on the principles of biological systems. There are different bio-inspired optimization techniques based on their development, intention, performance and application. Particle swarm optimization (PSO) is one of the bio-inspired optimization algorithms widely used because of its ease of implementation, high quality of solution and quick convergence.

2. RELATED WORK

The existing system is a two-tier distributed fuzzy logic based protocol to improve efficiency of data aggregation operations in multi-hop wireless sensor networks (WSNs).In a clustered network, member (leaf) nodes transmit obtained data to cluster-heads (CHs) and CHs relay received packets to the base station. In multi-hop wireless networks, this CH-generated transmission occurs over other CHs. Due to the adoption of a multi-hop topology, hotspots and/or energy-hole problems may arise. In this author propose a Two-Tier Distributed Fuzzy Logic Based Protocol (TTDFP) to extend the lifespan of multi-hop WSNs. The first tier of TTDFP is fuzzy clustering. In the second tier routing performance is increased.

III.FRAMEWORK

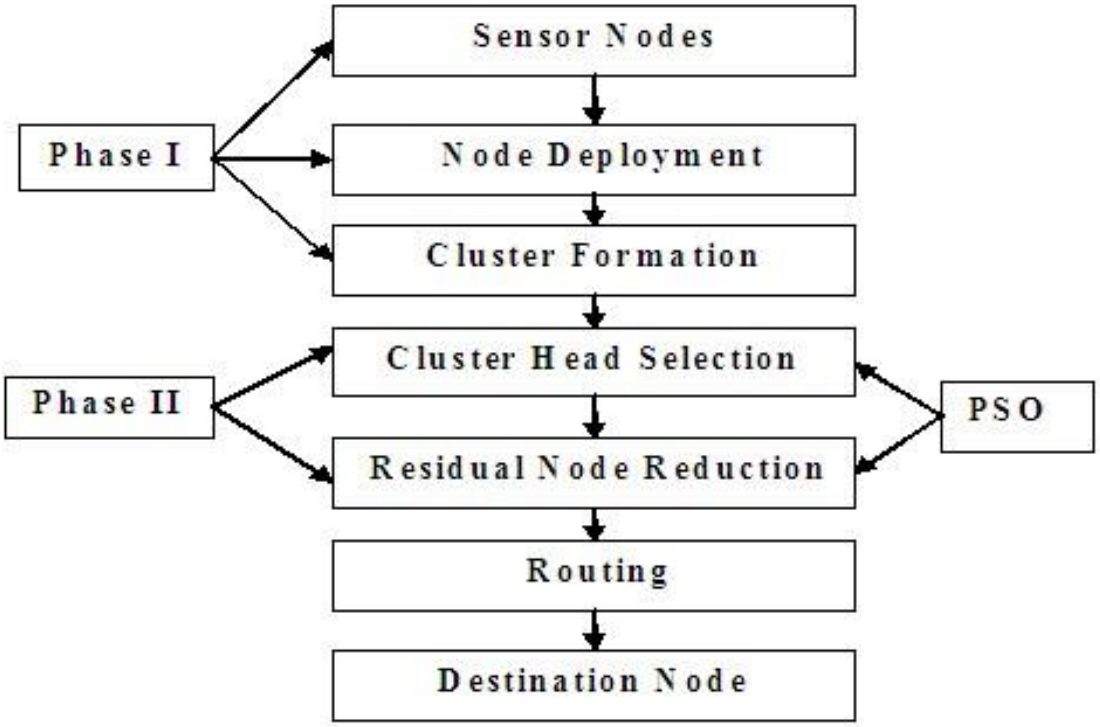

Figure : Steps of the proposed method.

Nodes are distributed in the environment and there is no access to replace batteries. Therefore, providing an algorithm to reduce energy consumption is a great major challenge. Fuzzy clustering is used to join sensors in the network and the particle swarm optimization algorithm (PSO) is used to estimate the initial value of cluster heads. Then, evaluation of proposed method by Net beans simulator. The proposed algorithm is compared with two-tier distributed fuzzy logic based protocol TTDFP which is investigated by energy consumption, Packet Delivery Ratio (PDR) and network throughput. In this research, fuzzy clustering and PSO is proposed to improve energy consumption for routing based on cluster heads. There are different algorithms for clustering. Fuzzy clustering is one of the best method to cluster.

IV.CONCLUSION

The energy consumption is reduced by aggregating redundant data at some specific node and routing data using energy efficient routing protocols Growing demand for WSN motivate the research and development of routing protocols used in WSNs. Sensor nodes may generate redundant data which increase the size of message. This Increase communication cost, energy consumption and decrease the lifetime of sensor networks. The energy consumption is reduced by aggregating redundant data at some specific node and routing data using energy efficient routing protocols.

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