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Power Resourceful Routing for Wireless Sensor Networks (WSN)

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Abstract

Wireless sensor network (WSN) refers to a group of spatially dispersed and dedicated sensors for monitoring and recording the physical conditions of the environment and organizing the collected data at a central location. A WSN consists of few hundreds to thousand sensor nodes. There is one limitation of wireless sensor nodes that they have limited energy resource. So instead of maximizing the lifetime of sensor nodes, we can distribute the energy dissipated throughout the WSN to minimize the maintenance and maximize the overall system performance. So here we study the energy efficient routing algorithms for WSNs.

Keywords: WSN, routing, sensor node.

I. Introduction

Wireless sensor network (WSN) refers to a group of spatially dispersed and dedicated sensors for monitoring and recording the physical conditions of the environment and organizing the collected data at a central location. WSNs measure environmental conditions like temperature, sound, pollution levels, humidity, wind speed and direction, pressure, etc [1].

WSNs were initially designed to facilitate military operations but its application has since been extended to health, traffic, and many other consumer and industrial areas. A WSN consists of anywhere from a few hundreds to thousands of sensor nodes. The sensor node equipment includes a radio transceiver along with an antenna, a microcontroller, an interfacing electronic circuit, and an energy source, usually a battery [4]. The size of the sensor nodes can also range from the size of a shoe box to as small as the size of a grain of dust. As such, their prices also vary from a few pennies to hundreds of dollars depending on the functionality parameters of a sensor like energy consumption, computational speed rate, bandwidth, and memory [2].

II. Sensor Nodes

A sensor node, also known as a mote, is a node in a wireless sensor network that is capable of performing some processing, gathering sensory information and communicating with other connected nodes in the network. A mote is a node but a node is not always a mote [1, 2].

A. Architecture of Sensor Node

- **Controller:-** The controller performs tasks, processes data and controls the functionality of other components in the sensor node. While the most common controller is a microcontroller.
- **Transceiver**:- The functionality of both transmitter and receiver are combined into a single device known as a transceiver.
- **External Memory**:- Two categories of memory based on the purpose of storage are: user memory used for storing application related or personal data, and program memory used for programming the device.
- **Sensors:-**Sensors are hardware devices that produce a measurable response to a change in a physical condition like temperature or pressure. Sensors measure physical data of the parameter to be monitored.
- **ADC**:- The continual analog signal produced by the sensors is digitized byan analog-to-digital converter and sent to controllers for further processing.

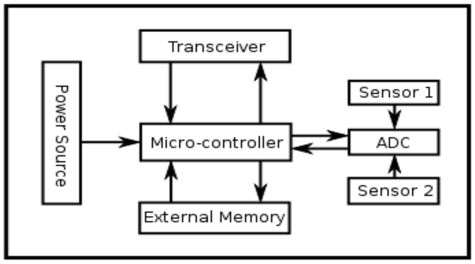

Figure (a): Architecture of Sensor Node

B. Routing

Wireless Sensor Networks (WSNs) consist of thousands of tiny nodes having the capability of sensing, computation, and wireless communications. Many routing, power management, and data dissemination protocols have been specifically designed for WSNs where energy consumption is an essential design issues. Since wireless sensor network protocols are application specific, so the focus has been given to the routing protocols that might differ depending on the application and network architecture [5]. The study of various routing protocols for sensor networks presents a classification for the various approaches pursued. The three main categories explored are data-centric, hierarchical and location-based. Each of the routing schemes and algorithms has the common objective of trying to get better throughput and to extend the lifetime of the sensor network. First routing algorithms for wireless sensor networks followed the traditional approach of topology based routing [3].

Dead ends are unable to forward the packets they generate or receive. These packets will never reach their destination and will eventually be discarded. Many geographic routing schemes fail to fully address important design challenges including [7].

- Routing around connectivity holes,
- Resilience to localization errors, and
- Efficient relay selection.

The main objective is to provide load balancing among the nodes and to overcome the packet loss and dead-end. So, ALBA mechanism performs load balancing based on splitting of packets, key generation and signature on data. The splitting of packets is based on number of inputs. Wireless sensor network are used in many applications like military, Environmental, habitat monitoring, building monitoring, health monitoring etc. In many applications, small sensor nodes

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are densely deployed in interested geographical area either in adhoc or in pre-planned manner and left unattended to sense parameters like humidity, pressure, speed, temperature etc. data send by these sensors are collected by the base station(observer).

C. Load-Balancing

Many energy aware routing algorithms and protocols have been proposed for wireless sensor networks recently to achieve aims like minimum energy consumption, maximized network lifetime, reduced communication latency and overhead etc. The potential energy conservation achieved by balancing thetraffic throughout the WSN [4]. We show that distributing thetraffic generated by each sensor node through multiple pathsinstead of using a single path allows significant energy savings [7].

D. Topologies

The usual topology of wireless sensor networks involves having many network nodes dispersed throughout a specific physical area. There is usually no specific architecture or hierarchy in place and therefore, the wireless sensor networks are considered to be ad hoc networks. An ad hoc wireless sensor network may operate in a standalone fashion, or it may be connected to other networks, such as the larger Internet through a base station. Base stations are usually more complex than more network nodes and usually have an unlimited power supply. Regarding the limited power supply of wireless sensor nodes, spatial reuse of wireless bandwidth, and the nature of radio communication cost which is a function of the distance transmitted squared, it is ideal to send information in several smaller hops rather than one transmission over a long communication distance [1].

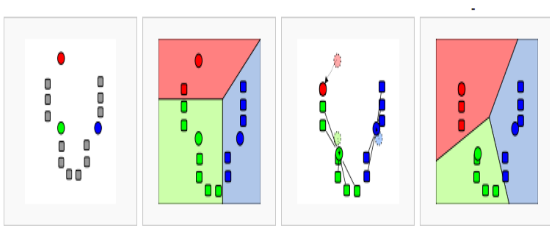

Figure (b): A standard clustering algorithm example

Recent advances in wireless communication technologies and the manufacture of inexpensive wireless devices have led to the introduction of low-power wireless sensor networks. Due to their

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ease of deployment and the multi-functionality of the sensor nodes, wireless sensor networks have been utilized for a variety of applications such as healthcare, target tracking, and environment monitoring [6]. The main responsibility of the sensor nodes in each application is to sense the target area and transmit their collected information to the sink node for further operations. Resource limitations of the sensor nodes and unreliability of low-power wireless links, in combination with various performance demands of different applications impose many challenges in designing efficient communication protocols for wireless sensor networks. Meanwhile, designing suitable routing protocols to fulfill different performance demands of various applications is considered as an important issue in wireless sensor networking. In this context, researchers have proposed numerous routing protocols to improve performance demands of different applications through the network layer of wireless sensor networks protocol stack [3]. Most of the existing routing protocols in wireless sensor networks are designed based on the single-path routing strategy without considering the effects of various traffic load intensities. In this approach, each source node selects a single path which can satisfy performance [5].

III. Drawbacks of Prevailing System

- In the existing scheme, authors have used Tree-Based metric calculation mechanism, collectively called Tree-Based, together to solve the problem of energy efficiency by using energy based routing to avoid the connectivity holes and the dead ends.
- The Tree-Based routing mechanism is capable of solving the problem of energy efficiency up to level but can't be considered efficient enough because it does not track the energy levels for metric calculation.
- There is a strong requirement of bypassing the connectivity holes effectively by calculating accurate and balanced paths to minimize the energy efficiency.
- The Tree-Based mechanism is based on proactive routing scheme for its resource based scheduling.
- Tree based mechanism uses multiple path calculation to send the data by route other than direct route with connectivity holes to avoid the data loss.
- The data is sent through relay nodes among other paths rather than sending it via flawed sink.
- Tree-based routing in the existing scheme is either not capable of selecting an alternative path on the basis of the energy residual and life estimation.

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- The Tree-Based is not an intelligent algorithm and can choose longer path than usual even while using geographical location because Tree-Based uses route cost/route metric to evaluate the best alternative path.
- The route cost calculation depends upon the usual routing protocol algorithm. However if the route cost computations process can be made independent of usual routing protocol algorithm on lower layer, it will become more efficient.

IV. Purposed Idea

The existing system will be improved and enhanced for its metric calculation to elect the best route and route for load balancing while sending the data towards the BTS. The BTS will be receiving the data from the cluster heads in the wireless networks. The metric calculation would be improved by combining the values of the next hop energy, hop count, all hop energy (all hops in the link), node id and bandwidth between the source and destination node. The adaptive load balance balancing rainbow protocol will use this new metric route to find the shortest route with balanced energy and higher bandwidth. The route cost calculation for load balancing will be based on the individual load on the relay node/s, the alternative routes with the minimum load will be also considered to find the alternative route. Among the shortlisted routes using the load as metric, the route with minimum total route cost will be used to forward the data. The existing algorithm will be compared with our proposed algorithm using end to end delay/latency, packet delivery ratio, network/route load and packet Efficiency of the alternative route. The project will be developed using NS2 simulator. The algorithm to detect the connectivity hole or link failure will be used to update the routing table while the primary route becomes unavailable. We will be using pushback algorithm to detect the link failure, and to execute the backup and load balance route finder event based improved adaptive load balancing rainbow protocol for WSNs.

In the nutshell, instead of cost calculation method, the cost calculation would be done on the basis of new metric parameters in the newer combination and weight-age. The new metric or cost calculation will be primarily based upon the energy threshold, residual energy, consumption prediction and next hop energy to make the final decision of path selection. The new algorithm will be capable of selecting the paths dynamically by automatically finding the neighbor nodes and the paths towards the destination. Among all of the paths, the best path is found on the basis of the new metric calculation method based on the energy levels among the nodes in the whole path and the next hop neighbor node.

V. Advantages of Purposed System

- It consumes less time and is efficient.
- The performance will be improved on the basis of multiple or single performance parameters.
- The proposed algorithm can be combined with other algorithmic methods of clustering, security in order create more robust WSNs.

VI. Conclusion

We conclude that by using this we can improve the performance on the basis of multiple or single performance parameters.Also the proposed algorithm can be combined with other algorithmic methods of clustering, security in order to create more robust WSNs. By using this system the processing time will becomes less and more secure due to which the energy can be saved.

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