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Finding Secure and Reliable Routing in Densely Distributed Wireless Sensor Networks

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Abstract: The main purpose of a sensor network is information gathering and delivery. Therefore, the quantity and quality of the data delivered to the end-user is very important. In this paper, we focus on designing a general energy efficient, fault tolerant, and highly reliable routing protocol that prolongs the network lifetime; we call it greedy geographical routing algorithm (GGRA). Our objective is to determine in a Multi-hop network the optimal number of cooperating nodes per hop to minimize the end-to-end total energy consumption while satisfying an outage probability requirement at each hop. Identify the effect of the number of cooperating nodes on energy consumption, all other parameters, i.e., transmission power; rate and reliability are kept constant. Simulation results reveal that the proposed algorithm yields a longer network lifetime, less packet latency, and higher delivery ratio than other existing schemes.

Keywords: network lifetime, secure, reliable, energy.

I. INTRODUCTION

Recent advancement in wireless communications, electronics, low power design and also tendency to use high performance low cost products have led to emergence of Wireless Sensor Networks (WSNs) [1]. As the main purpose of a WSN is information gathering and transmission of it to the sink node, the main problem is to deliver information correctly with minimum energy consumption. Besides, whereas the majority of developed applications for WSNs are event-critical applications, achieving reliable data transfer as the main factor of dependability and quality of service seems vital. An important issue in WSN is routing protocol; since it deals with energy consumption, delay, delivery ratio, and network lifetime. Several attempts have been recently made to propose reliable routing protocols.

The network throughput is usually measured by packet delivery ratio while the most significant contribution to energy consumption is measured by routing overhead which is the number or size of routing control packets. A major challenge that a routing protocol designed for ad hoc wireless networks faces is resource constraints. Devices used in the ad hoc wireless networks in most cases require portability and hence they also have size and weight constraints along with the restrictions on the power source. Increasing the battery power may make the nodes bulky and less portable. The energy efficiency remains an important design consideration for these networks. Therefore ad hoc routing protocol must optimally balance these conflicting aspects. To achieve the desired behavior, some proposals make use of clustering or maintain multiple paths to destinations (in order to share the routing load among different nodes). The majority of energy efficient routing protocols for MANET try to reduce energy consumption by means of an energy efficient routing metric, used in routing table computation instead of the minimum-hop metric. This way, a routing protocol can easily introduce energy efficiency in its packet forwarding. These protocols try either to route data through the path with maximum energy bottleneck, or to minimize the end-to-end transmission energy for packets, or a weighted combination of both. The energy optimization of a routing protocol, however, can exploit also other network layer mechanisms, like control information forwarding.

Energy efficient routing is an effective mechanism for reducing energy cost of data communication in wireless ad hoc networks. Generally, routes are discovered considering the energy consumed for end-to-end (E2E) packet traversal. Nevertheless, this should not result in finding less reliable routes or overusing a specific set of nodes in the network. Energy-efficient routing in ad hoc networks is neither complete nor efficient without the consideration of reliability of links and residual energy of nodes. Finding reliable routes can enhance quality of the service. Whereas, considering the residual energy of nodes in routing can avoid nodes from being overused and can eventually lead to an increase in the operational lifetime of the network. During the last decade, various routing algorithms have been proposed aiming at increasing energy-efficiency, reliability, and the lifetime of wireless ad hoc networks.

II. LITERATURE SURVEY

Paper 1: Parminder Kaur, Mrs. Mamta Katiyar, "The Energy-Efficient Hierarchical Routing Protocols for WSN: A Review", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 2, Issue 11, November 2012.

A WSN is a specialized wireless network made up of a large number of sensors and at least one base station. The foremost difference between the WSN and the traditional wireless networks is that sensors are extremely sensitive to energy consumption. Energy saving is the crucial issue in designing the wireless sensor networks[1].. Since the radio transmission and reception consumes a lot of energy, one of the important issues in wireless sensor network is the inherent limited battery power within network sensor nodes. In order to maximize the lifetime of sensor nodes, it is preferable to distribute the energy dissipated throughout the wireless sensor network. So it is essential to design effective and energy aware protocols in order to enhance the network lifetime. A WSN can have network structure based or protocol operation based routing protocol .In this paper, a review on network structure based routing protocol in WSNs is carried out. Energy consumption and network life time has been considered as the major issues.

Paper 2: Joohwan Kim, Xiaojun Lin," Minimizing Delay and Maximizing Lifetime for Wireless Sensor Networks With Anycast".

In this paper, we are interested in minimizing the delay and maximizing the lifetime of event-driven wireless sensor networks, for which events occur infrequently. In such systems, most of the energy is consumed when the radios are on, waiting for an arrival to occur. Sleep-wake scheduling is an effective mechanism to prolong the lifetime of these energy-constrained wireless sensor networks. However, sleep-wake scheduling could result in substantial delays because a transmitting node needs to wait for its next-hop relay node to wake up. An interesting line of work attempts to reduce these delays by developing .anycast.-based packet forwarding schemes, where each node opportunistically forwards a packet to the _rst neighboring node that wakes up among multiple candidate nodes. In this paper, we rst study how to optimize the anycast forwarding schemes for minimizing the expected packet-delivery delays from the sensor nodes to the sink. Based on this result, we then provide a solution to the joint control problem of how to optimally control the system parameters of the sleep-wake scheduling protocol and the anycast packet-forwarding protocol to maximize the network lifetime, subject to a constraint on the expected endto- end packet-delivery delay. Our numerical results indicate that the proposed solution can outperform prior heuristic solutions in the literature, especially under the practical scenarios where there are obstructions, e.g., a lake or a mountain, in the coverage area of wireless sensor networks.

Paper 3: Assistant Professor, Associate Professor," Improving Network Lifetime and Reducing Energy Consumption in Wireless Sensor Networks", D.Suresh et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 5 (2), 2014, 1035-1038

Energy efficiency and sensing coverage are essential metrics for enhancing the lifetime and the utilization of wireless sensor networks. Many protocols have been developed to address these issues, among which, clustering is considered a key technique in minimizing the consumed energy. However, few clustering protocols address the sensing coverage metric. An efficient power saving scheme and corresponding algorithm must be developed and designed in order to provide reasonable energy consumption and to improve the network lifetime for wireless sensor network systems. The cluster-based technique is one of the approaches to reduce energy consumption in wireless sensor networks. In this article, we propose a clustering algorithm to provide efficient energy consumption in such networks. The main idea of this article is to reduce data transmission distance of sensor nodes in wireless sensor networks by using the uniform cluster concepts. In order to make an ideal distribution for sensor node clusters, we calculate the average distance between the sensor nodes and take into account the residual energy for selecting the appropriate cluster head nodes. The lifetime of wireless sensor networks is extended by using the uniform cluster location and balancing the network loading among the clusters. Simulation results indicate the superior performance of our proposed algorithm to strike the appropriate performance in the energy consumption and network lifetime for the wireless sensor networks.

Paper 4 : Christophe J. Merlin and Wendi B. Heinzelman," Node Synchronization for Minimizing Delay and Energy Consumption in Low-Power-Listening MAC Protocols".

Low-power-listening MAC protocols were designed to reduce idle listening, a major source of energy consumption in energy starved wireless sensor networks. Low-power listening is a MAC strategy that allows nodes to sleep for ti s (the "inter-listening" time) when there is no activity concerning them. It follows that a node has to occupy the medium for at least ti s to guarantee that its destination will probe the channel at some point during the transmission. Low-power-listening protocols have evolved with the introduction of new radios, and the most recent contributions propose to interrupt communication between the sender and the receiver after the data packet has been successfully received and acknowledged. This results in significant energy savings because a sending node does not need to send for full ti periods. We propose a new and simple approach to synchronize nodes on a slowly changing routing tree so that energy consumption is further reduced at the sending node, and the delay is considerably less. Our method allows the nodes to use a lower duty cycle, at no cost of overhead in most cases. Simulation and implementation results show that energy consumption can be reduced by a significant factor (dependant on ti) and delay by at least 18%.

Paper 5 : Amit Sharma, Kshitij Shinghal, Neelam," Energy Management for Wireless Sensor Network Nodes", International Journal of Advances in Engineering & Technology, Vol. 1, Mar 2011, Issue 1,pp.7-13.

Wireless sensor networks consist of small, autonomous devices with wireless networking capabilities. In order to further increase the applicability in real world applications, minimizing energy consumption is one of the

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most critical issues. Therefore, accurate energy model is required for the evaluation of wireless sensor networks. In this paper, the energy consumption for wireless sensor network (WSN) node is analyzed. To estimate the lifetime of sensor node, the energy characteristics of sensor node are measured. Research in this area has been growing in the past few years given the wide range of applications that can benefit from such a technology. In this paper, analysis of energy consumption of a WSN node is analyzed with a proposed node. Based on the proposed model, the estimated lifetime of a battery powered sensor node can be increased significantly.

Paper 6 : Ishant Lambhate, Abhijit Bijwe," An Efficient Way to Reduce Energy Consumption and Delay using Multilevel Priority Packet Scheduling for WSN ",International Research Journal of Engineering and Technology (IRJET), Volume: 02 Issue: 04 | July-2015.

Wireless device networks have extensive range of application like environmental watching, traffic analysis, plan of action systems and process watching. Developing packet planning algorithms in wireless device networks with efficiency will enhance the delivery of packets through wireless links. Packet planning will guarantee quality of service and improve transmission rate in wireless device networks. It's the method accustomed chooses that packet to be serviceable or that to be born supported the priority like real time packet and non-real time packet. This paper deals with packet planning algorithms. Wireless device network contains a completely different packet planning strategy and each has their own advantage and disadvantage. This paper proposes a formula which is Energy aware and provides priority primarily based planning which also improve the performance of task scheduling schemes in terms of end to end delay and deadlock prevention.

Paper 6: Manoj Kumar Jain," ENERGY REDUCTION AND DELAY MINIMIZATION IN WIRELESS SENSOR NETWORKS THROUGH ASIPS", International Journal of Power Control Signal and Computation (IJPCSC) Vol. 2 No. 1 ISSN : 0976-268X.

Low energy consumption is a major design constraint for battery operated embedded systems such as wireless sensor networks or WSN. Low energy is more important compared to low power for such systems as it will increase lifetime of the system. The major component which can reduce energy is to reduce delay. WSN motes must power sensors, a processor, and a radio for wireless communication over long periods of time, and are therefore particularly sensitive to energy use. Recent techniques for reducing WSN energy consumption, such as aggregation, require additional computation to reduce the cost of sending data by minimizing radio data transmissions. Larger demands on the processor will require more computational energy, but traditional energy reduction approaches, such as multi-core scaling with reduced frequency and voltage may prove heavy handed and ineffective for motes. Instead, application-specific instruction set processor (ASIP) can reduce computational energy consumption by processing operations common to specific applications more efficiently than a general purpose processor. By the nature of their deeply embedded operation, motes support a limited set of applications, and thus the conventional general purpose computing paradigm may not be well-suited to mote operation. Both simple and complex operations can improve performance and use orders of magnitude less energy with ASIPs. This paper examines the design considerations of a ASIP for compressed Bloom filters, a data structure for efficiently storing set membership

III. EXISTING SYSTEM

Due to low battery life of wsn it's mandatory to increase network lifetime. Some sensor nodes may fail or be blocked due to lack of power, physical damage, or environmental interference. And average network delay, that is while transferring data from one location to another location, packet may loss due to lack in route establishment that leads to decreased network lifetime

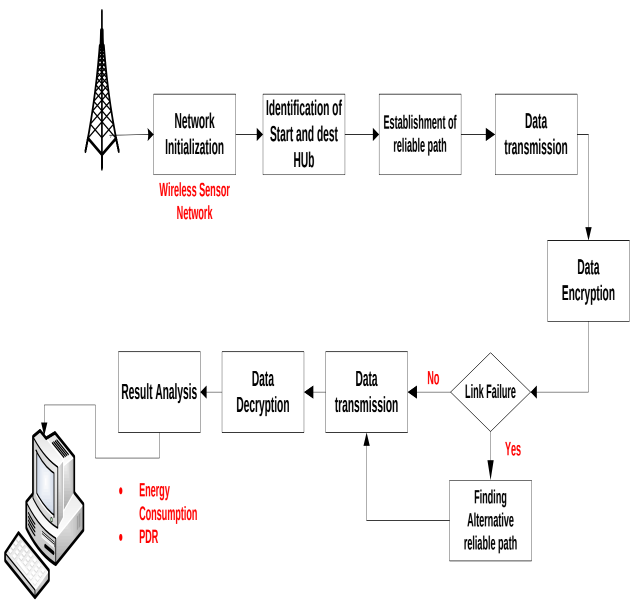
IV. PROBLEM STATEMENT

After doing literature survey we found that improvements in wsn with respect to battery life that is energy and also network lifetime with reduced average delay. Secured and efficient way for reliable routing protocol design.

V. OBJECTIVES

The Main Objective of this project is to provide efficient routing technique with reliable routing which helps in increasing overall network performance

VI. PROPOSED SYSTEM



Module Explanation:

1. Node deployment

Here Network can be initialized with some number of nodes say(N =20), along with the area of 100*100, node can be characterized using xloc and yloc with initial node properties, here initial energy of the node is 100j, and also nodes can be identified using Unique identity number.

2. Source and Destination Selection

After Network initialization next step is to select source and destination for transferring information from source to destination. And these nodes can be selected from users dynamically.

3. Data Encryption and Decryption:

For providing more security here we need to add security algorithms for securing data from hackers, here we are using blowfish algorithm for security.

4. Data Transmission:

After finding reliable routing using Reliable Minimum Energy Cost Routing next step is to transfer data, data of maximum 1000kb can be transferred to the destination. If any link failure occurs while transmitting data it finds alternate reliable path by using GGRA routing.

5. Alternate path:

When link failure occurs in middle of data transmission then by using GGRA routing another most reliable path is selected and by using that path data is transferred to desired destination.

Receiving data:

After successfully receiving data to the destination point that data is analyzed in next step.

VII. PERFORMANCE ANALYSIS

In this section, we evaluate the performance of our algorithm via simulation. We implemented a simulation framework using Matlab R2013a, an object-oriented discrete event network simulator. The goal of the simulation is to show that GGRA can provide a high quality transmission environment in an error-prone network. The results compared with existing algorithms.

PERFORMANCE METRICS AND SIMULATION RESULTS

We use the following metrics to evaluate the performance of GGRA and compare the results with the traditional schemes.

ENERGY EFFICIENCY

The average energy consumption of network nodes can provide a clear view of the network energy efficiency feature. The efficient energy consumption can lead to prolong the whole network lifetime that is one of the most important goals of a routing protocol.

DELIVERY RATIO

The Delivery Ratio parameter represents the network ability for transporting an offered packet load. is the ratio of the number of successfully received data packets at the sink to the total number of data packets sent by a source including retransmissions. This factor is one of the most important parameters ofQoS.

$$\text{Delivery ratio}=\frac{\text{Total packets received}}{\text{Total packets sent by source}}$$

The above equation shows that delivery ratio will increase by decreasing packet retransmissions. Inasmuch as delivery ratio strongly depends on the number of packet retransmissions, we have considered this parameter as an alternative factor for performance analysis.

VIII. APPLICATIONS

1. Health Information (e.g. blood pressure, heart rate).
2. Used in smart-houses with densely deployed sensors, users can access temperature, humidity, electricity consumption, and so forth in real time.
3. The protocol consists of a newly designed routing metric and a routing algorithm utilizing this metric. Our routing metric enables strong Quality-of-Service (QoS) support based on parallel transmissions which significantly reduces transmission delays in WSANs.

IX. CONCLUSION

In this paper, we focused on designing a general energy efficient, fault tolerant, and highly reliable routing protocol named **greedy geographical routing algorithm (GGRA)**. The routing decision is based on different parameter that is truth value. We evaluated the performance of GGRA protocol through simulation under different scenarios. We demonstrated that GGRA protocol exhibits a better performance when node failure will occurs. The algorithm could be modified to take into account some aspects that have not been addressed in this work, and that can be interesting subject of future research. For instance, studying a deadline-aware and reliable algorithm can be considered as a future work.

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