Analytical Study of Design And Implementation of Energy Efficient Routing Protocol For Wireless Sensor Networks

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Abstract- *Energy is an extremely critical resource for battery-powered wireless sensor networks (WSN), thus making energy-efficient protocol design a key challenging problem. Most of the existing energy-efficient routing protocols always forward packets along the minimum energy path to the sink to merely minimize energy consumption, which causes an unbalanced distribution of residual energy among sensor nodes, and eventually results in a network partition. Opportunistic routing, has been shown to improve the network throughput, by allowing nodes that overhear the transmission and closer to the destination to participate in forwarding packets, i.e., in forwarder list. The purpose of deploying a WSN is to collect relevant data for processing and reporting. In particular, based on data reporting, WSNs can be classified as time-driven or event-driven. We propose a hybrid data-gathering protocol that dynamically switches between the event-driven data-reporting and time-driven data-reporting schemes. Our experimental results show that there are significant improvements in energy balance, network lifetime, coverage ratio, and throughput as compared to the commonly used energy-efficient routing algorithm. Extensive simulations in TOSSIM show that our protocol EEOR performs better than the well-known ExOR protocol (when adapted in sensor networks) in terms of the energy consumption, the packet loss ratio, and the average delivery delay.*

Keywords- energy efficiency, routing protocol, packet losses, data gathering.

I. INTRODUCTION

Energy efficiency becomes one of the basic factors in WSN routing protocol design issue. Routing protocol design for WSN often guided by two essential requirement

- Minimize energy cost.
- Minimize network throughput.

Energy efficient routing protocol designed for extent the network lifetime through minimizing the energy consumption. However an energy balanced protocol intends to prolong the network lifetime through uniform energy consumption. In order to use the limited energy, the requirements focus on the less energy consumption sensor node and enhance the energy efficiency. WSNs span a wide spectrum in various domains, the environmental and technical requirement of which may differ significantly according to application used. The purpose of deploying a WSN is to collect/sensed regarded data and proceed for processing and reporting. Basically, based on data reporting, WSN can be classified as time-driven or event- driven and hybrid data gathering protocol which dynamically switches between event driven and time driven data reporting scheme. Most existing routing schemes attempt to find the minimum energy path to the sink to optimize, energy usage at the node. The majority routing protocols design for multihop WSNs have typically followed opportunistic routing. Opportunistic routing has been design to enhance the network throughput, by allowing node that overhear transmission between source node to destination node participant in forwarding packet's , i.e. in forwarder list.

II. BACKGROUND

According to data gathering application reported data is forwarded to the destination node using the concept of "forwarder list". The nodes in forwarder list are prioritized and the lower priority forwarder will discard the packet if the packet has been forwarded by higher priority forwarder.

While packets is forwarding, the EBRP schema useful, our schema called the Energy Balance Routing Protocol. This protocol develop with the concept of potential in classical physics in EBRP, forwards data packet's towards the sink node through dense energy areas so as to protect the nodes with relatively low residual energy. EBRP construct three independent virtual potential fields in term of depth, energy density, and residual energy. The depth field is used to establish a basic routing paradigm which keeps packets move towards the sink. The energy density filed ensures that the packets are always forwarded along the high energy area. Finally, the residual energy field aims to protect the low energy nodes. In the data reporting schema classified as time driven or event driven, when the sensor node randomly deployed the sensor nodes periodically sense the environment and transmit the data of interest continuously over time, or as event driven when sensor node react immediately to sudden and drastic changes in value of sensed object due to the occurrences of certain event. Aspects of this work enabling accurate analysis of future behavior of the environment being monitored. To fulfill these requirements, there must be a mechanism to determine in a timely manner when to switch between the data reporting schemes, and which sensor nodes to involve in the time-driven data-reporting process.

III. PREVIOUS WORK DONE

One challenging problem with packet transmission using forwarder list such that a certain network performance is optimize. In term of energy consumption, the packet loss ratio, and the average delivery delay in wireless network, various factors, like fading interference, and multipath effects, can lead to temporary heavy packets losses [1]. Experiment performed as that nodes closer to the sink tend to deplete their energy faster than the other. This uneven energy depletion dramatically reduces the network lifetime and decreases the coverage ratio. Therefore, result in point out that by the time the nodes one hop away from the sink exhaust their energy [2]. To ensure less energy consumption, existing work are in two fold. First, we have developed an adaptive hybrid data gathering protocol that allows a WSN to dynamically switch between the time-driven data-reporting scheme and the event driven data reporting scheme it is able to more accurately analyze environments than the event-driven data-reporting scheme and use less energy than the time driven data reporting scheme [3]. Second, evaluated the proposed protocol using significant simulation studies, one of that use combination of reactive and proactive data reporting schemes [3]. To minimize energy consumption, routing protocols proposed in the literature for WSNs employ some well-known routing tactics as well as tactics specific to WNSs, e.g., data aggregation and in-network processing, clustering, different node role assignments, and data-centric methods [3]. In proposed works, energy resources for battery powered WSNs, thus making energy efficient protocol for design key challenging problem. A novel routing scheme that overcomes the problem of energy consumption imbalance in most existing energy efficient routing algorithm called Energy Balance Routing Protocol (EBRP) [2], and demonstrates the advantages of balance energy consumption across the network [2]. Although given example is an earthquake detection system is able to gather advance reading of seismic wave produced both at the epicenter and in surrounding areas and quickly raise and alarm for earthquake-prone buildings. The event driven data reporting scheme may lead to reduce energy consumption and thus, prolong the network lifetime [3]. However, as the amount of received data determines the accuracy level, use of the time driven data reporting scheme is more appropriate when higher accuracy is required [3]. , the main idea of data aggregation and in-network processing is to combine the data from different nodes en route by eliminating redundancy, thereby minimizing the number of transmissions. This process ultimately saves energy and prolongs the network lifetime [3].

IV. EXISTING METHODOLOGY

Given methodology for forwarder list to transmit data packet and ensure less energy consumption, given two complementary cases as below.

- fix transmission power of each node (known as nonadjustable transmission model)
- Variable transmission power for each node. (Known as adjustable transmission model)

Optimum algorithms to select and prioritize forwarder list in both case are presented and analyzed as communication energy is a major contributor to total energy consumption and is determined by the total communication amount and transmission distance, the event driven data reporting scheme may lead to reduce energy consumption and thus prolong the network lifetime. This requirement classified following method.

- Time-driven data reporting
- Event drive data reporting

The basic idea underlying the methodology by using EBRP scheme is in following direction.

A. **Network partition**: The node in WSN may fail to operate for some reason, when the network may split into two or more disconnected partitions. This phenomenon is called network partition.
B. **Loop detection and elimination** :

Loop detection: Tracing the paths along which the packet's move and monitoring the events occurring in the network, find that the routing loops caused by EBRP can be classified into three types.
One- hop- loop
Origin – loop
Queue – loop

Loop Eliminations:

Once the routing loops are confirmed, it will be straight forward to eliminate them by cutting off the loop chain. EBRP does it by cutting the links belonging to the loop chain.

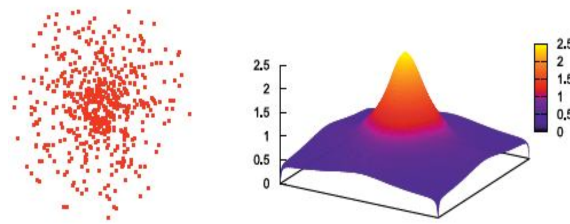
V. ANALYSIS AND DISCUSSION

For routing protocol design in WSNs, the energy balance and energy efficiency should be two different technical goals, since. They will lead to routing algorithm with different attributes an energy efficient routing protocol tries to extend the network lifetime through minimizing the energy consumption; whereas, energy balanced routing protocol intends to prolong the network life time through uniform energy consumption. Enlightened by the concept of the “Potential’’ in classical physics, we can purposely build up a virtual potential field using various information on energy nod to naturally “Push” the packet to the sink through the dense energy area since the energy is consumed by packet transmission and other operation the potential field is time varying. Therefore, the rout based on potential field will dynamically change, which implies that the energy consumption will be balanced. On other hand, once senor node switches to the time driven data reporting scheme, it broadcasts its changes to engage neighboring sensor node in the continuous data dissemination. The range of the neighborhood is determined by the PAD Algorithm, which is based on two configurable parameter.

Time-to-live (TTL) and
Valid Time (VT)

TTL: represents number of hops within sensor nodes must switch to the time driven data reporting scheme.

VT : Specifies how long a sensor node should use the time driven data reporting scheme regardless of the result of it PED algorithm here VT is used only for those sensor or nodes that are switched to the time driven data reporting scheme by TTL.
With opportunistic routing, focus on selecting and prioritizing forwarder list to minimize energy consumption by all nodes. This possible with two cases whether the transmission power off each node is fixed or dynamically fixed. Our extensive simulation in TOSSIM show that our protocol EEOR perform better them the well know ExORprotocol in term of the energy consumption. The packet loss ratio and average delivery delay.



(a) (b)

Fig. 1 :(a) Deployment of Sensors (b) Potential Field.[2]

VI. PROPOSED METHODOLOGY

In our study the drawback demonstrate with energy efficiency and energy consumption as the packet loss ratio, average delivery delay and other factor like fading, interference and multipath effects which causes the heavy packet losses.

To overcome this problem we suggest the concept of queue which alternative for the forwarder list. Queue concept determines the FIFO principal that means here priority requirement not necessary. FIFO (First In First Out) in data reporting, First reported data is forwarder to sink node or neighbor node. This principal improve the performance with fast packet delivery and consume less energy hence, the queue concept is advantageous for routing scheme in WSNs to overcomes the packet loss ratio, and average delivery delay.

VII. POSSIBLE OUTCOME AND RESULT

Most of routing protocol are implemented on a network simulator and analyzed it behaviors using synthetic environment that model the occurrence of fire this enable the development and low cost, low power, network enabled and multifunctional micro sensors. Due to their ease of deployment, reliability, scalability, flexibility andself organization the existing potential application of WSNs, span the wide spectrum in various domain. The environmental and technical requirement is major issue for routing of WSN which may differ significantly. Prolonging the functional lifetime always means increasing throughput considering multihop sensor network which reflect the functional throughput theoretically, the dynamics of hybrid virtual potential result in routing loops. The energy density field related to the deployment is relatively stable so it is sensitive to loops caused by network topology, but the residual energy may dynamically vary and also induces loop. Taking the complexity and diversity of WSNs into account, we define three different potential fields using depth, energy density, and residual energy, respectively, and then superpose them together to form a hybrid potential field to force the packets to move toward the sink as well as to keep the residual energy even. By this way, the occurrence of network partition caused by energy holes can be deferred, and the network lifetime could be extended. These three fields have different attributes and effects on the routing decision. In wireless networks, various factors, like fading, interference, and multipath effects, can lead to temporary heavy packet losses in a preselected good path. In the case of event driven data gathering protocol, the graph is stair shaped because only the sensor nodes in the burning area report the sensed temperature for the duration of a fire in the area. In case of the hybrid data-gathering protocol, its initial behavior is similar to that of the event driven data-gathering protocol in that sensor nodes react to the occurrence of an event. Compared our protocol with ExOR with respect to the total energy consumption, packet loss rate, end-to-end delay, and packet duplication ratio, Different operations have different energy consumption parameters, we first considered and compared several operations of nodes which dominate the energy consumption, like sending and receiving As we can see, the average packet loss rate of each pair increases as the hop count increases between a source and a destination node. For pairs with same hop numbers, the packet loss rate fluctuates due to the different unreliability of links and real-time traffic situation. In addition, in most cases, the packet loss rate is less than ExOR's.

VIII. CONCLUSION

Energy is one of the most critical resources for WSNs. Mostof works in the WSN routing have emphasized energy savings as an important optimization goal. However, merely saving energy is not enough to effectively prolong the network lifetime. The uneven energy depletion often results in network partition and low coverage ratio, which deteriorate the performance. Enabling accurate analysis of future behaviors of the environment being monitored, tofulfill these requirements, there must be a mechanism to determine in a timely manner when to switch between the data reporting schemes, and which sensor nodes to involve in the time-driven data-reporting process. It is interesting to design protocols using opportunistic routing that deliver the data most reliably, or deliver the data with the minimum delay. WSNs bring about flexibility, self-organization, self-configuration, inherent intelligent-processing capability, andenables rapid deployment. Routing approach is advantageous in given direction

As Deployment optimization, Topology control, Mobile sink/relay nodes, Data aggregation, Energy-balanced routing. The major technical problems for realization of industrial WSNs are resource constraints, dynamic topologies and harsh environmental conditions, Quality-of-Service (QoS) requirements, data redundancy, packet errors and variable-link capacity, security, large-scale deployment and ad hoc architecture, and integration with internet and other networks. Most QoS metrics are interdependent such that improving one may degrade the other node. In wireless networks, various factors, like fading, interference, and multipath effects, can lead to temporary heavy packet losses limited storage capacity of wireless sensor nodes. After the buffer of a node is full, it will either drop new packet or replace old packet with new one according to different priorities of packets.

Wireless Sensor Networks (WSNs) are deployed to carry out various applications, such as environmental monitoring, industrial control, disaster recovery, and battlefield surveillance. WSNs provide the efficiency of use in drastic environment such high temperature, low temperature, burning area, etc. WSNs are expected to play even more Important role in the next generation networks to sense the physical world. WSNs Motivated by military applications such as battlefield surveillance, WSNs are becoming increasingly common, and the existing and potential WSN applications span a wide spectrum in various domains, in which environmental and technical requirements may differ significantly. Examples of representative WSN applications are military applications, environmental monitoring, home and office intelligence, and medical care.

IX. FUTURE SCOPE

Hence the routing loops could also be further restrained and the integrated performance could be improved further. Continue investigation in this challenging direction as consume less energy for battery powered sensor part of our future work.

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