ENERGY EFFICIENT AND CLUSTER BASED DATA AGGREGATION USING ESTAR METHODOLOGY FOR WIRELESS SENSOR NETWORK

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ABSTRACT:

Wireless sensor networks (WSNs) are being envisioned for certain applications like habitat monitoring and environmental sensing. Wireless sensors are deployed to achieve network load balancing, prolonging network lifetime, and improving network coverage. To achieve these goals, energy estimation is one of the main constraints and concerns to consider, while deploying wireless sensors in a WSN field. In this paper, we propose an Energy-efficient based Routing Algorithm to prolong lifetime (E-STAR), which is able to dramatically prolong network lifetime while effectively reducing energy consumption. Through an analytical study, we provide guidance on how to choose parameters in our scheme and demonstrate that the scheme is efficient in both network lifetime and energy consumption. Simulation results show that, with the proposed Energy-efficient based Maximal Lifetime Routing Algorithm in WSN energy consumption, network lifetime, energy consumption balance can be improved in most of cases. It is an available approach to routing decision

Keywords: Wireless Sensor networks, E-STAR, anonymity, routing protocol, geographical routing.

1. INTRODUCTION

In the past decades, Wireless Sensor Networks (WSN), one of the fastest growing research areas, has been attracted a lot of research. Typically, a WSN consists of a data collection unit (also known as node or base station) and a large number of sensors that can sense and monitor the physical world, and thus it is able to provide rich interactions between a network and its surrounding physical environment in a real-time manner [2], [3]. The capacity-limited power sources of small sensors constrain us from fully benefitting from WSNs. Due to the unique many-to-one (converge-cast) traffic patterns, the traffic of the whole network will be converted to a specific set of sensor nodes (e.g., neighbouring nodes of the node) and results in the hotspot problem [4]. In multihop communications, nodes that are near a node tend to become congested as they are responsible for forwarding data from nodes that are farther away. For the controlled mobility, the key problem is to deterministically schedule the node to travel around the network to collect data. It is shown that by properly setting the trajectory even limited mobility would significantly improve the network lifetime[5]. However, the mobility also brings new issue, i.e., the delay of the data delivery caused by the movement of the node. Some previous proposals tried to avoid this issue by considering the so-called fast mobility, whereas the speed of the node is sufficiently high so that the resulting delay can be tolerated. To this end, we study the delay-bounded node mobility problem of WSNs in this paper. We assume that WSNs are deployed to monitor the surrounding environment and the data generation rate of sensors can be estimated accurately. We constrain the mobile node to a set of node sites. First, we propose a path selection strategy in the mobile node by establishment of Energy efficient hybrid clustering Technique named as E-STAR, which is an efficient routing protocol through hybrid-based dynamic clustering mechanism to partition the nodes into clusters and select the cluster head (CH) among the nodes based on the energy, and non CH nodes join with a specific CH based on the network life values. Error recovery has been implemented during the inter-cluster routing in order to avoid end-to-end error recovery. The rest of the paper is organized as follows: We present related work in Section 2. We describe and formulate the optimal path for mobile node propagation and collection in

Section 3. In Section 4, Simulations are reported with performance evaluation graph and tables. Finally, Section 5 concludes the paper.

2. RELATED WORK

2.1 DELAY IN DATA GATHERING

KashifSaleem et.al presented aBiological Inspired Self-Organized Secure Autonomous Routing Protocol (BIOSARP) for improving the packet delivery ratio[8]. A recent WSN routing protocol defined as Secure Real-Time Load Distribution (SRTLD) uses broadcast packets to perform neighbour discovery and calculation at every hop while transferring data packets. Thus, it has high energy consumption. The proposed novel Biological Inspired Self-Organized Secure Autonomous Routing Protocol (BIOSARP) enhances SRTLD with an autonomous routing mechanism. In the BIOSARP mechanism, an optimal forwarding decision is obtained using Improved Ant Colony Optimization (IACO). In IACO, the probability is computed based on the end-to-end delay, remaining battery power, and link quality metrics. The proposed BIOSARP has been designed to reduce the broadcast and packet overhead in order to minimize the delay, packet loss, and power consumption in the WSN. In this paper, it is presented the architecture, implementation, and detailed outdoor experimental testbed results of the proposed BIOSARP.The empirical study confirmed that BIOSARP offers better performance and can be practically implemented in the WSN applications for structural and environmental monitoring or battlefield surveillance.

LjubicaBlazevic et.al presented a Location-Based Routing Method for Mobile Ad Hoc Networks [9]. Using location information to help routing is often proposed as a means to achieve scalability in large mobile ad hoc networks. However location-based routing is difficult when there are holes in the network topology and nodes are mobile or frequently disconnected to save battery. Terminode Routing, presented here addresses these issues. It uses a combination of location-based routing (Terminode Remote Routing, TRR) used when the destination is far and link state routing (TLR) used when the destination is close. TRR uses anchored paths a list of geographic points (not nodes) used as loose source routing information. Anchored paths are discovered and managed by sources, using one of two low overhead protocols: Friend Assisted Path discovery and Geographical Map-based Path Discovery. Our simulation results show that terminode routing performs well in networks of various sizes. In smaller networks the performance is comparable to MANET routing protocols. In larger networks that are not uniformly populated with nodes terminode routing outperforms existing location-based or MANET routing protocols.

Ryo et.al presented Data mule scheduling approach for improving the data delivery latency in the data mule approach [13]. Data mule characterizes a mobile device that gathers data in a field of sensor by actually meeting the nodes in a sensor network. Data are gathered in data mule once these data are in the proximity of a sensor node. Hence this can act as option to multihop forwarding of data once it may be employed by the mobility of node in a sensor network. In general these data mule approach necessitates reducing the data delivery latency. The presented approach efficiently deals this problem and minimizes the data delivery latency. The presented work formulated the data mule's optimal motion control problem to reduce the latency as the

DMS problem. After that the 1D (one dimentitional) case of DMS problem has been studied and then devised an efficient heuristic algorithm. By means of analysing the numerical experiments and lower bound it has been illustrated that the presented algorithm runs faster and determines near optimal solutions those are within 10 percent of the existing optimal solution.

Chunsheng Zhu et.al presented a TPSDT (Time and Priority based Selective Data Transmission) and PSS (Priority-Based Sleep Scheduling) algorithm for transmitting a data in reliable way[3]. The integration of ubiquitous Wireless Sensor Network (WSN) and powerful Mobile Cloud Computing (MCC) is a research topic that is attracting growing interest in both academia and industry. In this new paradigm, WSN provides data to the cloud, and mobile users request data from the cloud. This paper first identifies the critical issues that affect the usefulness of sensory data and the reliability of WSN, then proposes a novel WSN-MCC integration scheme named TPSS, which consists of two main parts: 1) TPSDT (Time and Priority based Selective Data Transmission) for WSN gateway to selectively transmit sensory data that are more useful to the cloud, considering the time and priority features of the data requested by the mobile user; 2) PSS (Priority-Based Sleep Scheduling) algorithm for WSN to save energy consumption so that it can gather and transmit data in a more reliable way. Analytical and experimental results demonstrate the effectiveness of TPSS in improving usefulness of sensory data and reliability of WSN for WSN-MCC integration.

2.2 ENERGY EFFICIENCY

Ian et.al presented aEvent-to-Sink Reliable Transport (ESRT) protocol to achieve minimum energy consumption. Reliable event detection at the sink is based on collective information provided by source nodes and not on any individual report[12]. However, conventional end-to-end reliability definitions and solutions are inapplicable in the WSN regime and would only lead to a waste of scarce sensor resources. Hence, the WSN paradigm necessitates a collective event-to-sinkreliability notion rather than the traditional end-to-end notion. A new reliable transport scheme for WSN is proposed, the Event-to-Sink Reliable Transport (ESRT) protocol, is presented in this paper. ESRT is a novel transport solution developed to achieve reliable event detection in WSN with minimum energy expenditure. It includes a congestion control component that serves the dual purpose of achieving reliability and conserving energy. Importantly, the algorithms of ESRT mainly run on the sink, with minimal functionality required at resource constrained sensor nodes. ESRT protocol operation is determined by the current network state based on the reliability achieved and congestion condition in the network. This self-configuring nature of ESRT makes it robust to random, dynamic topology in WSN. Furthermore, ESRT can also accommodate multiple concurrent event occurrences in a wireless sensor field. Analytical performance evaluation and simulation results show that ESRT converges to the desired reliability with minimum energy expenditure, starting from any initial network state.

Charalampos et.al presented MobiCluster protocol for minimizing the overall network overhead and expenditure of energy connected with the data retrieval method by agreeing balanced consumption of energy between Sensor Nodes (SNs) and long-lasting network lifetime [2]. This is accomplished by constructing the cluster structures comprising of member nodes that direct their calculated data to their assigned Cluster Head (CH). The Cluster Head (CHs) execute data filtering ahead of the unrefined data developing possible spatial-temporal data redundancy and forward the sorted information to their allotted rendezvous nodes RNs usually positioned in closeness to the MS's trajectory. In addition to that a sophisticated method is introduced for registering suitable nodes as RNs taking into consideration for the density of sensor nodes and deployment model. Finally by means of extensive simulation tests performance gain has been validated over other alternative approaches.

2.3 ENERGY HOLE PROBLEM

Xiaobing et.al presented non uniform node distribution strategy in which its theoretical characteristics addresses the energy hole problem in Wireless sensor networks [15]. Even though it is impracticable to attain balanced energy depletion along with all the nodes by means of WSNs traffic pattern the possibility of network can be attained by the depletion of subbalanced energy in the network. Because of this the presented method attains very high energy efficiency. With this strategy the ratio among the adjacent $(i+1)^{th}$coronas node density and i^{th} node density has been formulated. After that an algorithm of q-Switch Routing has been used for the presented non uniform node distribution strategy. Extensive results by means of simulations demonstrate that once the network lifetime ends the nodes in every inner corona nearly exploit their energy at the same time even if nodes in the outermost corona include sufficient residual energy.

Guoliang et.al presented Rendezvous-based technique for gathering sensor data under temporal constraints [4]. The presented approach initially devises the Minimum-Energy Rendezvous Planning (MERP) problem in which its objective is to determine a set of RPs that can be visited by Mobile Elements (MEs) within a considerable delay whereas the network energy devoted in transmitting data from sources to Rendezvous Points (Rps) is reduced. The presented approach developed two rendezvous planning algorithms namely RPUG and RP-CP. RP-UG is a utility-based greedy heuristic which determines RPs with fine ratios of saving network energy to mobile elements travel distance whereas RP-CP determines the best RPs at the time MEs move with the data routing tree. At last RendezvousBased Data Collection (RDC) protocol has been presented and employed which facilitates consistent data transfers at RPs by means of efficiently organizing movement of MEs' and transmission of data transmission in the network. With the extensive simulation result, the presented approach outperforms with other traditional schemes in high-bandwidth collection of data under temporal constraints.

2.4 NETWORK LIFETIME

Degan Zhang et.al presented a Forward-Aware Factor (FAF-EBRM) to improve the network lifetime[3]. As an important part of industrial application (IA), the wireless sensor network (WSN) has been an active research area over the past few years. Due to the limited energy and communication ability of sensor nodes, it seems especially important to design a routing protocol for WSNs so that sensing data can be transmitted to the receiver effectively. An energy-balanced routing method based on Forward-Aware Factor (FAF-EBRM) is proposed in this paper. In FAF-EBRM, the next-hop node is selected according to the awareness of link weight and forward energy density. Furthermore, a spontaneous reconstruction mechanism for local topology is designed additionally. In the experiments, FAFEBRMis compared with LEACH and EEUC, experimental results show that FAF-EBRM outperforms LEACH and EEUC, which balances the energy consumption, prolongs the function lifetime and guarantees high QoS of WSN.

Young Sang et.al presented Delay tolerant mobile sink model (DT-MSM) for maximizing the lifetime of a Wireless sensor network by taking benefit of sink mobility when the existing applications tolerate delayed information delivery to the sink node [18]. Within a presumed level of delay tolerance each node does not necessitate to forward the data at once when it becomes presented. Instead the node might temporarily accumulate the data and broadcast it once the mobile sink is at the most desirable location for attaining the maximized lifetime of WSN. In order to find the optimal solution within the underlying structure. optimization problems has been formulated which exploit and increases the lifetime of the WSN dependent on the node energy constraints, delay bound constraints and flow conservation constraints. At last with the obtained simulation result on optimization problem the presented method maximizes the lifetime of network significantly.

3. SYSTEM SPECIFICATION

The energy protocol of E-STAR can take advantage of the fact that the nodes within the cluster communicate during the aggregator election procedure. In particular, announcement messages containing the identifier and the position information of their sources are flooded in the cluster. This can be used to set up backward pointers towards the sources of the announcement messages in the routing tables of the nodes. More specifically, in E-STAR, every node that hears an announcement records the identifier and the position of the originator of the announcement as destination, it records the identifier of the node from which it received the first copy of the announcement as the next hop towards the recorded destination, and it computes and records the power level needed to transmit to this next hop node. The identifier of the next hop is obtained from the lower-layer (e.g., MAC) header of the message encapsulating the announcement.

E-STAR communications to establish routing tables for intra-cluster routing. The intercluster routing protocol is used to route messages to and from a distant cluster. These messages can be queries from and responses to a distant base station, as well as backup messages destined to distant aggregators that contain replicated data. We recommend using a position-based routing protocol as the intercluster routing protocol for the following two reasons. First, E-STAR already makes the assumption that the nodes are aware of their positions, and therefore, this position information can naturally be reused for routing purposes. Second, intercluster routing is concerned with messages that need to be routed (i) to the aggregator of a distant cluster or (ii) to a distant base station. Regarding case (i), in E-STAR, the identifier of the aggregator node is not known explicitly outside the cluster, but, instead, one knows only the reference point to which the aggregator happens to be the closest node. Regarding case (ii), the query messages can contain the geographical position of the base station to which the responses should be sent back.

Thus, in all cases, messages need to be routed towards a, position-based routing seems to fit best for inter-cluster routing in E-STAR.

4. Module Description

- Node Creation
- Route Discovery
- Data Transmission
- Clustering Mechanism

4.1 Node Creation

Node Creation is the first module of the Project.The sensor nodes are to be deployed.The number of nodes should be specified by the authorized person. The Size of the nodes also specified at the same time of node creation. The nodes positions identified using x and y-axis.This module is the formation of nodes what all needed for sending and receiving information. One node is assumed as sender node and another node is assumed as receiver node. And some nodes are assumed as information passing nodes.

4.2 Route Discovery

E-STAR provides route anonymity, identity, and location anonymity of source and destination. Rather than relying on hop-by-hop encryption and redundant traffic, E-STAR mainly uses randomized routing of one message copy to provide anonymity protection. Multiple mobile sinks are allocated for every cluster for transferring data from one cluster to another. It collects data from a feasible site and reaches the destination.

4.3 Data Transmission

The sender node sends the information to the receiver node through this module. This module has an option for sending the data packets from one location to the other location. Transmit the data from the source node to destination node through the intermediate nodes which are selected randomly in the network zones. This module is for receiving the information. It checks whether the information is coming from authorized sender and from the correct path. After authentication, the receiver receives the information through the authorized nodes. E-STAR has a strategy to effectively counter intersection attacks, which have proved to be a tough open issue. E-STAR can also avoid timing attacks because of its non-fixed routing paths for a source-destination pair. Using "Malicious node detection" scheme to prevent the network from Active attackers.

4.4 Clustering Mechanisms

It is the process of grouping the member's nodes, where each node has an individual group head. Such that, the base station no need to distribute thedata to many members. The base station provides authorization data to group head and the group head will distribute to all members.Duetothe above process , efficiently manage the confidential data distributed in the network .It proposes a novel clustering algorithm called E-STARto limit the number of member nodes for each cluster head by using a threshold value. The proposed clustering approach selects a cluster head based on a new cost function which considers the residual battery level, transmission range, energy consumption and distance to the mobile sink. Specifically, sensor node(SN) located near the mobile sink trajectory are grouped in small- sized clusters while SNs located farther away are grouped in clusters of larger size.

4.4.1. Effective Nodes Selection

SNs guarantee connectivity of sensor islands with MSs; hence, their selection largely determines network lifetime. SNs lie within the range of traveling sinks and their location depends on the position of the CH and the sensor field with respect to the sinks trajectory. Suitable SNs are those that remain within the MS's range for a relatively long time, in relatively short distance from the sink's trajectory and have sufficient energy supplies.

5. EXPERIMENTAL RESULTS

Implementation and Sensor Node Details:

The E-STAR protocol was implemented and tested using construction of network model.

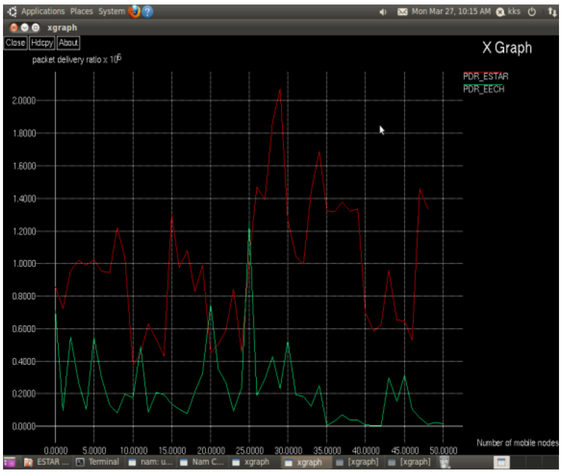

Figure 1: Packet delivery ratio vs. No. of mobile Nodes against the Path Discovery

The performance has been explained through the two important properties like node life time and delivery ratio.

In Figure 1, Experimental results show the used no. of nodes and the delivery ratio of the mobile node in data covering. The performance of the algorithms is measured by the average convergence speed with respect to the number of sensors while retaining the long lifetime state and by the number of fitness evaluations. We presented a mathematical formulation that jointly considers different issues such as node scheduling, data routing, bounded delay, and so on. The formulation is general and can be extended. As a result, the performance of the algorithm can be represented by the involving a mobile node and the impact of network parameters (e.g., the number of sensors, the delay bound) on the network lifetime. The linear trajectory significantly outperforms the other two and would save a relatively long computational time.

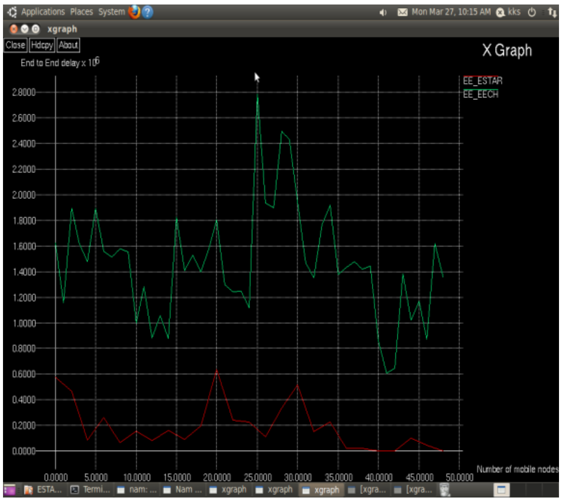

Figure 2: End to End Delay of the Mobile Sensor nodes vs. Number of the node

In Figure 2, end to end delay and node life time has been calculated based on the transmission distance of the node. The protocol code is a simplified implementation of all the modules except the cluster head (CH). Due to physical limitations of sensor nodes and the difficulties in diverse area deployment, it is extremely difficult to perform as extensive evaluation as done in the simulation study. The aim of this experiment is to practically investigate the feasibility of the protocol. The motivation is neither to evaluate the scalability of the protocol nor to compare it with other protocols, which were already carried out in the previous section. An experimental network of 100 nodes was deployed with one source and two nodes, where one acts as primary and the other as secondary. We fixed the maximum transmission power to 2, resulting in a power range of a few tens of centimetres (less than 1 m). The source node generated a 20 bytes packet each second and transmitted it to the primary node and possibly also to the secondary node. This depends on the packet type, decided upon each transmission. 40 percent of the packets were regular, 20 percent were delay-sensitive, 20 percent were reliability-sensitive, and 20 percent were critical.

6. Conclusion

In this paper, we introduced an energy model for estimating energy consumption through power dissipation for both static as well as sensors node in WSNs. This model considers all aspect of energy consumption through power dissipation, by deploying the sensors. In this paper, we propose an Energy-efficient based Routing Algorithm to prolong lifetime (E-STAR), which is able to dramatically prolong network lifetime while effectively reducing energy consumption. Last, we evaluate the performance of various schemes through simulation. The simulation results confirm the analytical study that our scheme is efficient in energy consumption, network lifetime, energy consumption balance in WSNs.

REFERENCE

[1] J. Burgess, B. Gallagher, D. Jensen, and B. N. Levine, "Maxprop: Routing for vehicle-based disruption tolerant networks," in *Proc. IEEE INFOCOM*, 2006, pp. 1–11.

[2] M. Chuah and P. Yang, "Node density-based adaptive routing scheme for disruption tolerant networks," in *Proc. IEEE MILCOM*, 2006.

[3] M. M. B. Tariq, M. Ammar, and E. Zequra, "Mesage ferry route design for sparse ad hoc networks with mobile nodes," in *Proc. ACM MobiHoc*, 2006, pp. 37–48.

[4] S. Roy andM. Chuah, "Secure data retrieval based on ciphertext policy attribute-based encryption (CP-ABE) system for the DTNs," Lehigh CSE Tech. Rep., 2009.

[5] M. Chuah and P. Yang, "Performance evaluation of content-based information retrieval schemes for DTNs," in *Proc. IEEE MILCOM*, 2007, pp. 1–7.

[6] M. Kallahalla, E. Riedel, R. Swaminathan, Q. Wang, and K. Fu, "Plutus: Scalable secure file sharing on untrusted storage," in *Proc. Conf. File Storage Technol.*, 2003, pp. 29–42.

[7] L. Ibraimi, M. Petkovic, S. Nikova, P. Hartel, and W. Jonker, "Mediated ciphertext-policy attribute-based encryption and its application," in *Proc. WISA*, 2009, LNCS 5932, pp. 309–323.

[8] N. Chen, M. Gerla, D. Huang, and X. Hong, "Secure, selective group broadcast in vehicular networks using dynamic attribute based encryption," in *Proc. Ad Hoc Netw. Workshop*, 2010, pp. 1–8.

[9] D. Huang and M. Verma, "ASPE: Attributebased secure policy enforcement in vehicular ad hoc networks," *Ad Hoc Netw.*, vol. 7, no. 8, pp. 1526–1535, 2009.

[10] A. Lewko and B. Waters, "Decentralizing attribute-based encryption," Cryptology ePrint Archive: Rep. 2010/351, 2010.

[11] A. Sahai and B. Waters, "Fuzzy identity-based encryption," in *Proc. Eurocrypt*, 2005, pp. 457– 473.

[12] V. Goyal, O. Pandey, A. Sahai, and B. Waters, "Attribute-based encryption for fine-grained access control of encrypted data," in *Proc. ACM Conf. Comput. Commun. Security*, 2006, pp. 89–98.

[13] J. Bethencourt, A. Sahai, and B. Waters, "Ciphertext-policy attributebased encryption," in *Proc. IEEE Symp. Security Privacy*, 2007, pp. 321–334.

[14] R. Ostrovsky, A. Sahai, and B. Waters, "Attribute-based encryption with non-monotonic access structures," in *Proc. ACM Conf. Comput. Commun. Security*, 2007, pp. 195–203.

[15] S. Yu, C. Wang, K. Ren, and W. Lou, "Attribute based data sharing with attribute revocation," in *Proc. ASIACCS*, 2010, pp. 261–270