An Enhanced and Energy-Aware Reliable Routing For Wireless Sensor Network in Internet of Things

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ABSTRACT:

Wireless sensor networks (WSNs) are resource constrained. Energy is one of the most important resources in such networks. Therefore, optimal use of energy is necessary. In this project, we present a novel energy-efficient routing protocol for WSNs. One of the emerging networking standards that gap between the physical world and the cyber one is the Internet of Things. In the Internet of Things, smart objects communicate with each other, data are gathered and certain requests of users are satisfied by different queried data. The development of energy efficient schemes for the IoT is a challenging issue as the IoT becomes more complex due to its large scale the current techniques of wireless sensor networks cannot be applied directly to the IoT. To achieve the green networked IoT, this paper addresses energy efficiency issues by proposing a novel deployment scheme. This scheme, introduces: (1) a hierarchical network design; (2) a model for the energy efficient IoT; (3) a minimum energy consumption transmission algorithm to implement the optimal model. The simulation results show that the new scheme is more energy efficient and flexible than traditional WSN schemes and consequently it can be implemented for efficient communication in the IoT.

Index Terms—Internet of Things (IoT); wireless sensor networks; clustering; energy consumption; transmission time

I. INTRODUCTION:

The Internet of Things (IoT) has been visualized as the communication and integration of smart objects (things). The dominance of IoT leads to a novel context of upcoming services and applications. Various objects such as mobile phones, sensors, Radio Frequency Identification (RFID) tags, etc. are components of the IoT, which are linked to the Internet via wireless and wired networks. To satisfy the various requirements of users, the smart objects can sense, gather and transmit data. Communication can take place between: (i) the objects themselves and (ii) objects and people. To gain insight into the various issues related to the real world physical processes, the IoT has been realized as a vital solution. The technological developments in the field of IoT have presented many implementation challenges. Sensed data can be sent in queried form or in a continuous way. This requires energy efficient communication among the sensor nodes. More objects are deployed in the IoT that is why large amounts of power are consumed in the whole process, so green networking plays a crucial role in the IoT to reduce power consumption and operational costs, lessen pollution and emissions and make the most of surveillance and environmental conservation [1–5]. The realization of cost reductions to achieve green networking is the research objective of this paper. Many energy efficient schemes for WSN have been proposed in the recent past such as hierarchy [6–9], ad-hoc [10–13] and exact [14–17] ones, but these studies have not examined the arrangement of the objects in consideration of an energy efficient IoT. In this paper, we have investigated the cost effective arrangement of the objects to ensure an energy efficient IoT and put forward an innovative deployment scheme. Firstly a hierarchical framework model [1] is given for the deployment of the IoT. This introduces the scalability feature in the IoT and makes it more extensible. After that an optimization model is presented on the basis of the proposed framework and this model is energy efficient, which smoothens the progress on the way to a green IoT. Finally a minimum energy consumption chain-based cluster coordinator algorithm (ME-CBCCP) is executed, which uses cluster-based topology and a novel transmission algorithm for the optimization of energy parameters. We prove that this scheme is more lithe and efficient compared to traditional approaches for WSNs and it can be easily
implemented in an energy efficient IoT. Our contributions in this project can be summarized as follows: (1) A hierarchical structure for placement of network components, that is objects/things in the IoT, is presented here. This structure has the scalability feature of the IoT to extend it up to any level. Direct communications between the relay nodes and sensor nodes at the cluster level, migrate the network load from local nodes to local relay nodes to provide energy efficient communication. Inter-cluster communication via cluster coordinators shifts the load from cluster heads (in a lower cluster) to the cluster coordinators (in upper clusters) thus enhancing the network lifetime. (2) An optimization problem is considered for the proposed network structure in terms of load balance and energy consumption for implementation of an efficient and scalable IoT. Thus, we propose, ME-CBCCP under the influence of clustering topology to resolve the optimization dilemma. This strategy facilitates the implementation of an energy efficient (green) IoT. (3) With extensive simulations on randomly deployed sensor nodes, the proposed scheme is validated in comparison to the traditional WSN schemes and found to be more favored for various applications of IoT.

2. RELATED WORK

Wireless sensor networks nodes are small in size and are powered by irreplaceable batteries so efficient use of energy is required. In REEP [1] there are five events: sense events, information events, request event, energy threshold value and request priority queue. Sink node generate sense event for collection of basic information. This protocol has very effective method for use of energy of node. Every node uses energy threshold value, on the basis of which each node decided to participate in the activities. On receiving sequence of information event from different neighbours nodes, each node queue them in request process queue. This is data centric protocol. For the energy efficient information flow it uses aggregated data from network. It uses local topology for path setup. Intanagonwiwat, R. Govindan, D. Estrin, J. Heidemann and Fabio Silva [2] proposed DD. DD is data centric which is uses distribution to achieve energy saving. DD consist of interests, data messages, gradients, and reinforcement elements. It is the directed-diffusion paradigm for distributed sensing algorithm.

DD performs data dissemination scheme such as omniscient multicast and its main focus on the MAC layer. The most widely used network architecture for routing protocols is the tree-based one. In this type of routing all nodes transmit data to one node that is a base station (BS). Many existing solutions like E-CH tree [12] and multi-hop LQI [15] construct trees to route the data in a many-to-one pattern, but these solutions are not applicable for IoT applications like environment monitoring and coal mine goaf applications. Other patterns required to be considered like many-to-many and one-to-many communication. The discipline of meta-heuristic Evolutionary Algorithms (EAs) has also been utilized by several researchers to tackle cluster-based routing problems in WSN [10–15], but at the cost of a stability period and delay which cannot be avoided in IoT applications.

3. EXISTING SYSTEM

Tree network is essentially a combination of bus network and star network, which can prolong the lifetime of network. Therefore, how to build a tree-based network with a maximum lifetime for sensor networks of IoTs has become a critical issue at present. But choosing a real maximum lifetime tree from all extended trees is a NP-complete problem [15]. So in order to meet the requirement of real-time, we need to choose a sub-optimal network. In [16], Zhu et al. have proved that a tree-based network cannot be built within a polynomial time. They construct a spanning tree in polynomial time through subset division. Even in the worst case the tree can be constructed within an exponential time. WSTDO (Weighted Spanning Tree Distributed Optimization) [17] is a distributed data transmission technology based on spanning tree and the network performance depends on density of nodes. It achieves a better performance in sparse networks. Ye et al. in [18] have verified that without data aggregation the upper limit of all one-hop nodes’ energy consumption is 98%. LBT (Load-Balanced and energy-efficient Tree) can maximize the network lifetime. Authors take load-balancing and energy-efficient of one-hop nodes into account to construct the tree-based network. Algorithm LBT can preserve that the energy consumption of the tree-based network is close to the upper limit, approximately. Data aggregation technology isn’t used in above literatures. Efficient Self-organization Protocol (ET-SP) in tree-based network is proposed. The network nodes (the nodes that have joined the network) are classified into three types: root node, sink node, sensor node. In the beginning of ETSP, there is only a root node whose hop is zero. Then, the root node searches child nodes by broadcasting packets. After receiving the broadcast packets, the neighboring non-network
nodes record the topology information and use different metrics such as number of child nodes, hop, communication distance and residual energy to reach available sink nodes’ weight. Next, the node with max weight is selected as sink node. When non-network nodes join the network successfully, they can be turned into network nodes at once.

3.1. DISADVANTAGES

- Increase the energy consumption and network load when data aggregation occurs.
- Power consumption of data processing increases significantly owing to the complexity of dynamic routing protocols for a large number of nodes.
- Less network life time.

4. PROPOSED SYSTEM:

We propose a novel scheme for routing in a mobile WSN in which both the sensor nodes and the BS are mobile. The proposed protocol, which is called **Energy Efficient Reliable Routing**, achieves fault tolerance by offering some alternate routes to forward data in presence of any fault in the existing route. The main objective is to extend the lifetime of the sensor nodes in the network. The protocol offers some suitable alternate routes for packet forwarding in presence of node or link failure in the current route. This arrangement does not allow the throughput level at the BS, in terms of packet delivery, to degrade drastically. The protocol takes care of the energy efficiency and the reliability of the routes. The data packets are routed through multiple hops in order to minimize the transmission energy requirements at the sender nodes. In addition, some sensor nodes are intelligently scheduled for dormant state, which is a low-power state. Those nodes are scheduled for dormant state, whose services are not required at a particular instant in time. At a later stage, these nodes may perform state transition and again become active while needed. The state transition is dictated by the BS. This saves significant amount of energy at the nodes. Thus, the battery lives of the sensor nodes get prolonged.

4. ADVANTAGES

- Enhanced Energy Efficiency and improved network lifetime.
- Throughput and packet delivery ratio can be improved significantly, with slightly.
- Reduced average end-to-end delay and Routing overhead of messages.

5. MODULES

1. Route selection
2. Malicious Node Detection
3. Good node selection
   - social trust
   - Qos trust
4. Trust based Routing

5.1 ROUTE SELECTION

- Each node maintains a routing table which stores
  - Next hop, cost metric towards each destination
  - A sequence number that is created by the destination itself
- Each node periodically forwards routing table to its neighbors to select route to reach destination.
- When the route request is reached to Destination, it selects the route as best to communication.
- And maintains the route for source to destination communication

5.2. MALICIOUS NODE DETECTION

- Sensor nodes in sensor networks are usually deployed in hostile environments such as battlefields. Consequently a sensor node may be compromised or out of function and then provides wrong information that may mislead the whole network.
- For example, a compromised sensor node (malicious node) can constantly report incorrect information to higher layers.
- If a SN does not forward a packet within a time limit, if a SN forwards the same packet multiple times without suppression, or if a packet is received directly from a non-neighbor SN or from a neighbor SN who is not supposed to send a packet during a particular time interval, then the SN in question is suspected of maliciousness.
- Due to maliciousness it does not
forward the packets.

5.3 GOOD NODE SELECTION

In cluster-based wireless sensor networks, considering two aspects of trust worthiness, namely, social trust and QoS trust to select the good node in WSN

5.3.1 SOCIAL TRUST

Social trust refers to properties derived from social relationships. Some metrics to measure these social trust properties can be frequency of communication, and quality of reputation.

5.3.2 QOS TRUST

QoS trust represents competence, dependability, reliability, successful experience. In designing network protocols, many prior works measured the trust value of a node based on performance metrics such as the node’s energy or computational power, lifetime, packet delivery rate.

5.4 .TRUST BASED ROUTING

In trust based routing Neighboring nodes monitor the actual and sent values of data. Whenever any node detects an malicious node by QoS trust and social trust properties, and broadcasts a message to inform other neighboring nodes. Whenever the counter reaches a threshold value for a specific node, its neighbours consider that node is un-trust node. The sending node stays awake until the receiving node has forwarded the packet. Therefore, nodes receive a trust value from their neighbours, the threshold for which can be increased or decreased depending on the application. If a malicious node is detected, the packet sending node find the good Neighbour for trust based routing.

5.5 FLOW CHART

6. CONCLUSION

In this project we have proposed EERR protocol. This protocol reduces the energy consumption due to excessive flooding of packets in the entire network. We have used time to live for packets and only one sensor node flood the information packet in the network. The routing information is forwarded on the basis of intensity of received signals. The simulation results show that EERRP is able to build reliable tree-based networks, reduces the energy consumption and prolongs the lifetime of sensor networks. Thus the proposed scheme is energy efficient and robust. Theoretical analysis and simulation results show that EERRP is more efficient than ETSP.

7. REFERENCES


