A STUDY ON DATA DISSEMINATION IN WIRELESS SENSOR NETWORK

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ABSTRACT

The applications of wireless sensor networks consists a wide variety of scenarios. The network is composed of a significant number of nodes distributed in an extensive area in which not all nodes are directly connected. Then, the data exchange is supported by multi-hop communications. Routing protocols are in charge of observing the routes in the network. To support network programming, we demonstrate deluge a reliable data dissemination protocol for propagating large scale data objects from one or more source nodes to nodes other nodes over a multihop, wireless sensor network. Existing work of data dissemination is like: flooding, gossiping, rumor routing, sequential assignment routing, directed diffusion, sensor protocol for information via negotiation, cost-field approach geographic hash table and small minimum energy communication network. Existing work based on review of existing research work in wireless sensor network and explores the possibilities of new research in these areas.

Keywords: Data Dissemination, Data Privacy Protection, Privacy, Directed Diffusion.

I INTRODUCTION

Sensor networks are built with the help of small and highly wireless node distributed in large number to monitor the system by the measurement of physical parameter such as pressure, temperature, or humidity, and characteristics of objects and the motion wireless nodes can be used in chemical processing, military, health and disaster relief scenarios. The main work of a wireless sensor node is to sense and collect the data from a certain domain, process and transmit it to the sink. However, ensuring the direct communication between a sensor and the sink may force nodes to emit their messages with such a high power that their resources could be quickly depleted. Micro- electro mechanical systems (MEMS) technology is recent advances of building sensors. Each node comprises by sensor network, is mainly consists of three subsystems: the sensor subsystem, the processing subsystem, the communication subsystem. The sensor subsystems are detecting the environment, the processing subsystem is local evaluation on the sensed data, and the communication sub systems are responsible for exchange the message in between two wireless nodes.

The rest of the paper is structured as follows. Section 3 shows the basic communication paradigms that wireless sensor networks. In section 4 shows the review of existing work. The application of these techniques leads to attribute-based, geographic, hierarchical and multipath routing protocols, as shown in Section 5. Section 8 draws the main conclusions of this work.

II ALGORITHM PARADIGMS FOR WIRELESS SENSOR NETWORKS

The communication of nodes is to execute certain algorithms [2]. There are three types of algorithms in wireless sensor network like centralized algorithms, distributed algorithms and local based algorithms. Centralized algorithms are accomplished in a node that posses the knowledge of the whole network. These algorithms are quite rare because of the cost of transmitting the data to make the node know the status of the whole network. In distributed algorithms are, the communication is supported by message-passing. In local based algorithms the nodes use restricted data acquired from a close area. With this local information, the algorithm is executed in one node.

The algorithm paradigm for wireless sensor networks is an important factor to take into account when deciding about the routing protocol to employ in the network. The routing protocol should strengthen and optimize the communication between neighbors. In another way, for centralized algorithms, combining the messages that go the central node (even when they are generated by different sources) could be an advantage. The distributed algorithms should support the communication between any two nodes. Finally, local based algorithms depend on some solution that provides geographic coordinates, like GPS, giving the solution more expensive.

III REVIEW OF EXISTING RESEARCH WORK

SENSOR NETWORK ARCHITECTURE

Sensor network architecture is basically divided into two categories: layered and clustered architecture [1]. The construction of sensor network is influenced by factors such as fault tolerance, scalability, and power consumption. The sensor network architecture is classified into two categories: layered and cluster architecture.

Layer architecture has a unique powerful base station (BS), and every node which is available in base station, have same hop-count. Layered architecture used with in building wireless backbones, and in military sensor-based structure, same as the multi-hop infrastructure network architecture (MINA). Soldiers are accessed wireless sensor nodes in the form of hand-held device. The advantage of a layered architecture is that each node involved only low-power, short distance transmission to node of the neighboring layers.

UNPF is a bunch of protocol for complete implementation of layer architecture for sensor network. UNPF is mainly consists of three protocol structure-

- Network initialization and maintenance protocol

- Mac protocol
- Routing protocol

A clustered architecture produced the sensor nodes into clusters; each node is called cluster-head. Each node which is involved in cluster are message exchanges with their cluster-head, base station is connected to the wired network. This is achieved through network layer protocols such as the low-energy adaptive clustering hierarchy (LEACH).

MEDIUM ACCESS CONTROL PROTOCOL (MAC PROTOCOL)

MAC protocol [1] must create a network infrastructure to establish communication links in between thousands of scattered sensors. It must also establish efficient and fair sharing among the nodes, so that overall network can be maximized. MAC protocol is divided into three basic kinds in sensor network: fixed-allocation, demand-based, and contention-based. Fixed-allocation is use common and share medium. Fixed-allocation protocol provides a bounded delay for each node. When channel are allocated according to the demand of node Demand-bases MAC protocol are use. Finally, the contention-based MAC protocols involve random-access-based contention for the channel when packets need to be transmitted. Self-organizing MAC for sensor (SMACS) network and eavesdrop and register (EAR) are two network which initialization network and mobility support respectively. In this protocol neighbor discovery and channel assignment take place simultaneously in a completely distributed manner. The EAR protocols establish seamless connection of nodes stationary and mobile condition. This node are generally use in mobile nodes. This scheme is a centrally controlled, which assume that the nodes are directly communicating base station or not. The TDMA scheme minimizes the time but time synchronization cost is very high. The FDMA scheme is provide the minimum required bandwidth for each connection. The Hybrid TDMA/FDMA uses an optimum number of channel which gives minimum power consumption. CSMA-based schemes are more suitable for distributed traffic flows. This scheme is provide a point-to-point traffic flow. The sensing periods of CSMA are constant for energy efficient, while the back-off is random to avoid repeated collisions.

LOCATION DISCOVERY

At the time of aggregation of sensed data location information of sensors has to be considered. Each node should know its location. The global positioning system (GPS) is not always suitable because it can not reach top of the leaf. The indoor localization techniques use a fixed infrastructure to trace the location of sensor nodes. Fixed beacon nodes are placed in the field of observation, such as within a building. Distributed sensors receive beacon signals from the beacon nodes. Sensor network localization is no fixed infrastructure, some of the sensor are act as a beacon. They have their location information using GPS. The time difference between beacon arrivals from different nodes can be used to estimate location, if RF or ultra-sound signals are used for communication. Localization algorithms require techniques for location estimation depending on the beacon node location. These are known as multi-lateration (ML) techniques. Three type of ML techniques like: Atomic ML, Iterative ML, Collaborative ML.

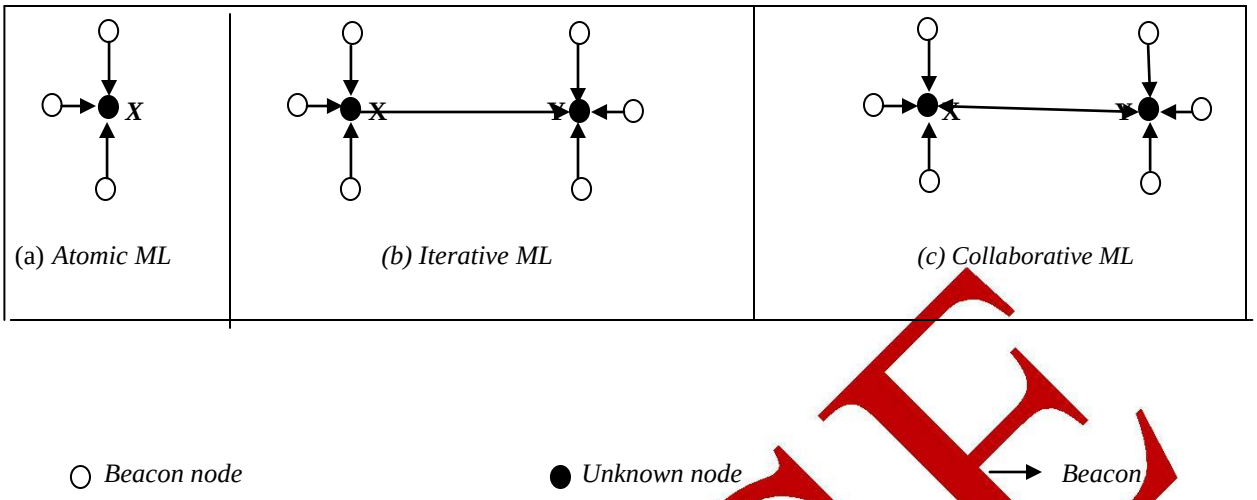

Figure 1: Atomic, Iterative, Collaborative multi-lateration

DATA DISSEMINATION

Data dissemination [1] is the process by which data are routed in the sensor network. Sensor node is collecting the data and communicates to the BS or any other node which is interested. The node which is generating the data is called a source and the information to be reported is called an event. A node which is interested in event and seeks information are called sink. Data diffusion consists of a two step like propagation and data propagation. For every event, sink is interest broadcasts to its neighbors. This process is similar to a multicast tree, sink is root node in this tree. There is several routing approach in data dissemination technique like: flooding, gossiping, rumor routing, sequential assignment routing (SAR), directed diffusion, sensor protocols for information via negotiation (SPIN), cost-field approach, geographic hash table (GHT) and small minimum energy communication network (SMECN).

- **FLOODING**

If the node is not the destination of the packet and the maximum hop-count is not reached so each node broadcast a packet and receives it. There are two type of flooding like: controlled flooding and uncontrolled flooding. In [1] a controlled flooding there are two algorithms like: sequence number controlled flooding (SNCF) and reverse path flooding (RPF). In SNCF all node attaches its sequence number and address. Flooding has some disadvantages like: implosion, overlap, resource blindness.

- **GOSSIPING**

It is a advanced version of flooding. Node sends a packet to a randomly selected neighbor and has lower overhead as compare to flooding. In [1] this technique there is no guarantee that all nodes of the network will receive the message. This technique is removing the problem of implosion.

- **GEOGRAPHIC HASH TABLE (GHT)**

These hash table is a system based on data-centric storage [1], these technique are inspired by internet-scale distributed hash table (DHT) system. Geographic hash table hashes keys into geographic coordinates and saved a pair at the sensor node which is nearest to the hash value. The evaluated hash value is mapped onto a unequaled node agreeable, so that queries for the data can be flow to the correct node. Stored data is reduplicate to ensure pleonastic in case of node fail down, and a consistency protocol is used to maintain the reduplicate data.

- **SMALL MINIMUM ENERGY COMMUNICATION NETWORK (SMECN)**

To construct a part of network with the help of given communication network [1]. If the whole sensor network is describe by a graph A, the subgraph A' constructed such that the energy usage of the network is reduces. The number of edges in A' is less than the number of edges in A, but all nodes of A are contained in A'. the connectivity between any two nodes is not interrupt by the subgraph. SMECN also follows the minimum energy (ME). The power required to injecting data between two nodes x and y is modeled as: $p(x, y) = t * d(x, y)^n$ ...(1)

APPLICATION OF THE OPTIMIZATION TECHNIQUE: ROUTING PROTOCOLS

In the following table we present attribute-base, geographic and multipath techniques. It is basically applied into wireless sensor network.

TABLE (1):-

	APPLIED TECHNIQUE					
PROTOCOL	ATTRIBUTE-BASED	LOCATION-BASED	ENERGY-EFFICIENCY	QOS	HIERARCHY	MULTIPATH
COUGAR	√					
DIRECT DIFFUSION	√					
RUMOR ROUTING	√					
ACQUIRE	√					
SPIN	√					
TEEN			√		√	
PEGASIS			√	√	√	
LEACH			√		√	
DirQ					√	

SHRP			√	√	√	√
SAR				√		√
ENERGY AWARE			√			√
MAXIMUM LIFETIME			√			√
M-MPR		√	√			√

ATTRIBUTE-BASED OR DATA-CENTRIC ROUTING PROTOCOLS

In this approach following protocol are to be used like: spin, direct diffusion, rumor routing, COUGAR, ACQUIRE.

SENSOR PROTOCOL FOR INFORMATION VIA NEGOTIATION (SPIN)

A collection of protocols called sensor protocols for information via negotiation (SPIN) is existing in [3]. SPIN are uses resource adaptation to address the disadvantage of flooding. Meta data is transmitted instead of row data. There are basically three type of massages: ADV, REQ and DATA. ADV's containing meta data. If its neighbor is interested, it sends the REQ for the data. Then the sender sends the DATA to the neighbor.

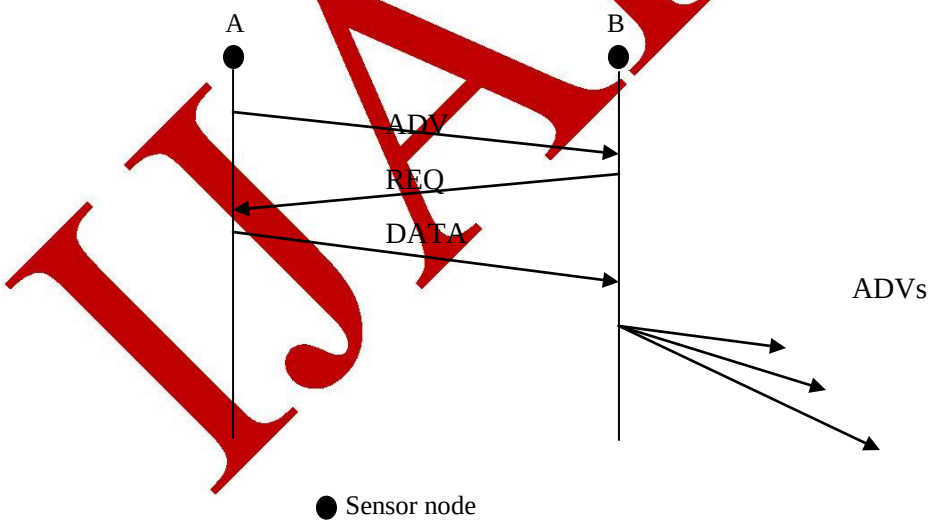

Figure 2: SPIN protocol

- **RUMOR ROUTING**

This algorithm is an agent-based path creation [5]. Agents are long-lived entities produce at random by nodes. Agents are basically packet which is transfer in the network to find shortest path to events that they encounter. When the query is reproduced at a sink, it id sent walk with the hope that it will find a path leading to the required event. This protocol is based on high probability of simple lines crossing each other on a planar graph, suppose the network topology is same as a planar graph, and the path established can be approximated by straight lines owing to high density of the node.

- **COUGAR**

In [6] COUGAR, the network is already seen as distributed databases where some nodes are containing the information are temporary unreachable. Since node stores important values, these networks are working same as a data warehouse. COUGAR gives a SQL-like interface extended to incorporate some clauses to model the probability distribution. The sink is responsible for creating a query which advised to select a special node called the leader. Leaders perform aggregation and send the results to the sink.

- **ACTIVE QUERY FORWORDIND IN SENSOR NETWORK (ACQUIRE)**

ACQUIRE [7] in wireless sensor network work as a distributed database. In this scheme, a node enter an acrobatic query packet into the network neighboring nodes are collects disused information, exhaust an update message to the node. Then, the nodes indiscriminately select a neighbor to disseminate the query which needs. As the active query progress through network, it is increasingly resolved into smaller components until it is completely solved. Then, the query is returned back to the querying node as a completed response.

- **HIERACHICAL ROUTING PROTOCOLS**

The main object of hierarchical routing protocol is to minimize energy consumption by distributing nodes into cluster. In each cluster, a node is selected as the cluster head. Another scheme for hierarchical routing protocol mainly differs in how the cluster head is chosen and how the node act as inter and intra-cluster domain.

- **LEACH**

LEACH [8][9] is a cluster based protocol that reduced energy level in sensor network. LEACH performs periodic re election and randomly select nodes in cluster-head. Each process of periodic re election of cluster-heads is called a round. The operation of LEACH is classified into two phases: set-up and steady.

$$T(n) = \begin{cases} \frac{P}{1-P[r*\mathrm{mod}(1/P)]}, & \text{if } n \epsilon G \\ 0, & \text{otherwise} \end{cases} \quad \ldots (2)$$

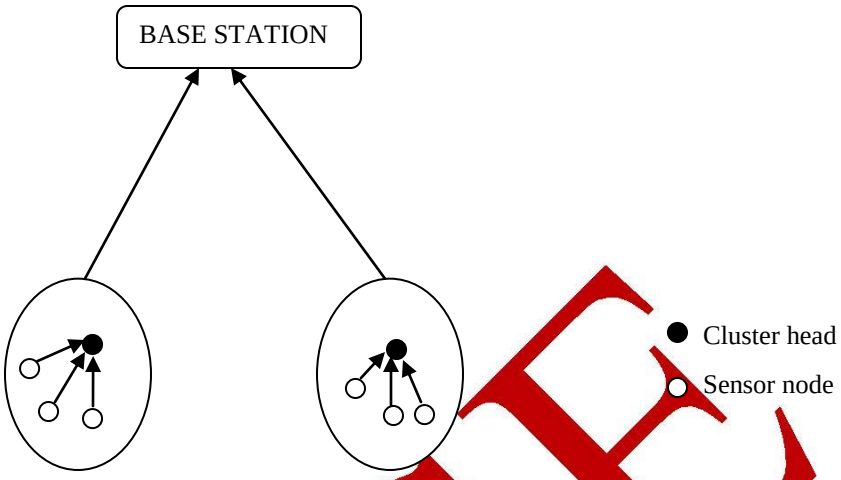

Figure 3: Cluster information in LEACH

- **POWER-EFFICIENT GATHERING IN SENSOR INFORMATION SYSTEMS**

In [10], [11] PEGASIS, use near optimal for this data gathering application in sensor networks. The key idea in PEGASIS is to form a chain among the sensor nodes so that each node will receive and transmit to a close neighbor. Gathered data transmit from node to node, get fused, and eventually a designated node send to the BS. Nodes take turns transmitting to the BS so that the average energy spent by each node per round is reduced. Building a chain to minimize the total length is similar to the traveling salesman problem (TSP), which is known as intractable.

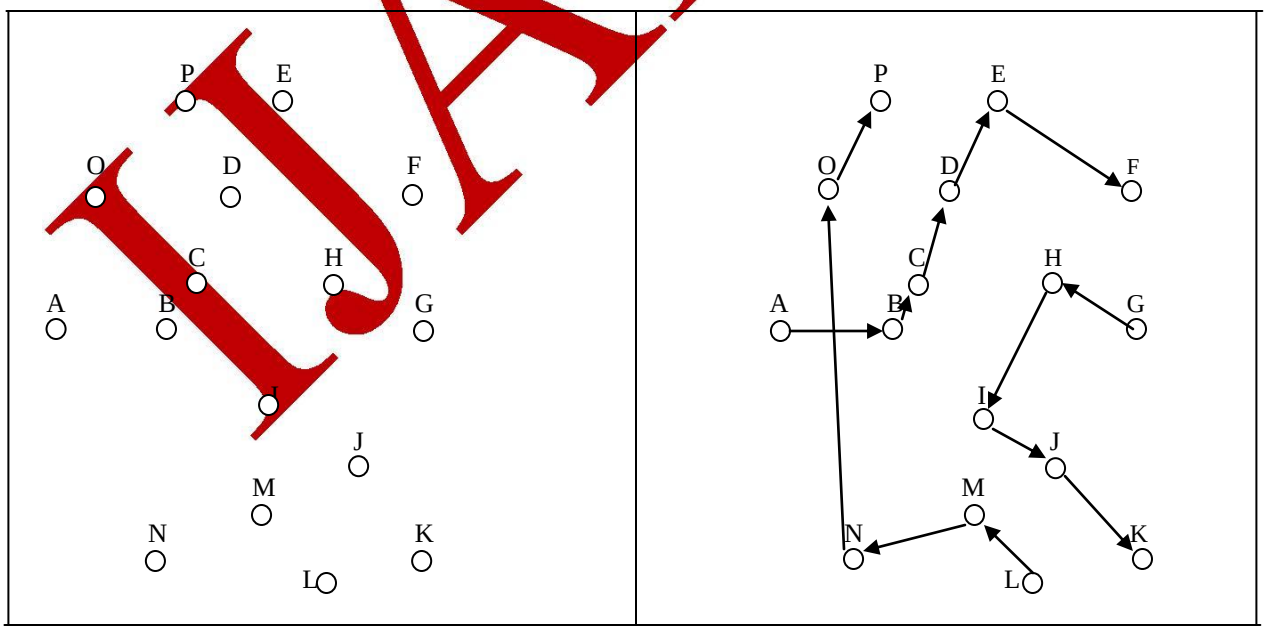

Figure 4: 17 node distribute randomly

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Figure 5: Chain of PEGASIS

- **TEEN**

TEEN [12] is reactive networks that respond immediately to changes in the relevant parameters. In this protocol a clusters head (CH) sends a hard threshold value. The nodes always sense their environment. The first time a parameter from the attribute set arrive at its hard threshold value, the node switches on its transmitter and sends its data. The nodes then transmit data in the live cluster period if the following conditions are true. The current value of the sensed attribute is greater than the hard threshold, and the current value of the sensed attribute differs from sensed value by an amount equal to or greater than the soft threshold. Both strategy looks to minimize energy spend transmitting messages. The drawback of this scheme is that, if the thresholds are not reached, the nodes will never communicate, the user will not get any data from the network at all and will not come to know even if all the nodes die. Thus, this scheme is not well suited for applications where the user needs to get data on a regular basis.

- **DIRECTED QUERY DISSEMINATION**

DirQ [13] optimizing the propagation of queries in a wireless sensor network. The main objective of DirQ is that the queries are just propagated by the minimum number of nodes that ensure that the queries arrive at the nodes that are able to service the query. To do so, certain information is exchanged in the network. The periodicity of the update messages depend on the rate of variation of the physical parameters that the network is sensing. Then, each node autonomously maintains its own threshold (δ). However, if the sink does not receive any message from a specific node then it assumes that this node has a measured value that has not changed much from what has been reported currently. To allow a skillful delivery of applications, all network nodes must be resourceful of storing information which can be considered a disadvantage depending on the amount of information stored in the topology and the number of nodes. DirQ is a protocol suitable for condition where the times of transmission of requests are known and number of requests is high.

- **MULTIPAL ROUTING PROTOCOLS**

In these protocols, a first node knows multiple routes to a last node. The routes can be parallel used or one of them can be active while the rest are maintained for future needs.

- **SEQUENTIAL ASSIGNMENT ROUTING (SAR)**

SAR [14] is the first protocols for wireless sensor networks that provide the invention of QoS routing criteria. It is depends on the association of a priority level to each packet. Additionally, the links and the routes are related to a metric that functionality their potential provision of quality of service. This metric is based on the energy cost and delay. Then, the algorithm build trees rooted at the one-hop neighbors of the sink. To do so, a various parameters such as the packet priority, the energy resources and the QoS metrics are taken into account. The protocol must periodically compute the routes to be prepared in case of failure of one of the active nodes.

- **MAXIMUM LIFETIME ROUTING IN WSN**

In maximum lifetime routing in wireless sensor network combines the energy consumption optimization with the use of multiple routes. In [15] this algorithm an active route is monitored to control its residual energy. Meanwhile other routes can be discovered. If the residual energy of the active route does not exceed the energy of an alternative route, the corresponding secondary route is then used.

- **ENERGY AWARE ROUTING IN WSN**

Once multiple paths are discovered, this algorithm associates a probability of use to each route [16]. This probability is similar to the residual energy of the nodes that form the route but it is also considers the cost of transmitting through that route.

- **MESH MULTIPATH ROUTING (M-MPR)**

This protocol [17] presents two operation modes. Firstly, in the disjoint MPR (D-MPR) with Selective forwarding each packet is individually analyzed by the source and it is routed through different routes. Secondly, the D-mesh multipath routing with data replication is based on the simultaneous emission of multiple copies of the same packet through distinct routes. Specifically, all the known routes that communicate the first and the last propagate the packet. For the route discovery, information about the position of the nodes and about their residual energy is exchanged.

- **CONCLUSIONS AND FUTURE WORK**

Wireless sensor networks (WSN) are one of most important area in the field of science and technology. Wireless sensor networks (WSN) have become more efficient due to the development in sensing and communication. There are several approaches in WSN. A sensor node should be energy efficient. Energy efficiency directly impact the network lifetime of the entire sensor network. The main aim of our existing work is to develop a routing protocol

which is energy efficient and it also enhance the network lifetime of the sensor network. In our work, we concentrated on the routing protocols namely LEACH, PEGASIS and Hierarchical PEGASIS. This paper presents a survey on how routing protocols are adapted to these characteristics.

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