IOSR Journal of Computer Engineering (IOSR-JCE)
e-ISSN: 2278-0661, p- ISSN: 2278-8727Volume 16, Issue 1, Ver. IX (Feb. 2014), PP 01-05
www.iosrjournals.org

Data Gathering Mechanisms with Multiple Mobile Collectors in Wireless Sensor Network

Ramarajan C, Ajitha P
PG Scholar Dept.of Information Technology Sathyabama University
Associate Professor Dept.of Information Technology Sathyabama University

Abstract: *Energy consumption becomes a primary concern in a Wireless Sensor Network. It have emerged as an effective solution for a wide range of applications. Introduced a new data-gathering mechanism for large-scale wireless sensor network by introducing mobility into the network. An M-Collector(mobile data collector) starts the data-gathering tour periodically from the static data sink, polls each sensor while traversing its transmission range. It directly collects data from the sensor in single-hop communications, and finally transports the data to the static sink. We propose a data-gathering algorithm where multiple mobile collectors traverse through several shorter sub tours concurrently to satisfy the distance/time constraints. To pursue high energy saving at sensor nodes, a mobile collector should traverse the transmission range of each sensor in the field such that each data packet can be directly transmitted to the mobile collector without any relay. Also it minimize the delay caused by the Mobile Collector to connect with the base station.*
Keywords: *Wireless Sensor Network, Data Transmission, Mobile Collector*

I. INTRODUCTION

Wireless sensor network (WSNs) have emerged as a new information-gathering paradigm in a wide range of applications, such as medical treatment, outer space exploration, battlefield surveillance, emergency response, etc. Sensor nodes are usually thrown into a large-scale sensing field without a preconfigured infrastructure. Before monitoring the environment , sensor nodes must be able to discover nearby nodes and organize themselves into a network. Most of the energy of a sensor is consumed on two major tasks: sensing the field and uploading data to the data sink. Energy consumption on sensing is relatively stable because it only depend on the network topology or the location of sensors. In some applications, sensors are deployed to monitor separate areas. In each area, sensors are densely deployed and connected, Whereas sensors that belong to different areas may be disconnected. Unlike fully connected networks, some sensors cannot forward data to the data sink via wireless links. A mobile data collector is perfectly suitable for such applications. A mobile data collector serves as a mobile "data transporter" that moves through every community and links all separated sub networks together. The moving path of the mobile data collector acts as virtual links between separated sub networks. In this paper, we consider applications, where sensing data are generally collected at a low rate and is not so delay sensitive that it can be accumulated into fixed-length data packets and uploaded once in a while. To provide a scalable data-gathering scheme for large-scale static sensor networks, we utilize mobile data collectors to gather data from sensors. Specifically, a mobile data collector could be a mobile robot or a vehicle equipped with a powerful transceiver, battery, and large-memory. The mobile data collector starts a tour from the data sink, traverses the network, collects sensing data from nearby nodes while moving, and then returns and uploads data to the data sink. Since the data collector is mobile, it can move close to sensor nodes, such that if the moving path is well planned, the network lifetime can be greatly prolonged. Here, network lifetime is defined as the duration from the time sensors start sending data to the data sink to the time when a certain percentage of sensors either run out of battery or cannot send data to the data sink due to the failure of relaying nodes. In the following, for convenience, we use M-collector to denote the mobile data collector.

II. RELATED WORKS

Some related works carried out similar to this [1] proposed a new energy-efficient approach for clustering nodes in ad hoc sensor networks. Based on Hybrid Energy-Efficient Distributed clustering, which periodically selects cluster heads according to a hybrid of their residual energy and secondary parameter, such as nude proximity to its neighbors or node degree. This method can be applied to the design of several types of sensor network protocols that require energy efficiency, scalability, prolonged network lifetime, and load balancing. Only provided a protocol for building a single cluster layer. [2] HuiTian et al present how to place SNs by use of a minimal number to maximize the coverage area when the communication radius of the SN is not less than the sensing radius, which results in the application of regular topology to WSNs deployment.WSN topology lifetime can extend by more than eight times on average by the mobile node rotation which is significantly better than existing alternatives. It considers WSNs that are mostly static with a small number of mobile relays not practically declared for Dynamic WSNs. **[3]**deals with mobile data gathering in the sensor network which employs one or more mobile collectors that are robots or vehicles equipped with powerful transceivers and batteries. The performance metrics observed are the data success rate (the fraction of generated data that matches the access points) and the required buffer capacities of the sensors and the MULEs. An important issue that is not addressed in this paper i.e. latency.**[**4] Xiaorui Wang et al model presented the design and analysis of novel protocols that can dynamically configure a network to achieve guaranteed degrees of coverage and connectivity. Proposed work differs from existing connectivity or coverage maintenance protocols in several key ways. Guaranteed connectivity and coverage configurations through both geometric analysis and extensive simulations can be provided which is the capability of our protocols. It is not extending solution to handle more sophisticated coverage models and connectivity configuration and develop adaptive coverage reconfiguration for energy-efficient distributed detection and tracking techniques.

[5] Maxim A. Batalin have developed an embedded networked sensor architecture that merges sensing and articulation with adaptive algorithms that are responsive to both variability in environmental phenomena discovered by the mobile sensors and to discrete events discovered by static sensors. They also showed relationship among sampling methods, event arrival rate, and sampling performance are presented. Sensing diversity does not introduced which is used to enhance Fidelity Driven Sampling. [6] and [7], resource-rich nodes act as cluster heads, and the network is organized into a two-layered hierarchical network. However, it is generally difficult to deploy powerful cluster heads to appropriate positions with-out learning the network topology. [8] and [9], a number of mobile observers, called data mules, pick up data directly from the sensors when they are in close range, buffer the data, and drop off the data to wired access points. The movement of mules is modeled as 2-D random walk. In [10], the benefits of mobile relay in WSNs were investigated. It was shown that when a mobile node is used as mobile relay, the network lifetime is improved compared with an all-static network. It was also proved that the mobile relay needs to stay only within a two-hop radius of the sink. The work in [11], discussed the event-collection problem by leveraging the mobility of the sink node and the spatial-temporal correlation of the event, in favor of maximizing the network lifetime with a guaranteed event-collection rate. This problem was modeled as a sensor selection problem, and the design of a feasible movement route for the mobile sink was analyzed to minimize the velocity requirements for a practical system.

III. EXISTING SYSTEM

We consider the problem of finding the shortest moving tour of an M-collector that visits the transmission rang of each sensor. The positions of sensors are either the polling points in the data-gathering tour or within the one-hop range of the polling points. For the sake of simplicity, we assume that M-collectors move at a fixed speed and ignore the time for making turns and data transmission, such that we can roughly estimate the time of a data-gathering tour by the tour by the tour length. Clearly, by moving through the shortest tour, data can be collected in the shortest time such that the users will have the most up-to-date data. We refer to this as the single-hop data-gathering problem (SHDGP).In this case, the M-collector must visit the location of every sensor one by one to gather data. Since sensors are close enough to M-collectors while uploading data, transmission power can be minimized, and the lifetime can be maximized. The goal of the TSP for points in the plane is to find a minimum distance (cost) tour that visits every point in the plane exactly once, which is known to be NP-hard. When (r/R) is greater than or equal to 1, the network reduce to a single-hop network, and like a base station in a WLAN, the M-collector can collect data directly from any sensor without moving. Considering the applications, such as environment monitoring and battlefield surveillance, in which sensors with fixed transmission power are deployed in a quite large area, we are interested in the more realistic case in which 0 < (r/R)<1.

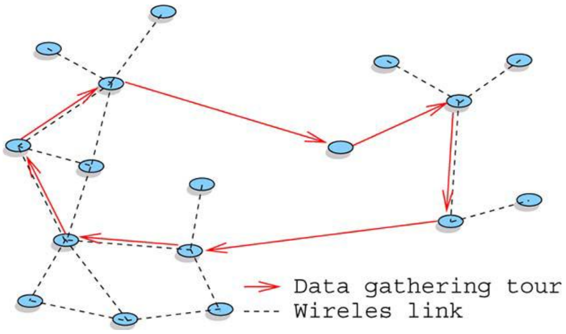

Fig.1 Single-hop data-gathering problem (SHDGP).

IV. Proposed Methodology

In this paper, we have proposed the algorithm called Data Gathering which is used to find the spanning covering tree for each sub-region. Also we can determine the shortest path for mobile collector to traverse through the network.

Step 1: Initial setup is to design the network as less hop count transmission.
Step 2: Design a pp from the sensor devices (here we are setting PP which can receive the data from number of nodes).
Step3: if sensor having the data, then sensor finding the PP, which is near to that sensor.
Step 4: if sensor found any PP point node is available then transfers data to PP
Step 5: if PP has more data then it informs to control station.
Step 6: control station receives the number of control information from different PP's.
Step 7: after collecting the control message, CS makes the shortest route to collect the data from PP's.
Step 8: MC moves towards each PP's and collects the info and returns back to CS

A. Analyzing the data sink details

Handover the data to data sink when data sink within the transmission coverage area of sensors. The sensors which are located in the range of data sink it transforms all the information to the data sink with minimum hops.

B. Setting Less Hop Count Transmission

Multi-hop routing, packets have to experience multiple relays before reaching the data sink. Minimizing energy consumption on the forwarding path does not necessarily prolong network lifetime as some popular sensors on the path. So to avoid the problem in multi-hop routing we are setting the less hop count transmission.

C. Select Sensor As PP

The selected polling points are the subset of sensors, each aggregating the local data from its affiliated sensors within a certain number of relay hops. These PPs will temporarily store the data and upload them to the mobile collector when it arrives. The PPs which are selected can simply be a subset of sensors in the network or some other special devices, such as storage nodes with larger memory and more battery power.

```
#Polling point Selection
Create a list E(all); #An empty set
Create a list S(all); #contains all sensors in network
Create a list G(all); #contains sub-region information
Calculate distance between each and every sensor in the G(0),
G(1),……
Select the nearer sensor as polling point for each sub-region
Create a list of all polling points P(all)
#Data-gathering
Create a list M(all); #for storing mobile collector position information
Calculate the distance between polling points present in P(all) and
M(all)
Assign a nearest mobile collector to every polling point
If { PP--->Sd} {
MC< ---Rd(PP)
MC--->Sd(BS)
}
#SECURITY
If{ Sd(PP)==1} {
Encrypt the data E(d) using Public key
MC< ---Rd(PP)
MC--->Sd(BS)
}
```

i. ***Static forward node***

When the node forwarding the data continuously, then that node will loss more energy. It may causes node failure

ii. Dynamic forward node

If the forward node is dynamically changed with less hop count node then energy loss of node should be very less. So, In the first path the hop count is 3 where as the hop count for the second path is 2. Therefore for data transmission the preferable path is second path.

D. Find and Collect Data from Pp's

Because of the freedom of mobile collector to move to any location in the sensing field, it provides an opportunity to plan an optimal tour for it.Our main idea is first to find a set of special nodes referred to as PPs in the network and then determine the tour of the mobile collector by visiting each PP in a specific sequence.When the mobile collector arrives it polls each PP to request data uploading and then it upload the data to MC.The Polling points collect the information from all the sensors and that aggregated information is collected by the Mobile collector.

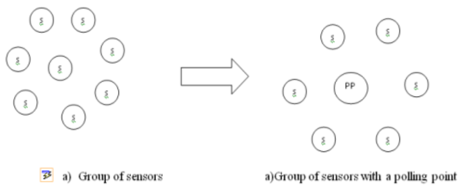

Fig 2. Cluster Formation using Sensors

From a group of sensors one sensor will be elected as a polling point, which receives and send the information to the sensors.

E. Handover the Data to BS

A Polling Point uploads the data packets to the mobile collector in a single hop.Mobile collector begins its tour from the static data sink, which is located either inside or outside the sensing field, and collects data packets at the PPs and then returns the data to the data sink. Finally MC Handover the data to data sink, such as BS.

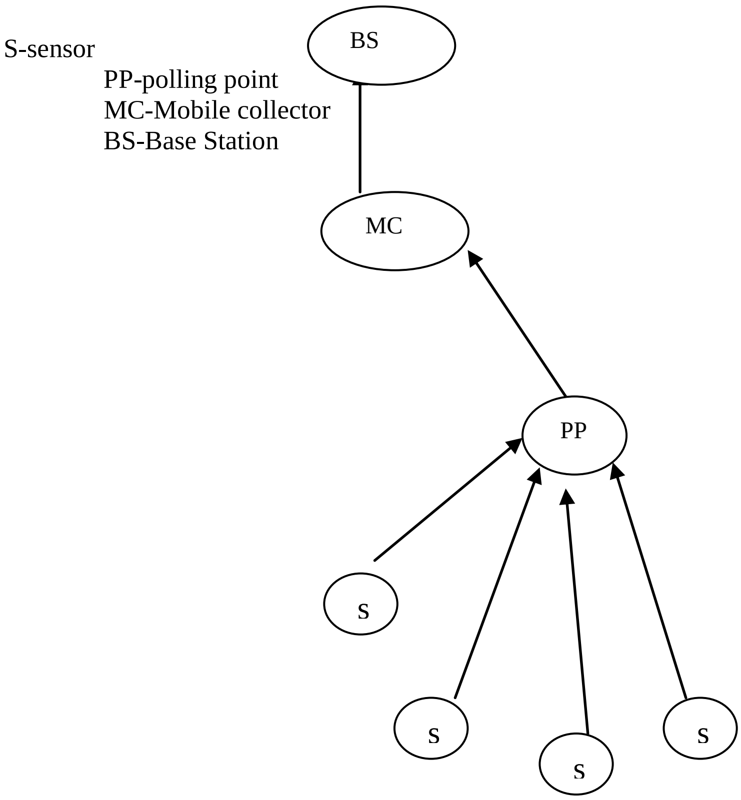

Fig.3 Architecture Diagram

The Mobile collectors move through all the polling points and collect the information and send it to Base Station

V. PERFORMANCE EVALUATION

We did our research analysis in WSN by using NS2. In Ns2 we can show two type of output, one is Nam window and another one is x graph.

In this paper, we studied the new concept that MC (mobile collector) can collect the data from the sensors (Polling point) at a regular interval of time. By collecting data from polling point at regular interval of time through single mobile collector makes time delay in large sensor networks. So we go for multiple mobile collectors to reduce the time delay and to avoid such interference of data occurring also. Collecting data through single hop of mobile collector reduce the consumption of energy and in multiple mobile collectors the energy consumption is not considered but gathering of data is in such a fast and reliable manner.

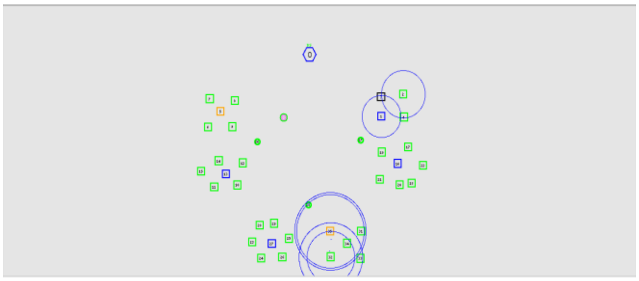

Fig.4 Nam window result mobile collector travelling

From Nam window result we can see the process of our proposed model (data transmission, mobile collector movement)

VI. CONCLUSION & FUTURE WORK

In this paper, we studied mobile data collection in wireless sensor networks by researching the tradeoff between the relay hop count of sensors for local data aggregation and the travel length of the mobile data aggregator. We proposed a data gathering in emergency situation to give practically good results. Extensive simulations have been carried out to validate the emergency data transmission of the system. The extension work what we done here is gathering data through single mobile collector or multiple mobile collector. The gathering of data from pooling point happening at regular intervals of time only, suppose a pooling point need to transfer emergency data in emergency situation how the transmission take place and how the data gathering occurring is our extension work.

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