MULTIPLE MOBILE SINK IMPLEMENTATIONS WITH OPTIMAL RE SCHEDULING ALGORITHM FOR HYBRID WSN

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Abstract: Wireless sensor networks are limited in energy, utilizing the sink mobility has been found a better choice to tackle the limited energy conserved environment; to improve the data collection in energy constrained networks, we proposed multiple mobile sink data collection in WSN. This deploys more than one mobile sink in the network environment for optimal and different delay constrained nodes. There is a need to extend WRP to the multiple mobile sinks/rovers case in order to improve the scalability. In this paper, a new a dynamic Multiple Mobile Sink algorithm is developed for fast data collection is proposed; this improves data delivery performance by employing multiple mobile sinks and by deploying fine scheduling at strategically important points in the sensor field.

Keywords: Access Point, Cluster Head, Fast data collection, Homogeneous, Heterogeneous network, Mobile sink, Wireless sensor network.

1. INTRODUCTION

Wireless Sensor Networks are composed of large number of sensor nodes, every node in WSN have to collect and process the data and finally forward it to the base station [1]. By transferring the data from one node to another may cause the energy oriented problem and may cause delay oriented issues. the main objectives is to minimize data collection delay and energy, by finding a subset of Representative points while adhering to the delay bound provided by an application. The proposal aims to balance the energy consumption at every sensor node by reducing the energy consumption and improves WSN lifetime. By minimizes network energy consumption by reducing the physical distance between sensor nodes and (access Points) APs. In this system, we aim to utilize multiple mobile sink to improve the scalability at different time requirements. We also pro-vide Effective load balancing to handle large WSN and heterogeneous nodes. The paper uses effective virtual grid based network structure for reliable routing. This paper utilizes the multiple mobile sink concepts for fast data collection in the high energy consumed sensory networks.

2. RELATED WORK

There are numerous work has been done for fast data Collection in wireless sensor network using mobile sink [2][3][4]. The most popular and recent technique in this research area is WRP (Weighted Rendezvous Point selection) to transmit the data to the mobile sink periodically. However, all the related works by other re-searchers have several limitations. Sensor networks offer opportunities to observe/interact with physical world aiding in gathering of data that was till recently difficult, expensive, or even impossible to collect. Sensor network deployments make sense practically only if run unattended for many months/years. Among wireless sensor node performances, radio transmissions are the most expensive in consuming energy.

In WSNs with a mobile sink, one fundamental problem is to determine how the mobile sink goes about collecting sensed data. One approach is to visit each sensor node to receive sensed data directly. In multi-hop communications, nodes that are near a sink tend to become congested as they are responsible for forwarding data from nodes that are farther away. This is essentially the eminent traveling salesman problem (TSP) [5], where the goal is to find the shortest path that visits all sensor nodes in the network. But, with an increasing number of nodes, this problem becomes intractable and impractical, as the resulting path length is likely to violate the delay bound of applications. Consider a WSN in which sensor nodes generate data packets periodically. Every data packet has to be disseminated to the sink node within a given threshold. There is a mobile sink that roams around a WSN to collect data from a set of APs [6][7]. The objective is to determine the set of APs and associated tour that visits these APs within the maximum allowed packet delay. The fundamental problem then becomes computing a tour that visits all these APs within a given delay bound. This may result in data loss and improper data collection. Existing techniques [8][9][10] failed to perform data collection with different delay requirements. In that, a mobile sink is requisite to meet the sensor nodes or parts of a WSN more often than others while ensuring that energy usage is minimized, and all data are collected within a given deadline. There is a need to extend WRP to the multiple mobile sinks/rovers case in order to improve the scalability. While extending number of mobile sinks, it may involve with many sub problems such as interference and coordination between Mobile sinks. This theme was not applied in the existing work.

3. PORPOSED SYSTEMS

A Successful data collection in wireless sensor network is a trivial task in order to perform the above a novel scheme called MMS an Optimal Multiple Mobile Sink Routing Protocol with several mobile sinks is proposed. Unlike the existing approaches, this improves data delivery performance by employing several mobile sinks and by deploying fine scheduling at strategically important points in the sensor field, the proposed scheme does not allow packet drop at such situation. It aims to optimize the trade-off between nodes energy consumption and data delivery. The proposed system gives a detailed description of the MMS scheme which includes the procedure of constructing the virtual infrastructure and maintaining fresh routes towards the latest location of the mobile sink. A virtual infrastructure developed by partitioning the sensor field into a virtual grid of uniform sized cells where the total number of cells is a function of the number of Sensor Nodes (SNs.) This includes the scheduling process and communication among cell headers over the sensor grid. A set of nodes close to centre of the cells are appointed as cluster heads (CH), which are the in-charge for keeping track of the latest location point of the mobile sink and relieve the rest of member nodes from taking part in routes re-adjustment. Nodes other than the cluster head-ers associate themselves with the closest CH's and re-port the observed data to their cluster heads. Adjacent cluster headers communicate with each other via gate-way nodes. The set of cluster headers nodes together with the gateway nodes constructs the virtual backbone structure. Before describing the methodology of MMS scheme, it is worthwhile to highlight the various statements of the sensor networks. In WSN Nodes are randomly deployed and throughout remain static and all the nodes are of homogeneous architecture and know their location information. Some nodes adapt their transmission power based on the distance to the destination nodes. The mobile sink does not have any re-sources constraints and it performs periodic data collection from SNs while moving along the periphery of the sensor field and maintains communication with the closest border-line cluster heads for data collection.

To address the above problem, a new method called weighted Optimal Mobile Sink Routing Protocol (MMS) is proposed, whereby each sensor node is assigned in a grid corresponding to its hop distance from the trip and the number of data packets that it forwards to the closest RP. MMS is validated via extensive computer simulation that enables a mobile sink to retrieve all sensed data within a given deadline while conserving the energy expenditure of SNs. The use of MMS, this helps to bound the trip length. This means subsets of SNs are designated as APs, and non-RP nodes simply forward their data to APs.

A trip is then computed for the set of APs, which is called rendezvous is designed for selecting the most suitable APs that minimize energy consumption in the transmission while gathering a given packet at the given time limit. A secondary problem here is to select the set of APs that result in uniform energy expenditure among

SNs to maximize network lifetime.

3.1 MMS (**Multiple Mobile Sink with Optimal Scheduling):**

The MMS created to minimize energy consumption by reducing multi-hop transmissions from SNs to APs. By selecting the sensor node that forwards the highest number of data packets and have the longest hop distance from the trip and it reduces the network energy consumption. MMS achieves 52% more energy savings and 31% better distribution of energy consumption between SNs. MMS establishes a virtual grid structure that allows the fresh sink position to be easily delivered to the grid and regular nodes to acquire the sink position from the grid with minimal overhead whenever needed. The grid structure can be easily regulated, so this mitigating the hotspot problem.

The mobile sink selects cell header nodes along its path and the CH nodes relay sensor data to the sink. In case the sink position information obtained by a sensor node loses its freshness, the sensor data is relayed through the SNs to the current CH node, preventing packet losses. This mechanism is based on progressive sink localization. MMS relies on minimal amount of broadcasts; so, it is applicable to be used for sensors utilizing asynchronous low-power MAC protocols de-signed for WSNs. MMS does not have any MAC layer requirements except the support for broadcasts. It can operate with any energy-aware, duty cycling MAC protocol (synchronized or synchronized). MMS is suitable for both event-driven and periodic data reporting applications. It is not query based so that data are disseminated reliably as they are generated. MMS provides fast data delivery due to the quick accessibility of the pro-posed grid structure, which allows the protocol to be used for time sensitive applications.

3.2 MMS scheduling process:

In the MMS, different communications have per-formed. The followings are the detailed descriptions of the communication process of CH and MS.

- **CH to MS interaction:**

In MMS, the communication between CH to MS (mobile Sink) will be performed when the CH needs to transmits the collected data from different sensor nodes to the mobile sink. This will happen in two stages. Based on the buffer size and time, the data transmission interval differs, so the CH needs to update the data collection interval to the MS. In MMS, CH sends the data collection request in order to inform the CHs buffer information to mobile sink. However, MS maintains routes based on the priority in a distributed manner, keeping a routing table and its buffer details of every CH. The CH disseminates a data collection request if it would need to send data to a mobile sink immediately. This might happen if the CH has high data or few lifetimes. This situation has become defective and this should be informed to the MS. The field priority number of CH packet contains the last known buffer size and life time details associated with the sensor nodes and their data.

- **MS to MS interaction:**

After receiving request from CH, the MS communicates with another MS for fast rescheduling. This kind of process should be performed rapidly to avoid the data loss in the MMS environment. With the use of multiple mobile sinks, the data collection job has been divided among the MSs. In this communication, the protocol exchanges the priority packets, which received from the CHs. Based on the load and position the re scheduling process will be performed. The originating MS for data collection also performed only after the MS to MS communication.

- **CH to CH interaction:**

In MMS, the communication between CH to CH will be performed periodically to exchange the mobile sink positions, these will be handled with the help of routing protocol, with every route request, the MMS send the mobile sink’s details to the cluster head. being one-hop from the mobile sink sets the mobile sink as its next-hop and shares this information with the previous originating CH and its down-stream adjacent CHs. In the same manner as in the AOMDV, MMS uses the route request in order to create a path to a mobile sink. However, MMS maintains routes in a distributed manner, keeping a routing table, at every transit node belonging to the path sought. A CH broadcasts a route request if it would need to know a route to a mobile sink. This might happen if the mo-bile sink is not known beforehand or if the existing path to the mobile sink has expired its lifetime and it has become defective. The field sequence number of mobile sink RREQ packet contains the last known sequence number associated with the mobile sink node. This value is copied from the routing table. If the sequence number is not known, the zero will be assumed. The CH sequence number of RREQ packet contains the value of the sequence number of the source node. To maintain consistent routes, a periodic transmission of the message "HELLO" is performed. If three messages "HELLO" is not consecutively received from a neighbor node, the link in question is considered failing.

4. RESULTS AND DISCUSSIONS

The simulation is carried out within the Network Simulator 2.in Linux operating system with Ubuntu as the interface tool. The mobility model uses the random waypoint model. There are 100 nodes defined in a simulation area of size 1200m x1200m. The mobility of nodes is limited to 5ms. The traffic model chosen is Constant Bit Rate (CBR) connections with packet size of 512 bytes to emulate traffic over the network. Each packet starts from a random location to a random destination with a randomly chosen speed. Once the destination is reached, another random destination is targeted after a time break.

The idle time in these transactions are unique, which affects the relative speeds of the mobile nodes in the network.

Table 1: Stimulation Parameters

Parameter Name	Value
Stimulation tool	NS2
Antenna	Omni antenna
Channel	Wireless
Number of Mobile nodes	100
Communication agent	TCP
LL	Link layer type
Number of Mobile Sinks	3

Two sets of experiments are conducted. The simulation parameters for the sensor network are as follows:

a) Each cell is segmented into 50×50 and 100m×100m,
b) Sensor nodes are randomly deployed in the given area,
c) Initial energy of each sensor node is 2 Joule,
d) Totally 4 cells are used,
e) Each experiment is conducted for 2 simulation scenarios and the average is used for documentation,
f) Base station is located at the centre of the sensor network is used in simulation. Table 1.0 and 2.0 gives the simulation parameters.

Table 2: Configuration Table

Parameter	Values
Topography size	1200 * 1200
Number of nodes	100
Mobile sink location	a) random position, and b) outside network field at the distance of 80 m
data packet length	a) It is assumed that each sen sor generates fixed b) Length data packet of size 512
Initial Energy	Each sensor is initialized with 1 J

The table 2.0 shows the implementation parameters used in the proposed system. The next section defines the results of the proposed system in terms of packet delivery ratio. The ratio between the, number of received data packets to the number of total data packets sent by the source will be used to analyze the PDR ratio. The following formula used to calculated the PDR ratio of the proposed system

$$PDR = \frac{Number\ of\ packet\ received}{Number\ of\ packet\ send} 100$$

The calculated PDR is compared with the existing system WRP (Weighted Rendezvous Point Selection) with single mobile sink. The packet delivery ratio is in-creased in MMS than the existing system.

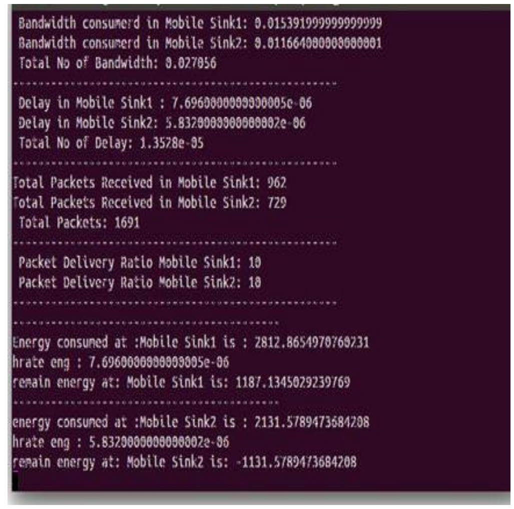

Figure 1: Mobile sinks resource comparison

Figure 2: Packet delivery ratio comparison chart

The fig 2.0, the comparison of WRP and MMS in terms of PDR ratio is plotted from the NS2 Xgraph. At every time interval the PDR value is increased. With the huge size of sensor nodes, the mobile sink can effectively collect the data's. So this increases the PDR time to time.

5. CONCLUSION

Wireless sensor networks data collection from energy constrained nodes is an important task. Mobile sink based data collection techniques has been introduced to perform optimal route planning, data collection scheduling, and fast emergency message gathering by dis covering the multiple mobile sinks. This avoids data loss issues in energy restricted nodes by applying grid based data collection and dissemination by sharing the positions of MS with their neighbors and also addressed the selection of energy optimized node with stable path among the neighbors, and it is not only describes the selection of correct position neighbors but also best link stability APs in the route selection. Thus overcome the data loss and also data dissemination failures. The availability of MS has been identified with the duration probability of a MS that is subject to link failures caused by MS mobility.

The proposed work is implemented using NS-2. The performances are analyzed and addresses that MMS scheme has reduced the packet loss and delay and increases the packet delivery ratio and Energy of the network. In this work to reduce the communication energy, the network was divided into a number of clusters. Also energy heterogeneity is introduced over nodes present in the network. The high energy nodes are always acting as cluster heads and the low energy nodes are member nodes of the cluster. Also the number of cluster heads is fixed, and there is no need for the cluster head selection algorithm to rotate the CH nodes. Hence energy minimization can occur. The one time clustering WRP network is simulated and the result is compared with WRP protocol, which shows that the network lifetime improved by 1.5 times compared to WRP.

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