Efficient Data Collection in WSN using Optimal Subsink Selection

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Abstract—**Wireless Sensor Networks is a new class of distributed systems that are an integral part of the physical space. A sensor node, also known as a mote is a node in a wireless sensor network that is capable of processing, collecting sensory information and having communication with other interconnected nodes in the network. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory space, computation speed, bandwidth and communication. Quality of the sink moving on the affected pathway will improve the energy potency in wireless sensor networks.However because of the pathway constraints, a mobile sink with constant speed has restricted communication time to gather knowledge from the device nodes deployed at random. This has important challenges in conjointly raising the number of information collected and reducing the energy consumption.Tohandle this issue a Knowledge assortment technique which is known as maximum amount shortest path is employed, that will increase network turnout and also it conserves energy by advance allocation of sensor nodes. Maximum amount shortest path which is specified systematically for linear integer programming issue, this we can overcome by utilizing the algorithm of genetics. Overlapping time strategies area unit are partitioned, in which they are performing three rounds are considered between device nodes during which the discovery phase information is collected. This approach improves the energy utilization potency and will increase the number of information collected.**

Keywords— **Wireless sensor networks, Subsink, sink mobility, data collection, Genetic algorithm.**

I. INTRODUCTION

Energy is an important concern in wireless sensor network design because, once the nodes square measure deployed within the setting, it becomes impractical to interchange expenditures batteries. One of the main energy expenditures is in human action the detector readings, in raw or processed kind, from the sensors to a central user location. The quality of sink movement in the affected pathway which is employed to boost the energy potentiality of single hop sensor networks. Usually, these readings are relayed to a base station using ad hoc multi-hop routes in the sensor network. A problem with this approach is that the nodes closer to the base station relay data from nodes that are farther away can run out of the batteries. Thus, the nodes closest to the base station consume batteries faster than the remaining network, leading to a non-uniform depletion of energy in the network. Once the nodes nearer to the base station exhaust their energy, the network is disconnected and considered dead for all practical purposes. A significant advantage in network lifetime can be gained if the energy spent in relaying data can be saved. An alternative for data transfer is to use mobility. A Mobile Sink (MS) moving through the network deployment region can collect data from the static sensor nodes when the mobile node is within communication range of the nodes. This will increase the latency of information transfer; however it is suitable in much delay-tolerant application like in environmental studies. The field experts, such as biologists and ecologists, are interested in studying the behavior of the environment and do not need to take any real-time action. As a result, this is not a problem if information does not reach them as soon as it is generated.

Another advantage of using a MS is that it can handle sparse or disconnected networks. The placement of sensor may lead to disconnected networks. To maintain connectivity in sparse networks, increase the communication range such that network is connected. But, since the energy grows linearly with the transmission range while the energy used by a mobile increases only linearly with distance moved (at a given speed), using a MS is again advantageous.

The MS collects information employing an information assortment theme, known as the major quantity of Shortest Path (MASP) that will increase the number of information collected in addition as conserves less energy by optimizing the assignment of detector nodes. This approach focuses in universe applications, like ecological setting observation and health observation of huge buildings.

The Sensor device nodes are at random deployed within the neighborhood of the mobile flight. The MS put in on a transportation vehicle moves on a set Flight L Sporadically. MS arrives at the top purpose of its path once and returns back to the beginning purpose, it completes one circle. The MS collects information from device nodes whereas moving to them. In stepping with the process communication vary of the sink, the monitored region is split into 2 components, the direct communication space (DCA) and therefore the multi-hop communication space (MCA) for far away sensors. Sensor Device nodes at the intervals DCA, are referred to as subsinks, and that they directly transmit information to the MS owing to their proximity of the flight Device nodes at intervals MCA are referred to as members 1st relay the data between the subsinks that complete the ultimate information transmission to the MS.

The communication period between every Subsink and the mobile sink is assumed to the mounted movement path and constant speed of MS. Therefore every Subsink has associate degree boundary on the quantity of information that may be transmitted to the mobile sink in one spherical. The output of the WSN relies on the connection between the boundary on the info collected and therefore the range of members residing in every Subsink. Here every Subsink has enough storage to buffer information. The most challenge here is to search out associate degree economical assignment of members to the subsinks that improves the data delivery Performance also it reduces energy consumption.

II. RELATED WORK

Based on the mechanical phenomenon of the mobile sink, existing analysis on sink quality will be classified into 03 categories: random path, affected path, and governable path. In sensor networks wherever the trail is random. The mobile sinks are typically mounted on some individuals or animals moving every way to gather interested info perceived by the sensor nodes, because of random movement of the nodes. It's troublesome to make certain knowledge of the data transfer latency and therefore the data delivery ratio. On the Opposite hand it's attainable to ensure that the information delivery potency with mutual assistance of economical Communication protocols but the information assortment schemes trajectories of the mobile sinks are affected or governable. This section reviews the information assortment approaches in WSN with path constrained mobile sinks and path controllable mobile sinks, which might be sub classified consistent with the communication mode (single or multiple hops) and therefore the number of mobile sinks

A. Path Constrained Mobile Sink

Predictable sink quality is exploited in [3] to boost energy efficiency of detector networks. A mobile sink is put in on a public transport vehicle that moves on a hard and fast path periodically. However, all detector nodes can entirely transmit transmit knowledge to the sole mobile sink in one-hop mode wireless detector networks with mobile sinks However, it is additionally assumed that every one sensor nodes in MSSN square measure located located inside the direct communication vary of the mobile sink. In our paper, an information assortment theme supported the multi-hop communication intended to boost the amount of information and cut back energy consumption. In [6], [8], the authors propose mobile detector networks with a path constrained sink supporting multihop communication. A communication protocol and speed manage algorithm of the mobile sink square measure instructed to boost the energy performance. During this protocol, a shortest path tree is employed to choose the cluster heads and route knowledge, which can cause imbalance in traffic and energy dissipation. To handle the imbalance drawback, the MASP theme planned during this paper intended reinforce knowledge assortment from the viewpoint of selecting cluster heads additional with efficiency. Moreover if a mobile sink is mounted on public transportation, e.g., a bus, the speed cannot typically be modified freely to the purpose of information assortment. In [7], a routing protocol referred as Mobiroute is usually recommended for WSN with a path sure mobile sink to prolong the network time period and improve the packet delivery magnitude relation where the sink sojourns at some anchor points and therefore the pause time is far longer than the motion time. So the mobile sink has enough time to gather knowledge, which is different from our situation.

B.Path Controllable Mobile Sink

Most of the present work regarding path-controllable sink mobility has centered on a way to style the optimum pathway of mobile sinks to boost the network performance. Mobile component programming drawback is studied in [11], where the trail of the mobile sink is optimized to go to each node and collect knowledge before buffer overflows occur. The add [11] is extended to support additional advanced scenario with multiple sinks in [13]. A partitioning-based algorithm is conferring in [12] to schedule the movements of the mobile component to avoid buffer overflow. A rendezvous-based knowledge collection approach is planned in [15] to pick out the optimum path owing to the delay limitation in WSNs with a mobile base station. The rendezvous points buffer and mixture knowledge originated from the supply nodes through multihop relay and transfer to the mobile element once it arrives.

III. PROBLEM FORMULATION

In our state of affairs, let m sensor nodes be deployed arbitrarily and let ls nodes near the mechanical aspect of the mobile sink be chosen as subsinks. The opposite nodes removed from the mobile sink select totally different subsinks as their destinations. The mobile sink moves on a set path regularly with constant speed to gather knowledge. We tend to assume that the mobile sink has unlimited energy, memory, and computing resources. Every sensor node endlessly collects knowledge and transmits them either on to the mobile sink or to at least one of the subsinks that finally delivers the info to the mobile sink. We tend to assume that every Subsink has enough storage to buffer knowledge. Our state of affairs every member among the MCA must select one and only 1 Subsink as its destination. We tend to think about an extreme dense sensor network, during which all members will reach the subsinks through single-hop or Multihop communication.

Our objective is to enhance the energy potency for knowledge gathering that minimizes the energy consumption of entire network beneath the condition of increasing condition of increasing the Whole quantity of knowledge collected by the mobile sink

A. OBJECTIVE OF MASP

Aim of MASP is to assign the member to subsinks. The total quantity of data, C_{total}, collected by the mobile sink in one circle consists of the info collected from all subsinks. Now let us consider m_i members to the subsink k and the length of one motion circle is a seconds. Every sensor nodes gather the information with a proportion of ts and broadcast to its subsink sequentially. Here consider subsink k broadcast the data to the mobile sink for the period of a_i with the proportion of data t_c per circle. Then the total quantity of data c_i attained as

$$c_i = \min[t_c a_i, t_s(m_i+1)a]$$

Here tc and ai are constants. The computation of C_{total} is analogous to the node density of the entire network. For example if there are too several nodes to measure within the monitored space it is not possible for the mobile sink to gather all knowledge perceived by the nodes as a result of the limit of total length of communication time. Another way if there are fewer nodes to measure within the monitored space it is possible to collect all the data induced in the whole network. The following two conditions to be stated to broaden the $C_{total.}$

IV. PROPOSED WORK

A.GENETIC ALGORITHM

The 0-1 linear integer programming drawback developed in a Section three is reminiscent of a generalized assignment issue that is NP-hard. In this section, we tend to propose a centralized heuristic resolution for the MASP drawback supported Genetic algorithmic program (GA).GAs offer a wise heuristic for finding several combinatorial improvement issues. The GA tries to mathematically simulate the furnished processes of biological evolution and mix Survival of the fittest members in a population with a structured however randomized data exchange to create exploration mechanism exploration mechanism. Each solution within the population is evaluated in keeping with some fitness value. Extremely match solutions within the population square measure given opportunity to breed. New “child” solutions are generated and unfit solutions within the population square measure replaced. This evaluation selection reproduction cycle is repeated till a satisfactory resolution is found. In this paper, we tend to adopt associate approach kind of like the one in [21] thus on generate a family of potential solutions and then improve practicability optimality at the same time. For convenience, we have a tendency to adopt the initial kind of the answer to the improvement drawback (12), a two-dimensional binary matrix, because the illustration of the individual’s body.

B.TWO PHASE COMMUNICATION PROTOCOL

A.IDEA OUTLINE

Considering the robust computation capabilities of the mobile sink, we tend to let most of the extremely resource-consuming computations be dead by the mobile sink within the communication protocol that consists of 2 main hases:discover part and information assortment part.

B.DISCOVER PART

The main tasks of the discover part embrace learning the topology data and assignment of members to their subsinks To complete the tasks, the discover phase is performed through 3 completely different rounds represented below wherever the “Task” has a similar that means because the earlier “round” represented in section one.

1. Task1. During this task the mobile sink transmits broadcast messages unceasingly. All nodes receiving the broadcasts message from the mobile sinks are mechanically hand-picked as subsinks. Then the subsinks begin building the shortest path trees (SPTs) rooted from them in entire network.

2. Task 2. During this task, the subsinks send the shortest hop data collected in spherical one to the mobile sink once sink once it passes by. In some areas with terribly dense readying of sensing element nodes, the communication durations of the subsinks might overlap within the case that over one subsink is located at the same time inside the communication range of the mobile sink. The mobile sink calculates the length of the communication time allotted to every subsink per some rules. Finally, the genetic algorithm can be dead to get the optimized assignment of members and subsinks.

3. Task 3. In Task 3, the mobile sink traverses the pathway once more to broadcast the results of member assignment to the monitored space. .Each node receiving the printed message can get a subsink as its destination. Then the node can delete its own item within the broadcast message and beam it. Finally, the optimized member assignment data will be disseminated to the complete network.

C.DATA COLLECTION PART

In this part, all nodes begin assembling knowledge from the monitored space formally. The members send the detected data or forward knowledge to the destination subsinks according to the routing table inbuilt spherical one of the discover part. To deal with the network dynamics caused by the node failure or node addition, existing on-demand routing protocols may be wont to realize the highest valid subsink because the temporary destination for one node. Once it cannot reach its subsink with success. Subsinks preached all knowledge from their members and themselves before the mobile sink enters into their communication range Throughput the particular knowledge assortment. In the MSF scheme, the subsink stop receiving the detected info from its downstream nodes and build use of all time resource and information measure resource to transmit knowledge to the mobile sink. Next, we will analyze the practicableness of the MSF theme by explaining the data buffered on the child nodes may be received by the subsink while not touching traditional assortment.

D.SPT SETUP FOR ZONE PARTITION

According to the complexness analysis in Section four, it takes long time to calculate the best mapping between every member and every subsink in massive scale device networks with high density. supported the above observation, we tend to propose associate algorithmic rule to create shortest path trees (SPTs) supported zone partitioning without looking forward to geographical info concerning the sensors and also the sinks. Through zone partitioning, we can divide the total monitored space into many zones and then, the MASP theme which is performed severally to induce the optimal assignment of the members to the subsinks in every zone. Let us outline the subsequent message format. In our protocol every member must acquire the shortest hop info to every subsink within the same zone. So every node keeps a routing table with one entry for each possible destination subsink associate actual implementation is likely to wish to stay the subsequent info concerning every route entry:

-destination : It refers to the address of the subsink.

- metric: It associate to the number, indicating the quantity of hops

-zone: It refers to the zone ID that the entrance belongs to.

- z_flag: zero or one. A route with z_flag set to one indicates that the route is invalid and buffered for future use.

V.IMPLEMENTATION

The WSN data collection model is implemented using Network Simulator. There are two methods implemented in this simulation. In method one the base station is fixed and data is collected from sensor nodes by base station. In method two the mobile Sink which is movable on a fixed path collect the data from different types of sensor nodes. The present implementation does not use genetic algorithm to obtain data collection path. Fig 1 and Fig .2. Shows the comparison of base station and mobile sink in which nodes deployed randomly. Compared with Base station, mobile sink is better to collect data from the nodes because in base station sensor nodes are fixed whereas in mobile sink mobile nodes are movable and all other nodes are fixed in mobile sink to collect data. This concept is demonstrated through the graph.

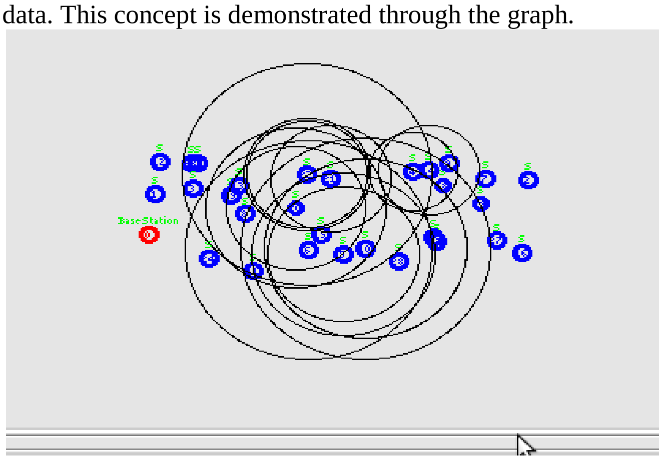

Fig 1.Base Station

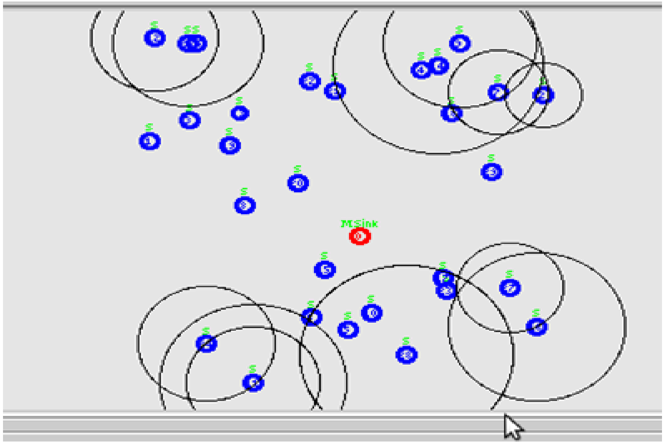

Fig 2. Mobile Sink

Fig.3. represents the total amount of data collected by mobile sink and base station. The most theoretical is that addition of the boundary on knowledge transmitted by every subsink. Base station has very low efficiency and collects only about half of the maximum. As the total number of sensor nodes increases, there are more subsinks in the monitored area and hence the amount of data collected by MASP also increases. Energy consumption is one of the most concerned problems in sensor networks. Fig.4. compares the energy consumption among mobile sink and static sink. In Fig. 4, the sink mobility approaches perform better than the static sink approach in terms of total energy consumption. Let us Consider the amount of data and energy consumption together, we can find that MASP has significantly higher data collection efficiency and can collect about two times more than SPT with almost the same energy consumption.

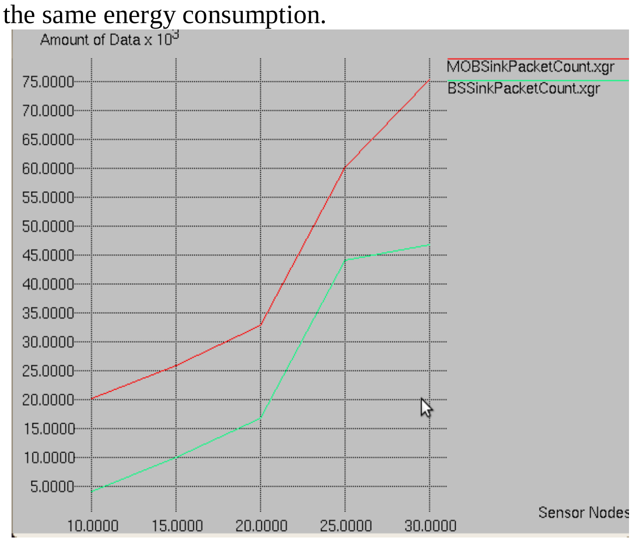

Fig 3: Total amount of Data Collected by Mobile Sink and Base Station

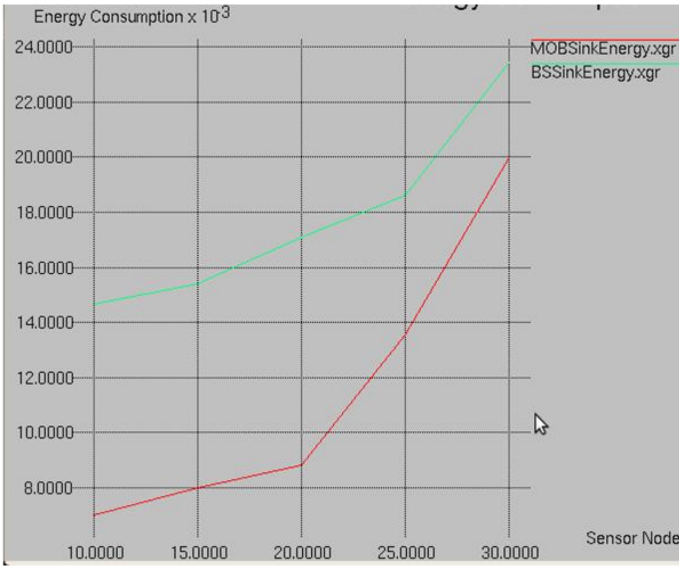

Fig 4. Energy consumed by the mobile sink and base station

VI. CONCLUSION AND FUTURE WORK

In this paper, we tend to planned associate economical information assortment scheme known as MASP for wireless detector networks with path-constrained mobile sinks. In MASP, the mapping between sensor nodes and subsinks is to optimized to maximize the quantity of information collected by mobile sinks and jointly balance the energy consumption MASP has smart scalability to support detector networks with denseness and multiple mobile sinks. A heuristic supported genetic algorithm and native search is given to resolve the MASP optimization downside. Additionally, we tend to style a communication protocol that supports MASP and adapts to dynamic topology changes. Simulation experiments under NS2 shows that MASP improves the energy utilization potency and outperforms SPT and static sink methods in terms of total quantity of information with virtually the same energy consumption. For future work, we tend to conceive to validate the planned schemes on totally different eventualities with numerous movement trajectories of mobile sinks. Considering that minimizing the total energy consumption might not cause the most network lifespan, we tend to conjointly conceive to study the subsink choice problem with network lifespan maximization because the improvement objective as future work

REFERENCES

[1]]. Shay Gao, Hongke Zhang, Sajal K. Das, "Efficient Data Collection in Wireless Sensor Networks with Path-Constrained Mobile Sinks "Ieee Transactions On Mobile Computing, Vol. 10, No. 5, April 2011

[2]A. Chakrabarti, A. Sabharwal, and B. Aazhang, "CommunicationPower Optimization in a Sensor Network with a Path-ConstrainedMobile Observer," ACM Trans. Sensor Networks, vol. 2, no. 3,pp. 297-324, Aug. 2006.

[3]A. Kansal, A. Somasundara, D. Jea, M. Srivastava, and D. Estrin,"Intelligent Fluid Infrastructure for Embedded Networks," Proc.ACM MobiSys, pp. 111-124, 2004.

[4] J. Luo, J. Panchard, M. Piorkowski, M. Grossglauser, and J.Hubaux, "MobiRoute: Routing towards a Mobile Sink for Improving Lifetime in Sensor Networks," Proc. Second IEEE/ACM Int'l Conf. Distributed Computing in Sensor Systems (DCOSS),pp. 480-497, 2006.

[5] A. Somasundara, A. Kansal, D. Jea, D. Estrin, and M. Srivastava,"Controllably Mobile Infrastructure for Low Energy EmbeddedNetworks," IEEE Trans. Mobile Computing, vol. 5, no. 8, pp. 958-973, Aug. 2006.

[6]A. Somasundara, A. Ramamoorthy, and M. Srivastava, "Mobile Element Scheduling for Efficient Data Collection in Wireless Sensor Networks with Dynamic Deadlines," Proc. 25th IEEE Int'l Real-Time Systems Symp. (RTSS), pp. 296-305, 2004.

[7] Y. Gu, D. Bozdag, R. Brewer, and E. Ekici, "Data Harvesting with Mobile Elements in Wireless Sensor Networks," Computer Networks,vol. 50, no. 17, pp. 3449-3465, 2006.

[8] A. Somasundara, A. Ramamoorthy, and M. Srivastava, "Mobile Element Scheduling with Dynamic Deadlines," IEEE Trans. Mobile Computing, vol. 6, no. 4, pp. 395-410, Apr. 2007

[9]R. Sugihara and R. Gupta, "Improving the Data Delivery Latencyin Sensor Networks with Controlled Mobility," Proc. Fourth IEEE Int'l Conf. Distributed Computing in Sensor Systems (DCOSS),pp. 386-399, 2008.

[10] G. Xing, T. Wang, Z. Xie, and W. Jia, "Rendezvous Design Algorithms for Wireless Sensor Networks with a Mobile Base Station," Proc. ACM MobiHoc, pp. 231-240, 2008.

[11]C. Chu and E. Beasley, "A Genetic Algorithm for the Generalised Assignment Problem," Computers and Operations Research, vol. 24,no. 1, pp. 17-23, 1997.

