Energy Utilization and Data Gathering In Wireless Sensor Networks Using Mobile Sink

S.Usha[1], Dr.A.Tamilarasi[2], S.Anburaman[3]
[1]University College of Engineering, Panruti, Tamilnadu
[2] Kongu Engineering College, Erode, Tamilnadu
[3]S.K.P Engineering College, Tiruvannamalai, Tamilnadu

anbuselvamusha2000@yahoo.co.in,drtamil@kongu.ac.in,deligentraman@gmail.com

Abstract*— Recent work has shown that sink mobility along a constrained path can improve the energy efficiency in wireless sensor networks. However, as a result of the path constraint, mobile sink with constant speed has limited communication time to collect data from the sensor nodes deployed randomly. This places significant challenges in jointly consumption. To address this issue, we propose a novel data collection scheme, termed the Maximum Amount Shortest Path (MASP) that increases network throughput as well as conserves energy by optimizing the assignment of sensor nodes. MASP is contrived as an integer linear programming problem and then solved with the help of a genetic algorithm. A two-phase communication protocol rooted on zone partition is designed to implement the MASP scheme. We also progress a practical distributed approximate algorithm to solve the MASP problem. In annexation ,the impact of different overlapping time partition methods is studied.

***Keywords*— Wireless Sensor, Random Deployment, Energy consumption**

I. INTRODUCTION (*Heading 1*)

A. Mobile Computing

Mobile computing is a form of human -computer interaction by which a computer is expected to be transported during normal usage. Mobile computing has three aspects: Mobile communication, Mobile Hardware and Mobile software. The first aspect addresses communication issues in ad-hoc and infrastructure networks as well as communication properties, protocols, data formats and concrete technologies. The second aspect is on the hardware, e.g. ,mobile devices or device components. The third aspect deals with characteristics and requirements of mobile applications.

Mobility originated from the desire to move either toward resources or away from scarcity. Mobile computing is about both physical and logical computing entities that move. physical entities are computers are computers that change locations. Logical entities are instances of a running user application or a mobile agent.

Mobile computing is about both physical and logical computing entities that move. Physical entities are computers that change locations.

Logical entities are instances of a running user application or a mobile agent. Mobile agents can migrate anywhere over the internet. But active applications can only move to a local cluster of applications.

B. Wireless Sensor Networks

A Wireless sensor network (WSN) consists of specially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants and to a main location. The more modern networks are bi-directional, enabling also to *control* the activity of the sensors. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control machine health monitoring, and so on.

The WSN is built of "nodes"- from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. The cost of sensor node is similarly variable, ranging from hundreds of dollars to a few pennies, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth.

The topology of the WSN's can vary from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding.

C. System Overview

The sink mobility has become an important research topic in wireless sensor networks (WSNs). Existing work has shown that sink mobility can improve the performance of WSN's. In mobile sinks are mounted on some people or animals moving randomly to collect information of interest sensed by the sensor nodes where the sink trajectories are random. In the scenarios where the trajectories of the mobile sinks constrained or predetermined. In path constrained sink mobility is used to improve the energy efficiency of single-hop sensor networks which may be infeasible due to the limits of the path location and communication power. In multi-hop sensor networks with a path-constrained mobile sink where the Shortest Path Tree(SPT) method is used to choose the cluster heads and route data that may result in low energy efficiency for data collection. A routing protocol called MobiRoute is for WSN's with a path predictable mobile sink where all sensor nodes need to aware of the movement of the mobile sink.Based on the trajectory of the mobile sink, existing research on sink mobility can be classified into three categories: random path, constrained path and controllable path .

II. RELATED WORK

A. Path-Constrained Sink Mobility

Predictable sink mobility is exploited into improve energy efficiency of sensor networks. A mobile sink is installed on a public transport vehicle which moves along a fixed path periodically. However, all sensor nodes can only transmit data to the single mobile sink in one-hop mode. Actually, single-hop communication between all sensor nodes and the mobile sink may be infeasible due to the limits of existing road infrastructure and communication power. This paper, a data collection scheme based on the multi-hop communication is designed to improve the amount of data and reduce energy consumption.

A communication protocol and a speed control algorithm of the mobile sink are suggested to improve the energy performance and the amount of data collected by the sink. In this protocol, a shortest path tree (SPT) is used to choose the cluster heads and route data, which may cause imbalance in traffic and energy dissipation.In mobi-route protocol, is suggested for WSNs with a path predictable mobile sink to prolong the network lifetime and improve the packet delivery ratio, where the sink sojourns at some anchor points and the pause time is much longer than movement time. Accordingly, the mobile sink has enough time to collect data, which is different from our scenario. Moreover, in mobi-route all sensor nodes need to know the topological changes caused by the sink mobility

B. Path-Controllable Sink Mobility

Most of the current work about path-controllable sink mobility has focused on how to design the optimal trajectories of mobile sinks to improve the network performance. The mobile sinks need to visit all sensor nodes to collect data generation rate of each node. A rendezvous –based data collection approach is proposed to select the optimal path due to the delay limitation in WSNs with a mobile base station. The mobile element visits exact locations, called rendezvous points, according to the pre-computed schedule to collect data. The rendezvous points buffer and aggregate data originated from the source needs through multi-hop relay and transfer to the mobile element when it arrives

III. MODULES DESCRIPTION

A. MASP Using GA(Genetic Algorithm)Approach

Gas provides a smart heuristic for solving many combinational optimization problems. The GA attempts to mathematically simulate the adaptive processes of biological evolution with a structured but randomized information exchange to form a search mechanism.Each solution in the population is evaluated according to some fitness measure. Highly fit solutions in the population are given opportunities to reproduce. New "child" solutions are generated and unfit solutions in the population are replaced.

A –I Process of SubSink Formulation

In this module our genetic algorithm, the random solutions are generated as initial population by choosing a random sub-sink for each member. The initial solutions generated randomly satisfy some constraint but possibly violate another some constraints. So the initial population may consist of some infeasible solutions. Our objective function based on GA is not only to minimize the hop sum but also to improve the feasibility of the solutions.

A-II Process of Fitness Value Calculation

A binary tournament selection is used to select parents from the initial population. First, two pairs of solutions are drawn randomly from the population. Then, for each pair, the solution with higher fitness value is discarded, and the other one is chosen as one parent for crossover. Here, the fitness value is the only criterion to choose parents.

A-III Process of Sub-sink Confirmation

The child solution will be rejected, if it is identical to one solution in the current population. The solution with the highest unfitness value is replaced by the child solution if the latter has lower unfitness value, which helps eliminate the infeasible solution more quickly in the population. If all solutions are feasible with zero unfitness value, the individual with the highest fitness will be replaced by the child solution if the fitness of the latter is lower.

B. Communication Establishment

B-I Discover Phase

The main tasks of the discovery phase include learning the topology information and assigning the members to their corresponding sub-sinks. To complete the tasks, the discovery phase is performed through three different rounds described below where the "round" has the meaning of when mobile sink arrives at the end point of its path once and returns back to the start point, we say that has completed one round.

B-II Building Shortest Path Tree Process

In this round, the mobile sink transmits broadcast messages continuously. All nodes receiving the broadcast messages from the mobile sinks are automatically selected as sub-sinks. Then the sub- sinks start building the Shortest Path Trees(SPTs) rooted from themselves in entire network. As a result, each node obtains the shortest hop information from themselves to all sub-sinks and then sends the related hop information to the corresponding sub-sink. The latter will transmit the hop information to the mobile sink in round 2.Another information task in Round 1is that the mobile sink need to record the time when each node enters and leaves its communication range. For the mobile sink, the data collection processes the forward direction and the reverse direction are symmetrical. So only the time records in the forward direction are needed

B-III Send Hop Information

In this round, the sub-sinks send the shortest hop information collected in Round 1 to the mobile sink when it passes by. In some areas with very dense deployment of sensor nodes, the communication durations of the sub-sinks may overlap in the case that more than one sub-sink is located simultaneously within the communication range of the mobile sink.

B-IV Assign Member

In Round 3, the mobile sink traverses the trajectory again to broadcast the results of member assignment to the monitored area. The broadcast message consists of the list of the mapping relation between each member and its destination sub-sink. Each node receiving the broadcast message will get a sub-sink as its destination. Then the node will delete its own item in the broadcast message and rebroadcast it. Finally, the optimized member assignment information will be disseminated to the entire network.

B-V Data Collection Phase

In this phase, all nodes start collecting data from the monitored area formally. The members send the sensed data or forward data to the destination sub- sinks according to the routing table built in Round 1 of the discovery phase. To deal with the network dynamics caused by the node failure or node addition, existing on-demand routing protocols may be used to find closest valid subsink successfully.

C. Zone Partition

We propose an algorithm to build shortest path trees(SPTs) based on zone partitioning without relying on geographical information about the sensors and the sinks. Through zone partitioning, we can divide the whole monitored area into several zones. And then, the MASP scheme is executed separately to get the optimal assignment of the members to the sub-sinks in each zone

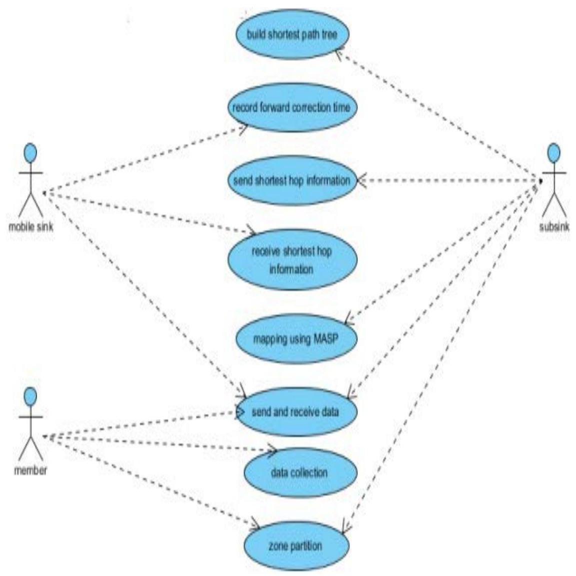

Fig 1.Use Case Diagram

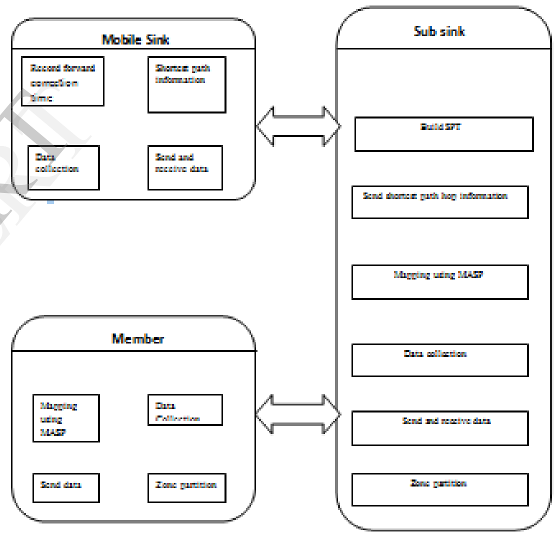

Fig 2. Architecture Diagram

IV. IMPLEMENTATION

System implementation is a stage in the paper where the theoretical design is turned into working system. It is the process of converting a new system into operation. The implementation phase of software development is concerned with translating design specification into source code. The most crucial stages is giving the users confidence that the new system will work effectively and efficiently. Given one standard database containing cloud user personal details and the data storage details. The system is constructed to accommodate any number of users enters into it simultaneously. The process is to verify the incoming user and allow then to access the cloud based on their access rights.

V. CONCLUSION

In this paper, I proposed an efficient data collection scheme called MASP for wireless sensor networks with path constrained mobile sinks. In MASP, the mapping between sensor nodes and subsinks is optimized to maximize the amount of data collected by mobile sinks. A heuristic based on genetic algorithm and local search is presented to solve the MASP optimization problem.

To reduce the computational complexity, I show that MASP improves the energy utilization efficiency and outperforms SPT an static sink methods in terms of total amount of data with almost the same energy consumption.

VI. REFRENCES

[1] R.C. Shah, S.Roy, S.Jain, and W. Brunette, "Data MULEs: Modeling a Three-Tier Architecture for Sparse Sensor Networks",Proc. First IEEE Int'l Workshop Sensor Network Protocols and Applications, pp.30-41, 2003.

[2] C. Chu and E. Basley, "A Genetic Algorithm for The Generalised Assignment Problem",Computers and Operations Research,Vol.24,no.1,pp.17-23,1997.

[3] A.Somasundara, A. Ramamorrthy 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.

[4] J. Al-karaki and A.Kamal," Routing Techniques in Wireless Sensor Networks: A Survey",IEEE Wireless Comm.Magazine,Vol.11,no.6,pp.6-28,Dec.2004

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

[6] M. Marta and M. Cardei, "Using Sink Mobility to Increase Wireless Sensor Network Lifetime", Proc.Ninth IEEE Int'l Symp.World of Wireless,Mobile and Multimedia Networks(WoWMoM),pp.1-10,2008.

[7] L. Song and D.Hatzinakos, "Architecture of Wireless Sensor Networks With Mobile Sinka: Sparsely Deployed Sensors", IEEE Trans. Vehicular Technology, Vol.56,no.4,pp.1826-1836,july 2007.

[8] ShuaiGao,Hongkezhang,Sajal K Das, "Efficient Data Collection in Wireless Sensor Networks with Path Constrained Mobile Sinks",IEEE Transactions on Mobile Computing, Apr 2011, Vol. 10, no. 4,pp 1-20,2011