An Effective Mobile Data Collection for Wireless Sensor Network using Multi Cluster Elective- Dual Data Uploading Algorithm

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Abstract— In this paper a three-layer structure is proposed for mobile data collection in wireless sensor networks, which contains the sensor layer, cluster head layer, and mobile collector (called SenCar) layer. The framework employs circulated load balanced clustering and dual data uploading, which is referred to as ELBC-DDU. The objective is to complete good scalability, and low data collection expectancy. At the sensor layer, a distributed load balanced clustering (ELBC) algorithm is proposed for sensors to self-consolidate themselves into clusters. In contrast to existing clustering methods, the structure generates multiple cluster heads in each cluster to balance the work load and facilitate dual data uploading. At the cluster head layer, the bury-cluster transmission range is carefully chosen to guarantee the connectivity among the clusters. Many cluster heads within a cluster cooperate with each other to perform energy-saving bury-cluster communications. Through bury-cluster transmissions, cluster head information is forwarded to SenCar for its moving trajectory planning. At the mobile gatherer layer, SenCar is equipped with two antennas, which enables two cluster heads to synchronously upload data to SenCar in each time by applying multi-user multiple-input and multiple-output (MU-MIMO) procedure. The trajectory planning for SenCar is improved to fully utilize dual data uploading capability by correctly selecting polling points in each cluster. By visiting each selected polling point, SenCar can efficiently collect data from cluster heads and transport the data to the fixed data sink. Extensive simulations are conducted to calculate the success of the proposed scheme. The results show that when each cluster has atmost two cluster heads, the scheme achieves over more drive saving per node and more energy saving on cluster heads comparing with data gathering through multi-hop relay to the static data sink.

Key words: WSN, Load balancing, ESenCar, Polling Point, Multi Cluster Polling Point, Trajectory Planning

I. Introduction

Wireless sensor network (WSN) are spatially circulated autonomous sensors to monitor physical or environmental conditions, such as illness, sound, pressure, etc. and to helpfully pass their data through the network to a main location. The more current networks are bi-directional, also allowing control of sensor activity. The development of wireless sensor networks was inspired by soldierly applications such as field surveillance; today such networks are used in many engineering and consumer applications, such as engineering process monitoring and control, machine health monitoring, and so on.

The data collection technique is used to collect the combined data from the sensor node to the sink node. The main objective of the data gathering process is to reduce the postponement and improves the network's lifetime. There are various techniques used to collect the data from basis node to sink node.

First, all the sensors are fixed and then the network is considered as fixed network. The fixed sensor node forwards the data to the sink by one or extra hops. So, the sensor located closer to the sink gets depleted soon. Second, the hierarchy form of data gathering. The nodes can be categorized into subordinate layer and developed layer. The nodes in the lower level layers are similar sensor nodes. The nodes in the developed layer are more powerful than the no des in the lower layer. The developed layer nodes are called as group heads. The hierarchy topology is also called as clusters. Third, Mobile Collector is used to gather the data periodically.

A mobile data observer is used to gather the data animatedly. The nodes that can be located closer to the data viewer can upload the data straight. The nodes that can be located far away from the viewer can forward the data by relaying. Solitary Hop Data Gathering problem (SHDGP) and mobile Data Collecting are the two methods that can be used to increase the lifetime of the network. Solitary Hop Data Gathering Problem (SHDGP) is used to achieve the uniform drive consumption. The mobile Data Gathering algorithm is used to find the least set of points in the sensor network. It serves as data collecting points for mobile node.

To make the framework employs circulated load balanced clustering and dual data uploading.

To propose a distributed load balanced clustering (ELBC) algorithm for sensors to self-establish themselves into clusters in the sensor layer.

To make the scheme generates multiple cluster heads in each cluster to stability the work load and facilitate dual data uploading.

At the cluster head layer, to carefully choose the inter-cluster transmission range to guarantee the connectivity among the cluster.

II. Related works

Kenan Xu et al [1] describe the lifetime of a wireless sensor network (WSN) by designing energy efficient networking protocols, the impact of arbitrary device deployment on system lifetime is not stressed enough. Some research efforts have tried to adjust device deployment with respect to lifetime by assuming devices can be placed deliberately. However, the methodologies and results there in are not applicable to a randomly deployed large scale WSN. In this research, we propose three arbitrary deployment strategies for relay nodes in a heterogeneous WSN, namely, connectivityoriented, lifetime-oriented and hybrid deployment. We study how a strategy can affect both connectivity and network lifetime of a multi-hop varied WSN, in which relay nodes transmit data to the base station via multi-hop relay. The presentation of the three strategies is calculated through simulations. The results of this research provide a viable solution to the problem of improving provisioning of a large scale heterogeneous WSN.

Jin Wang et al [2] describe many applications of wireless sensor networks (WSNs) where sensors are arranged in areas accessed by laid roads sinks can be collected on mobile devices like bus or handcart. Relate to WSNs with static sink(s), Wireless Sensor Networks with Mobile Sink(s) (MSSNs) are more dominant at drive economization, delay decrease and network lifetime maintenance. In this paper, we propose a Global Best Path (GBP) data collecting algorithm based on wireless Sensor Networks with solitary Mobile Sink (GBP-MSSN). It aims at determining the best position for the solitary mobile sink and further using total sensors' information to generate the best scheme to collect data from specified node. Creating of best scheme is conducted by GBP algorithm which can balance drive consumption among whole sensor networks and further extend the network lifetime. Simulation results show that our GBP-MSSN algorithm overtakes conventional algorithms like LEACH, GAF, etc.

Yan Wu et al [3] describes exploit the network lifetime, which is defined as the time until the first node depletes its energy. The problematic is shown to be NP-comprehensive. We design an algorithm which starts from an arbitrary tree and iteratively decreases the load on blockage nodes (nodes likely to soon deplete their energy due to high degree or low remaining energy). We then encompass our work to the case when there are multiple base stations, and study the construction of a maximum lifetime data collecting forest. We show that both the tree and forest construction algorithms terminate in in polynomial time and are provably near best. We then verify the efficacy of our algorithms via numerical comparisons.

Arati Manjeshwar et al [4] describe the wireless sensor networks are expected to find wide applicability and increasing deployment in the adjoining future. In this paper, propose a formal classification of sensor networks, based on their mode of functioning, as active and responsive networks. Reactive networks, as opposed to passive data collecting active networks, respond immediately to changes in the related parameters of interest. We also introduce a new drive efficient protocol, TEEN (Threshold sensitive Drive Efficient sensor Network protocol) for reactive networks. We calculate the presentation of our protocol for a simple temperature recognizing application. In terms of energy efficiency, our protocol has been practical to outperform existing conventional sensor network protocols.

In the current body of research complete in the area of wireless sensor networks, we see that specific attention has not been given to the time criticality of the board applications. Most present protocols assume a sensor network collecting data periodically from its environment or answering to a particular query. We feel that there occurs a need for networks geared towards responding directly to changes in the identified attributes. We also trust that sensor networks should provide the end user with the capability to control the trade-off between drive efficiency, accuracy and response times dynamically. So, in our research, we have concentrated on developing a communication protocol which can fulfill these requests.

Sudharman K. Jayaweera et al [5] describe the energy-efficient effective multiple-input multiple output (MIMO)-based communications architecture is planned for energy-limited, distributed and supportive wireless sensor networks. Assuming a space-time block coding (STBC) based MIMO system, the drive and delay efficiencies of the proposed MIMO-based communications structure are derived using logical techniques. The efficiency of the proposed MIMO-based communication system is associated to the system and channel transmission parameters. These investigations show that MIMO techniques can be completed to provide significant drive savings and delay efficiencies at the same time with judicious choice of system parameters at the design level. Further, the dependence of drive efficiency of proposed MIMO-based wireless sensor network proceeding failing coherence time and the required amount of training is studied. These results explain the application of proposed cooperative MIMO-based arrangement in wireless sensor networks even after allowing for additional training overheads

III. SYSTEM METHODOLOGY

The existing system presents the distributed load balanced clustering algorithm at the sensor layer. The important process of clustering is the selection of cluster heads. To prolong network lifetime, we naturally expect the particular cluster heads are the ones with higher residual drive. Hence, we use the percentage of residual drive of each sensor as the initial clustering priority. Accept that a set of sensors, denoted by S = {s1, s2, …, sn}, are homogeneous and each of them autonomously makes the decision on its status based on local information. After successively the LBC algorithm, each cluster will have at most M (>=1) cluster heads, which means that the size of CHG of each cluster is no more than M. Each sensor is enclosed by at least one cluster head inside a cluster. The LBC algorithm is included of four stages: (1) Initialization; (2) Status claim; (3) Cluster forming and (4)Cluster head synchronization.

The existing system has following disadvantages.

- How to find polling points and companionable pairs for each cluster is not studied.
- Divider the continuous space to locate the best polling point for each cluster is not carried out.
- To achieve optimal overall spatial diversity is not carried out.

The main contributions of this proposed work can be shortened as follows. First, we propose a distributed algorithm to organize sensors into clusters, where each cluster has multiple cluster heads. In difference to clustering techniques proposed in previous works [10] algorithm balances the load of intra-cluster aggregation and allows dual data uploading between multiple cluster heads and the mobile collector. Second, many cluster heads within a cluster can collaborate with each other to perform energy efficient inter-cluster transmissions.

Different from other classified schemes, cluster heads do not relay data packets from other clusters, which effectively improve the burden of each cluster head. Instead, forwarding paths among clusters are only used to route lesser-sized identification (ID) evidence of cluster heads to the mobile collector for optimizing the data collection tour. Third, we organize a mobile collector with two antennas (called SenCar in this paper) to allow parallel uploading from two cluster heads by using MU-MIMO

The SenCar collects data from the cluster heads by visiting each cluster. It selects the stop locations inside each cluster and determines the sequence to visit them, such that data collection can be done in smallest time. Our work mainly distinguishes from other mobile collection schemes the utilization of MU- IMO technique, which enables dual data uploading to shorten data transmission latency. We synchronize the mobility of SenCar to fully appreciate the benefits of dual data uploading, which ultimately leads to a data collection tour with both small moving trajectory and short data uploading time

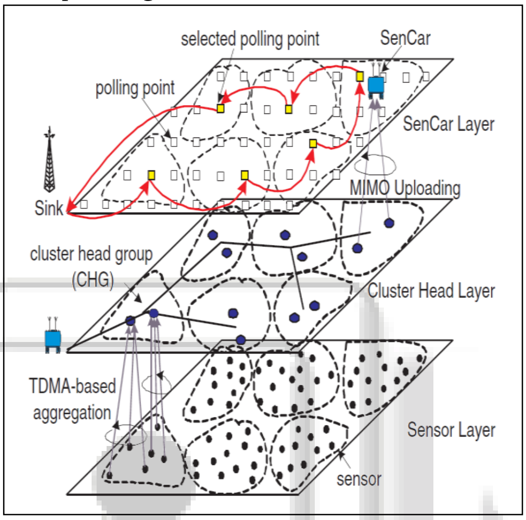

Fig. 1: Mobile Data Gathering

The proposed system includes answering the problem of how to catch polling points and compatible pairs for each cluster. A discretization scheme is developed to partition the nonstop space to locate the optimal polling point for each cluster. Then finding the compatible pairs becomes a similar problem to achieve optimal overall spatial diversity. The second problem is how to schedule uploading from multiple clusters. An algorithm that familiarizes to the transmission scheduling algorithms is included.

The first step in the software development life cycle is the identification of the problem. As the success of the system depends largely on how perfectly a problem is identified. At present distributed load balanced clustering algorithm is accessible at the sensor layer in which the critical operation of clustering is the selection of cluster heads. To prolong network lifetime, it is naturally expected the selected cluster heads are the ones with higher residual energy.

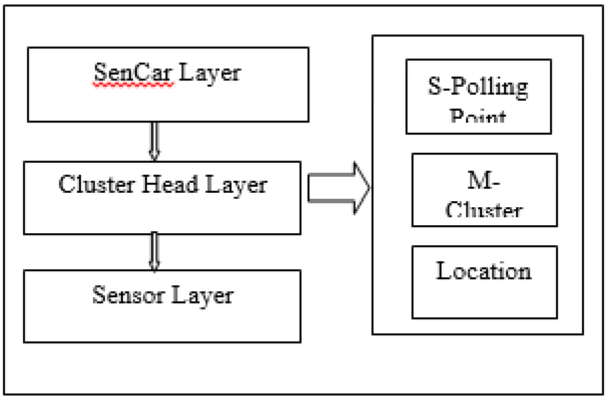

Fig. 2: Proposed Architecture

Hence, the percentage of residual energy of each sensor is used as the initial clustering priority. It is also assumed that a set of sensors, denoted by S = {s1, s2, …, sn}, are homogeneous only. Since there is no application with the feature to have heterogeneous nodes in the network and to achieve optimal overall spatial diversity along with schedule uploading from multiple clusters, this project solves the problem through the application. The proposed system has following advantages.

- How to find polling points and compatible pairs for each cluster is studied.
- Screen the continuous space to locate the optimal polling point for each cluster is carried out.
- To achieve optimal overall spatial diversity is carried out.
- Schedule uploading from multiple clusters in done

IV. EXPERIMENTAL RESULTS

Compared with data collection via a static sink, introducing mobility for data collection enjoys the benefits of balancing drive consumptions in the network and connecting disconnected regions. The mobility under arbitrary walk where the mobile collector picks up data from nearby sensors, buffers and finally offloads data to the wired access point and however, random trajectory cannot guarantee latency bounds which are required in many applications. In proposed to control data mules to traverse the sensing field along parallel straight lines and collect data from nearby sensors with multi-hop transmissions.

The following Table 4.1 and Fig 4.1 describes experimental result for existing system performance rate analysis. The table contains number of cluster, cluster size and number of aggregated data and ordinary combined data details are shown

S. N O	Cluster	C A	C B	CC	C D	CE	C F
1	2 Cluster	73	56	72	74	72	65
2	3 Cluster	62	73	73	75	69	74
3	4 Cluster	69	70	76	65	74	69
4	5 Cluster	65	77	75	68	73	72
5	6 Cluster	69	75	71	64	65	68
6	7 Cluster	70	76	70	62	67	72
7	8 Cluster	72	69	68	75	74	69

8	9 Cluster	78	78	65	59	72	74
	No. of Aggregated data	558	574	570	542	566	563
	Average %	69.75	71.75	71.25	67.75	70.75	70.375

Table 4.1: Cluster Size: Performance Rate

The following Table 4.2 Fig 4.2 describes experimental result for existing system over all experimental result analysis. The table contains combined cluster, number of aggregated data cluster data and average aggregated data details are shown

Combined Cluster	No. of. Combined Data	AVG % Combined
Cluster A	558	69.75
Cluster B	574	71.75
Cluster C	570	71.25
Cluster D	542	67.75
Cluster E	566	70.75
Cluster F	563	70.375

Table 4.2: Overall Experimental Result - Existing System

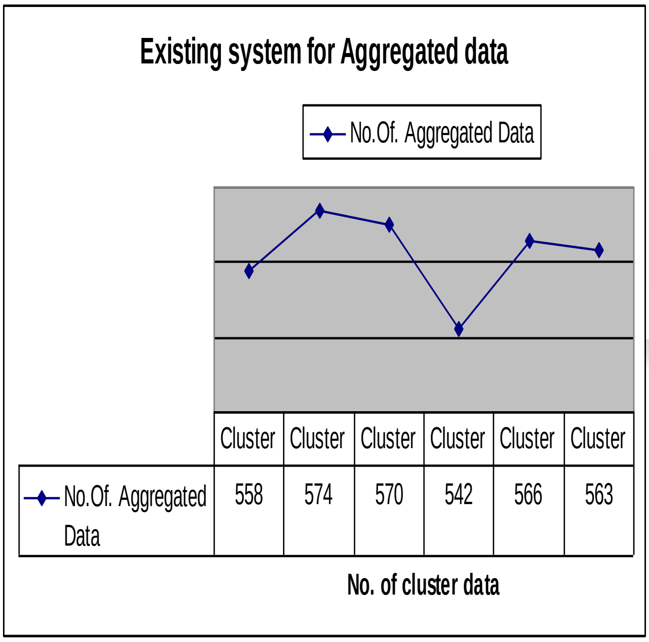

Fig. 4.1: Performance rate Analysis

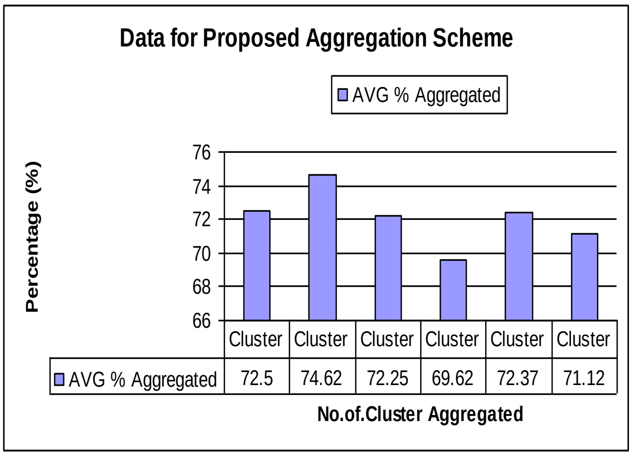

Fig. 4.2: Cluster Size: Performance Rate

V. Conclusion

Through this paper mobile data gathering framework for mobile data collection is proposed in a Wireless Sensor Network. It consists of sensor layer, cluster head layer and SenCar layer. It employs distributed load balanced clustering for sensor self-organization, adopts common inter-cluster communication for energy-efficient transmissions among CHGs, use dual data uploading for fast data collection. In the cluster head layer, inter-cluster transmission range is chosen to assurance the connectivity among the clusters. Multiple cluster heads within a cluster are cooperating with each other to perform inter-cluster communications. Through inter-cluster transmissions, cluster head information is forwarded for its moving trajectory planning. The performance study demonstrates the effectiveness of the proposed framework. The results can greatly reduce drive consumptions by alleviating routing burdens on nodes and balancing workload among cluster heads. It is also justified the drive overhead and explored the results with different numbers of cluster heads in the framework. A sample run of the system has been made and is giving good results the procedures for processing is simple and fixed order. The process of preparing plans been missed out which might be considered for further modification of the application.

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