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WIRELESS SENSOR NETWORK IN GROUP OF DATA USING LOAD BALANCED CLUSTERING

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ABSTRACT

This project proposed a **three-layer framework** is proposed for **mobile data collection** in wireless sensor networks, which includes the **sensor layer**, **cluster head layer**, and **mobile collector** (called SenCar) layer. The framework employs **distributed load balanced clustering** and **dual data uploading**, which is referred to as LBC-DDU. The objective is to achieve good scalability, and low data collection latency. At the sensor layer, a distributed load balanced clustering (**LBC**) algorithm is proposed for sensors to **self-organize themselves into clusters**. In contrast to existing clustering methods, the scheme generates **multiple cluster heads in each cluster to balance the work load** and facilitate dual data uploading.

At the cluster head layer, the **inter-cluster transmission range** is carefully chosen to guarantee the connectivity among the clusters. Multiple cluster heads within a cluster cooperate with each other to perform energy-saving inter-cluster communications. Through inter-cluster transmissions, cluster head information is forwarded to SenCar for its moving trajectory planning. At the mobile collector layer, SenCar is equipped with two antennas, which enables two cluster heads to simultaneously upload data to SenCar in each time by utilizing multi-user multiple-input and multiple-output (MU-MIMO) technique. The **trajectory planning for SenCar is optimized to fully utilize dual data uploading capability** by properly selecting polling points in each cluster.

1. INTRODUCTION

1.1 WIRELESS SENSOR NETWORK

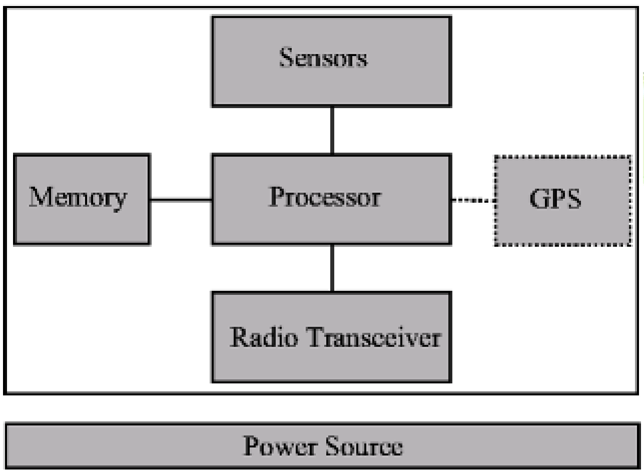
Wireless sensor network (WSN) are spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity. 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. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, 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 WSNs 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.

Applications of Wireless Sensor Networks

- Process Management
- Area monitoring
- Health care monitoring
- Environmental/Earth sensing
- Air pollution monitoring
- Forest fire detection
- Landslide detection

WSN Provide a bridge between the real physical and virtual worlds. Allow the ability to observe the previously unobservable at a fine resolution over large spatio-temporal scales. Have a wide range of potential applications to industry, science, transportation, civil infrastructure, and security. The below mentioned diagram shows the Basic Components of a WSN Node



Challenges of WSN is

- Energy Efficiency
- Responsiveness

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- Robustness
- Self-Configuration and Adaptation

PROPOSED SYSTEM

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

ADVANTAGES

The proposed system has following advantages.

- How to find polling points and compatible pairs for each cluster is studied.
- Partition 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
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MODULE DESCRIPTION

The following modules are present in the project.

- **NODE ADDITION**
- **BATTERY STATUS UPDATE**
- **INITIALIZATION**
- **STATUS CLAIM**
- **CLUSTER FORMING**
- **RECEIVE PACKET**
- **FIND OPTIMAL SPATIAL DIVERSITY**

1. NODE ADDITION

In this module, the node id, name, initial X and Y Positions details are keyed in and saved in 'Nodes' table.

2. BATTERY STATUS UPDATE

In this module, the node id is selected and battery percent is updated. The details are keyed in and saved in 'BatteryStatus' table.

3. INITIALIZATION

In this module, the network initialization process (First phase of the algorithm) is carried out. In the initialization phase, each sensor acquaints itself with all the neighbors in its

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proximity. If a sensor is an isolated node (i.e., no neighbor exists), it claims itself to be a cluster head and the cluster only contains itself. Otherwise, a sensor, say, si, first sets its status as “tentative” and its initial priority by the percentage of residual energy.

Then, sorts its neighbors by their initial priorities and picks M-1 neighbors with the highest initial priorities, which are temporarily treated as its candidate peers. The set of all the candidate peers of a sensor is denoted as **A**.

It implies that once si successfully claims to be a cluster head, its up-to-date **candidate peers would also automatically become the cluster heads, and all of them form the CHG of their cluster**. si sets its priority by summing up its initial priority with those of its candidate peers.

4. STATUS CLAIM

In this module, status claim process (Second phase of the algorithm) is carried out. In this phase, each sensor determines its status by iteratively updating its local information, refraining from promptly claiming to be a cluster head. The node degree is used to control the maximum number of iterations for each sensor. Whether a sensor can finally become a cluster head primarily depends on its priority.

Specifically, the priority is partitioned into three zones by two thresholds. ¯h and ¯m (¯h > ¯m), which enable a sensor to declare itself to be a cluster head or member, respectively, before reaching its maximum number of iterations. During the iterations, in some cases, if the priority of a sensor is greater than Πh or less than tm compared with its neighbors, it **can immediately decide its final status** and quit from the iteration.

5. CLUSTER FORMING

In this module, cluster forming process (Third phase of the algorithm) is carried out. This process decides which cluster head a sensor should be associated with. The criteria can be described as follows: for a sensor with tentative status or being a cluster member, **it would randomly affiliate itself with a cluster head among its candidate peers for load balance purpose**.

In the rare case that there is no cluster head among the candidate peers of a sensor with tentative status, the sensor would claim itself and its current candidate peers as the cluster heads. It calculates the final result of clusters, where each cluster has two cluster heads and sensors are affiliated with different cluster heads in the two clusters.

In case a cluster head is running low on battery energy, re-clustering is needed. This process can be done by sending out a re-clustering message to all the cluster members. Cluster members that receive this message switch to the initialization phase to perform a new round of clustering.

6. RECEIVE PACKET

In this module, during the cluster forming process, received packet steps are carried out. Here what are the nodes in the clusters should be updated as potential cluster heads is decided. Likewise what are the nodes in the clusters should be updated as candidate cluster head peers are decided.

7. FIND OPTIMAL SPATIAL DIVERSITY

In this module, for the given node (A), the nearest cluster heads (NCH) other than the current cluster head (CH) are found out and it can be used for cluster changing by A.

CONCLUSION

Through this project, mobile data gathering framework for mobile data collection is proposed in a WSN. It consists of sensor layer, cluster head layer and SenCar layer. It employs distributed load balanced clustering for sensor self-organization, adopts collaborative inter-cluster communication for energy-efficient transmissions among CHGs, uses dual data uploading for fast data collection.

The performance study demonstrates the effectiveness of the proposed framework. The results can greatly reduce energy consumptions by alleviating routing burdens on nodes and balancing workload among cluster heads. It is also justified the energy overhead and explored the results with different numbers of cluster heads in the framework. A trial run of the system has been made and is giving good results the procedures for processing is simple and regular order. The process of preparing plans been missed out which might be considered for further modification of the application. The following enhancements are should be in future.

- ✓ The application if developed as web services, then many applications can make use of the records.
- ✓ Multi Threading approach can be used so that the cluster forming speed is increased.

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