Investigation an Algorithm on Distributed System and Centralized for WSN

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Abstract: In this paper we are studying about Investigation an Algorithm on Distributed System and Centralized for WSN**.** Wireless Sensor Networks are networks that consist of sensors which are distributed in an ad hoc manner. These sensors work with each other to sense some physical phenomenon and then the information gathered is processed to get relevant results. A wireless sensor network consists of protocols and algorithms with self-organizing capabilities. A sensor node is made up of four basic components are sensing unit, a processing unit, a transceiver unit, and a power unit. Presently the network model, proposed modified distributed algorithms, performance evaluation criteria and simulation setup that have been used in the Paper to carry out the research. The work has been carried out by using C++. The simulation setup and its implementation have been reported in this paper. The algorithms work by having each sensor transition through these possible prioritized cover sets, settling for the best cover it can negotiate with its neighbors. A local lifetime dependency graph consisting of the cover sets as nodes with any two nodes connected if the corresponding covers intersect captures the interdependencies among the covers. . Nodes check to see if the area that they cover can be sponsored by their neighbors and they looked into a coverage-preserving node-scheduling scheme, which can reduce energy consumption, consequently increase system lifetime, by turning off some redundant nodes.

***Index Terms* – Network, Sensor, Wireless, Centralized, WSN, C++, Power, Lifetime, Neighbors.**

I. INTRODUCTION

The network could be easily extended by simply adding more sensor nodes with no rework or complex reconfiguration. In contrast to traditional wireless networks, the sensor nodes in WSNs do not necessarily need to communicate directly with the nearest high power control center, but mostly with their neighboring sensor nodes and each individual sensor node becomes part of an overall infrastructure. In addition, the network can automatically adapt to compensate for node failures. When compared with traditional ad-hoc networks, WSNs have some limitations such as limitation in power, computational capacities and memory. Sensor nodes carry limited power supply which are generally irreplaceable and may be deployed with non-rechargeable batteries. Since the sensor nodes will die one after another during the operation of the network, all the network requirements must be met with minimum power consumption due to battery limitations, and in most applications, it is impossible to replenish power resources. In WSNs, a decrease in the number of available sensor nodes can deeply degrade the network performance or may even kill the network, as either some area is not covered or some data is not transferred through the network. Moreover, it is impossible to replace thousands of nodes in hostile or remote regions, and thus the sensor nodes needs to be utilized in an efficient manner. Another factor to be considered here is the slow improvement in battery capacities over the years [4]. Thus energy saving has become a critical issue in WSNs, and the most energy saving must to come from energy aware protocols. The main tasks of a sensor node in a sensor network are to collect data (monitoring), perform data aggregation, and then transmit data. Among these tasks transmitting data requires much more energy than processing data [6] and the most recent efforts on optimizing the wireless sensor network lifetime have been focused on routing protocol (i.e., transmitting data to the base and data request from the base to the sensor node).

II. REVIEW OF WORK

In 2001, M. Potkonjak [35] report a general area coverage problem and introduce the notion of a field as the set of points that are covered by the same set of sensors. The essential approach behind the picking of a sensor is to first pick the one that covers that largest number of previously uncovered fields and to then avoid including more than one sensor that covers a sparsely covered field.
In 2002, D. Tian and N. D. Georganas [19], the authors contribute a distributed and localized algorithm that works in rounds, with a scheduling phase followed by a sense phase. Nodes check to see if the area that they cover can be sponsored by their neighbors and they looked into a coverage-preserving node-scheduling scheme, which can reduce energy consumption, consequently increase system lifetime, by turning off some redundant nodes.
In 2003, Ting Yan, Tian He and John A. Stankovic [14], the authors introduce algorithms where each sensor can produce a number of schedules which are exchanged with the neighboring sensors and the most desirable scheduled is then selected. Every node is able to dynamically make a decision a schedule for itself to guarantee a certain degree of coverage with average energy consumption inversely proportional to the node density.

In 2004, P. Berman, G. Calinescu, C. Shah and A. Zelikovsky [7], propose a good centralized approximation algorithms as well as distributed algorithms aimed at prolonging the lifetime. They have invented maximum sensor network lifetime problem and solving this problem as well as explored the case when the monitored area is required to partially cover. In this disjoint set cover problem is further extended by not involving the sensor sets to be disjoint (i.e., a sensor can be active in more than one sensor set) thereby, allowing the sets to operate for different time intervals. They devote a distributed algorithm based on using the faces of the graph. If entirely faces that a sensor covers are covered by other sensors with higher battery that are in an active or deciding state, then a sensor can switch off (sleep). Their work has been extended to target coverage in the load balancing protocol (LBP).

In 2005, Mihaela Cardei, Jie Wu, Mingming Lu, and Mohammad O. Pervaiz [5],the authors utilize a sensing model that allows a sensor to adjust its range from one of several different fixed values. The authors address the problem of finding the maximum number of sensor covers and target coverage problem. They present a linear programming based formulation, a linear programming based heuristic and also greedy formulations for this problem. The authors add the requirement of connectivity to the sensor covers and present distributed heuristics to maximize the total number of rounds. Their problem expression attempts to maximize the number of set covers such that each set monitors all targets and every sensor in every set is assigned a range. They also present a centralized greedy heuristic and a distributed greedy heuristic.

M. Cardei et al.[5], in 2005 introduce target coverage problem where disjoint sensor sets are modeled as disjoint set covers so that every cover set completely monitors all the target points. These sensor sets can be scheduled to activate successively so that at any time, one sensor set is in active state and other sensors are in sleep state. These alternations increase the lifetime of the network.

In 2006, Mihaela Cardei and Jie Wu [9] suggested that the coverage problem and it can be classified into three groups: area coverage (where the objective is to cover an area), target coverage (where the objective is to cover a set of targets) and breach coverage (where the objective is to find out the maximal support/breach path that traverses a sensors field). The goal of the coverage problem is to maximize the network life time while covering the sets of targets/area.

A. Dhawan et al, in 2006 propose maximization of sensor network lifetime with adjustable sensing range algorithm in [17]. It is an extension of the centralized algorithm in [7] with adjustable sensing range sensor networks. Their approach differs significantly from [5] in that they focus on maximizing the lifetime whereas [5] focuses on maximizing the number of cover sets. They also develop their sensor networks with non-uniform batteries at the sensors and allow the sensors to change sensing range smoothly.

III. DECENTRALIZED ALGORITHMS

In this kind of distributed algorithm, the work time line is divided into rounds and each round usually contains two phases, which are the decision phase (the small interval of time as equated to length of the whole round for sensors to decide to turn on or turn off) and sensing phase (the remaining time of a round for sensors to do their sensing tasks). The algorithm is periodically executed at the beginning of each round [2]. The advantage of this type of algorithm is that the energy consumption and some other constraints can easily be taken into account since the sensors can update and then exchange the information (including their residual energy and sensor id) each time carrying out the algorithm[38, 39]. Nevertheless, its disadvantage is that at each round, the sensors must consume the certain amount of energy in decision phase even when it may not join the network that round [2].

IV. DECENTRALIZED ALGORITHMS THAT WORK IN ROUNDS DECENTRALIZED ALGORITHMS THAT WORK IN ROUNDS

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Distributed Algorithms

In this section, first, the two distributed algorithms ALBPS and ADEEPS for SNLP are discussed [1]. After that the two enhanced distributed algorithms namely, HALBPS and HADEEPS, are proposed. The working procedure of proposed algorithms is similar to ALBPS and ADEEPS. In the ALBPS and ADEEPS, initial energy of each sensor node is fixed but in the proposed algorithms, nodes are heterogeneous and they have different energy levels. Proposed algorithms use a new heterogeneous model with three types of nodes such as normal, advance and super nodes they are heterogeneous in form of energy with some fraction.

- To detect a disaster such as forest fire, flood, tsunami, volcano activities that is about to happen.
- To track the movement, health condition of animal/insects etc.

Health applications: It can be used:

- To remotely monitor/track/diagnose thecondition/status(position, quantity, heart rate, blood pressure) of doctor, patient or drug, equipment, etc.
- To tele-monitor human physiological data (e.g. patient behavior), and the data will be collected and analyzed to detect early symptoms of a disease, and to find new treatment, etc.

***Commercial applications*:** It can be used to detect/track/monitor vehicles, to manage/control inventory/warehouse, to support interactive devices, or to control environment of a building.

***Scientific exploration**:* WSNs can be deployed under the water or on the surface of a planet for scientific research purpose.

Area monitoring: Area monitoring is a common application of WSNs. In area monitoring, the WSN is deployed over a region where some phenomenon is to be monitored. For example, a large quantity of sensor nodes could be deployed over a battlefield to detect enemy intrusion instead of using landmines. When the sensors detect the event being monitored (heat, pressure, sound, light, electro-magnetic field, vibration, etc), the event needs to be reported to one of the base stations, which can take appropriate action (e.g. send a message on the internet or to a satellite).

V. COMPARISON WITH AD HOC NETWORKS

The number of nodes in a sensor network can be several orders of magnitude higher than the nodes in an ad hoc network. Sensor nodes are densely deployed. Sensor nodes are limited in power, computational capacities and memory. Sensor nodes are prone to failures. The topology of a sensor network changes frequently. Sensor nodes mainly use broadcast, most ad hoc networks are based on p2p. Sensor nodes may not have global ID

VI. PROPOSED MODIFIED DISTRIBUTED ALGORITHMS

In the new algorithms HALBPS and HADEEPS, both the energy level and distance are considered in the sensors decisions. The following shows the steps in our simulation:

Step:-1. Targets and sensors are read into the memory.

Step:-2. Sensor nodes are in a deciding state and decide whether they can go to sleep or become active and cover the target.

Step:-3. All the sensor nodes know about its energy level, sensor id and target id. The energy consumption level of the sensor depends on the energy model. It can be either linear or quadratic energy with a new heterogeneous model.

Step:-4. Each sensor knows its neighboring sensors, neighboring sensors distance and covered targets.

Step:-5. For the each sensor

In Heterogeneous Adjustable Range Load Balancing Protocol (HALBPS), checks with each neighbor sensors starting from the farthest target whether that target can be covered by the neighbor sensor with larger battery level. If the neighbors target can cover the farthest target with larger battery level, then the sensor removes that target from the covered target list and reduces the sensing range to the next target. This sensor will go to sleep if the range reaches zero. This process stops after all sensors make a decision.

In Heterogeneous Adjustable Range Deterministic Energy-Efficiency Protocol

(HADEEPS), each sensor decides which targets they are in-charge of by using the maximum lifetime of all the targets of its neighbors. After making this decision, each sensor decides to become active with range r (r ≤ maximum sensing range) or decides to sleep. This process stops after all sensors make a decision.

Step:-6. After all sensors decide their state to be active or idle, each sensor will stay in that state for a certain period of time (shuffle time) or until there is an active sensor which exhausts its energy supply and is going to die. All sensors are alerted using wake-up call causing all sensors to change their state back to the deciding state with their maximum sensing range and repeat the process from step 5.

Step:-7. This simulation is repeated until a target cannot be covered.

Step:-8. Then, the process terminates and the lifetime of the network is printed out.

VII. CONCLUSION

Presently the network model, proposed modified distributed algorithms, performance evaluation criteria and simulation setup that have been used in the Paper to carry out the research. The work has been carried out by using C++. The simulation setup and its implementation have been reported in this Paper. In this PAPER, we have also explained modified distributed algorithms using the different adjustable range sensors and node heterogeneity. We have tested the performance of the algorithms by simulating it over a wide range of simulation parameters. Paper-3, describe the simulation and comparative analysis of the distributed algorithms (ALBPS, HALBPS, ADEEPS and HADEEPS) for maximizing the lifetime of WSNs with heterogeneity for adjustable sensing range. the simulation and comparative analysis of the distributed algorithms (HALBPS and HADEEPS) for maximizing lifetime of WSNs with heterogeneity and adjustable range for different deployment strategies. The simulation and comparative analysis of the energy-efficient data gathering algorithms (DALBPSH and AEEDPSH) for improving lifetime of WSNs with heterogeneity and adjustable sensing range has been done. The high compression rate will help to reduce energy consumption during the data transmission process, and the high response speed will help the work with high efficiency. This method can also be used in other object motion or deformation with large range and other field to improve the monitoring efficiency. These algorithms are based on constructing minimal cover sets each consisting of one or more sensors which can collectively cover the local targets. Some of the covers are heuristically better than others for a sensor trying to decide its own sense-sleep status. This leads to various ways to assign priorities to the covers. The algorithms work by having each sensor transition through these possible prioritized cover sets, settling for the best cover it can negotiate with its neighbors. A local lifetime dependency graph consisting of the cover sets as nodes with any two nodes connected if the corresponding covers intersect captures the interdependencies among the covers. . Nodes check to see if the area that they cover can be sponsored by their neighbors and they looked into a coverage-preserving node-scheduling scheme, which can reduce energy consumption, consequently increase system lifetime, by turning off some redundant nodes.

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