A Progress on Target Management Protocol for Wireless Sensor Networks

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Abstract- There has been the no. of development in the field of a random deployment of sensor node for monitoring the e specific target for maximum duration to face target coverage problem. Sensor node have a limited energy, memory, speed and bandwidth hence these cannot handle the extreme environmental condition efficiently. since a large no; of sensor nodes are required to enhance the fault tolerance of wireless sensor network ,can lead to excessive resources wastage especially energy hence the justified energy management is an important issue of target coverage problem in this paper a protocol is propose for target coverage management while focusing to minimize the energy consumption.

Keywords— Wireless sensor network, target detection, energy efficient, coverage protocol

I. INTRODUCTION

A WSN can be defined as a network of devices, denoted as *nodes*, which can sense the environment and communicate the information gathered from the monitored field (e.g., an area or volume) through wireless links. The data is forwarded, possibly via multiple hops, to a *sink* (sometimes denoted as *controller* or *monitor*) that can use it locally or is connected to other networks (e.g., the Internet) through a *gateway*. The nodes can be stationary or moving. They can be aware of their location or not. They can be homogeneous or not. Recent advances in technologies made it technically and economically feasible to combine sensing, processing and communicating capabilities into small low cost sensor devices. Once these nodes get deployed, they self organize to form Wireless Sensor Network (WSN) and communicate via wireless links to perform a specific task of real world. Various applications WSN includes National Security [5], Habitat Monitoring [14,15], Environment observation and forecasting like temperature, sound and pressure etc [16], Health Applications [5,17], Home and Office Applications [18],.Therefore WSNs are becoming an active research field with numerous research activities carried out every year to explore and solve different constraints. The Wireless Sensor Network may be defined as being composed of large number of spatially distributed autonomous wireless sensor nodes that co-operatively monitor the physical conditions of the environment such station which acts an interface between these sensor nodes and the real world.
Typically a Wireless Sensor Node consists of a sensing unit, a processing unit, a communication unit and a power unit [19, 20], that is used for sensing the relevant data, processing of the collected data and as temperature, pressure, humidity, wind speed, sound, etc. and forward the sensed information to the special node called base Communicating with other connected nodes in the WSN. These nodes after deployment form the network to monitor the specific region of interest.

1.2. Coverage Problem

An important problem addressed in Wireless Sensor Network is Coverage Problem [1, 2]. It is basically concerned with a question: How efficiently the specific region of interest is being covered by the sensor nodes. The objective is to have the region monitored by at least one sensor node. It may be broadly classified into three main categories:

- ✓ Area Coverage Problem [4, 5, 22, 10, 12] where the goal is to monitor a specific region or area.
- ✓ Target Coverage Problem [1, 6, 4, 13, and 21] where the goal is to monitor a specific set of targets or Points.
- ✓ Coverage dealing with the determination of the maximum support [7, 11].

In this paper we will be dealing only with the Target Coverage Problem which is concerned with the coverage of specific targets by the sensor nodes. These nodes require energy for performing the coverage task. Since, the sensor nodes are usually battery powered; therefore judicious management of energy is an important concern so that coverage task can be performed for a maximum duration. In this paper, we propose an algorithm to perform the coverage task with minimum participation of sensor nodes to cover the targets, thereby consuming minimum energy. This paper is organized as follows: In section 2, the Target Coverage Problem and the related works are discussed. In section 3 we present a Target Coverage Management Protocol for WSN. Finally, in section 4 we conclude our work.

II. TARGET COVERAGE PROBLEM AND RELATED WORKS

In WSN one of the most challenging problems is Target Coverage. Wireless sensor network concerned with maximization of network life time by monitoring the specific target with a set of randomly dispersed sensors. We consider number of targets (i.e. r1, r2, r3…..rm) their locations are already determined. A set of superfluous deployed nodes is given. An aircraft is keeping the track of these specific targets, it is assumed that a sensor node covers the target if the Euclidean distance between the sensor node and the target is smaller or equal to the sensing range of the sensor node [1]. The sensor node requires battery power to monitor

the targets. But each of these nodes has limited battery life so efficient utilization of the available energy resources is required. This becomes important for performing the coverage task for a maximum period of time. So Energy conservation becomes an important issue while tracing the targets.

2.1. Challenges: While tracing the target nodes in wireless sensor node, various challenges may be occurs like:

- ✓ The Sensor nodes are prone to failure due to various environmental conditions.
- ✓ The topology of a sensor network changes very frequently.
- ✓ Sensor nodes have limited in power supply
- ✓ Wireless Sensor Networks processing sensitive data are facing the risks of data manipulation, data fraud and sensor destruction or replacement.

WSN deals with real world problems where the sensed data must be delivered within fixed time limits. However most a protocol fails to meet these deadlines. Therefore extra sensor nodes require improving the fault tolerance. However it leads to consumption of more energy and as we now that nodes have the limited power supply. So while covering the targets, minimum consumption of energy must be taken into consideration in order to achieve coverage for a maximum duration. An energy saving technique is to alter the sensor nodes between high energy consumption active mode and low energy consumption sleeping mode [1,11]. The nodes that are actually performing the coverage task are in active mode that consumes a considerable amount of energy while the rest nodes may enter into sleep mode which consumes negligible amount of energy. The latter nodes can be re-entered into active mode when needed and the former may go into sleep mode. This scheduling of nodes may result in efficient energy conservation. Sensor nodes (say s1s2…….sn). Four sensor nodes represented by small filled circles are in active mode covering the targets represented by small squares. Rest sensor nodes represented by small circles are in sleep mode.

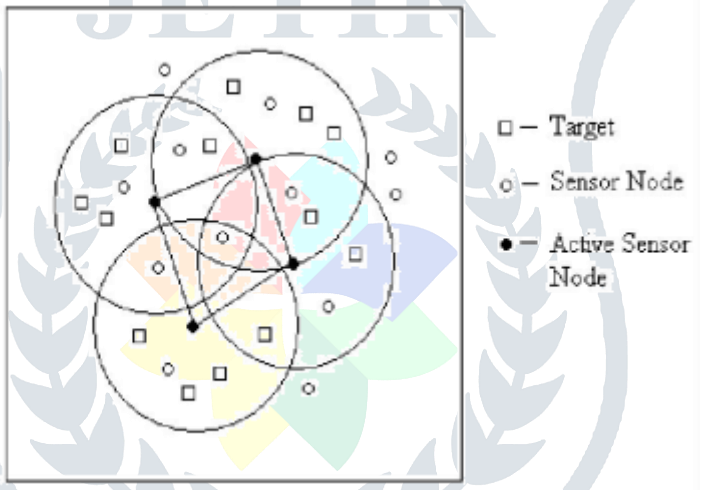

Fig 1: Target Representation

Target rk is within sensing range of sensor nodes si and sj (denoted by Wi and Wj respectively). It may be possible to assign one of these nodes to cover the target based upon the shortest Euclidean distance between the sensors node and the target, i.e. if (dik <= dkj),then si = { rk} else sj ={rk}.

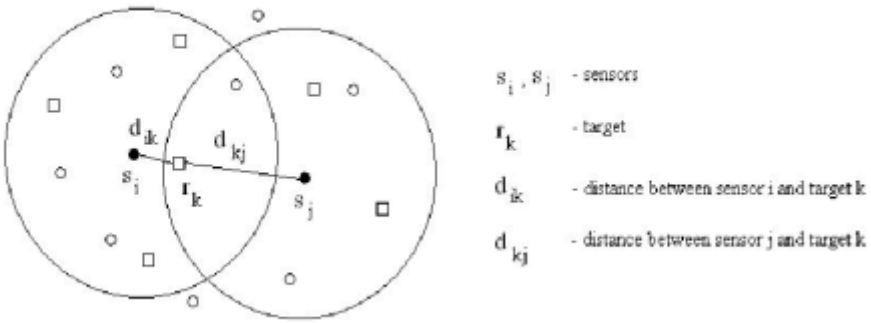

Fig 2: Scenario of Target Coverage Problem

Numerous research works [1, 3, 6, 4, 9, 13] have been conducted to cover the required targets by the randomly dispersed sensor nodes: Simplest method was to have all the redundant nodes deployed to get activated but at the cost of unnecessary wastage of energy resulting in coverage of the targets for a minimum duration. Later several energy efficient approaches were proposed in

which the nodes alter between the active and sleep modes. Set covers of sensor nodes are formed with each set cover having sensor nodes covering all the targets. According to the work in [13] several dis-joint set covers of active sensor nodes are successively activated until all the nodes get exhausted of their energy. Work in [1] came with a much more energy aware approach in which non-disjoint set covers were formed with a sensor node being part of more than one set cover which resulted in coverage of the targets for longer period of time. Many coverage approaches also dealt with partial coverage where information is collected only about a sub-set of targets [9].

III. PROPOSED WORK

We propose that in the formation of non-disjoint set covers of sensor nodes to cover the specific targets, if a target is within the sensing range of two or more sensor nodes, then only one of the sensor nodes may be initiated to monitor the specific target while the other sensor nodes of that sensing range may not be required to participate. This prevents unnecessary wastage of the energy as each sensor node consumes a specific amount of energy to continuously sense a target. Coverage of a target is based on the shortest Euclidean distance between them.

```
for i 1 to n
        do for j 1 to n
                do for k 1 to m
                        do if ( dik <= Wi ) && ( dkj <= Wj ) find t min(dik, dkj)
                                st = st ∪ rk
                               if (t = = i)
                                        sj = sj – rk
                               else if (t = = j)
                                        si = si - rk
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Algorithm for Coverage of targets by sensor nodes based on shortest Euclidean distance between the sensor nodes and the targets. Consider a scenario in which there are five number of targets r1,r2,r3,r4,r5 which are covered by a set of six sensor node s1,s2,s3….s6 with the sensor target coverage relationship s1={r1,r5}, s 2={r1,r2}, s3={r2,r3}, s4={r3,r4}, s5={r4,r5}, s6={r1,r2,r3,r4,r5}) each sensor nodes assume the Euclidean distance.

These sensor nodes get organized to six non-disjoint set covers to monitor the targets for a maximum duration (assuming that a sensor node covers the target if the Euclidean distance between the sensor node and the target is smaller or equal to the sensing range of the node) : SC1 = {s6}, SC2 = {s2,s3,s5}, SC3 = {s2,s4,s5}, SC4 = {s1,s3,s4}, SC5 = {s1,s2,s4}, SC6 = {s1,s3,s5}.Energy consumed by a sensor node to cover a particular target in each set cover is represented by a unique rectangular box as shown in the Figure 3. Here, if each sensor node consumes x unit of energy to keep track of a target, the total energy consumed by all the sensor nodes is 35x units of energy.

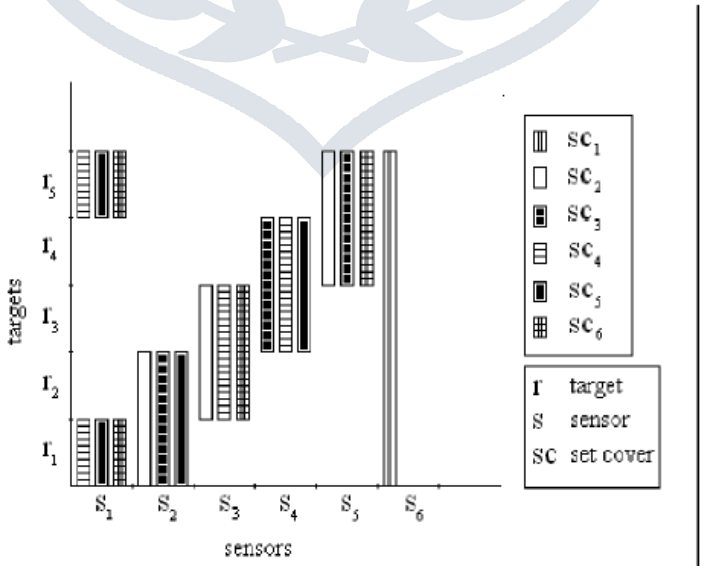

Fig 3: Coverage of targets by sensor nodes in different set covers according to our proposed work.

However we propose that the targets, which are within the sensing range of more than one sensor nodes, may be covered by only one of these nodes having the minimum distance to the target. For instance in the set cover SC2, r2 is covered by s2 and s3. So here r2 now would be covered only by s2 due to shortest distance between them. Rest calculation is done similarly as shown in

Figure 4. Here, the total energy consumed by all the sensor nodes is 30x units of energy, thus a saving of 5x units of energy can obtained as compared to the previous work. This method in certain situations may result in load balancing between the sensor nodes. We have proposed the protocol for smooth management of the Target Coverage Scenario where the energy consumption is lower as compared to the existing protocol.

IV. CONCLUSION

Desired target coverage is an important issue in WSN. In this paper basic target coverage problem and their strategies are discuss to achieve the maximum coverage including energy efficiency. Maximization of network life time and minimum participation of sensor node are considered as to specific issues while performing target coverage. Science energy is the scarcest resources for sensor node, a justified management of energy resources to the sensor node is introduced which result in saving a considerable amount of energy of the node by eliminating the other simultaneous activity of redundant sensor nodes while observing and covering a specific target

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