Volume 4, Issue 5, May 2014 ISSN: 2277 128X

International Journal of Advanced Research in Computer Science and Software Engineering

Research Paper

Available online at: www.ijarcsse.com

Target Coverage Management Protocol for Wireless Sensor Network

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ABSTRACT: One of the major challenges of wireless sensor networks is concerned, the target coverage problem The maximum period for monitoring specific targets for random deployment of sensor nodes. The small size of the sensor node, energy, memory, computational speed and limited resources in terms of Bandwidth, and can not withstand extreme environmental conditions. Therefore, a greater number of sensors Nodes in order to improve fault tolerance of sensor networks are deployed to specific requirements. However, the high redundancy of sensor nodes can lead to excessive power dissipation. After nodes. The target coverage problem of rational energy management becomes an important concern. In this paper We aim to reduce energyconsumption with the aim to propose a protocol for management coverage....

Keywords: Wireless Sensor Network, Target Coverage, Energy Conservation

I. INTRODUCTION

Recent advances in technologies have made it Technically and economically feasible to combine Sensing, processing and communication capabilities Small low-cost sensor devices. Once this Nodes get deployed, they organize themselves to form Wireless Sensor Network (WSN) and communicate Through a special act of real wireless link World. With the availability of various sensor nodes Sensing capabilities results in hundreds of varieties Including national security applications [8], Habitat monitoring [17,18], environmental Observation and forecasting [19], health Application [8,20], home and office applications [21]. WSNs are therefore becoming an active Research area with many research activities Out every year to detect and resolve the various Constraints. Wireless sensor networks can be defined as Being composed of a large number of spatial Distributed autonomous wireless sensor nodes that Cooperative monitoring of the physical conditions Environment such as temperature, pressure, Humidity, wind speed, sound, etc. Forward Based on the information put particular node called Which serves as an interface between the sensor station Nodes and the real world [9]. Usually consists of a wireless sensor node Sensing unit, a processing unit, a communication Unit and a power unit [22,23], that is used for The relevant data processing, sensing Collect data and communicate with other WSN nodes connected. Since these nodes As for monitoring network deployment Particular area of interest....

1.1. Characteristics

- Some of the unique features
  Lack of WSN include:
  > Sensor nodes are deployed in densely
  Particular area of interest.
  >After deployment, these nodes
  Automatically configure themselves into a network
  > Sensor network topology changes often.
  > Nodes are usually battery operated.
  >They are equipped with limited resources.
  > They are prone to failures.
  > They are application specific...
  Therefore the sensor network design objectives Capacity, self - configurability, including low power Consumption, flexibility, low cost nodes, small Node size, fault tolerance, security, and support for QoS requirements....

1.2. Coverage Problem

An important issue addressed in wireless Sensor network coverage problem [1,2]. It's Basically concerned with the question: How In the specific area of interest is being efficiently Covered by the sensor nodes? The aim is to Area is monitored by at least one sensor Node. It can be broadly classified into three main Department:

>Area coverage problem [4,5,25,13,15] where The goal is to monitor a particular area or region

>The target coverage problem [1,6,7,16,24], where A specific goal or set of goals is to monitor Points.

> Dealing with the determination of coverage The maximum support / breach path [10.14]

In this paper we will be working with The target coverage problem is concerned with Coverage of specific targets by sensor nodes.

These nodes require energy to perform Coverage work. Since, sensor nodes are usually Battery operated, so the prudent management.Energy is an important concern is that coverage Can be for a maximum period of work. In In this paper, we propose an algorithm to perform Work with minimal involvement of sensor coverage To cover the target nodes, the consumption Minimum energy. This paper is organized as follows: In Section 2, The target coverage problem and related construction are discussed. In Section 3 we present a target Management protocol for WSN coverage. Finally, In Section 4 we conclude our work.

II. TARGET COVERAGE PROBLEM AND RELATED WORK

The target coverage problem is one of Challenges of wireless sensor networks. It's Concerned with the maximization of sensor networks. While monitoring the performance of a lifetime Dispersed randomly from a set of specific goals Sensor nodes (shown in Figure 1). Considering a Target number (say, R1, R2, R3 ..... RM) whose Predetermined locations are already set Sensor nodes (S1 say, S2 ..... Sn) are Redundantly deployed through a plane That, assuming that keep track of these specific goals The sensor covers the target node, then the Euclidean The distance between the sensor nodes and the goal is Smaller or equal to the node's sensing range [1]. Each of these nodes requires energy monitor Target. Since the nodes have limited battery Life, the efficient use of available energy Resources is critical to the performance of Work coverage for a maximum period of time. Hence, energy conservation is a The important point target tracking....

2.1. Challenges:

Wireless Sensor Nodes while covering the specific targets may suffer from some challenges[22] like:

>The Sensor nodes are prone to failure due to extreme environmental conditions.

> The topology of a sensor network changes very frequently.

> Sensor nodes are limited in power, computational capacities, and memory.

> 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 protocols fail to meet the dead lines.

Therefore more number of sensor nodes than the specific requirements are deployed to improve the fault tolerance. However, this high redundancy of sensor nodes can lead to excessive energy wasta geand also the maintenance of batteries of the sensor nodes is not a simple task. 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 in Figure 1, representing the four sensor nodes Small filled circles are covered by active mode Represented by small squares goals. Rest Sensor nodes are represented by small circles Sleep mode.

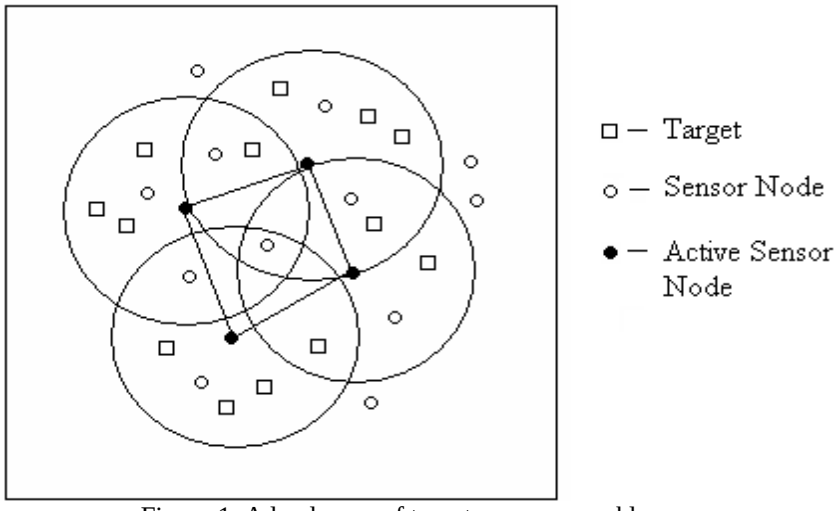

Figure 1. A landscape of target coverage problem

Numerous research [1,3,6,7,12,16] works Was held to cover the expected goals Randomly dispersed sensor nodes simplest method To get all redundant nodes were deployed But at the expense of unnecessary wastage of active Resulting in a coverage target for energy. Minimum period. After several energy-efficient The approach has been proposed to replace nodes

Between active and sleep modes. The set covers Sensor nodes are formed, with each set being covered. Sensor nodes to cover the targets. According to [16], several dis-cover set of joint work The active sensor nodes are activated by gradual. All nodes depleted of their energy. Work [1] came up with a lot more energy conscious approach Was formed with the non-disjoint cover.set

Cover more than one set of sensor nodes being part of Now the goals which resulted in coverage Period of time. Many approaches to coverage Information dealt with the partial coverage Target [12] collected on a subset of....

III. OUR PROPOSED WORK

We propose that the formation of non-disjoint Cover to cover specific set of sensor nodes Goal, the goal is to double the sensing range
Sensor or sensor nodes, only one To monitor specific target nodes can be started While the sensing range of other sensor nodes Shown, can not be required to attend Figure 2. This prevents unnecessary wastage
A specific energy consumption of each sensor node as Constant amount of energy to a target emotion. In Figure 2, the target RK Within the sensing range Sensor node si & SJ (denoted by wi and WJ Respectively). It is possible to assign Based on these nodes to cover the target. The minimum Euclidean distance between sensor Node and the target, ie if (Dik <= dkj), ,then si ={ rk} else sj ={rk} as shown in Table

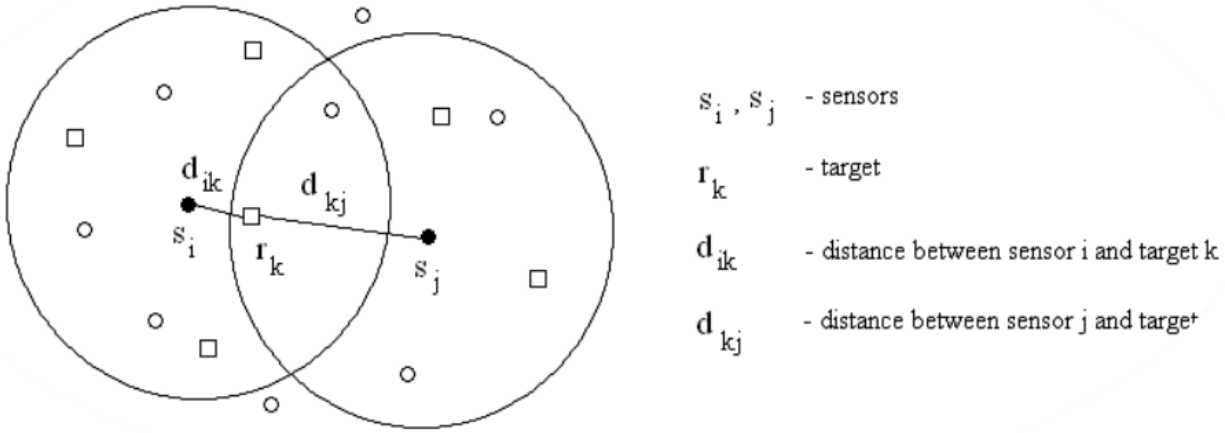

Figure 2. Coverage of a target by sensor nodes based on

shortest Euclidean distance between them.

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step1 :    for i should be 1to n
 step2 :    do for j should be 1 to n
 step3 :    do for k should be 1 to m
 step4 :    do if ( distance between sensor i and target k is
                  less then equal to active sensor node)
                    and
                ( distance between sensor j and target is less
                  then equal to  active sensor node )
 step5 :    find t _ min(distance between sensor i and target
                k,(dik),,  distance between sensor j and target( dkj))
 step6 :    st = st ∪ rk
 step7 :    if (t = = i)
 step8 :       sensor = sensor - target
 step9 :     else if (t = = j)
 step10 :     active sensor node = active sensor node - target
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Table 1.Algorithm for Coverage of targets by sensor nodes based on shortest Euclidean distance between these nodes and the targets Consider a scenario in which there are five number of targets (r1,r2,r3,r4,r5) which are being covered by a set of six sensor nodes
(s1,s2,s3,s4,s5,s6) with the sensor-target coverage relationship known as:
s1={r1,r5}, s2={r1,r2}, s3={r2,r3}, s4={r3,r4},s5={r4,r5}, s6={r1,r2,r3,r4,r5} and the Euclidean distance assumed as shown in Table 2. Here each sensor node's sensing range is assumed to be 41
unit of distance
.d11 = 32 d12 = 63 d13 = 75 d14 = 61 d15 = 40
d21 = 38 d22 = 22 d23 = 67 d24 = 91 d25 = 88
d31 = 71 d32 = 37 d33 = 24 d34 = 64 d35 = 79

d41 = 93 d42 = 80 d43 = 36 d44 = 30 d45 = 56
d51 = 98 d52 = 105 d53 = 76 d54 = 36 d55 = 37
d61 = 37 d62 = 37 d63 = 37 d64 = 37 d65 = 37
Table 2.Assumed Euclidean distance between the sensor nodes and the targets
According to the work in [1] ,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.

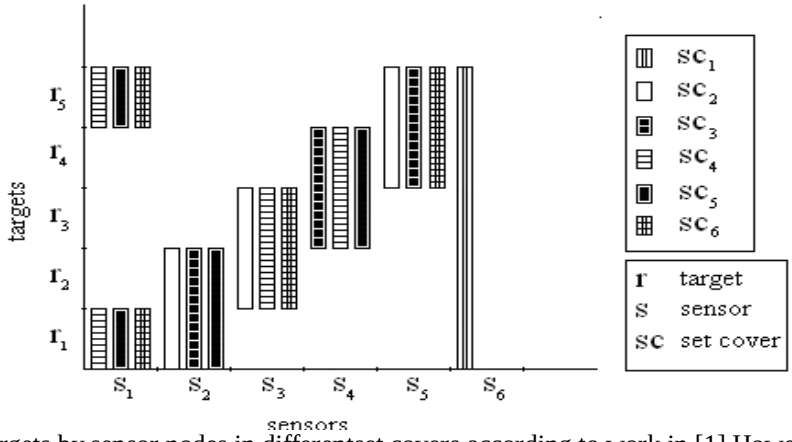

Figure 3.Coverage of targets by sensor nodes in differentset covers according to work in [1].However we propose that the targets, which are

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 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.

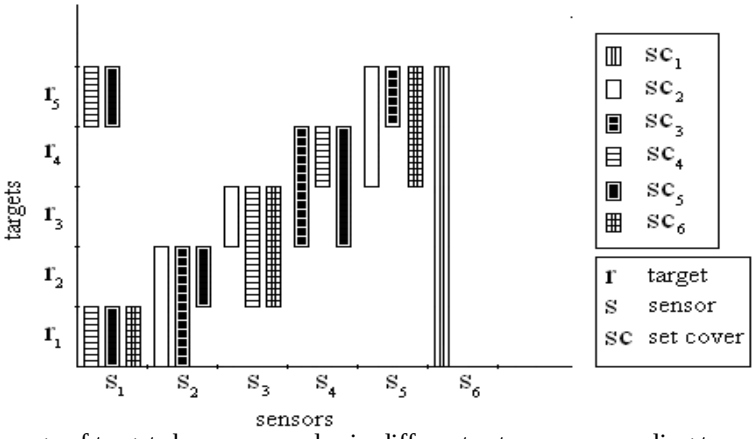

Figure 4 .Coverage of targets by sensor nodes in different set covers according to our proposed work.

IV. CONCLUSION

Coverage of specific goals is an important Concern in wireless sensor networks. In this paper We discuss the basic target coverage problem And some strategies for achieving energy efficient Referred to in target coverage Idea is to maximize the network lifetime and While the minimum participation of sensor nodes Coverage performance. Energy Scarcest resource of sensor nodes. So, taking In consideration of the prudent management Energy resources of the sensor nodes, in that it results Considerable amount of energy savings By eliminating nodes together While unnecessary activation of sensor nodes Looking at a particular target....

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Journal of Theoretical and Applied Information Technology
15th January 2012. Vol. 35 No.1 © 2005 - 2012 JATIT & LLS. All rights reserved. ISSN: **1992-8645** www.jatit.org
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