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Reducing Energy Consumption and Processing Time in Mobile Sensor/Robot Networks

Shalini.S[#1], Anitha Christi Angelin[*2]

[#]PG Scholar, Assistant Professor

Abstract*— In the existing system, to maintain the network connectivity distributed partition detection algorithm which quickly makes the sensors aware of the partitioning in the network. This process is led by the sensors whose upstream nodes fail due to damages. But in this method there is more processing time and high energy consumption. In the proposed system, in order to reduce energy consumption and processing time a mobile sensor design in which the sensor node is used to control the movement of the robot built with commercial off-the-shelf (COTS) components. We use a sensor relocation application to demonstrate the feasibility of our design.

Keywords*— Wireless sensor networks, COTS, Partition Detection, Route Recovery, Mobility, Energy efficiency.

I. Introduction

Wireless sensor network consists of large number of portable sensors placed in the field with the help of wireless communication module. The purpose is to sense, collect and process the information from all the sensor nodes and then sending it for the analysis. Earlier it was used in military surveillance and medical care. But its usage has been acknowledged and is almost used in many fields such as Biomedical, Home Security, Real-time collection of data, tracking forest fire/endangered species and so on [3].

The sensor node failure may occur due to many factors such as environment, communication factor or battery failure. One of the most challenging problems in WSN is maintaining network connectivity to reliably communicate between sources to a specified sink, in an energy-efficient manner. The partition in the network may lead to memory and power exhaustion in disconnected nodes and network congestion in disconnected segments, such as data loss and wasted resources. Currently many researches are engaged in developing schemes to fulfil the requirements. The aim is to provide a detailed description about the current research issues that has been proposed in this field. Previous work which considered utilizing mobility for networking, assumed mobility to be outside the control of the communication sub-layer [2]. Mobility was either treated to be random, following partially predictable patterns or even deterministic but not controlled. Once the base station determines the network partitioning, one or more mobile nodes are sent through tunnelling method.

A mobile node is equipped with a radio transmitter receiver so that it can communicate with the sensor nodes. Furthermore, it maintains connectivity with the base station through the wireless sensor network which is explained in [1]. This paper explains the self rejuvenating the failed nodes with reduced energy utilization.

II. RELATED WORKS

The basic method of detecting the partition is through ACK. When node sends a message to the other nodes, it expects for its ACK. If it does not receive ACK within a certain TTL period, it is predicted to be prone to failure. Once

TTL period is over, it disconnects and starts to search for the other route. This method may not provide the exact prediction of partition since it cannot distinguish whether it is partition or node failure.

Route is the path, which the nodes in the network follow in order to forward the data to the destination. If the connectivity is cut then the recovery process is applied to find the other paths to the destination. This is also a tedious process. Hence many researchers have come up with different Detection algorithms to find the partition in the network and re-establish the connectivity.

In the sensor relocation application, after a sensor node failure creates a coverage hole, a mobile sensor node is relocated to cover the hole in a timely and energy-efficient way. The use a sensor relocation application to demonstrate the feasibility of our design. In the sensor relocation application, after a sensor node failure creates a coverage hole, a mobile sensor node is

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relocated to cover the hole in a timely and energy-efficient way. However, it is still a challenge to design and implement a distributed sensor relocation algorithm in the resource constrained sensor node. To design a distributed sensor relocation algorithm and provide novel solutions to implement this algorithm in the mobile sensor platform.

III. METHODOLOGY

The sensor network is modelled as a complete weighted graph G (V, E), where a vertex corresponds to a mobile sensor node. The edge weight is the distance between two nodes. The following notations are used for describing the algorithm.

S_i node i's ID. The target position is represented by S_0 and the redundant node is denoted asS_r. t_i the departure time of S_i movement. T_i:S_i's movement; T_i :: S_i's recovery delay constraint. P_i the remaining energy of S_i before movement; E_i the total energy consumption of the cascading schedule; E_{min} the minimum of the remaining energy after movement; d_{ij} distance between S_i and S_j; v_j node S_i's moving speed; Suppose S_j moves to replace S_i . S_j is called successor, and S_i is called S_j's predecessor. In order not to interrupt the supported application, each node S_i is associated with a recovery delay constraint T_i within which S_i's successor must take its place after its movement. T_i is determined by the application based on S_i's sensing task, the size of the coverage hole generated by S_i's movement, and other factors. S_i's departure time is normalized to be the time period after the relocation request is sent and t_0 is set to 0. Due to the recovery delay restriction, an inequality $\frac{d_{ji}}{v_j} - (t_i - t_j) \leq$ must be satisfied if S_j is S_i's successor. is usually set to $T_i + t_i - d_{ji/}$ such that more nodes can be the candidates to choose for S_j's successor. A cascaded movement schedule is a set of cascading nodes and their departure time in a relocation. For energy-efficiency, the schedule should minimize the total energy consumption and maximize the minimum remaining energy so that no individual sensor is penalized. However, in most cases, these two goals cannot be satisfied at the same time. A centralized modified Dijkstra's algorithm is used to calculate the shortest cascaded movement schedule, which is the schedule with the least total energy consumption. In this algorithm, an edge that does not satisfy the recovery delay constraint is not selected in any cascading path. To find the best schedule, first calculates the shortest cascaded movement schedule and records its total energy consumption E and its minimum remaining energy E_n. Then, all the edges S are deleted if $P_i - d_{ij} \leq E_n$ and $d_{i0} \geq$. Therefore a new graph is generated. This process continues and a new shortest schedule is calculated as long as the difference between the total energy consumption and the minimum remaining energy is increased compared to the previously calculated schedule. When the process terminates, the schedule calculated before the last schedule is the best schedule, i.e., the schedule with the smallest difference between the last two schedules.

Based on the direct distance to S_0 nodes that are closer to S_0 than S_r together with S_r are sorted into a sequence denoted as below:

$N_0, N_1, \ldots N_n$

Here, N_0 refers toS_0, N_n refers to S_r and the total number of nodes is n+1. If two nodes are at the same distance toS_0, the node with a smaller node ID is numbered first. Let $E_m(i, l)$ be the minimum total energy cost of a cascading path from N_i to N_0 that has l intermediate nodes from $N_{i-1}, N_{i-2}, \ldots \ldots N_1 (l \leq i-1)$. The direct distance from N_i to N_j is denoted as D (i.j). Then the shortest cascading path on the current graph, denoted as $E_m(n, n-1)$ can be computed as,

$$E_m(i,l) = \begin{cases} D(i,0) & l = 0 \\ \min\{D(i,j) + E_m(j,l-1) \mid \frac{D(i,j)}{N_i's}\, speed \leq T_j + t_j \&\& i > j \geq 1\} & otherwise \end{cases}$$

This distributed solution is broadcast-based and needs multiple iterations. In each iteration S_0 first initiates a schedule computation by broadcasting a request message. A node S_j receiving the request first determines if it can become the successor of the sender S_i based on the following two conditions: (1) it can take S_i's place withinT_i; (2) its remaining energy after moving is no larger than the minimum remaining energy in the last schedule. If both conditions are satisfied, it rebroadcasts the request with recalculated current total energy consumption E_j and the minimum remaining energy E_{min} and remembers its predecessor S_i. If several such messages are received, the one that can minimize the total energy cost is chosen. This iteration terminates when the

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request arrives at the redundant sensor S_r. The process continues until the best schedule is found.

IV. PERFORMANCE

A. *Energy Consumption*

The consumption of energy in Wireless Sensor Network is the crucial factor because of constant usage. This is also important for the increase of lifetime of the sensor. By using the centralized modified Dijkstra's algorithm the shortest cascaded movement is calculated which in turn compares and calculates the difference between the total energy consumption and the minimum remaining energy is increased compared to the previously calculated schedule. The differences in energy between the proposed and existing methods are shown in Fig.1.

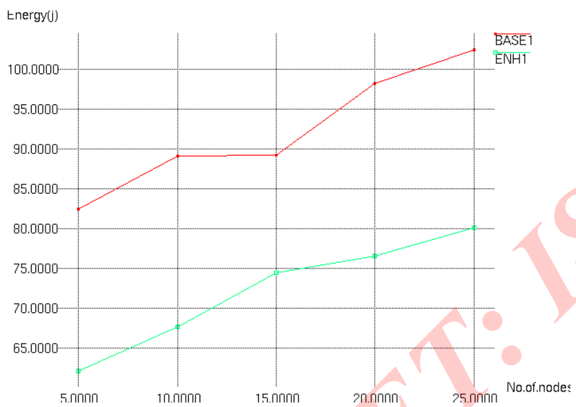


Fig. 1 A line graph using colors which contrast well both the existing and the proposed method energy comsumption

B. *Processing Time*

It is assessed to check if a single movement would drain all of the energy of a node. Excessive movement of a single node, can cause battery depletion and further node failures. The proposed distributed approaches follow former paths during recovery, maximum movement is expected to be higher than the centralized heuristics which can exploit the minimum distance between the partitions. Thus, we report a ratio which is the maximum movement distance normalized based on the corresponding total travel distance. The compared time between the existing and the proposed methods are shown in Fig.2.

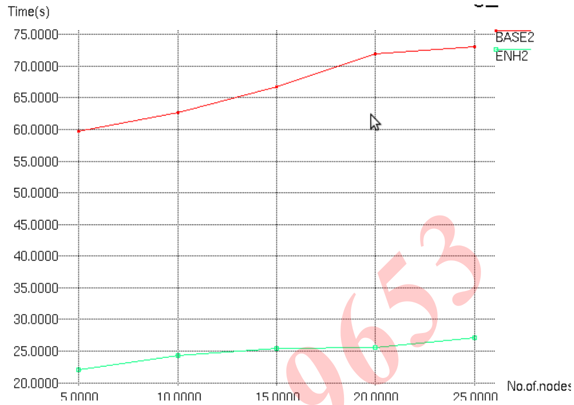


Fig. 2 A line graph which explains the existing and proposed methods processing time.

V. CONCLUSIONS

Compared with most previous studies that, in some way, restricted their working conditions, the techniques presented in the base paper are much less restrictive. Considering the possibility of network partitioning where the sensors are not able to transmit their readings to the sink, the approach first detects such a partition and then strives to fix the partition by relocating some of the mobile sensor nodes. The Proposed method reduces both the energy consumption and the processing time.

REFERENCES

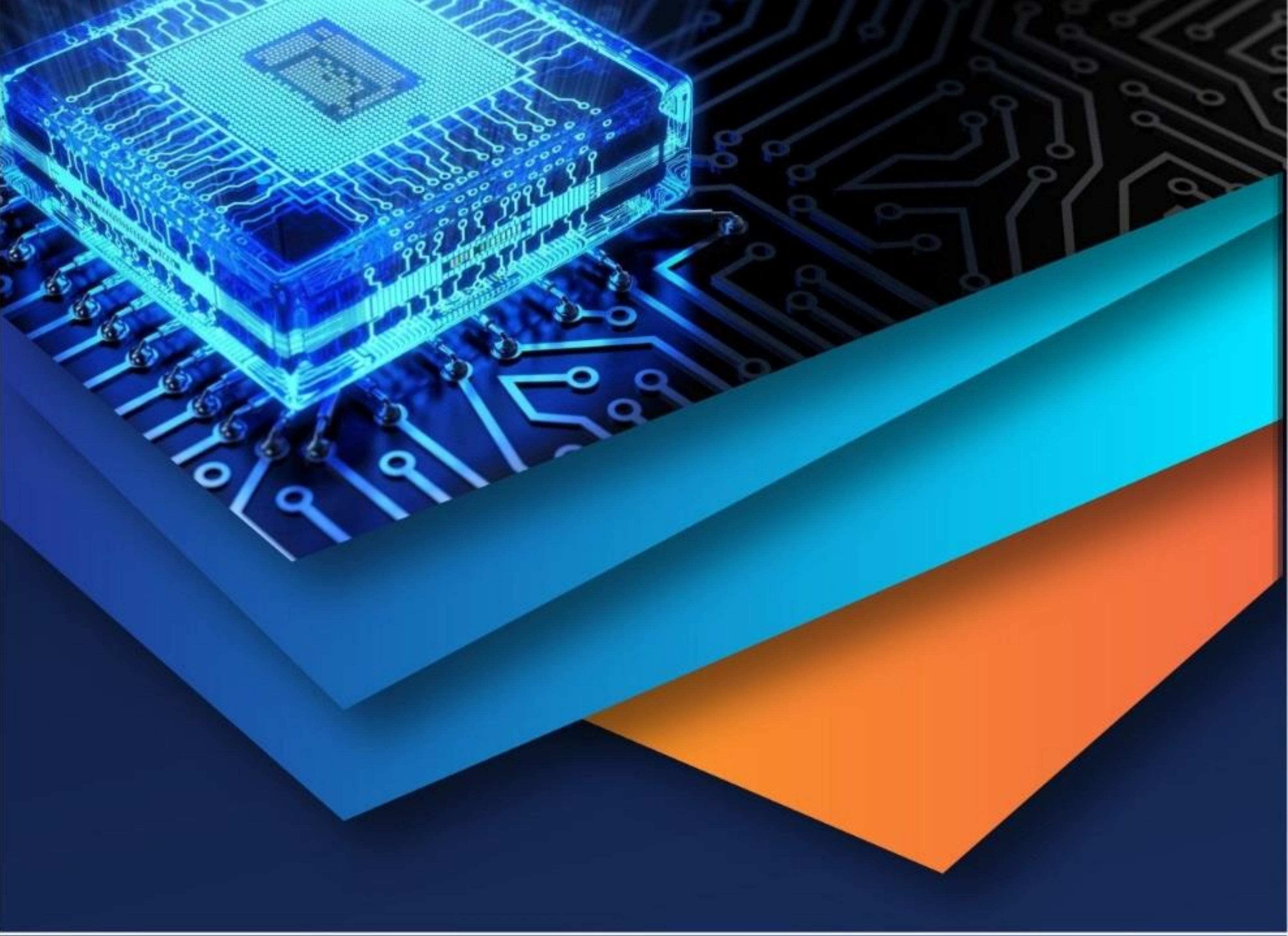
[1] Akkaya K, Senturk I.F, Shanthi Vemulapalli., Handling large-scale node failures in mobile sensor/robot networks., Journal of Network and Computer Applications 36 (2013) 195–210.

[2] Ritter H, Winter R, Schiller J., "A Partition Detection System for Mobile Ad-Hoc Networks".

[3] Myounggyu Won, Radu Stoleru., "A Destination-based Approach for Cut Detection in Wireless Sensor Networks,

[4] N. Shrivastava, S. Suri, and C. T´ oth, "Detecting cuts in sensor networks," *ACM Transactions on Sensor Networks*,

[5] Won M, George SM, Stoleru R. Towards robustness and energy efficiency of cut detection in wireless sensor Networks. Ad Hoc Networks2011;9(3):249–64 http://dx.doi.org/10.1016/j.adhoc.2010.06.008.



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