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Predictive Energy Efficient Technique for Objects Tracking Sensor Network

[1] K.P. Linija Shylin , [2] Sharath Kumar S, [3] Nuthan S.M. [4] Sudha V.
[1] Assitant Professor, Department of ECE, Sri Sairam college of Engineering, Anekal, Bengaluru.
[2,3,4] Student, Department of ECE, Sri Sairam college of Engineering, Anekal, Bengaluru.

Abstract:- **In this paper, we devise and evaluate a fully decentralized, light-weight, dynamic clustering algorithm for target tracking. Instead of assuming the same role for all the sensors, we envision a hierarchical sensor network that is composed of a) a static backbone of sparsely placed high-capability sensors which will assume the role of a cluster head (CH) upon triggered by certain signal events and b) moderately to densely populated low-end sensors whose function is to provide sensor information to CHs upon request. A cluster is formed and a CH becomes active when the acoustic signal strength detected by the CH exceeds a predetermined threshold. The active CH then broadcasts an information solicitation packet, asking sensors in its vicinity to join the cluster and provide their sensing information. To achieve significant reductions in the energy dissipated by the OTSNs while maintaining acceptable missing rate levels. PTSP is tested against basic tracking techniques to determine the appropriateness of PTSP under various circumstances. The PTSP outperforms all the other basic tracking techniques and exhibits significant amounts of savings in terms of the entire network's energy consumption total energy consumed.**

Keywords:: **Object Tracking Sensor network (OTSN), cluster head (CH).**

I. INTRODUCTION

A prediction based tracking technique using sequential patterns (PTSPs) designed to achieve significant reductions in the energy dissipated by the OTSNs while maintaining acceptable missing rate levels. PTSP is tested against basic tracking techniques to determine the appropriateness of PTSP under various circumstances. the PTSP outperforms all the other basic tracking techniques and exhibits significant amounts of savings in terms of the entire network's energy consumption total energy consumed .Including the active and sleep mode energy consumption for each sensor node in the network, and missing rate which represents a ratio of the missing reports to the total number of reports received by the application. Sensor networks have emerged as a promising tool for monitoring (and possibly actuating) the physical worlds, utilizing self-organizing networks of battery-powered wireless sensors that can sense, process and communicate. In sensor networks, energy is a critical resource, while applications exhibit a limited set of characteristics. The requirements and limitations of sensor networks make their architecture and protocols both challenging and divergent from the needs of traditional Internet architecture.

The basic goals of a WSN are to:

(i) Determine the value of physical variables at a given location,
(ii) Classify a detected object, and
(iii) Track an object.

The important requirements of a WSN are
(i) Use of a large number of sensors,
(ii) Attachment of stationary sensors,
(iii) Low energy consumption,
(iv) Self organization capability,
(v) Collaborative signal processing.

A sensor network is a network of many tiny disposable low power devices, called nodes, which are spatially distributed in order to perform an application-oriented global task. These nodes form network by communicating with each other either directly or through other nodes. One or more nodes among them will serve as sink(s) that are capable of communicating with the user either directly or through the existing wired networks.

The primary component of the network is the sensor, essential for monitoring real world physical conditions such as sound, temperature, humidity, intensity, vibration, pressure, motion, pollutants etc. at different locations. The tiny sensor nodes, which consist of sensing, on board processor for data processing, and communicating components, leverage the idea of sensor networks based on collaborative effort of a large number of nodes. Figure 1 shows the structural view of a sensor network in which

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sensor nodes are shown as small circles. Each node typically consists of the four components: sensor unit, central processing unit (CPU), power unit, and Communication unit. They are assigned with different tasks. The sensor unit is responsible for collecting information as the ADC requests, and returning the analog data it sensed.

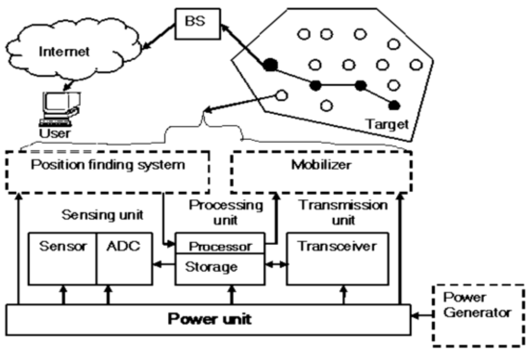

Figure 1: Structural view of sensor network

ADC is a translator that tells the CPU what the sensor unit has sensed, and also informs the sensor unit what to do. Communication unit is tasked to receive command or query from and transmit the data from CPU to the outside world. CPU is the most complex unit. It interprets the command or query to ADC, monitors and controls power if necessary, processes received data, computes the next hop to the sink, etc.

Power unit supplies power to sensor unit, processing unit and communication unit. Each node may also consist of the two optional components namely Location finding system and mobilizer. If the user requires the knowledge of location with high accuracy then the node should pusses Location finding system and mobilizer may be needed to move sensor nodes when it is required to carry out the assigned tasks. Instead of sending the raw data to the nodes responsible for the fusion, sensor nodes use their processing abilities to locally carry out simple computations and transmit only the required and partially processed data. The sensor nodes not only collect useful information such as sound, temperature, light etc., they also play a role of the router by communicating through wireless channels underbattery-constraints[1]. Sensor network nodes are limited with respect to energy supply, restricted computational capacity and communication bandwidth. The ideal wireless sensor is networked and scalable , fault tolerance, consume very little power, smart and software programmable, efficient, capable of fast data acquisition, reliable and accurate over long term, cost little to purchase and required no real maintenance[2].

A sensor node, also known as a 'mote' is a node in a wireless sensor network that is capable of performing some processing, gathering sensory information and communicating with other connected nodes in the network. The typical architecture of the sensor node is shown in the figure to the right

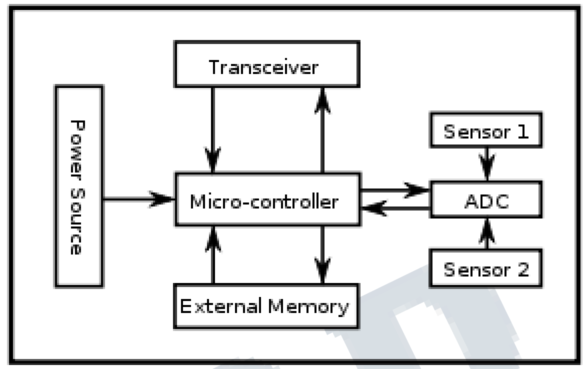

Figure 2: The typical architecture of the sensor node

Characteristics and requirements of Sensor node should be small size, consume extremely low energy, operate in high volumetric densities, be autonomous and operate unattended, and be adaptive to the environment. As wireless sensor nodes are micro-electronic sensor device, can only be equipped with a limited power source of less than 0.5 Ah and 1.2 V.

PREDICTIVE TRACKING SENSOR NETWORK:

1. Object tracking is an important application in wireless sensor networks
   a. Terrorist attack detection
   b. Traffic monitoring
2. Most of researchers concentrate on tracking objects and finding efficient ways to forward the data reports to the sinks
   a. propose a quantitative analytical model to find such an optimal tracking interval
   b. study the effect of the tracking interval on the miss probability
   c. Propose a scheme called Predictive Accuracy-based Tracking Energy Saving (PATES) by exploiting the tradeoff between the accuracy and cost of sensing operation.

3. Object Tracking Sensor Networks
   a. An object tracking sensor network refers to a wireless sensor network designed to monitor and track the mobile targets in the covered area
   b. Generally, each sensor consists of three functional unit

II. EXISTING SYSTEM

The scheduled monitoring (SM) technique, all the sensor nodes in the network are allowed to stay in sleep mode; they

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change their status to active mode for a brief period of time where they start sensing their monitored area and report their findings to the base station, given that both the sensor nodes and the base station are well synchronized[3].
To avoid missing reports there are many nodes being activated to participate in the object detection process while those nodes are not actually required[4].

III. PROPOSED SYSTEM

The proposed PTSP is based on two stages:
1) Sequential pattern generation
2) object tracking and monitoring.

SEQUENTIAL PATTERN GENERATION:

In the sequential pattern generation stage, the prediction model is built based on a huge log of data collected from the sensor network and aggregated at the sink in a database Producing the inherited behavioral patterns of object movement in the monitored area. Based on these data, the sink will be able to generate the sequential patterns that will be deployed by the sink to the sensor nodes in the network.
To use a special form of sequential patterns, tri-sensor patterns. Tri-sensor patterns can be represented as follows: [SourceSensor, CurrentSensor, DestinationSensor].
To calculate the confidence in addition to its support, of each particular tri-sensor pattern. This can be viewed as the estimate of the probability P(Y |X), which is the probability of finding the right-hand side of the pattern in sequences while these sequences also contain the left-hand side of the pattern.

OBJECT TRACKING AND MONITORING:

The sensor nodes to predict the future movements of a moving object in their detection area. In the second stage, the actual tracking of moving objects starts. This stage has two parts:

a. activation mechanism, which entail the use of the sequential patterns to predict which node should be activated to continually keep tracking of the moving object
b. Objective of this stage is to keep in sleep mode for the longest possible period, any sensor node that has no object moving in its detection area, thus saving its energy.
c. in the case of a moving object in the vicinity of a certain sensor node, this sensor node will not be awake all the time. It ought to switch to sleep mode as long as possible while not impairing the tracking process

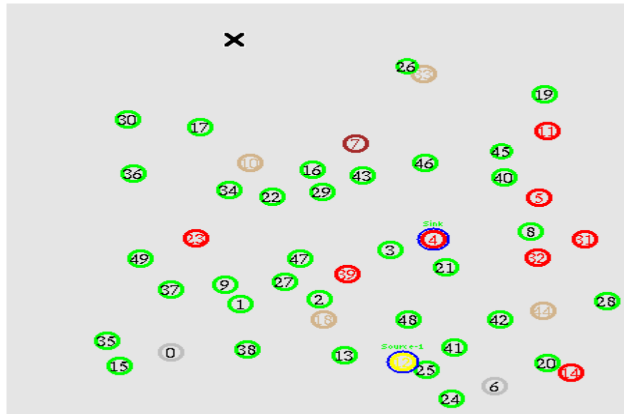

Figure 3:Sequential Pattern Generation

2. Missing object recovery mechanism, which will be used to find missing objects in case the activated node is not able to locate an object in its detection area.
To determine which recovery mechanism would generate the lowest energy consumption. The developed techniques are source recovery, destination recovery, and all neighbors' recovery.
1) Source recovery mechanism: In this recovery mechanism the current sensor will activate all its neighboring sensor nodes if the object is not in its detection area and if it did not receive an ACK message from the destination sensor(s) after the passing of a certain timeout period.
2) Destination recovery mechanism:This recovery mechanism is similar to the previous mechanism, except that the current sensor will activate all the neighboring sensors of the destination sensor, instead of the neighboring sensors of the current sensor.
3) All neighbors' recovery mechanism:This recovery mechanism combines both previous recovery mechanisms since the current sensor will activate all its neighboring sensor nodes in addition to the destination sensor neighboring sensor nodes

PERFORMANCE ANALYSIS

End-to-end delay refers to the time taken for a packet to be transmitted across a network from source to destination. In this graph, we have compared the SMAC and PSTN, as the time increases mobility of SMAC increases and the PSTN rate remains constant.

ENHANCE FROME BASE PAPER USING VORONOI PTSP

A Voronoiis a special kind of decomposition of a given space

Example:metric space, determined by distance to a specified family of the object. These cells are usually called the sites or the generators and to each such objects one associates a corresponding coronoidcell, namely the set of all points in given space whose distance to the given object is not greater than their distance to other objects

Packet delivery Ratio,we have compared the SMAC and PSTN ,as the time increases PSTN mobility gets increased. The greater value of packet delivery ratio means the better performance of the protocol.

$$\textit{Packet Delivery Ratio} = \frac{\text{No. of packets received}}{\textit{No. of packets send}} * 100 \quad (1)$$

Figure 4: End –To –End Latency

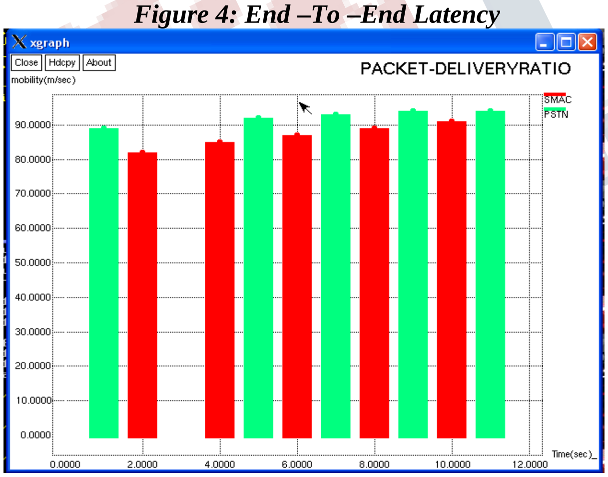

Figure 5: Packet –Delivery Ratio

In fig (6),End to End delay is calculated with respect to the packets and time,

$$\textit{Delay} = \frac{\textit{Inter arrival between 1st \& 2nd packet}}{\textit{Total data packet delivered time}} \quad (2)$$

In this Figure 7 which represents object Speed Analysis through an parameters PTSP, CM, SM, VORNOI PTSP. When we compare this, Vornoi PTSP which will consume less energy with respect to object speed.

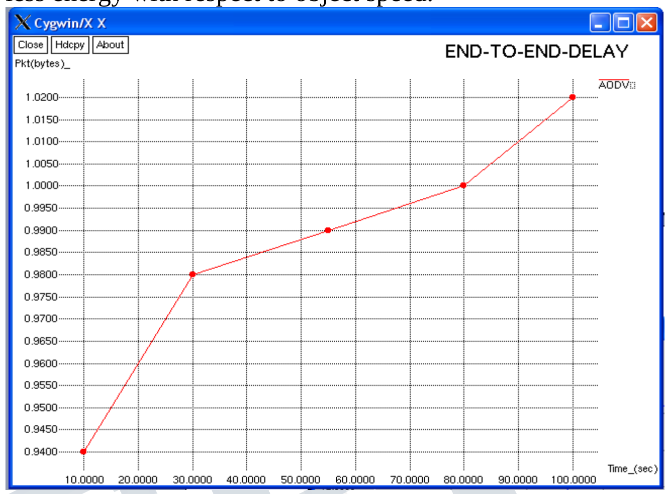

Figure 6: End-To-End-Delay

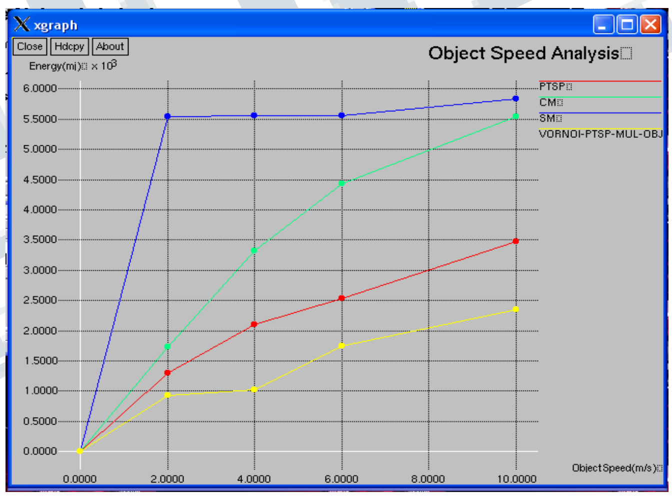

Figure 7: Object Speed Analysis

IV. CONCLUSION

In this paper we have proposed voronoi PTSP algorithm, Recovery mechanism is the all neighbor recovery mechanism, which combines the source and destination recovery mechanisms by activating all the neighboring sensor nodes of both the current sensor and the destination sensor .Energy consumption will be more and it will reduces missing rate.Object tracking is considered one of the most demanding applications in WSNs due to its application requirements, which place a heavy burden on the network resources, particularly energy consumption.

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