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Certain Investigations of an energy Efficient Predictive Technique Using OTSN

***M. Anto Bennet*[1]*, M. Mahesh*[2]*, T.R. Arun*[2]*, and M. Sudhakaran*[2]**

[1]Professor, Department of Electronics and Communication Engineering, VELTECH, Chennai-600062, India

[2]UG Student, Department of Electronics and Communication Engineering, VELTECH, Chennai-600062, India

ABSTRACT: The prediction based tracking technique using sequential patterns (PTSPs) designed to achieve significant reductions in the energy dissipated by the Object Tracking Sensor Network (OTSN) 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. And it can be enhanced by using Voronoi techniques. 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.

KEYWORDS: prediction based tracking technique using sequential patterns (PTSPs), Object Tracking Sensor Network (OTSN), Wireless Sensor Networks (WSN), Group Probability Suffix Tree (GPSTs), Data Aggregation Algorithm (GDAR).

INTRODUCTION

Wireless Sensor Networks (WSN) is a trend of the past few years, and they involved employing a large number of small nodes. The nodes then sense environmental changes and report them to other nodes over flexible network architecture. Sensor nodes are great for deployment in hostile environments or over large geographical areas. It consists of spatially distributed autonomous sensors to cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance. They are now used in many industrial and civilian application areas, including industrial process monitoring and control, machine health monitoring, environment and habitat monitoring, healthcare applications, home automation, and traffic control. In addition to one or more sensors [1,2].

Each node in a sensor network is typically equipped with a radio transceiver or other wireless communications device, a small microcontroller, and an energy source, usually a battery. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust although functioning "motes" of genuine microscopic dimensions have yet to be created. The cost of sensor node is similarly variable, ranging from hundreds of dollars to a few pennies, depending on the size of the sensor network and the complexity required of individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and bandwidth. To minimize the transmit power efficiently subject to transceiver. The basic goals of a WSN are used to determine the value of physical variables at a given location, Classify a detected object. The important requirements of a WSN are use of a large number of sensors, Attachment of stationary sensors, Low energy consumption, Self organization capability, Collaborative signal processing. Object tracking is considered as one of the killer applications for sensor networks. There are a lot of research issues in design and implementation of the object tracking sensor networks (OTSNs), including data fusion, aggregation, routing, and energy conservation, etc. Among those, energy conservation is one of the most critical one. Like other sensor networks, the OTSN is driven by scarce energy resource. Therefore, energy saving is the major issue addressed. In the following, it provide some background of the OTSNs, describe the assumptions the factors at contribute to energy consumption and design complexity of the OTSNs [3,4].

In an OTSN, a number of sensor nodes are deployed over an area, called monitored region. The approximate geographical boundaries of the monitored region are known to the applications that retrieve the information of interests (such as location, speed, direction, size, and shape) of a tracked moving object. Base station or gateway acts as the interface between the OTSN and applications by issuing the command to the network and collecting the information of interests from the distributed sensor nodes. The sensor nodes are static and that a base station has good knowledge of the network topology (in terms of the location of each sensor node) during the operating period. The sensor nodes are enabled for computation, sensing and communication by the Micro-Controller Unit (MCU), sensor components and the RF radio component respectively. To facilitate the energy conservation, most of today's sensor nodes allow these three basic components to be inactivated separately when they are not needed. These sensor nodes have the responsibility for tracking any moving object which intrudes the monitored region, and reporting the properties of the moving objects to the applications in a specified frequency. Deciding the location, speed, and direction of a moving object needs several sensor nodes to work together, which may require hierarchical technologies and overlapping levels of sensing (this is called sensor fusion).

LITERATURE SURVEY

An untapped opportunity in the realm of wireless data lies in low data-rate (< 10 Kbits/sec) low-cost wireless transceivers, assembled into distributed networks of sensor and actuator nodes. This enables applications such as smart buildings and highways, environment monitoring, user interfaces, entertainment, factory automation, and robotics[5]. While the aggregate system processes large amounts of data, individual nodes participate in a small fraction only (typical data rates <1 Kbit/sec). These ubiquitous networks require that the individual nodes are tiny, easily integral into the environment, and have negligible cost. Partitioning the link by introducing repeater nodes results in a linearization of the energy as a function of distance. The high sensor network density ensures sufficient repeater nodes for message relay. Thus, the average wireless hop length is below 10 m, (mixers and oscillators) increase receive power (from 0.7 mW at 170 MHz to >100 mW at 2.4 GHz for existing low-data rate radios). In monitoring sensor networks, data coming from various streams of the sensor nodes have to be examined dynamically and combined into normal patterns in order to detect potential anomalies. These issues and considered mechanisms to achieve a higher level of security and reliability in these networks. In order to support data aggregation through efficient network organization, nodes can be partitioned into a number of small groups called clusters. Each cluster has a coordinator, referred to as a Cluster Head, and a number of member nodes. Clustering results in a two-tier hierarchy in which cluster heads (CHs) form the higher tier while member nodes form the lower tier. The member nodes report their data to the respective CHs. The CHs aggregate the data and send them to the central base through other CHs. Because CHs often transmit data over longer distances, they lose more energy compared to member nodes[6,7].

The network may be re clustered periodically in order to select energy-abundant nodes to serve as CHs, thus distributing the load uniformly on all the nodes. Besides achieving energy efficiency, clustering reduces channel contention and packet collisions, resulting in better network throughput under high load. Clustering has been shown to improve network lifetime, a primary metric for evaluating the performance of a sensor network. Although there is no unified definition of "network lifetime," as this concept depends on the objective of an application, common definitions include the time until the first/last node in the network depletes its energy and the time until a node is disconnected from the base station. In studies where clustering techniques were primarily proposed for energy efficiency purposes, the network lifetime was significantly prolonged. The security issues and some method of identifying faulty nodes are Energy Efficiency, Network Life Time, Data Accuracy ,Statistical en-route Filtering, Abnormal relationships test, Distributed deviation detection[8,9].

PROPOSED SYSTEM

DATA FLOW DIAGRAM

Wireless Sensor Network has some important requirements in use of a large number of sensors, Attachment of stationary sensors, Low energy consumption, Self organization capability, Collaborative signals 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. 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.

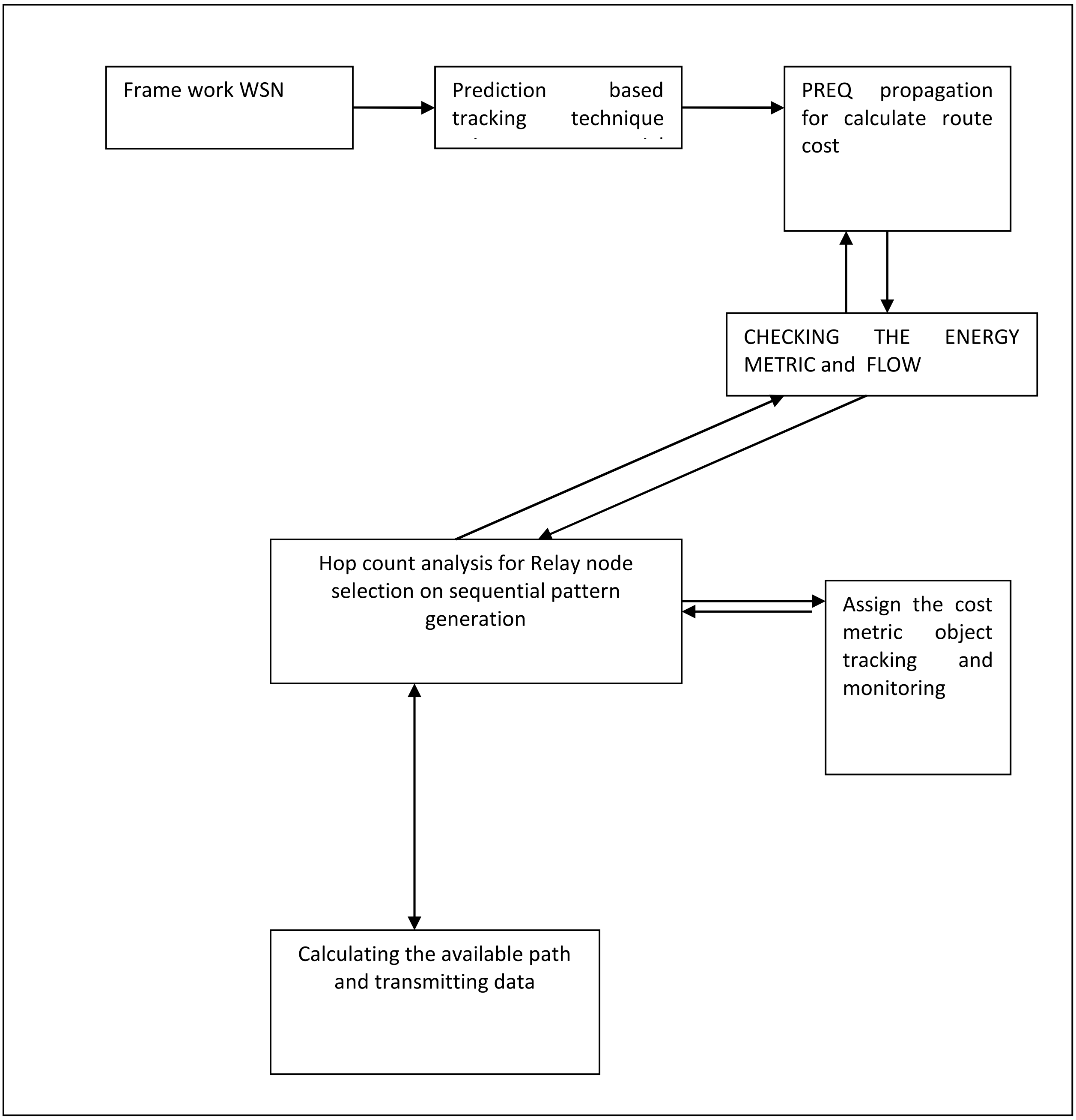

Fig :1 Frame work of WSN

HIERARCHICALLY PREDICTION-BASED QUERY ALGORITHM

After the groups and their best at Group Probability Suffix Tree (GPSTs) are produced. The information is sent to the CHs such that a group query and group update can be achieved efficiently. For the query-based OTSN, while receiving a query, the sink firsts predicts the most possible cluster that the object is currently located by using GPST and then sends the query to the CH. While the CH receives the query, it performs another prediction to get the most possible sensor that can detect the object. After receiving the query, the sensor invites its neighbors within Group Data Aggregation Algorithm (GDAR) to participate in tracking the object.

GROUP DATA AGGREGATION ALGORITHM

The update-based OTSN, while an object is detected by a sensor, a group data aggregation process is initiated. The sensor performs as the master sensor that invites its neighbors within GDAR to collaborate in tracking objects and handles the local data collection for a period. In order to transmit sensor data with the minimum electric energy, after that, the master sensor reports to the CH about the detected objects and the id of the sensor that detects most objects. Finally, the CH further compresses total data amount by using group id and filters redundant data according to the speciess precision

ACOUSTIC TARGET TRACKING ALGORITHM

In this paper, it devise and evaluate a fully decentralized, light-weight, dynamic clustering algorithm for single target tracking. This focus on acoustic target tracking, although the proposed approaches can be readily applied to other types of tracking applications. Sensors in the acoustic tracking systems perform two types of computation. Sensing the energy level of signals, .Analyzing and classifying the sound and performing the data fusion. The algorithms will be implemented in a centralized and distributed way, which is a novel and significant achievement. It can save a lot of energy and reduce the communication load of the supporting sensor networking systems; it will increase its robustness to failure and respectively the reliability of the tracking module. The innovative elements of this proposal rely on the powerful methodology and the focus on very important problems that have been in the scope of interest of scientists and engineers. Problems such as group object tracking and distributed particle filtering represent substantial research challenges which makes this research unique. Different techniques will be developed in this paper outperforming the previously existing techniques in the literature, which will be suitable for on-line implementations. The main interest will be focused on innovative Bayesian techniques, such as sequential Monte Carlo methods (also called particle filters), Monte Carlo Markov chains and Unscented Kalman filtering and its derivatives are used to solve the signal tracking algorithm. The Monte Carlo approach is generic, scalable, and flexible and has opportunities for parallelization and distributed implementation. Monte Carlo methods afford natural incorporation of constraints which is difficult or impossible with standard filtering techniques of moving objects as expected since the missing rate is the ratio of the missing reports to the total number of reports. Therefore, this ratio is not affected by the increase in the number of objects.

CONTINOUS MONITORING ALGORITHM

Even though it is likely that the number of missing reports will increase, this number will be matched with an increase in the number of total reports. Thus, the ratio remains unchanged. Another experiment has also been conducted to evaluate how the changes in the speed of a moving object could affect the energy consumed by a tracking technique. The prediction model is to predict the next location of an object and to activate the appropriate sensor. Additionally, since the CM is better than the SM, when there is a low number of an object in the network, we will only use the CM for the purposes of comparison against PTSP. This results from the fact that, when the object moves with a faster speed, the prediction for the destination sensor will be harder; thus, a greater recovery process is required and, eventually, an increase in the overall energy consumption of the network. We noticed that PTSP was outperforming CM when the object speed was below 30 m/s. This is considered an excellent performance when compared with the speed of the object; tracking an object moving at a speed of 25 m/s, for example, is not an easy task, if energy saving is also a factor of the tracking technique. The energy consumption of the CM is not affected by the object's speed, as it will be always able to locate the object. It is apparent that, in the context of the missing rate levels, PTSP has kept an acceptable level of missing rate, although it did increase along with the increases in the object speed. In this paper, It have evaluated the three previously explained recovery mechanisms (source recovery, destination recovery, and all neighbors recovery) in terms of energy consumption, the source recovery mechanism is the best in terms of energy consumption, which is based on activating the neighboring sensor nodes of the current sensor.

RECOVERY MECHANISM

The next best 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. As for the worst recovery mechanism in terms of energy consumption, it was the destination recovery mechanism. This recovery mechanism became the worst because it required the network to go through the second phase of recovery more often than the other recovery mechanisms. The second phase of recovery involves activating all the sensor nodes in the network; it incurs more energy consumption in comparison with the first phase of recovery. Therefore, we have chosen the first recovery mechanism (source recovery) as our recovery mechanism of choice in all the previous experiments since it was the most energy-conservative recovery mechanism.

ALGORITHM USED IN OTSN

CLUSTER HEAD

While a sensor detects an object, it invokes a group data aggregation and then informs a list of detected objects and a sensor id to the CH. CHs therefore collect objects' moving sequences within its cluster. In this section, we first present the group moving pattern mining algorithm and then propose an efficient object tracking sensor network. The group moving pattern mining algorithm has four steps: building PST for each object, constructing a similarity graph on PSTs, extracting highly-connected components, and selecting Group Probability Suffix Tree (GPST). After the mining is performed, CH sends the group information to upper layer and gets a group id in return. The group information, group id and GPST are used in the hierarchically prediction-based query and group data aggregation. Building PSTs for All Objects the movement data set in the CH is a set of moving sequences collected within this cluster.

In the step, the CH builds a PST for each object. We propose, with the use of Voronoi technique, a probabilistic leader volunteering procedure, and a sensor replying method. Initially, we enable all the sensors to calibrate their relative positions to their neighbors (at the CH <-> CH level and the sensor <-> sensor level) at the time of network deployment. The Cluster Head Selection is based on the following aspects:

1. Initial Energy: This is an important parameter to select the CH. When any algorithm starts it generally considers the initial energy.

2. Residual Energy: After some of the rounds are completed, the cluster head selection should be based on the energy remaining in the sensors.

VORONOI TECHNIQUES

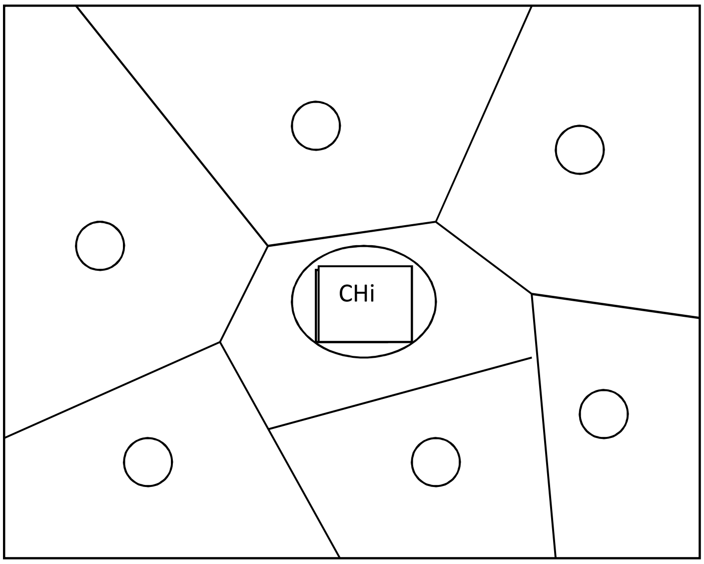

Fig 2 Voronoi diagram of CHi

Then, with the use of Voronoi diagram, each CH (or sensor) can calculate and tabulate the probability that given a distance estimate between a target and itself, the CH (sensor) is closest to the target. This information is used to set up the back-off timer used by a CH to announce its willingness to be active in the leader volunteering process. If no other CHs volunteer before the timer expires, the CH becomes active. Dynamic clustering mechanism for object tracking in wireless sensor networks. With forming the cluster dynamically according to the route of moving, the proposed method can not only decrease the missing-rate but can also decrease the energy consumption .By reducing the number of nodes that participate in tracking and minimizing the communication cost, thus can enhance the lifetime of the whole sensor networks shown in fig 2.

ENERGY EFFICIENT CLUSTERING MECHANISM

In cluster re-forming procedure, after a new cluster head is successfully elected, a new cluster will be formed around it. The new cluster head is selected by the former cluster head through broadcasting a confirming packet. The sensor nodes of the old cluster which receive the confirming packet will first check out whether they are the neighbor nodes of the new cluster head, if so, they would go into listening mode and wait for getting new scheduling information from the new cluster head and if not they would go to sleeping mode immediately. After receiving the confirming packet from the former cluster head, the new cluster head will wait for a short random time, and when its timer expires it will broadcast a re-clustering command pack et which contains the new scheduling information to the neighboring sensors and then go into listening mode.

EXPERMENTAL RESULTS

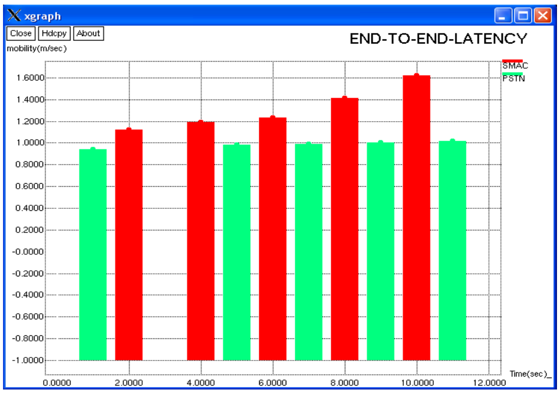

Fig3. END –TO-END LATENCY

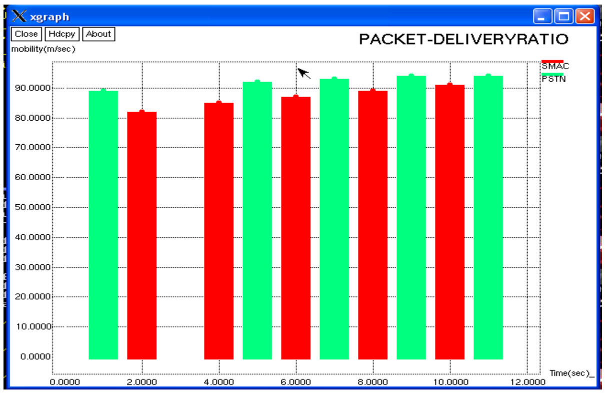

Fig 4. PACKET –DELIVERY RATIO

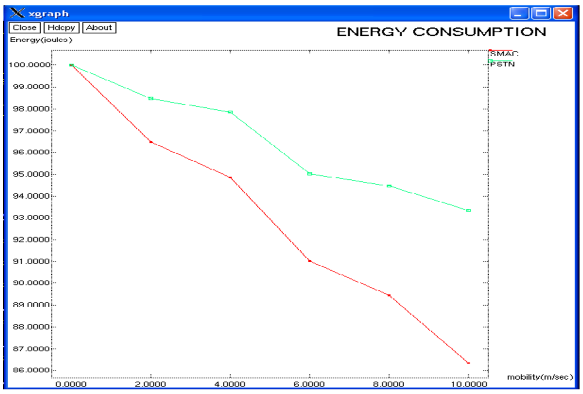

Fig 5. ENERGY CONSUMPTION

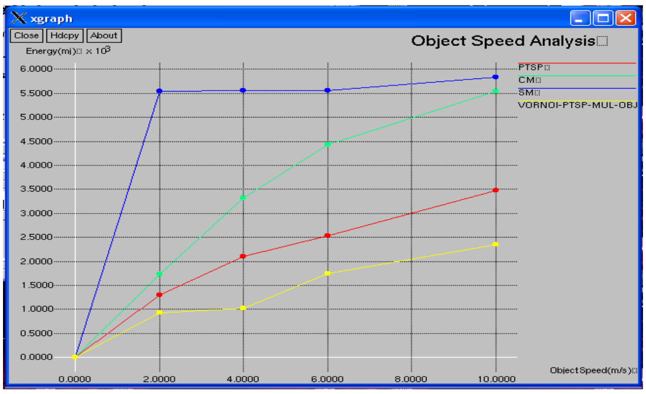

Fig 6. OBJECT SPEED ANALYSIS

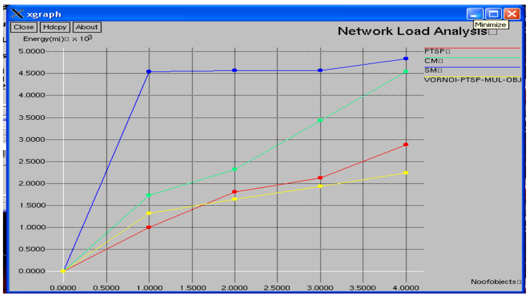

Fig 7.NETWORK LOAD ANALYSIS

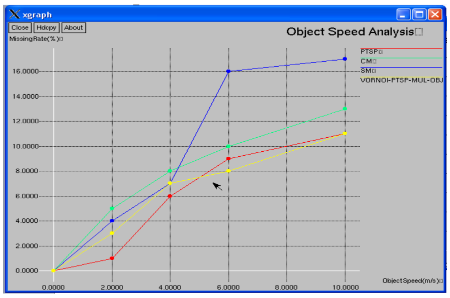

Fig 8. OBJECT SPEED ANALYSIS

There are five basic parameters to be analyzed. They are:

1. End to End Delay.2.Packet Delivery Ratio 3.Energy Consumption 4.Network Load Analysis 5.Object Speed Analysis

End To End Delay

This analysis is taken between PSTN technique and SMAC .In this prediction technique is used to define future state energy. End-End delay refers to the time taken for a packet to be transmitted across a network from source to destination. In the above graph, as the time increases mobility of SMAC increases and the PSTN rate remains constant shown in fig 3.

Delay = Inter arrival between 1st and 2nd Packet /Total data packets delivered time

X axis $\longrightarrow$ Time (sec)

Y axis $\longrightarrow$ Mobility (m/sec)

Packet Delivery Ratio

Packet delivery ratio is the ratio between number of received packets received to the number of packets sent multiplied by hundred. This is a comparative analysis between 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 is shown in fig 4.Finally Cetain analysis of packets sent and receives shown in fig 6,7,8.

Packet deliver ratio = (Number of packets received / Number of packets sent) ×100

X axis $\longrightarrow$ Time in sec

Y axis $\longrightarrow$ Mobility (m/sec)

Energy Consumption

Energy consumption is defined as the ratio of energy expanded in each node on ideal state, sleep state, transmitting and receiving state (i.e.) energy consumed in each state to the total average energy consumed is shown in fig 5.

Energy Consumption = (Energy consumed in each node based on ideal sleep transmit and Receive)/(Total average energy consumed)

Transmission Range = Throughput is varied with respect to the receiving signal strength

X axis $\longrightarrow$ Mobility (m/sec)

Y axis $\longrightarrow$ Energy (Joules)

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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