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AN EFFICIENT OPTIMIZATION METHOD BASE ON PSO FOR ENERGY CONSUMPTION IN WIRELESS SENSOR NETWORKS

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ABSTRACT

Developments in wireless communications and electronics have made designing low-cost sensor networks possible. The sensor networks have many application areas such as health, military, home, agriculture, environmental. Because each sensor has to be low-cost, they have very limited battery and a lifetime of the network depends heavily on saving energy. One way of saving energy is by designing appropriate routing protocols. In this paper, energy consumption methods in the wireless sensor network are researched and a method proposed for saving the energy of the sensors and consumption energy in the network based on particle swarm intelligent optimization algorithm.

KEYWORDS: *Necessity of Extension of Life, Wireless Sensor Networks, Media Based on the Information*

INTRODUCTION

Wireless sensor networks, recently have been a new technology on the agenda[1]. By using wireless network sensors, information can be collected interactively and can be evaluated collectively. Also, if it is necessary changes can be made to the media based on the information. Limited energy sources are one of the major problem encountered in wireless network sensors. In generally, sensors are located in remote or inhabited places, so that it is not possible to recharge the battery or replace the battery. This is the most efficient way of using energy, reveals the necessity of extension of life. To be used for this purpose the most natural of the methods, only at the required number of by keeping the sensor active, to prevent energy consumption by others. The sensors to be selected include the desired area efficiently. Also, the minimum number of sensor active to extend the life of the network and at the same time sufficient coverage information retrieval[2].

Dali Wei et al [3] provide the value of energy consumption $ED(Ri)$ of a region Ri during a period.

In this paper, we defined the Zigbee wireless sensor network and we explained what is wireless sensor network, in which areas is it used, working principle, which methods are used. Zigbee is one of the most important application areas of the wireless sensor network. Another wireless sensor networks are HomeRF, bluetooth, wibree, zigbee and xbee. Zigbee may be more advantageous than other wireless sensor networks. For example, easier, battery life is longer, support for a large number of mesh and lower costs. In short, this paper will define zigbee wireless sensor networks systems, information about the parameters affecting the signal strength and methods used to increase the success rate in greater communication andabout the used methods will be given information for increase success rate in wireless sensor networks. After the introduction and literature review, we will try to experiment with these parameters and methods in the simulation environment. in this study the most recent articles will be evaluated; comments and analyzes will be made.

History of Sensors

People have the capacity to perceive some of the events that occur in their surroundings. This capacity is based on sensory organs. Devices that detect the environment are called sensors. It is highly probable that the first sensor to be discovered is a magnetic compass. Perhaps this compass was obtained by rubbing a metal wire friction loaded with friction to show the north and south direction in a small environment. In 1070, the Chinese began to take advantage of sea transportation [1, 4].

Magnetic sensors in the future. II. During World War II it was used both by the US and Japan for the detection and tracking of submarines. The Japanese have given the name jikitanchiki to the equipment that is usually released from ships and airplanes by means of wires. After the war, the US Navy continued to develop magnetic sensors. Today, weapons for security, devices used to search for knives are the continuation of this technology.

Temperature measurement until about 260 years ago was extremely subjective. Brightness, the color was a good indicator for hot metals. However, the temperature was not able to determine the temperature in which no color change was observed. In the past, Egyptians, Assyrians, Greeks, Romans, and Chinese all wanted to measure temperatures, but they did not develop a valid system. Galileo invented the first documented thermometer in 1592. However, this thermometer was influenced by air pressure and did not give very clear results. So she could not meet the needs. In 1714, Daniel Gabriel Fahrenheit invented mercury thermometer. Fahrenheit was filled with mercury in a pipe and then expanded according to the mercury temperature. This thermometer made it possible to clearly measure the temperature of the materials. Later in the 18th century, Anders Celsius thought it would be more advantageous to divide the thermometer into 100 equal parts. He accepted 100 as a freezing point as a boiling point. At the beginning of the 19th century, William Thomson suggested the existence of an absolute zero. In the 20th century, Lord Kelvin worked on absolute zero and developed a thermometer to be called by his name because he did not consider the Celsius thermometer suitable for this job.

Energy Consumption in Cluster Formation

The selection of CHs is a two-stage process as explained in detail in previus sections. Designating the length of a control packet as lo, we obtain the total clustering energy consumption during a DCR in Ri as:

$$E_{Cluster}(i) = Wa\sigma T \left[l_o(e_t + \epsilon fs/\pi\sigma pi) + \left(\frac{T}{pi} - 1\right) l_{oer}\right] + +W\, a\sigma(1 - pi)l_o\,(e_t + 4\epsilon fs/9\pi\sigma pi + e_r) \quad (1)$$

Dali Wei at al [3] compared the performance of EC with HEED [5] and UCR [6]. HEED is a distributed clustering algorithm in which CHs transmit data to a sink node via multi-angle routing. There is a repetitive CH selection mechanism in which each node is connected to the residual energy with the possibility that it is a CH. The performance results show that the AT extends the network life and, despite the various traffic loads at these locations, the sink allows the node energy levels to be balanced at different jumps. EC performs better than well-known and popular clustering algorithms such as HEED and UCR. The dot indicates the sensor nodes and a larger point is used for a higher residual energy level. As can be clearly seen, the HEED sensors have greatly varying energy levels, while both UCR and EC perform energy balancing with better performing ECs in energy conservation. A number of sensors have seen a jump as they consume their energy source although the EC and UCR both achieve energy equivalence, the EC is the appropriate choice of cluster sizes and the mechanism by which the clusters perform better than the UCR in energy efficiency due to their energy conservation characteristics.

In EAP, a node with a high residual energy ratio to the average residual energy of all neighboring nodes in the cluster range is likely to be cluster head. This can better manage heterogeneous energy conditions according to existing clustering algorithms that only select a cluster head based on its own residual energy. After the cluster formation phase, EAP creates a covering tree on the set of cluster heads. Only the root node of this tree can communicate with the sink node through single-pass communication. Since energy consumed for all communications on the network can be calculated with the free-space model, the energy will be saved extremely, and the life of the sensor network will increase.

$$.P_{cover}=\sum_{i=k}^{m} C_m^i . \left(\frac{r}{R}\right)^{2i} (1-\frac{r^2}{R^2})^{m-i} \quad (2)$$

Ming at al[7] EAP, a new energy-efficient data collection protocol with intracluster coverage. EAP aggregates the sensor nodes in groups and creates a redirect between the cluster heads for energy-saving communications. In addition, EAP offers space coverage to reduce the number of working nodes in the cluster to extend the network lifetime.

Zhang at al [8] proposed an energy-balanced routing method based on the forward-difference factor (FAF-EBRM). In the FAF-EBRM, the next hop node is selected according to the difference in link weight and forward energy density. Moreover, a spontaneous restructuring mechanism for local topology is additionally designed. Experiments show that FAFBRM performs better than LEACH and EEUC when compared to LEACH and EEUC, balancing energy consumption of the FAF-EBRM, extending the function life and guaranteeing high QoS of the WSN.

In the network model of this protocol, all sensor nodes are isomorphic and have limited abilities to calculate, transmit, and store data. The energy of the sensor nodes is limited and the starting energy is E_0. Knots die when energy is exhausted. However, the energy of the sink node can be added. Once the nodes and sink locations are stationary, they do not change and a node cannot achieve the absolute position in its position device. Nodes can change the transmission power according to the distance of the receiver. The sink node may send messages to all sensor nodes in the sensing area. The distance between the signal source and the receiver is calculated based on the received signal power. Regional center nodes are not initially selected, but they appear during topology evolution. The significance nodes, the density, and the density, have more connections at significantly higher levels than the neighbor nodes.

Establishment of the model is the forward transmission area of node i is FTA(i). figure 1 shows that $\odot_1$is a circle with Sink as the center and as the radius,$\odot_2$ is a circle with as the center, and as the radius:

$$.FTA(i) = \odot o_1 \cap \odot o_2 \quad (3)$$

$$.d_i = \max(d_{ij}), j\epsilon N_i \quad (4)$$

Where N_i is the set of nodes that have a communication link with node i.

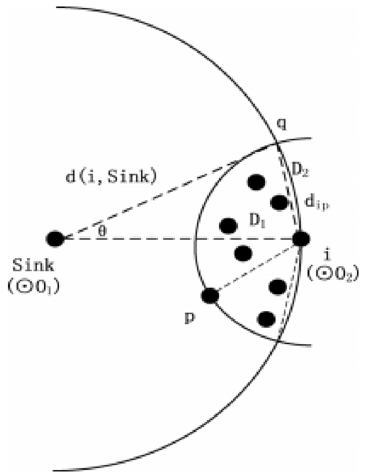

Figure 1: Forward Transmission Area

Material and Methods

We use radio model which is shown in figure 2.

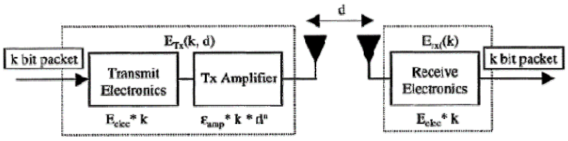

Figure 2: Radio Model

The whole of sensors need the energy to transmit a packet of k bits information to a distance d and to receive an information packet of k bits, is given as:

$$E_{Tx}(k,d) = E_{Tx-elec}(k) + E_{Tx-amp}(k,d)$$
$$E_{Tx}(k,d) = E_{elec} \times k + E_{amp} \times k \times d^n \quad (5)$$

The n value is depended on the distance between threshold distance values. If the distance is big than the threshold value n will equal to 4 and if the distance is less than the threshold value n will equal to 2.

$$E_{Rx}(k) = E_{Rx-elec}(k) E_{Rx}(k) = E_{elec} \times k$$
$$E_{Rx}(k) = E_{elec} \times k \quad (6)$$

The proposed method flowchart is shown in figure 3.

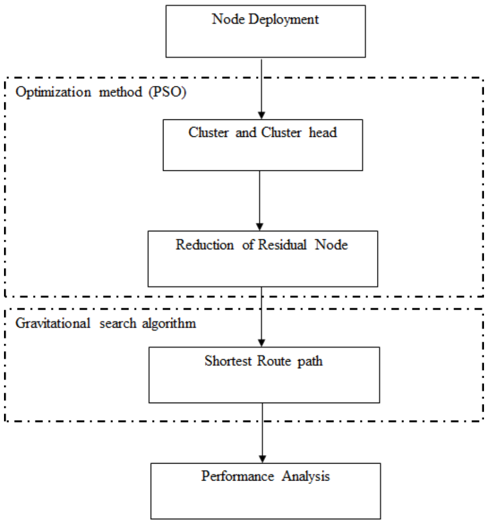

Figure 3: Proposed Method

The Psudo code for the proposed method is shown in figure 4[9].

```
[x*] = PSO()
P = Particle_Initialization();
For i=1 to it_max
  For each particle p in P do
    fp = f(p);
    If fp is better than f(pBest)
        pBest = p;
    end
  end
  gBest = best p in P;
  For each particle p in P do
      v = v + c1*rand*(pBest – p) + c2*rand*(gBest – p);
      p = p + v;
  end
end
```

Figure 4: Psudo Code for the Proposed Method

In this paper, we compared the proposed technique with Low Energy Adaptive Clustering Hierarchy (LEACH) and Optimized Energy Efficient Routing Protocol (OEERP) methods, DRINA and BCDCP. In the OEERP method, the lifetime of a wireless sensor network is improved by using a cluster-based protocol in which the node acting as the cluster header changes over time in each slot. This WSN life cycle improves mainly for two reasons. The first reason is that the unloading of the battery is uniform in nodes, and the second reason is that no node for infrared transmitters for a long time does not depend on access to the access point.

The total energy consumption vs. Time is shown in figure 5.

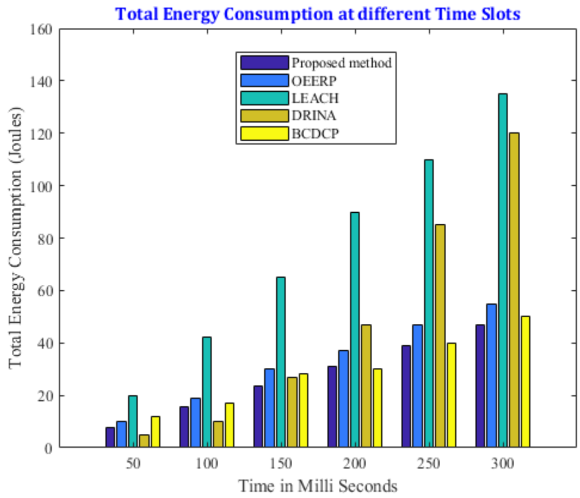

Figure 5: Total Energy Consumption VS Time

As shown in this figure the proposed method has the lowest one than the other four methods. This value is about 8 Joule. The OEERP method has 10 Joule and the highest one is the LEACH method which its energy is 20 Joule. We reduced 20% the energy consumption from OEERP and 60% from the LEACH method. That's mean the proposed method is 40% of the LEACH energy and 80% of the OEERP energy.

CONCLUSIONS

The aim of our paperwork is to save the energy of the nodes. The important goal of this paper is to reduce the total energy consumption of the wireless sensor network. Changing the cluster head election probability as dynamically and with more efficiency makes the sensors use low energy and save a lot of energy in the whole of the network. In this paper, evaluated a clustering-based method for homogenous wireless sensor networks. In our method, we change the cluster head election probability as dynamically and with more efficiency. Then we are going to compare our protocol performance with distributed energy-efficient clustering and stable election protocol. We expect the performance of our proposal system will overcome the previous works.

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