

Research on Passive Cluster Model of City's Intelligent Energy Based on WSN

Huazhen Liu^{1, a}

¹North China Electric Power University, Energy and power engineering (Practice), China 102206

^a1305992161@qq.com

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Abstract. under the intersection of microelectronic technique, computer technology and wireless communications, embedded technology with low energy consumption breeds the new WSN technology, which is universally applied in fields such as science, medical treatment, business, national defense etc, which reveals huge application values. But WSN also has certain defects and shortages, it has limited energy, storage space and computation ability, so routing algorithm focuses on characteristic research has become to be the important topic. This paper puts forward new hierarchical, scattered energy effective passive cluster model EEPSCS, which has greatly changed the defects in traditional passive cluster model such as quick energy consumption in communication node, network disconnection etc, so it has certain practice and application values.

Introduction

WSN is composed of plenty of cheap and micro sensor nodes arranged in the detection area, it forms one multi-hop and self-organization network system through wireless communications, which changes intersection model of human and nature world to certain extent. But WSN has limited node computation ability, storage ability and prepared energy, while in the data transmission process, sensor node needs to cost much more energy, how to reduce data transmission and meanwhile simplifies system computation process, it usually uses cluster method to solve this problem.

Structure and System of WSN

WSN is composed of several sensor communications, one sensor includes perceptron, processor, wireless network communication module and energy supply module, which is indicated by the following figure 1:

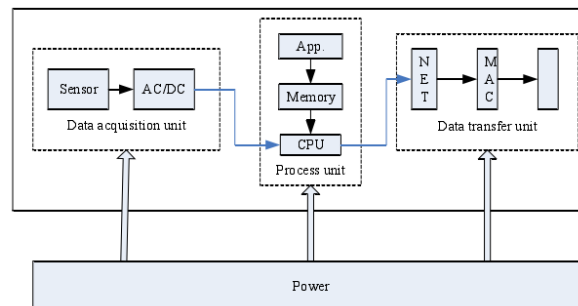


Figure 1 Structure of sensor node

As one kind of wireless self-organization network, WSN can meet functions such as periodic data collection, event driven as well as data storage and transfer etc. Design of WSN must consider energy consumption, data transmission distance and interruption, sampling ratio etc. System and structure of WSN includes sensor nodes, cluster node and management node, which is indicated by figure 2. Of which, sensor nodes are distributed in one

detection area, these nodes construct one local area network by way of organization.

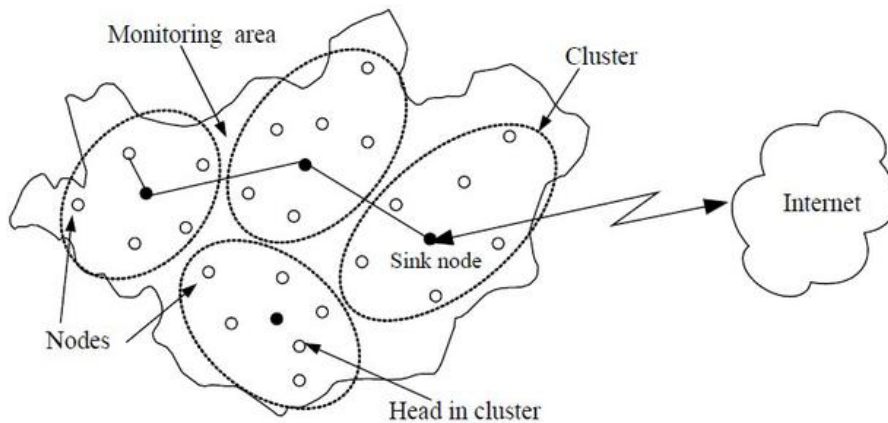


Figure 2 System and structure of WSN

This paper uses energy consumption model of Leach algorithm to calculate energy used by one node in unit time for interrupting target. E_{elec} indicates energy needed by wireless circuit, while E_{ep} and E_{fs} respectively indicates amplifier energy of multi-route model and free space model. The energy consumption $C_t(s_i)$ of one sensor s_i in every time unit is as follows:

$$C_t(s_i) = C_{tx}(l, d) + E_{rx}(l) \quad (1)$$

Of which, $E_{rx}(l) = lE_{elec}$ is the energy consumed by receiving signal of 1bit and

$$E_{tx}(l, d) = \begin{cases} l(E_{elec} + E_{fs}d^2), & d < d_0 \\ l(E_{elec} + E_{mp}d^2), & d \geq d_0 \end{cases}$$

is the energy used by sending data signal of 1 bit to the other node of

distance d . In the end, the received tracking data equals to 1bit, and it is proportion to the covered group number.

K average cluster algorithm of WSN

Cluster analysis, its short form is clustering; it regards the divided sub-set as cluster. K average algorithm is to make cluster analysis by using distance as judgment base, when 2 objects are closer to each other and its similarity is much bigger, and finally it obtains compact cluster as target.

The division technology based on form center uses form center of C_i to replace this cluster, the form center of cluster is its central point, and form center can be defined by many ways. Object $P \in C_i$, which represents difference between object P and this cluster C_i , it uses $dist(p, c_i)$ to make measurement, of which, $dist(p, c_i)$ is the Euclidean distance of P and C_i . The quality of cluster C_i 的 can use equation to make measurement.

$$E = \sum_{i=1}^k \sum_{p \in C_i} \text{dist}(p, c_i)^2 \quad (2)$$

Of which, E represents the average sum of all the object difference; P means the space point, means the given object. c_i is the form center of cluster C_i . As for all the objects in every cluster and gets the square of Euclidean distance from object to their form center of clusters, and then makes summation operation. This target function makes the generated result much more compact and independent.

Construction of WSN energy consumption model

In the WSN transmission, the reduction of transmitting power will present index decrease with the increase of transmission distance. When the distance d between transmitting node and receiving node is less than one value d_0 , it adopts free space model and transmitting power presents d^2 decrease, otherwise it adopts multi-route decrease model, transmitting power presents d^4 decrease.

In the same wireless energy model, the consumption energy of transmitting k bite data is composed of transmitting circuit consumption and power amplification consumption, of which, it adopts free space model and multi-route decrease model, E_{elec} is the consumption energy of transmitting circuit, ε_{fs} and ε_{amp} are the necessary energy of power amplification under 2 kinds of communication channel.

$$ET_x = \begin{cases} K * E_{elec} + K * \varepsilon_{fs} d^2, & d < d_0 \\ K * E_{elec} + K * \varepsilon_{amp} d^4, & d \geq d_0 \end{cases} \quad (3)$$

$$E_{Rx} = K * E_{ele} \quad (4)$$

In equation (4), which represents energy consumption of data of k bite, it is only caused by circuit consumption. In addition, making cluster processing on data signal will also cause circuit energy consumption, suppose the number of cluster member is M , cluster M member data signal and self data signal into one effective signal consumption energy $EC = (M + 1) * EDA * k$, of which, EDA represents the consumed energy of clustering single data signal. From here it is easily to see that energy consumption of WSN mainly takes place in data collection, procession and communication, of which, data communication is the main energy consumer.

Passive cluster model of EEPCS energy effective

EEPCS respectively adopts class selection mechanism and effective gateway selection mechanism based on intelligent delay strategy to generate class and gateway, which increases class state, prepare gateway and gateway state. In the beginning of network, all the nodes just appear, their state is set as initialization state.

When it receives data needs transmitting, it transforms node under initialization state into CH-Ready, when node of CH-Ready transmits data packet to the outside, its state is changed as Quasi-CH, and it sets timer value by delay intelligent strategy put forward in $W1 = \delta_1 * (RP / LE)$. When timer is full and Quasi-CH dose not receive information from CH, its state is transformed as CH, this node adds its state to the data packet transmitted outside and transmits to the other nodes, and state transformation of EEPCS is indicated by the following:

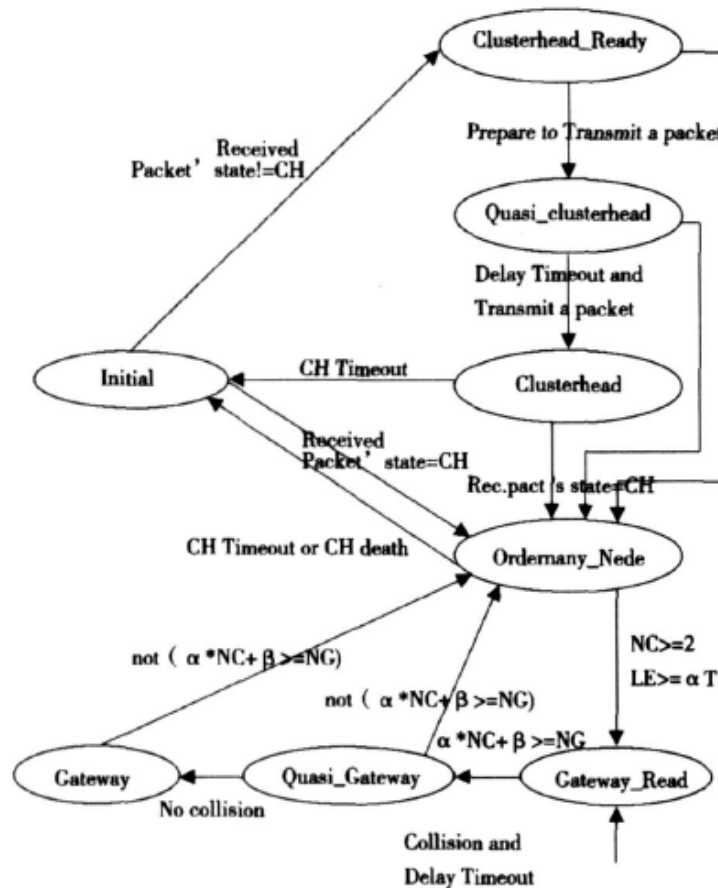


Figure 3 State transformation figure of EEPCS

Set area as 25×25, 50×50, 100×100, initial energy of every sensor node is 100W and transmission energy consumption of all directions is the same, transmitting ability is 20Marksand the initial energy of every node is 100%, data transmission consumes 0.04W, receiving data consumes 0.01W, the probability of node randomly transmitting broadcast is 4%, the adopted time changes among 10, 20, 30. Calculate delay waiting time W, δ takes value in [0,10], make performance test on simulation for PC and EEPCS. The relations of maintenance time of result cluster, remaining energy and network density indicated by the following figure 4: :

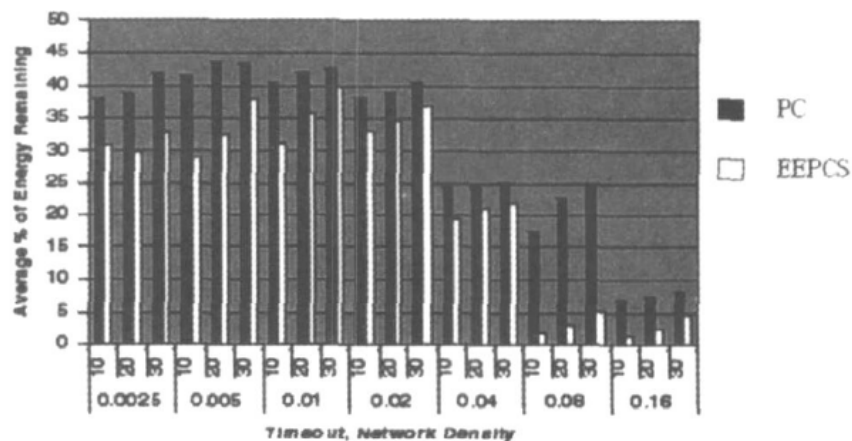


Figure 4 Effect of clustering maintenance time on average remaining energy of PC and EEPCS
From the above figure, it can be seen that the shorter of cluster maintenance time of PC and EEPCS, the

more even of network energy consumption, and node state transforms much more frequently, using intelligent delay strategy can equalize network energy consumption and network life cycle of EEPCS is bigger.

Conclusion

In a word, it adopts EEPCS energy passive cluster model in city intelligent energy, which can greatly reduce network communication load, save energy, equalize energy consumption, lengthen life cycle of network, which can make up for the shortages of WSN itself, it is the main trend of WSN development in the future, so it should arouse our attention and enlarge practice, application range, well service for production and life of people.

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