ISSN: 2414-1895 DOI: 10.6919/ICJE.202110_7(10).0058

Research on WSN Clustering Routing Protocol in Distribution Network System

Jia Yang[1], Qiyue Duan[1,*], Yingxu Wu[2]

[1]School of Electrical and Electronic Engineering, Chongqing University of Technology, Banan District, Chongqing 400054, China;

[2]Sichuan Wenma Expressway Co., Ltd, Wuhou District, Chengdu 610000, China.

*Corresponding Author. E-mail: 1376189768@qq.com

Abstract

Aiming at the problems of data loss, retransmission and invalidity in urban wireless meter reading system, a new WSN clustering routing algorithm for urban meter reading system is proposed. Firstly, this algorithm makes an overall analysis of the urban meter reading system, establishes the system model and analyzes the main functions of each part. Then, in the clustering stage, the chaotic quantum particle swarm algorithm is used to obtain a better coverage rate of sensor nodes, improve the search efficiency of the algorithm and find the global optimal solution. Finally, the high-performance network transmission path selection model is established, and the network delay reliability and delay are weighted. The path selection mathematical model is established, and the path is solved to complete the inter-cluster communication. Through a large number of simulation experiments, this algorithm can effectively balance the energy consumption of the entire network and improve the real-time and reliability of data transmission in the power communication network.

Keywords

Wireless Sensor Network; Double Cluster Heads; Clustering Routing; Path Solving.

1. Introduction

Urban residents have large distribution density and concentrated residence. Urban wireless meter reading system needs to distribute a large number of sensor nodes. The operation business of urban power grid requires high data timeliness and reliability. The distributed wireless sensor network nodes need a large number of relay nodes to ensure reliable data forwarding when transmitting data, which will increase the workload of routing path query and increase routing delay. Due to the large scale of power meter reading system, the nodes will collide when transmitting data, resulting in network congestion, data loss and other issues, which cannot guarantee the reliable transmission of the network. The above problems pose higher challenges to the routing protocols of wireless sensor networks. Therefore, in order to ensure real-time and reliable data transmission, one of the key issues is to design a WSN routing protocol with good performance. In recent years, many researchers have proposed various WSN routing protocols.

For the traditional meter reading system, urban meter reading system requires longer working life and higher data transmission reliability. In Reference 5-6, a WSN routing deployment algorithm considering path loss and energy loss was proposed. The weight of path and energy loss was calculated comprehensively to achieve the selection of the best reliable transmission path. However, if the algorithm does not increase the network overhead, it is easy to cause data loss. In literature 3, a routing algorithm for wireless sensor networks based on smart grid is proposed. Considering the

ISSN: 2414-1895 DOI: 10.6919/ICJE.202110_7(10).0058

network delay, average hops, routing overhead and other aspects, the node responds to the packets whose destination address is its own, which makes the whole network information transmission complicated and increases the network energy consumption.

In Reference 4, an efficient and reliable clustering algorithm for WSN based on quantum bee colony algorithm was proposed. The network energy consumption was more balanced, the energy consumption of cluster head nodes was the lowest, and the network connectivity was better, but the reliability of data transmission was low. In this paper, an improved Chaos Quantum-behaved Particle Swarm Optimization-Path Selection (CQPSO-PS) algorithm is proposed, which is suitable for the communication network of urban wireless meter reading system, optimizing the communication mode of power management, serving for power meter reading and power management, and improving the timeliness and reliability of power grid data transmission.

2. Design of urban meter reading system

2.1 The design scheme of structure

Figure 1 is the system architecture diagram of urban meter reading data communication networking scheme. The system consists of the meter with 485 interface, data acquisition terminal, concentrator, underlying data communication channel, remote data communication channel and power management center.

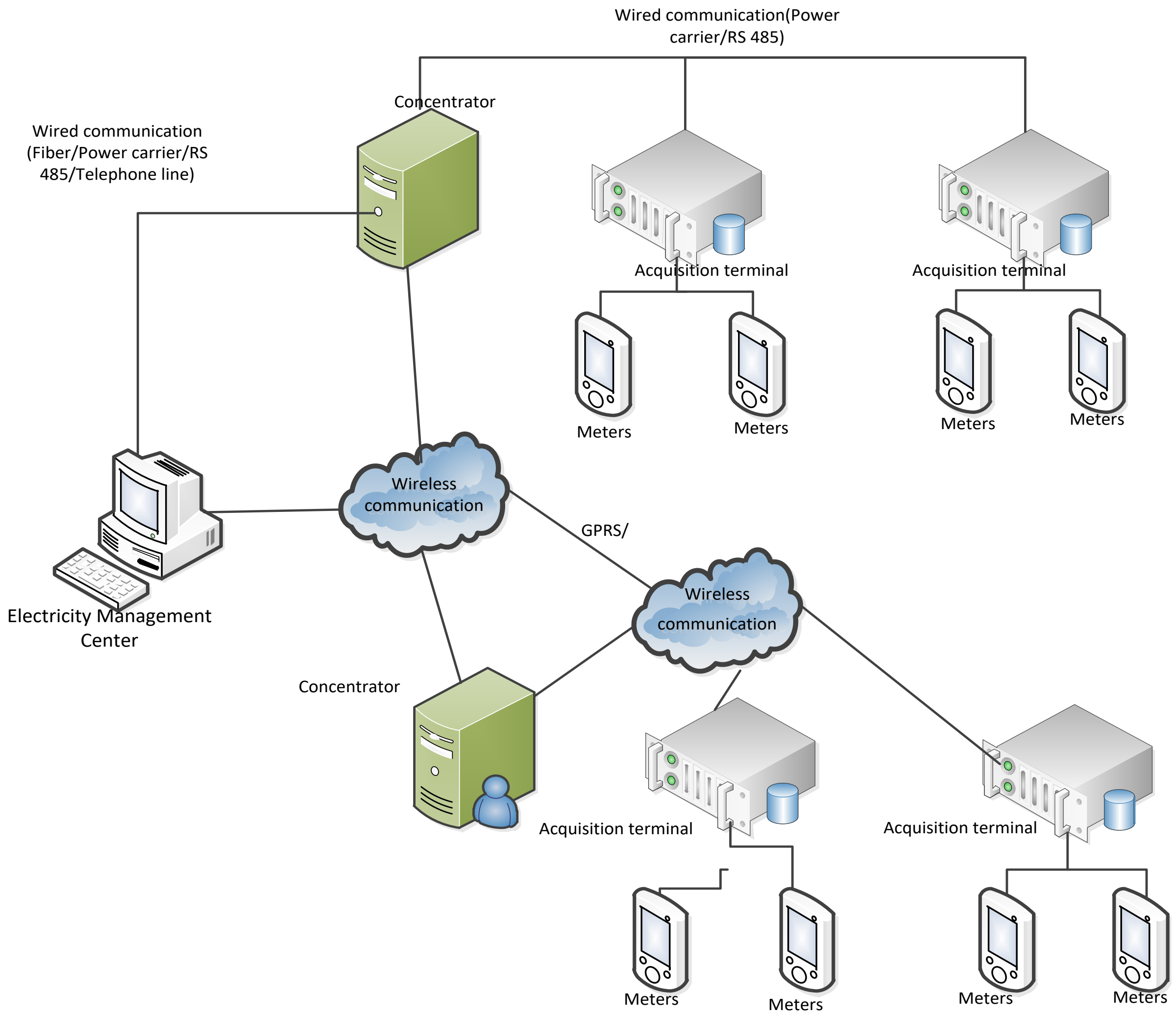

Fig. 1 Architecture of Data Communication Network Scheme for Urban Meters

ISSN: 2414-1895
DOI: 10.6919/ICJE.202110_7(10).0058

2.2 Main functional analysis of system components

The data collector can directly obtain the data of user power consumption by using the 485 bus. The data communication between the energy meter data concentrator and the data collector is realized by using the underlying data communication channel. The underlying data communication can be realized by using the data radio, GPRS and wireless ad hoc network. In this paper, the wireless ad hoc network is used for the underlying communication. The communication between the electricity management center and the electric energy meter data concentrator can realize remote data communication through the remote data communication channel. The remote data communication can adopt the communication mode of combining wired and wireless. The specific situation of the cell is referred to, such as whether there is fiber or telephone line and other existing wired communication. This communication networking mode is unique and flexible, and has good scalability and compatibility, which can meet the communication selection scheme of power departments for meter reading and installation.

The field simulation of the data acquisition end is shown in Fig. 2. The data acquisition terminal focuses on the use of embedded technology for micro-processing so that the acquisition terminal has a convenient and efficient function. At the same time, it combines computer network technology and digital signal technology to ensure the normal operation of the system, and optimizes the combination of multiple high-tech such as wireless ad hoc network technology. The data acquisition terminal has the functions of data acquisition and processing, time-sharing billing, remote monitoring and control, etc. At the same time, the system will alarm and simple fault diagnosis. The line damage and balance in the detected area will also be briefly analyzed. The data acquisition terminal will seamlessly connect with the information management of the power sector, and the management of the power management department will save a lot of manpower and material resources.

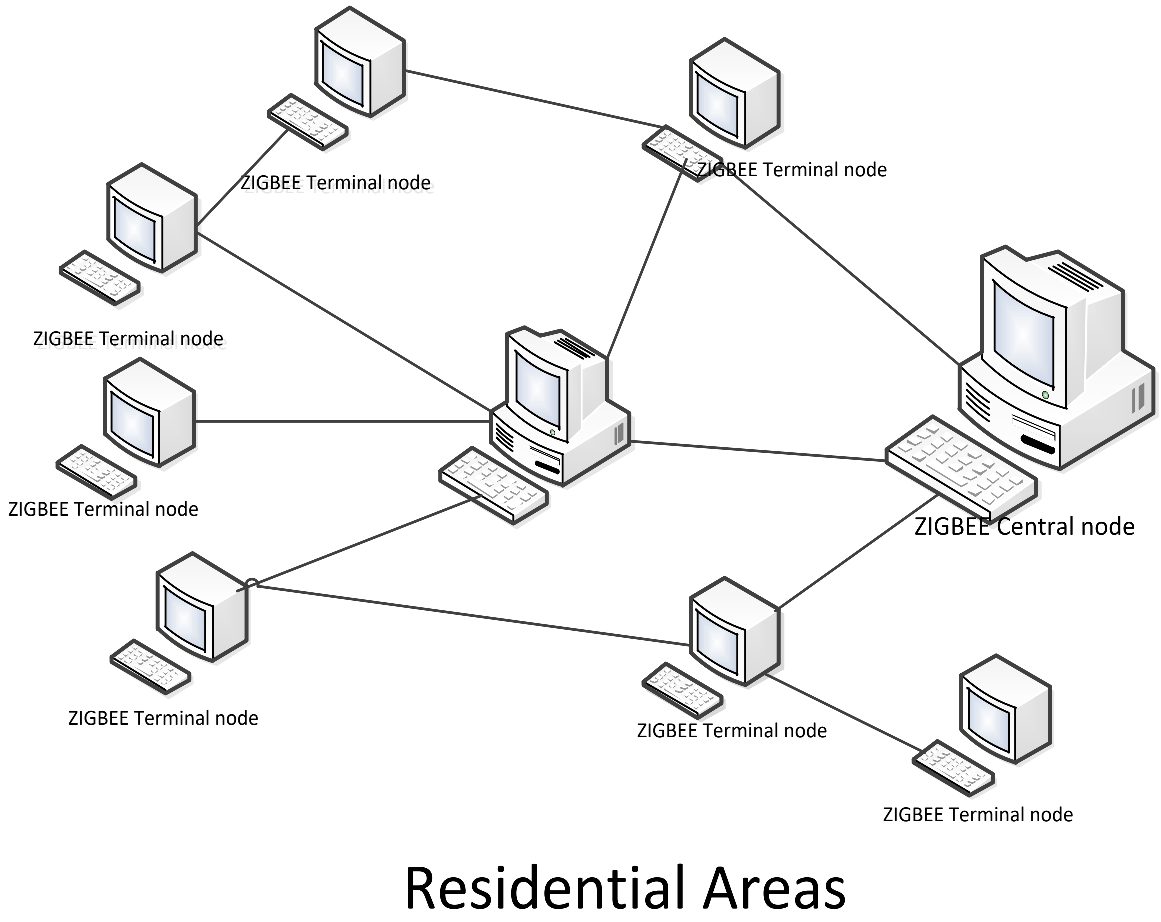

Fig. 2 Field simulation of data acquisition terminal

ISSN: 2414-1895
DOI: 10.6919/ICJE.202110_7(10).0058

From the analysis of the communication function of the collected data, it is concluded that data communication is divided into wired and wireless ways. The 485 serial communication, TCP/IP broadband network communication and power line carrier communication, as well as public telephone network communication are wired communication, general packet radio technology (GPRS), wireless data radio communication and GSM-CSD, and wireless ad hoc network communication are wireless communication. At present, the automatic meter reading system used in China includes a variety of communication methods. Ensuring timely and reliable meter reading data is the primary goal of wireless meter reading system, so improving the compatibility of meter reading data is an urgent problem to be solved. In summary, through analysis, comparison and research, this paper summarizes the structure of wireless communication network platform for urban meter reading as shown in Fig. 3.

The requirements for meter reading in power system are comprehensively analyzed, and the path optimization and energy consumption optimization of wireless sensor network communication data transmission are carried out to complete the multi-hop ad hoc network. Test nodes to ensure the safety and reliability of data transmission in meter reading system.

Its main functions are as follows:

From the analysis of the communication function of the collected data, it is concluded that data communication is divided into wired and wireless ways. The 485 serial communication, TCP/IP broadband network communication and power line carrier communication, as well as public telephone network communication are wired communication, general packet radio technology (GPRS), wireless data radio communication and GSM-CSD, and wireless ad hoc network communication are wireless communication. At present, the automatic meter reading system used in China includes a variety of communication methods. Ensuring timely and reliable meter reading data is the primary goal of wireless meter reading system, so improving the compatibility of meter reading data is an urgent problem to be solved. In summary, through analysis, comparison and research, this paper summarizes the structure of wireless communication network platform for urban meter reading as shown in Fig. 3.

The requirements for meter reading in power system are comprehensively analyzed, and the path optimization and energy consumption optimization of wireless sensor network communication data transmission are carried out to complete the multi-hop ad hoc network. Test nodes to ensure the safety and reliability of data transmission in meter reading system.

Its main functions are as follows

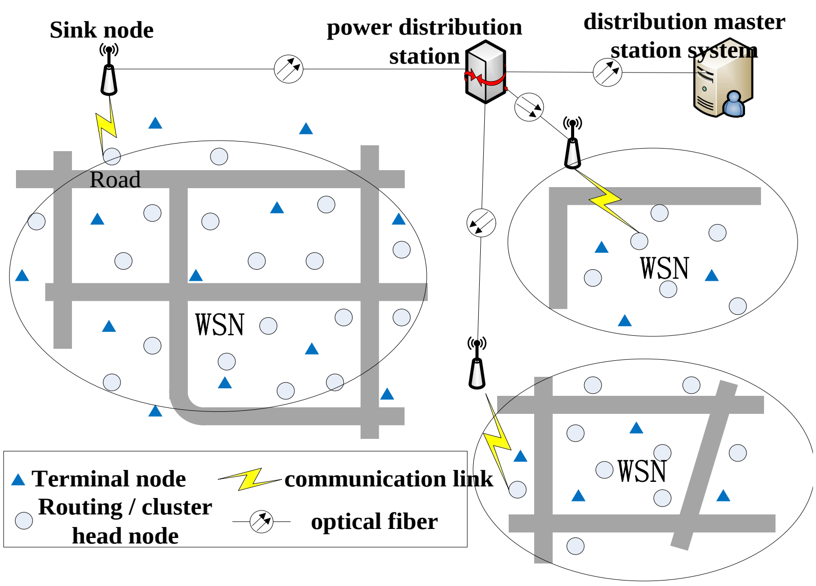

Fig. 3 Structure of wireless communication network platform for urban meter reading

ISSN: 2414-1895
DOI: 10.6919/ICJE.202110_7(10).0058

2.3 Chaos Quantm Particle Swarm Optimization Clustering Routing Algoruthm for Urban Meter Reading System

At present, the urban power lines are complex. Whether in the densely populated urban center or around the suburbs, the wiring construction is extremely complex, not only human and material difficulties. Wireless sensor network access to urban meter reading system can effectively solve the shortcomings of the above wired network, and wireless ad hoc network has the advantages of convenient, efficient and easy to implement. WSN clustering routing has become the most efficient way of data transmission in urban meter reading monitoring system. Therefore, in the design of clustering routing protocol, we must focus on the real-time and accurate data transmission when ensuring the network life cycle, that is, data are transmitted along the best path.

Based on the above analysis, this paper proposes a path selection CQPSO-PS clustering routing protocol for wireless sensor networks. In the clustering stage, the chaotic quantum particle swarm optimization can avoid the shortcomings of the standard particle swarm algorithm, such as low swarm intelligence and insufficient collaborative search ability. At the same time, it can effectively improve the search utilization of the algorithm and enhance the coverage of sensor nodes. Inter-cluster routing will use path solving weighting modeling for communication.

3. Mathematical models

3.1 Logistic chaotic mapping

The general characteristics of chaotic motion include randomness, regularity and ergodicity. Wireless sensor networks can improve the performance of system search and optimization by integrating chaotic motion. The main aspect of its randomness is that it can form negative feedback in the search process, so as to avoid particles in the population from avoiding local optimum in the search. The regularity avoids the chaos of the traditional algorithm and makes the new solution all have basis. The role of ergodicity is to achieve non-repetition and non-forgetfulness in the entire feasible solution region and improve the global optimization ability of the algorithm. This paper uses a typical Logistic chaotic map, the equation as (1) shows:

$$Z_{i+1} = vZ_i(1 - Z_i), i = 1,2,\dots,N\,; v \in (2,4] \tag{1}$$

where v is the control parameter, N is the number of chaotic search, and when v=4, $0 \le Z0 \le 1$, Logistic is completely in a chaotic state.

3.2 Basic idea of algorithm

There are some shortcomings in the particle swarm algorithm of wireless sensor networks, including slow convergence rate and local extremum. Therefore, this paper proposes a clustering routing algorithm for WSN based on chaotic quantum particle swarm. Compared with the traditional particle swarm optimization algorithm, the algorithm is optimized in the iterative calculation. By judging the variance of the fitness value, the algorithm is re-searched to avoid falling into local optimal solution.

In the iterative optimization process of the algorithm, when some particles in the quantum particle swarm find the local optimal solution, other particles will be attracted and quickly gathered together. This phenomenon will make the algorithm fall into local optimum, which is called premature convergence. When this phenomenon occurs in the population, the particle distribution is more concentrated, and the local optimal solution and the global optimal solution are confused, which reduces the optimization ability of the algorithm. References [7-8] proposed the premature judgment method of population fitness variance in order to ensure the diversity of particles and increase the richness of particles, which can avoid the dilemma of particles falling into local optimum. However, increasing the calculation amount of the algorithm and increasing the running time of the algorithm have become obvious shortcomings of this mechanism. In order to optimize these deficiencies, the prematurity judgment mechanism proposed in this paper is realized by the variance of excellent individual fitness. The theory is mainly based on: If a group is in the state of premature convergence, the individuals with larger fitness in the population are compared with the population in detail, and whether there is a similar phenomenon is analyzed and observed. The determination is as follows:

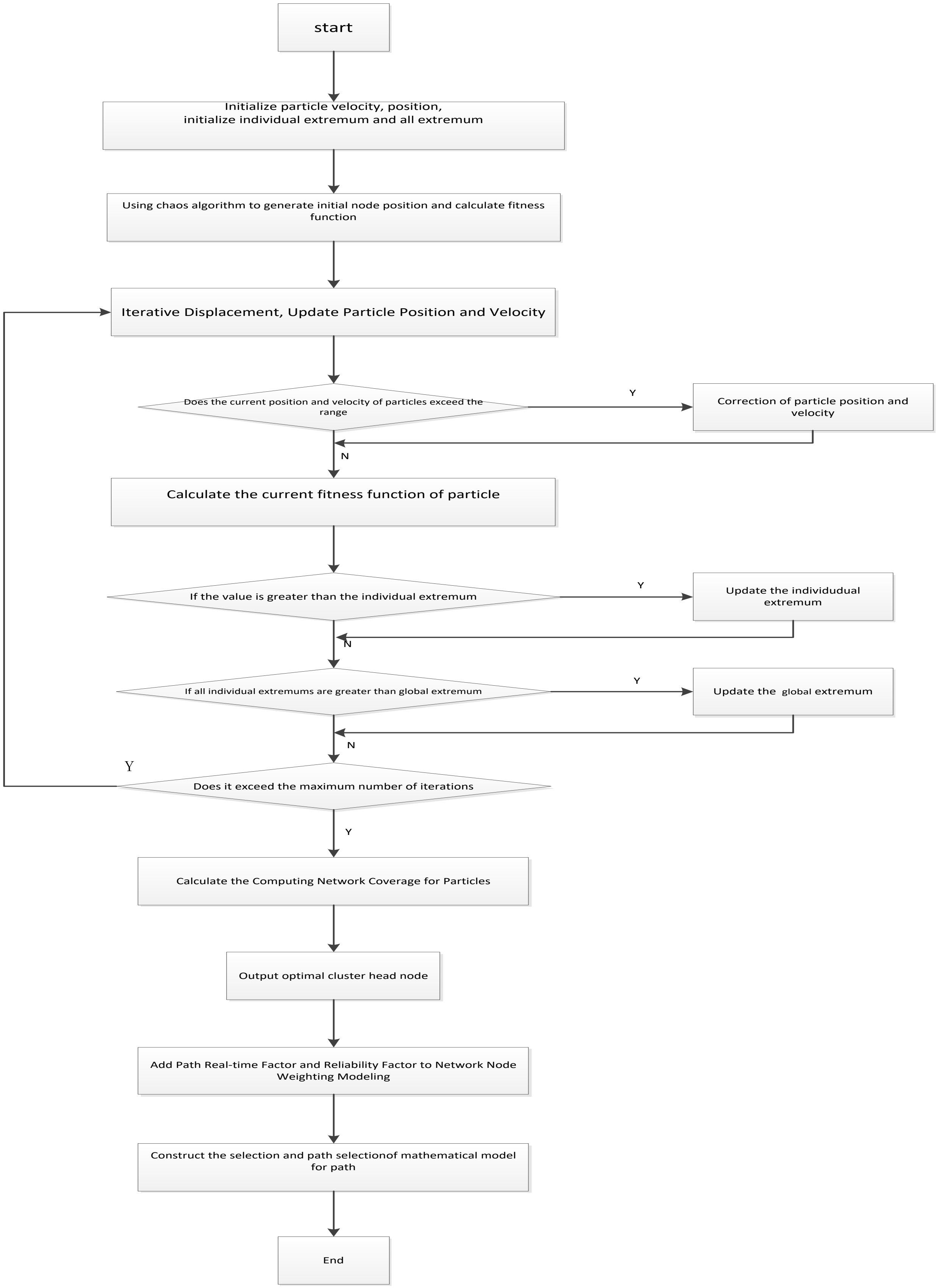

Fig. 4 Flow chart of CQPSO-PS algorithm

ISSN: 2414-1895 DOI: 10.6919/ICJE.202110_7(10).0058

The variance of the fitness value of the excellent individual supposes that the number of particles in the population is M, denoted by $f_1(n), f_2(n),..., f_M(n)$ respectively as the fitness of M particles in the nth generation, and the average fitness of the population is denoted by $f\_avg(n)$, as shown in formula (2). If the fitness value of the particle is greater than the average fitness of the individual population, this kind of individual is collectively referred to as excellent individuals. Assuming that there are $Y(Y<M)$ excellent individuals, the average fitness of these excellent individuals is denoted as $f\_e(n)$, and the variance of the fitness value of the excellent individual is defined as $\sigma^2(n)$. The calculation method is referred to (3). Among them: H is a normalization factor, its role is to limit the size of the variance of excellent individual fitness. In this article, the value of H is shown in formula (4).

$$f\_avg(n) = \frac{1}{M}\sum_{i=1}^{M} f_i\,(n) \tag{2}$$

$$\sigma^2(n) = \frac{1}{m}\sum_{i=1}^{m}\left(\frac{f_i(n)-f\_e(n)}{H}\right)^2 \tag{3}$$

$$H = max\{1, max[\,|f_i - f\_e|]\}, i \in [1, Y] \tag{4}$$

The difference between $f\_e(n)$ and $f_i(n)$ is calculated here, which is mainly to avoid the influence of these individuals with fitness difference on the calculation results of the whole population.

3.3 Routing path selection between clusters

Simple observation cannot meet the requirements of real-time and reliability of information transmission in urban wireless meter reading system, and the transmission delay factor and reliability factor of wireless sensor network nodes need to be added.

3.3.1 Network node connectivity path link set

In the wireless meter reading system, all nodes have unique ID, where the identifier of the source node is set to W, and the identifier of the destination node is set to S. In addition, all nodes can be called intermediate nodes. In the process of data transmission, only a connected path can be used for data transmission, which is defined as the link between the source node and the node. A source node transmits data to the destination node can have multiple connectivity paths and at least one path. In this paper, the path formed by the node and the link is defined as a set to form the path set of the whole network. D is used to represent all sets of N nodes to the destination node S, and its elements are usually satisfied with the node subset $O_{Di}=\{O_1.O_2....O_n\}$ and the link subset $E_{Dk}=\{e_1, e_2,...,e_{n-1}\}$.

3.3.2 Network node delay weighting

Generally, the delay t_{ij} between nodes O_i and O_j can represent the delay weighting between nodes O_i and O_j. The length of transmission distance between nodes and the number of nodes that passes through in the transmission process are the influencing factors of data delay between nodes. The following assumptions are made in the study: O_i and O_j nodes are adjacent and connected, the data transmission is m, the transmission distance is P_{ij}, and the exchange delay is t_0, then:

$$t_{ij} = \frac{P_{ij}}{v} + mt_0 + \Delta t \tag{5}$$

v is the transmission speed of information. Δt is the random jitter delay.

3.3.3 Network node reliability empowerment

The reliability t_{ij} between nodes O_i and O_j can represent the reliability weighting between nodes O_i and O_j, which means the efficiency of transmitting certain data packets. An average state of the packet transmission efficiency of a sensor node in a stable state of data transmission over a certain period of time. Therefore, the reliability can be calculated by mathematical statistics. When the failure rate α and the repair rate β are constants, the reliability weighting f_{ij} is expressed as :

$$f_{ij} = \frac{\beta}{\beta+\alpha} \tag{6}$$

3.3.4 Real-time and reliability of path

Think of the whole network as a larger set of nodes and links. Assuming that there are X paths that can be passed from the source node W_i to the destination node S, these are defined as $D_1, D_2,..., D_k,...,$

ISSN: 2414-1895
DOI: 10.6919/ICJE.202110_7(10).0058

D_X, thus forming a path set $D_k=\{O_1, O_2,..., O_n\}$ and a link set $E_k=\{e_1, e_2,..., e_{n-1}\}$, then the path represents a series system consisting of all nodes and links through the path, and generally path reliability refers to the product of reliability weighting values. For :

$$R_{Dk} = R_{On} \coprod_{i=1}^{n-1}(R_{e\,i}\, R_{Oi}) \tag{7}$$

In which: R_{Dk} is the reliability of path D_k. n is the total number of nodes passed by the path. R_{On} and R_{Oi} are the reliability of the nth node and the reliability of the ith node respectively. R_{ei} is the reliability of the i link.

Taking path D_k as an example, the total delay of nodes and links passing through the path is usually called transmission delay. According to Equation (5), the expression of link delay is:

$$T_{Dk} = \sum_{i=1}^{n-1} \frac{l_{ei}}{c} + nt_{oi} + \Delta t \tag{8}$$

In which: T_{Dk} for path L_k information transmission delay. t_{oi} is the node delay value, and l_{ei} is the length of the link e_i.

3.3.5 Mathematical model of path selection

Each source node in the network itself corresponding to the routing is usually manifested in the above series system, while taking into account real-time and reliability to provide the optimal routing system. Under the premise of fast search, the optimization model can be expressed as follows: Firstly, the real-time and reliability of wireless meter reading information transmission are the primary reconstruction objectives.

$$max(R_{D1}, R_{D2}, \ldots, R_{Dk}, \ldots R_{Dx}),\ s.t. T(T_{D1}, T_{D2}, \ldots, T_{Dk}, \ldots, T_{Dx}) < T_0 \tag{9}$$

In which: T_0 is the maximum allowable delay for wireless sensor network transmission specified in the power system, $T(\cdot)$ is the network transmission delay of a path selected in the candidate path, if $T(\cdot)$ is greater than T_0, the path is removed from the candidate path, and vice versa when $T(\cdot)$ is less than T_0 is left as a candidate path. The value of path reliability R is based on Equation (6) and related records of the power sector.

3.3.6 Path selection steps

1 Sensor network is a dynamic topology network, so the routing table between nodes is not static but dynamic. The establishment of dynamic routing table between nodes is the first step of path selection. The number of failure nodes and failure paths can be reflected by dynamic routing table.

2 By using the chaotic quantum particle swarm optimization algorithm, all paths from the communication node to the destination node are searched globally as candidate paths.

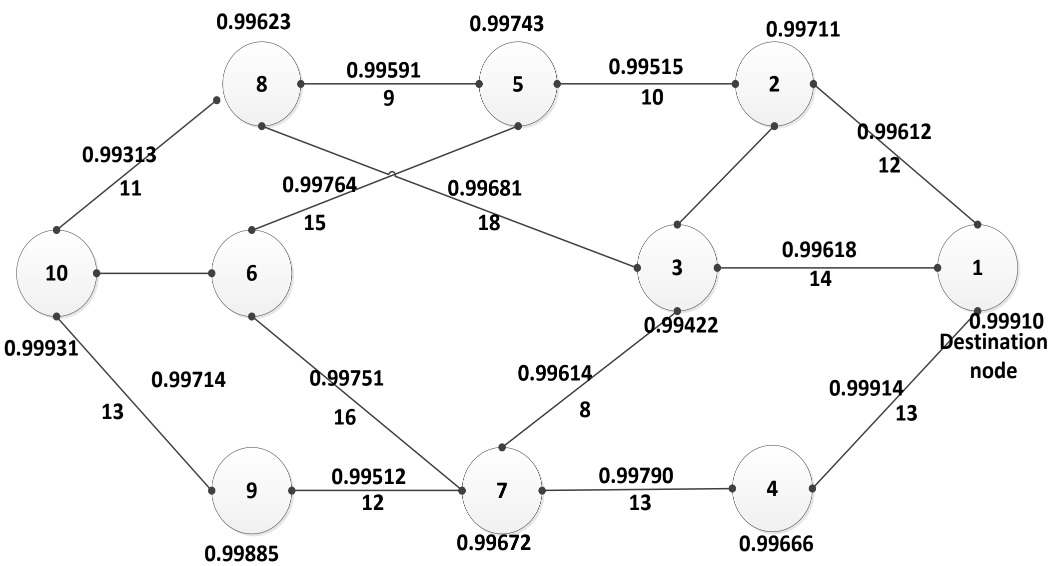

Fig. 5 10-point network diagram

Volume 7 Issue 10, 2021
DOI: 10.6919/ICJE.202110_7(10).0058

3 The calculation of candidate paths is based on Equations (5)-(8). After calculating the candidate paths, the paths that do not meet the conditions are removed from the candidate paths according to Equation (9).

4 The binary insertion sorting algorithm is performed in all the appropriate candidate paths in 3, and the path with the highest reliability is marked as the first transmission path.

5 The dynamic routing table is continuously updated in real time according to the selected path, and the information is transmitted along the selected path in 4. The 10 - node network topology is taken as an example, as shown in Fig. 5. (For example, the transmission distance between node 8 and node 3 is 18 m and the reliability is 0.996810)

4. Simulation and results analysis

This paper uses MATLAB2016b to simulate, and compares the proposed algorithm with LEACH and QPSO. Simulation parameters are shown in table 1

Table 1. Parameters

Parameter	Value	Parameter	Value
Node initial energy	10J	Carrier frequency f	15kHz
Node sensing raidus R_s	15m	Information elicitation factor α	0.9
Energy consumption of data E_{da}	8nJ/bit	Expectation heuristic factor β	1.8
Packet size	1000bit	Path pheromone persistence ρ	0.8
Data header size	50bit	Quantum bit inspired factor γ	0.9
Energy diffusion factor	1.5	Data transmission rate R_b	15kbps
Node energy threshold E_{th}	0.001J	Fusion efficiency	0.95

4.1 Evaluation index of wireless routing

4.1.1 Clustering effect diagram

In the algorithm of meter reading system, whether the clustering results are balanced or not directly affects the performance of the whole network. Unbalanced clustering results in cluster head 'piling up' and cluster head dispersion in some areas, which directly affect data acquisition and acceptance. Reasonable clustering is a prerequisite to ensure reliable data transmission of the algorithm.

4.1.2 Residual average node residual energy

It is an important index to measure the energy balance of cluster routing protocol in meter reading system. The energy mean function $m_E(t)$ of the whole WSN at a certain time is used to measure the energy balance of the network. The greater the $m_E(t)$, the better the energy balance of the network at t time. Average node residual energy :

$$m_E(t) = \frac{\sum_{i=1}^{M} E_i(t)}{M} \tag{10}$$

Where M represents the number of nodes in the network. $E_i(t)$ denotes the residual energy of the node i at t time.

4.1.3 Packet loss rate

It refers to the percentage of the lost packets in the test data to the total transmitted packets, and the packet loss rate is related to the frequency and length of packet transmission. The reasons for packet loss include data timeout, node queue overflow and routing search failure. It reflects the transmission of application layer data packets, and also reflects the network performance indicators of MAC and routing protocols. Packet loss rate function:

$$Packet\_loss(ab) = 1 - \pi(1 - pl(x,y)) \tag{11}$$

Volume 7 Issue 10, 2021
DOI: 10.6919/ICJE.202110_7(10).0058

pl (x, y) denotes the packet loss rate of communication links *(x, y)* between adjacent nodes *x* and *y*. When the packet loss rate exceeds 20 %, the communication protocol is not up to standard, which will greatly reduce the reliability of data transmission.

4.2 Comparison of clustering effect between CQPSO-PS and other protocols

In the same simulation environment, the effects of LEACH protocol, QPSO protocol and CQPSO-PS protocol in this paper in the clustering stage are compared. Figs. 6-8 show the clustering structure distribution of the three protocols in the same round of simulation.

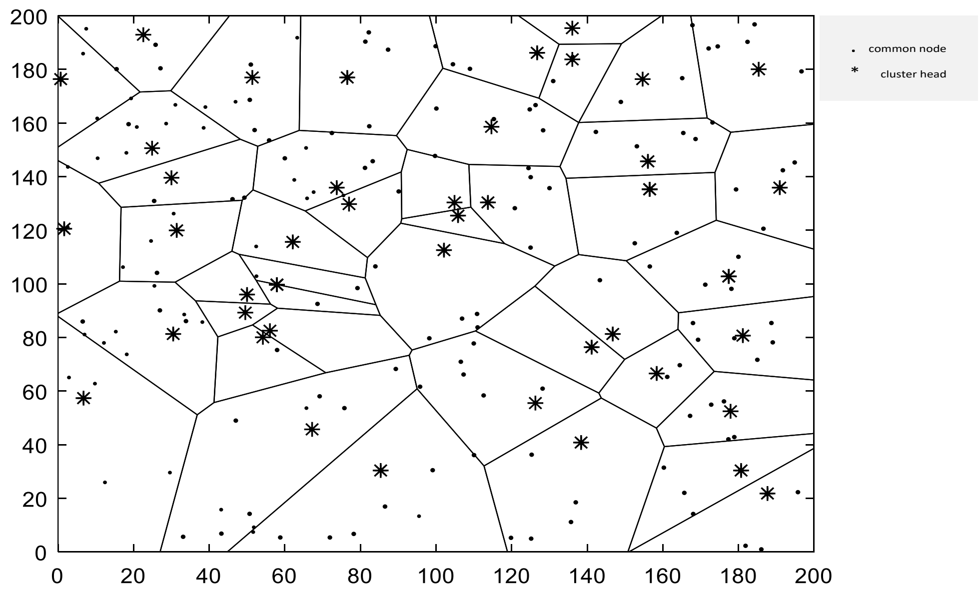

Fig. 6 The clustering Simulation results of LEACH

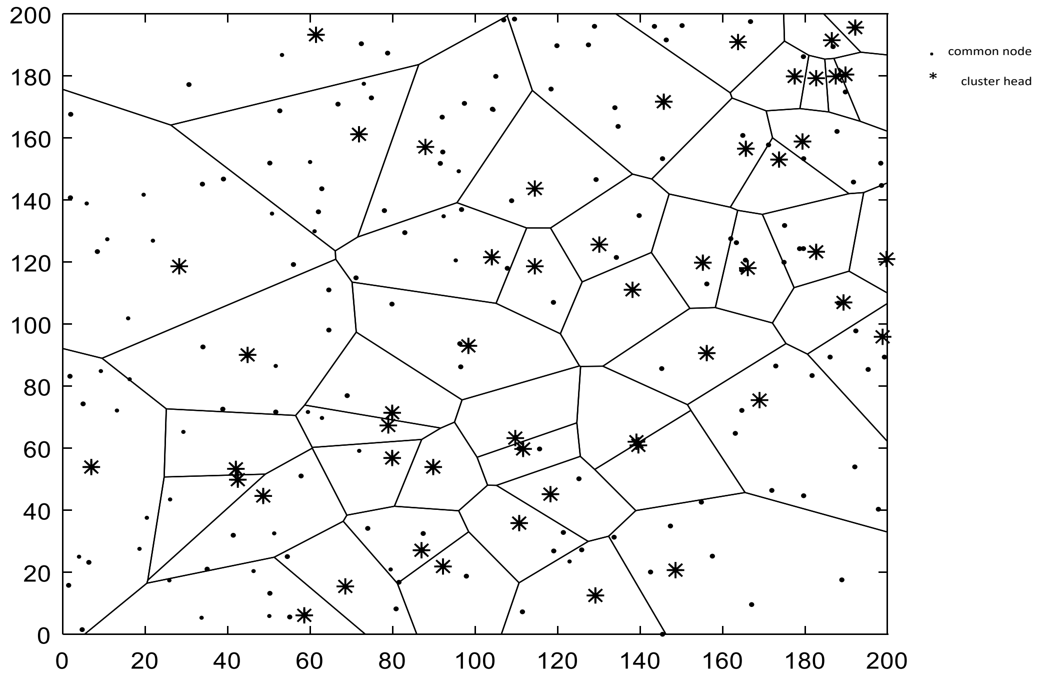

Fig. 7 The clustering Simulation results of QPSO

International Core Journal of Engineering
ISSN: 2414-1895 Volume 7 Issue 10, 2021
DOI: 10.6919/ICJE.202110_7(10).0058

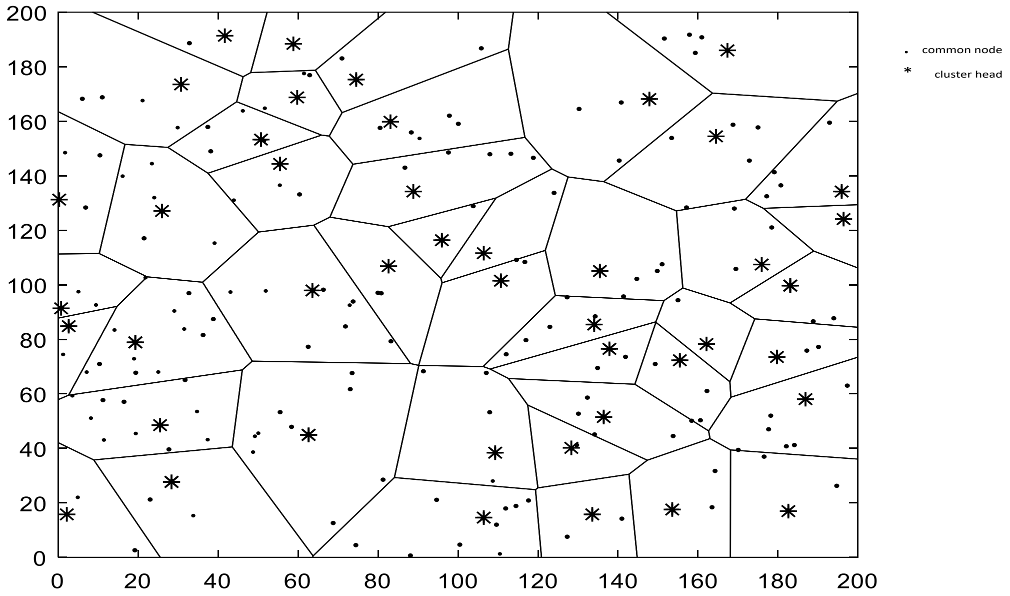

Fig. 8 The clustering Simulation results of CQPSO-PS

It can be seen from the above three clustering results that the cluster head distribution of LEACH protocol is relatively uneven, and there is a large degree of cluster head overlap in the region. The cluster head distribution of DQPSO protocol is relatively uniform than that of LEACH protocol, but there is still a small number of cluster heads that are too close. The clustering results of CQPSO-PS are compared with the former two protocols. It is obvious that the cluster head distribution is more uniform and there is no cluster head ' heap ' phenomenon. The reason is that on the basis of quantum particle swarm algorithm, the chaotic mapping algorithm is added, and the excellent effective value judgment mechanism is used to effectively reduce the dense distribution of cluster heads, so that the reasonable distribution of cluster heads lays a good foundation for inter-cluster routing.

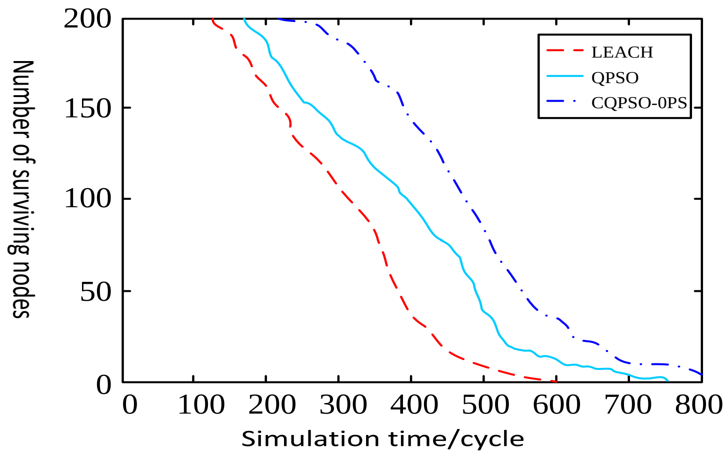

Fig. 9 Number of surviving nodes

4.3 Comparison of energy balance effect between CQPSO-PS and other protocols

As shown in Fig. 9, LEACH protocol begins to die at 120 rounds, and all nodes die at 600 rounds. The QPSO protocol starts to die in 160 rounds, and all nodes die in 750 rounds. In this paper, the

 Volume 7 Issue 10, 2021
DOI: 10.6919/ICJE.202110_7(10).0058

protocol is that the node dies at 220 rounds, and the node has not completely died at 800 rounds. It is expected that the node will die completely at 850 rounds, extending the lifetime by 41.67 % and 13.33 % respectively compared with LEACH and DPSO. The main reason is that the chaotic quantum swarm algorithm is adopted in this paper, which brings negative feedback in global optimization. The algorithm refers to the prematurity judgment mechanism of excellent fitness variance to iterative optimization calculation, and re-searches in the local optimal solution, which greatly reduces the probability of the algorithm falling into the local optimal solution, ensures the rich diversity of the whole population particles, and provides the most suitable particle selection state for the algorithm to find the most suitable cluster head, and is responsible for the communication between clusters. To balance the whole network energy consumption and prolong the network lifetime.

4.4 Comparison of Transmission Reliability between CQPSO-PS and other protocols

4.4.1 Comparison of total packets transmitted by three protocols

Figure 10 is the comparison of the total amount of data packets transmitted by the three protocols. Combined with Figure 4.9, with the passage of simulation time, the three algorithms begin to appear node death. From Figure 10, it can be seen that the algorithm of CQPSO-PS protocol is about 133.33 % higher than LEACH protocol in the total amount of data packets transmitted, and about 40% higher than QPSO protocol in the total amount of data packets transmitted. With the passage of simulation time, the number of packets received by the base station in the CQPSO-PS algorithm increases gradually in unit time. Finally, the number of packets received per unit time tends to be stable at $7*10^4$ *bit*, which is the largest compared with the other two algorithms. In the case of sending the same number of packets, the data loss is greatly reduced. The reason is that CQPSO-PS algorithm carries out weighting modeling in data transmission, adds reliability weighting f_{ij} and calculates path reliability factor R_{Dk} to select the optimal path, improves link quality and ensures data transmission reliability.

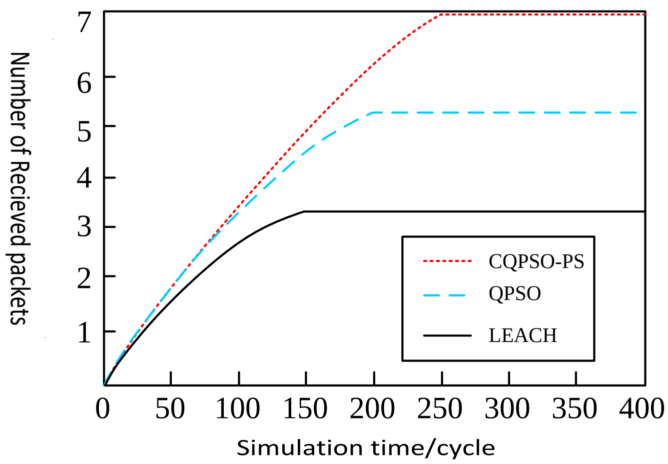

Fig. 10. Comparison of total packets transmitted by three protocols

4.4.2 Comparison of packet reception rates of three protocols

It can be seen from Fig. 11 that in terms of packet reception efficiency, the algorithm in this paper is particularly prominent compared with the other two algorithms, namely, the CQPSO-PS algorithm has a strong ability to receive packets. The simulation results show that the packet acceptance rate of LEACH protocol has been declining in the whole simulation process, resulting in a large number of data loss. The packet acceptance rate of QPSO algorithm is better than that of CQPSO-PS algorithm at the beginning, but with the continuation of the simulation, the packet acceptance rate decreases significantly, which is not conducive to the continuous transmission of data. The packet acceptance rate of CQPSO-PS algorithm is more than 95 % in the whole simulation process, which greatly ensures the reliability of data transmission. This is because CQPSO-PS algorithm considers delay

Volume 7 Issue 10, 2021
DOI: 10.6919/ICJE.202110_7(10).0058

weighting t_{ij} and delay factor to calculate T_{Dk} in path selection modeling. Because of the implementation of the optimization and improvement measures, the high reliability of the routing path is enhanced, and the continuous and reliable transmission of data is guaranteed, which can better adapt to the working requirements of the power wireless meter reading system.

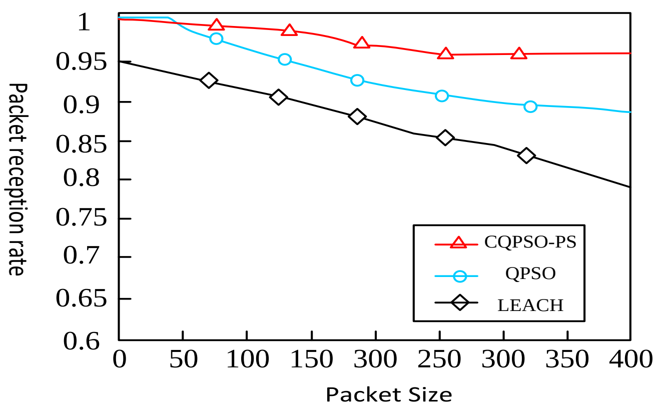

Fig. 11 The Packet reception rate

5. Conclusion

This paper analyzes the existing problems and challenges of urban meter reading system, and proposes a clustering routing protocol for wireless meter reading WSN of urban power. In the clustering stage, chaotic quantum swarm algorithm is used. On the basis of random simulation of particle state by quantum particle swarm algorithm, chaos idea is added to keep the diversity of particle population at all times, so as to serve the selection of the optimal cluster head in the algorithm. In the routing stage, the information transmission path selection model is given, and the delay and reliability of nodes are weighted to select and solve the path. The data acquisition and transmission process is optimized, and the information reliability of urban wireless meter reading system is improved by simulation comparison, and the problems of data loss, retransmission and invalidity are reduced.

References

[1] Juping, Zhou Xiaoxin, Chen Weijiang, etc. 'Smart Grid +' Research Review [J]. Power automation equipment, 2018, 38 (05):2-11.

[2] Xiao Zhenfeng, Xin Peizhe, Wu Xiaoping. Research on wireless sensor network deployment to meet reliable and ubiquitous needs [J]. Journal of Wuhan University (Engineering Edition), 2019,52(5): 446-450.

[3] Huang Guanjin, Gao Peng, Ye Meng. Research on routing algorithm of wireless sensor network based on smart grid [J]. Information and communication, 2016 (168):26-28.

[4] CAO L, YUE Y G, LUO Z Q, elat. Research on efficient and reliable routing algorithm for Internet of things perception layer [J].Video engineering, 2017,41(11/12):151-157.

[5] Sun Jun. Quantum behavior particle swarm optimization algorithm [D].Wuxi: Jiangnan University, 2009.

[6] Shen Qingming, Yan Lijun. Feature selection method based on chaotic search [J]. Military engineering, 2013, 34 (12): 1616-1619.

[7] Pangshan, Yang Xinyi, Zhang Xiaofeng. Multi-population quantum particle swarm optimization algorithm for chaotic mapping [J].Computer engineering and application, 2012,48(33):56-62.

[8] Gu Haihong, Qi Mingjun, Li Shiyong. China National Standardization Management Committee. Specifications of Crane Design (China Standardization Press, China 2008), p. 16-19.