Design of Distributed Hybrid Pipeline Multimedia Aided Scheduling System

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Abstract. The traditional auxiliary scheduling system in the multimedia auxiliary scheduling work, the scheduling scope is very small, resulting in poor scheduling effect. In order to solve this problem, a new distributed hybrid pipelined multimedia assistant scheduling system is designed, and the hardware and software of the system are designed respectively. The hardware part mainly designs the collector, controller and processor. The heater selects the TSDA-523 as the new type to improve the acquisition effect. The controller adopts the LPI controller to realize continuous control. The processor selects the AN176 as the central integrated processor to process a large amount of multimedia data in a short time. The software is composed of information collection, information processing and information dispatching. In order to detect the effect of the system, compared with the traditional system, the results show that the system can achieve large-scale scheduling, and effectively improve the scheduling effect.

Keywords: Distributed · Hybrid pipeline · Multimedia aided · Auxiliary scheduling

1 Introduction

The plant production scheduling and production scheduling should not only consider the production plan of single production line, but also coordinate and arrange the production plan of several different production lines in the workshop, so as to arrange the production order to the appropriate production line, which brings more difficulty and challenge to the production scheduling [1, 2].

After many years of research and development, the scheduling problem of mixed pipelines proposed by Salvador in 1973 has been well solved under various constraints, but the task assignment of multiple mixed pipelines is relatively weak. The distributed hybrid pipeline scheduling problem is developed under the circumstance that the traditional pipeline scheduling is not suitable for the parallelism of the traditional mass production pipeline and the customized pipeline, and is used to coordinate the production conditions of several different pipelines, comprehensively consider the production priority of the production orders in each pipeline, and establish a more scientific, more economical and more executable production planning and production scheduling model

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[3]. DHFSP is the synthesis of traditional assembly line scheduling, parallel machine scheduling and planning, and it is the abstract generalization of modern industrial workshop production. To some extent, this method can meet the market demand of multi-category and small-scale customization, so the research of distributed hybrid pipeline has great academic significance and application value [4].

The proposed method only discusses the production scheduling problem with the same process route, and is unable to adapt to the more complex and changeable mixed pipeline production, and is unable to meet the needs of the transformation from mass production to mass customization conducted by the current manufacturing enterprises [5, 6].

In this paper, a distributed hybrid pipeline multi-media assistant scheduling system is designed, which can simulate the scheduling strategy, solve the scheduling problem of the distributed hybrid pipeline, and solve the process matching the actual production, so it has strong availability. In addition, fuzzy adaptive technique is used to automatically adjust the crossover probability and mutation probability, and active detection stop method is used to shorten the computation time and improve the algorithm efficiency. Experimental results show that the system has strong scheduling ability. It is innovation lies in the large-scale scheduling requirements, information collection, information processing and information scheduling three parts of the overall detection system, which can effectively improve the scheduling effect in the process.

2 Hardware Design of Distributed Mixed Pipelined Multimedia Assistant Scheduling System

The hardware structure of the distributed hybrid pipelined multimedia auxiliary scheduling system is complex. The composition diagram is shown in Fig. 1 below:

Looking at Fig. 1, we can see that the hardware of the scheduling system consists of four parts. This paper only designs the collector, controller and processor in Fig. 1.

2.1 Design of Collector

A new type of collector, TSDA-523, is selected. The collector has the advantages of high efficiency, low energy consumption and safe and reliable performance. The collector structure is shown in Fig. 2:

Observation of Fig. 2 can be seen, the collector mainly through the control of a variety of auxiliary information to complete the sub-room control. Ancillary information has a unique design loop that maximizes the use of information. The information analysis system is designed to be integrated, which makes the system very reliable and greatly reduces the difficulty of dispatching [7].

The collector uses the special intelligent processor to solve the big data problem, make it intelligent, and realize automatic running.

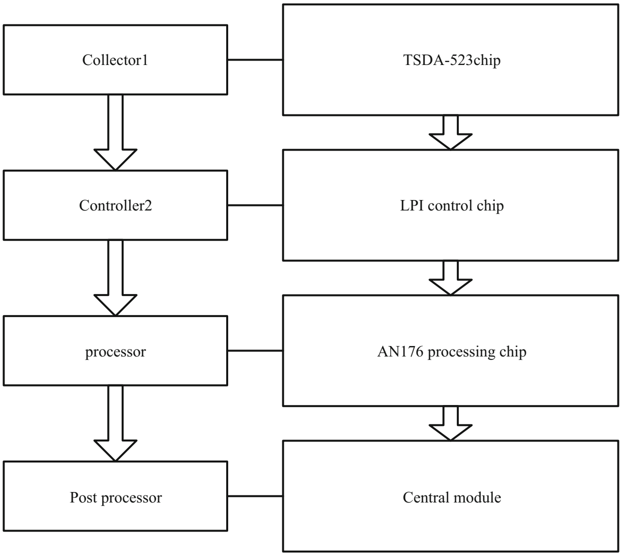

Fig. 1. Hardware structure diagram of distributed mixed pipelined multimedia assistant scheduling system

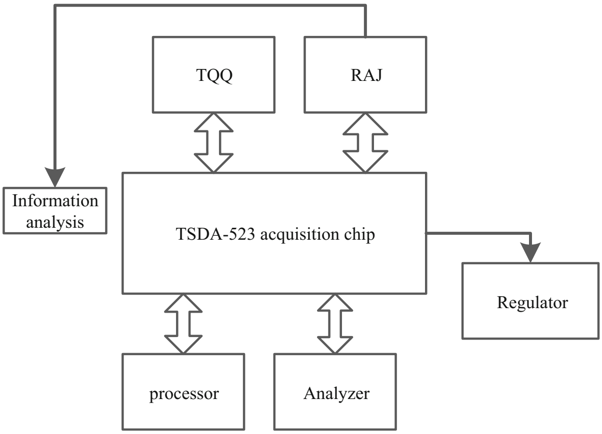

Fig. 2. Collector

2.2 Controller Design

In this paper, LPI controller and switched reluctance motor are used, which has the characteristics of high performance and simple structure and is widely recognized in the market. Switchability refers to the continuous mode of switch when the motor is working. Magnetoresistivity refers to the variable reluctance ability of the reluctance motor, or more accurately, the variable reluctance ability of the doubly salient pole motor. The switched reluctance motor uses the motor's speed control system to replace energy, and its speed control system also includes a controller. Controllers are important for scheduling and provide the energy and control methods required for switched reluctance motors [8].

The controller structure is shown in Fig. 3:

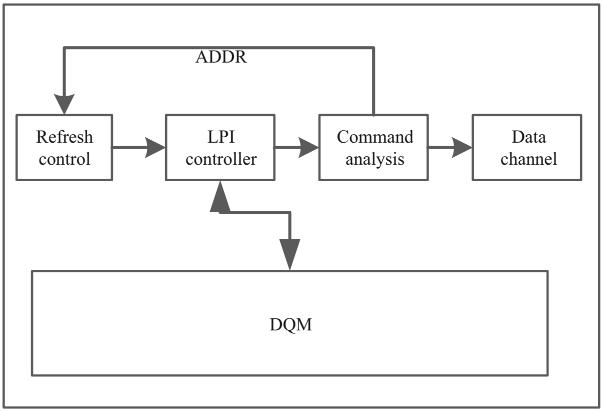

Fig. 3. Controller structure

The controller motor in Fig. 3 is a fully controlled switched reluctance motor. At that time, the technology was not mature enough, the structure was complicated, and the incompatibility and the current interference caused the use of the driving signal. In this paper, the internal structure of SRM controller is optimized and a new structure of SRM controller for ball mill is developed, which solves the problem of complex internal structure of traditional controller and strengthens the use of motor. The left and right layout connects the main circuit of the controller with the control circuit of the electric appliance, and the mounting board and the control interior are provided with upper and lower parts to control the number of rectifier bridges and power devices [9]. It has the advantages of low noise, high output rate, wide range and so on. The outlet mode of the motor controller in the market is single, and needs to match with the new mold, which increases the production capital. The controller circuit diagram is shown in Fig. 4 below:

According to the control circuit diagram in Fig. 4, the controller structure in this paper connects the controller box, capacitor module and power module with 8 connectors, and a cavity is arranged in the controller box. The capacitor module and the power module are connected by a DC bus, which is connected with 3 connectors, and the remaining 5 connectors are connected with the power module. Six connectors are mounted at the front end of the controller housing and two are positioned on the controller side wall. In this paper, a new structure of motor controller is designed and provided, which completely overcomes the problem of single controller output, greatly reduces the cost and reduces the production pressure [10].

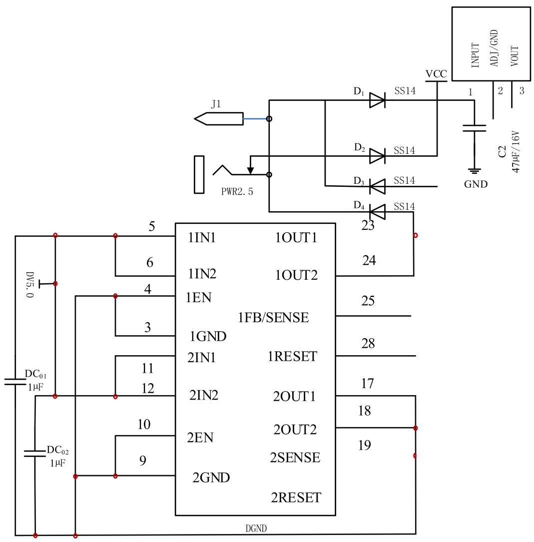

Fig. 4. Controller circuit diagram

2.3 Processor Design

Many different network protocols have been transplanted in the existing embedded system, network transmission is more efficient and reliable than other transmission methods, so this paper chooses to send and receive data by network transmission. Although the embedded processor designed in this paper is the same, the bus can be up to 24, the frequency can reach 50 MHz, and integrated with multi-functional modules. High-performance and ultra-low power consumption are the characteristics of the chip, which can work under various frequencies and support zero-state waiting.

The processor in Fig. 5 interrupts while programming, allocates priorities, handles eight internal and external interrupts, and integrates multiple interfaces with peripherals. The processor is equipped with ROM controller, asynchronous serial port, interrupt pin, timer and other devices, and the production cost is greatly reduced. Processor internals can provide fast unbuffered access, with a dedicated bus Corenuetc connection. Processors are divided into 8/16-bit two, and set the boot mode. Compared with the design structure of this paper, the traditional computer architecture is not compatible with other series processors. The CPU of this paper is AN176, and the depth module of Ethernet driver chip is CS7970B [11–13].

The processor circuit diagram is shown in Fig. 5 below:

As can be seen from Fig. 5, the processor bus consists of a local bus, a peripheral bus, and a device control register bus. XIknx is the foundation for all embedded processors and provides a licensing standard for users. Access to system resources through the peripheral bus and kernel. Fully synchronous bus can be called OPB, which is responsible for bus level functions. Synchronous bus can not be directly connected to the processor core, providing 32-bit separation function. The processor core can access external devices, and the PLV interface can provide 32-bit addresses for instruction data. PLV can support

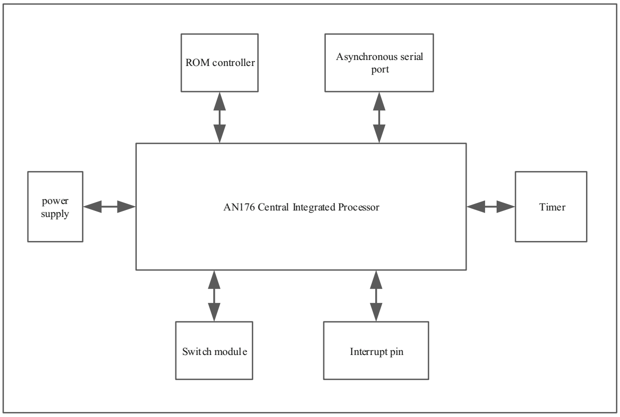

Fig. 5. Processor wiring diagram

the host and slave with multiple bus interfaces, and connect with PLB signal to read and transmit data. PLV host can connect by accessing independent data bus and address bus. The slave computer is connected by separate data line and address line, the bus ownership is obtained by competition, and the host computer can flexibly provide various priorities for the user.

2.4 Network Detection Module

In this paper, the internal network for centralized monitoring operations, to assist the RoF-DAS architecture system for accurate research, for this purpose, select the RH6010 four-channel network detector for this study, and set the network detector as follows (Fig. 6):

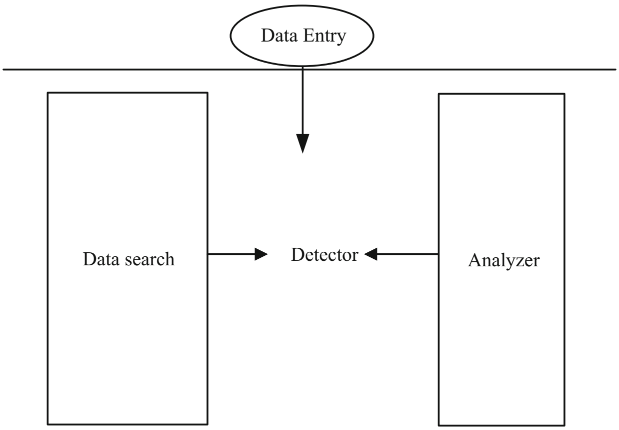

Fig. 6. Working process diagram of network detector

The network detector has aluminum 2U black wire-drawing panel, using Linux system, stable performance, fast running, can use DSP software audio decoding program, high fidelity, ensure the system in the process of running security. Receiving platform instructions and audio signals, supporting platform remote control of volume, supporting the platform to set and manage permissions on the machine and the platform to upgrade the machine remotely. With the function of clock automatic calibration, the platform can broadcast the data to different areas and groups. After getting the related information, it can check and observe the status of the information network, and use the automatic alarm system to warn the abnormal situation.

The internal circuit adopts full SMD process, with more stable performance, built-in four network hardware audio decoding module, support for TCP/IP, UDP, IGMP (multicast) protocol, and can adjust the operation of the system to achieve the setup of the overall network detection module.

2.5 Monitoring Module

After the design and research of the network detection module is realized, the information is monitored, the status and specific flow of the data are grasped, and the judgment and research of the dispatching data are convenient, and the JINSONG wireless remote monitoring camera is selected to monitor and record, and the monitoring camera is constructed as follows (Fig. 7):

Fig. 7. Surveillance camera chart.

The monitoring camera has remote real-time monitoring function. Users can watch remote monitoring video through Internet in real time by using monitoring client software. Monitoring client software can be installed on PCs and Wince mobile phones to facilitate data monitoring operations and reduce the time required for research. The working voltage range is DC9V-100V, and the working current range is 12V/30MA-60MA. The working temperature range is-30 °C–75 °C, and the storage temperature range is-30 °C–80 °C. Can ensure that the system is in a more appropriate environment to work, in the operation process in accordance with the above standards for operation.

3 Software Design of Distributed Mixed Pipelined Multimedia Assistant Scheduling System

After completing the hardware design of the system, the software shall be continuously reformed and studied on the basis of enhancing the performance of hardware components of the system, and the flow chart of software design shall be set up as follows (Fig. 8):

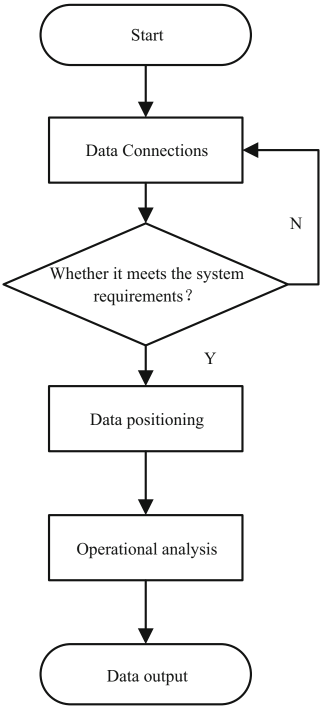

Fig. 8. System software design flow chart

In the above figure, it can be divided into the following steps according to the process of software operation:

Wavelet computing technology is used to connect terminal equipment and cloud computing data center system. Wavelet computing has strong computing ability and can calculate various kinds of information. The wavelet computation process is shown in Fig. 9:

At the same time, the data shall be arranged according to the combination order of the connections, and the data that conform to the system control interval shall be adjusted, and the adjustment equation shall be set for analysis:

$$K = \sqrt{P - A}^{3} \tag{1}$$

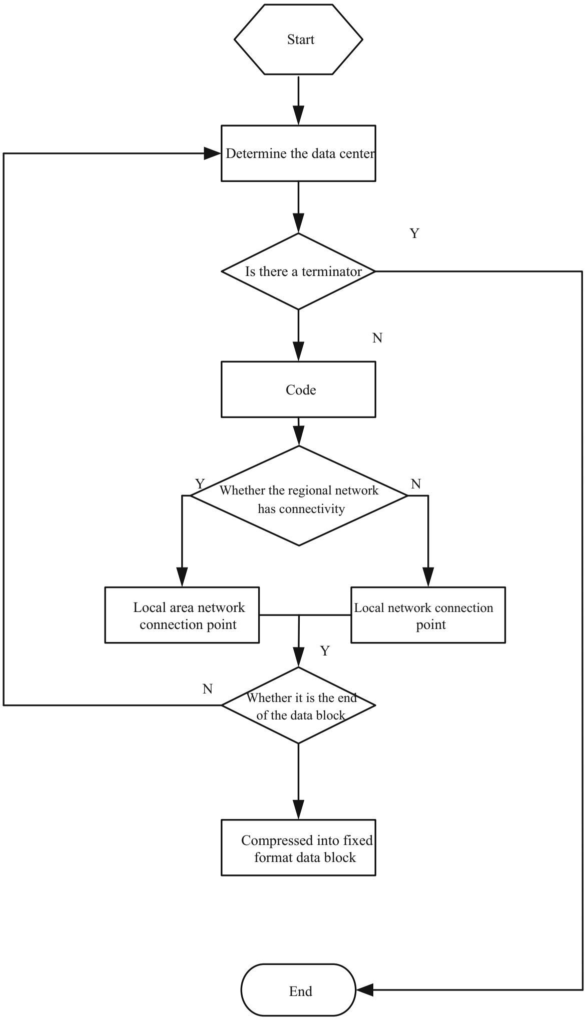

Fig. 9. Wavelet computation flow

In the above expression, K is the adjusted result parameter, P is the system operation interval parameter, and A is the combined order value. After the abovementioned operations, the adjusted data shall be filtered, the filtered data status shall be monitored in real time, and the status data shall be recorded. The setting up of data records is illustrated as follows:

After realizing the data recording operation in the above figure, the filtering data is calibrated to realize the initial judgment operation under the wavelet calculation data.

Under the research environment, the position information of the data is searched by the positioning system, and the scheduling intensity is accurately measured by the wavelet calculation method.

$$F = \frac{G}{N} \cdot \int kt + l \tag{2}$$

Among them, F represents the dispatch strength research data, G represents the data parameter condition, N represents the research data overall quantity, ft represents the fog computation calibration value, and l represents the data parameter. In the process of measurement, it is necessary to strengthen the control between the cloud user and the terminal system to avoid the information confusion between the user and the terminal. When a contract is signed between the user and the DR implementing agency, the stimulating demand response can be used to establish a model. The contract signed should clearly indicate the amount of user load reduction, compensation and the punishment if the user fails to respond in accordance with the contract. The IBDR response cost refers to the outage loss caused by the reduction of electricity load. The response cost is usually a quadratic function. If the distributed energy storage load of the power system is reduced, the demand-response costing process is as follows:

$$\alpha_{Ij,t} = e_{1,j} \tag{3}$$

Among them, the quadratic coefficient $\alpha_{I,j,t}$ representing the response cost of the excitation load of the node j and the quadratic coefficient $e_{1,j}$ representing the compensation amount received by the node j.

$$\beta_{I,j,t} = e_{2,j} + \rho_P \tag{4}$$

Among them, $\beta_{I,j,t}$ is the primary coefficient representing the response cost of the excitation load of the node, $e_{2,j}$ is the primary coefficient representing the compensation amount of the node j, and the electricity price ρ_P of the corresponding retail end of the power system, which is usually fixed.

According to formulas (3) and (4), it is possible to derive the corresponding cost of demand to reduce the electricity load $P_{I,j,t}$:

$$C_{I,j,t} = \alpha_{I,j,t}P^2{}_{I,j,t} + \beta_{I,j,t}P_{I,j,t} \tag{5}$$

After the above operation, the system software design is realized and the overall system design research is completed.

4 Experiment and Research

In order to test the scheduling research of the scheduling system in this paper, the simulation operation is carried out in the research experiment scene, and the design effect is compared with that of the traditional scheduling system. Taking the Simulink neural network module of MATLAB software as the simulation analysis tool, 20 groups of historical data of pipeline operation of a certain platform as the simulation data samples, excluding two groups of unavailable data Bureau, and randomly selecting two groups of data in the remaining 18 groups for experiment.

In view of the complexity of the research on RoF-DAS architecture and the difficulty of data manipulation in the research on the degree system, it is necessary to eliminate the experimental environment. The experimental parameters needed in the experiment are as follows (Table 1):

Table 1. Experimental parameters

Project	Data
Node value	20
Operational data rate	25 Mbps
Signal transmission power	0.05W
time interval	100 ms
Simulation experiment time	60 s
Network channel bandwidth	20 MHz

Based on the above experimental parameters, the comparison of vehicle information collection capability between the traditional system and the system studied in this paper is obtained. The experimental diagram is shown in Fig. 10 below:

Due to the use of fog computation, this system can collect a lot of information, distributed RoF-DAS architecture, so that all the information can be saved in the network cloud. During the storage, processing and other operations, the system relies more on local devices than on the server, which relaxes the system's requirements on the server, improves the system's fault tolerance, and enables the system to collect a lot of information in a short time.

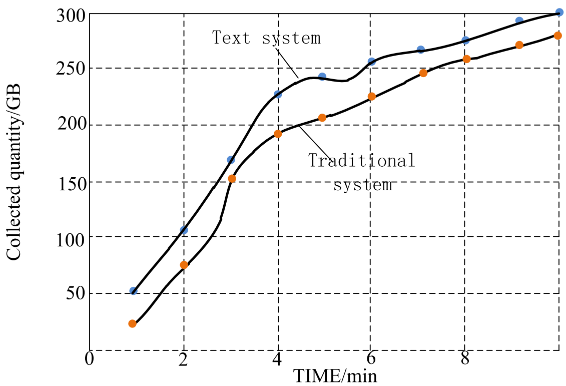

Fig. 10. Experimental results of information-gathering capability

Figure 11 shows the variation of the access time delay rate of time-delay-sensitive information with the amount of data passing through a given number of devices in a system.

In the case of a small number of scheduling, the access time delay rate of the two systems is small, but the access time delay rate of the scheduling system is lower than that of the traditional systems. With the increase of the number of system access time delay rate, the traditional system access time delay rate increases rapidly, because the traditional design algorithm can not meet the needs of a large number of experimental

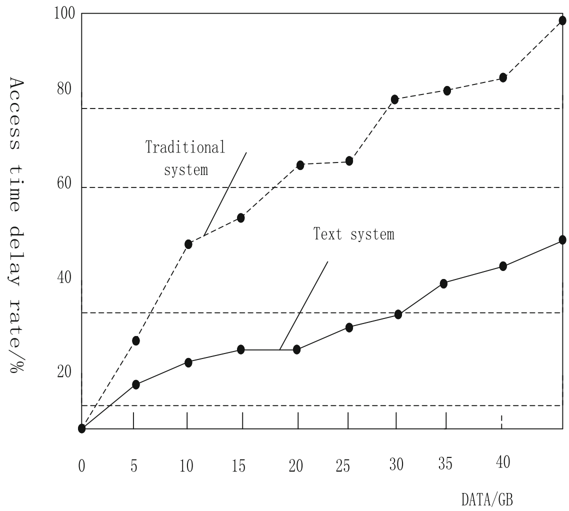

Fig. 11. Comparison chart of simulation experiments.

data through the study, and the contradiction between the more data lead to higher access time delay rate.

To sum up, the design of scheduling system can effectively alleviate the contradictions in the system, reduce the number of interfering factors, and provide a better experimental environment for the study.

5 Summary and Prospect

In this paper, the design of scheduling system is divided into two parts: hardware design and software design. In the process of hardware design, we classify the modules according to the problems of the hardware components, and operate the data according to the corresponding modules, so as to improve the efficiency of system operation and reduce unnecessary time waste. In the process of software design, we use wavelet computing technology and control the data collected to realize the transformation of the system program and realize the design of the whole system.

Compared with the traditional system design, the scheduling system design in this paper can improve the effectiveness of the system to a higher degree, expand the scope of the system data to provide users with more convenient operation services, but still need to continuously strengthen the operation of the system to promote the overall system research to a better state.

References

1. Li, Y., Yang, W., He, P., et al.: Design and management of a distributed hybrid energy system through smart contract and blockchain. Appl. Energy **248**(15), 390–405 (2019)

2. Spencer, A.A.M.S., Luciano, S., Mario, M.: Analysis and design of high-efficiency hybrid high step-up DC-DC converter for distributed PV generation systems. IEEE Trans. Ind. Electron. **66**(5), 3860–3868 (2018)
3. Zhang, L.P., Liu, W., Qi, B.: Innovation design and optimization management of a new drive system for plug-in hybrid electric vehicles. Energy **186**(1), 115823.1–115823.19 (2019)
4. Zkik, K., Hajji, S.E., Orhanou, G.: Design and implementation of a new security plane for hybrid distributed SDNs. J. Commun. **14**(1), 26–32 (2019)
5. Kano, Y., Matsui, N.: Rotor geometry design of saliency-based sensorless controlled distributed-winding IPMSM for hybrid electric vehicles. IEEE Trans. Ind. Appl. **54**(3), 2336–2348 (2018)
6. Kim, H., Kim, S.: Two dimensional cavitation waterhammer model for a reservoir-pipeline-valve system. J. Hydraul. Res. **57**(3), 327–336 (2018)
7. Fu, W., Liu, S., Srivastava, G.: Optimization of big data scheduling in social networks. Entropy **21**(9), 902 (2019)
8. Liu, S., Li, Z., Zhang, Y., et al.: Introduction of key problems in long-distance learning and training. Mobile Netw. Appl. **24**(1), 1–4 (2019)
9. Liu, S., Liu, D., Srivastava, G., et al.: Overview and methods of correlation filter algorithms in object tracking. Complex Intell. Syst. (2020) https://doi.org/10.1007/s40747-020-00161-4
10. Chu, Z., Tian, H., Li, Z., et al.: A High-Performance Design of Generalized Pipeline Cellular Array. IEEE Comput. Archit. Lett. **19**(1), 47–50 (2020)
11. Fu, H., Fu, W.: Research on the influence of multimedia on Chinese teaching in senior high school. World Sci. Res. J. **6**(5), 86–94 (2020)
12. Na, G.: Research on remote control method of English multimedia online teaching system in big data environment. J. Phys. Conf. Ser. **1486**(5), 052010 (8pp) (2020)
13. Jinxia, H.E., Huang, X.: An investigation of pre-service teachers' perceptions and experiences on student-created videos. J. Educ. Multimedia Hypermedia **29**(1), 35–53 (2020)