Research Article

Application of Internet of Things Technology in Optimization of Electronic Assembly Process Parameters

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In order to meet the demand of the Internet of things in the intelligent power monitoring system, this paper proposes a method to build an intelligent power monitoring system by combining 4G technology, the Android operating system, and other technologies closely related to the Internet of things. This method is evaluated by building an intelligent monitoring system and a transit node system and observing the test speed in the coco data set and the Pascal VOC data set. The experimental results show that the accuracy of animals measured by this method can reach up to 81%; the accuracy of humans can reach up to 76%; and the accuracy of vehicles can reach up to 87%. Conclusion. The application of Internet of things technology in the optimization of electronic assembly process parameters can quickly and effectively reflect the information in practical applications, so as to achieve the goal of seamless link and information exchange between things and people, and accurately manage and control the physical world in real time on the basis of scientific decisions.

1. Introduction

With the development of the third scientific and technological revolution, the Internet of things technology has played a promoting role in all walks of life [1]. The Internet of things technology, in short, is a technology that uses sensor equipment to realize the network transmission of information resources and exchange and share information through the corresponding information media, so as to realize the function of intelligent management. With the support of Internet of things technology, information transmission and exchange are more safe, efficient, energy-saving, and environmentally friendly, and they truly realize the intelligentization of network flow transmission [2]. It has always been a world leader in R & D and innovation in the field of Internet of things technology. In recent years, colleges and universities have attached importance to talent development and industry technology leadership and have made many achievements internationally. The Internet of things technology has the same advantages and has an important influence in the world. At the same time, in the field of global sensor networks, China is also one of the leading countries in the formulation of international standards. However, at present, the development of the smart grid is common all over the world and is still in its infancy. However, many professionals have realized the great value potential that the smart grid brings to mankind.

The smart grid, under the Internet of things technology, plays an important role in the sustainable development of the social economy. Compared with the traditional power grid and power equipment, the smart grid based on the Internet of things technology can effectively protect the environment, achieve the development of environment-friendly industries, and reduce greenhouse gas emissions. It can also realize the optimization of the power industry structure and make the power allocation more efficient. It can also improve the efficiency of energy transportation and use and enhance the security and stability of power grid operation. At the same time, it can continuously promote technological development and innovation in the field of animal networking and the power grid industry to drive social and economic development.
2. Literature Review

Robinaugh, D. J., and others put forward a formal theory that can diagnose specific equipment exceptions based on redundant information. In this way, the status of equipment can be observed and monitored, so that equipment exceptions can be detected and eliminated in time [3]. Li et al. and others gave a comprehensive overview of abnormal diagnosis techniques through the literature [4]. The development of the abnormal diagnosis of mechanical equipment has gone through a long process. The general stage is divided into three stages. The first stage is a period of relatively low productivity. During this period, mechanical equipment with a simple structure and working principle is produced, and the existence of abnormalities is detected through the inspection and experience of professional technicians. In the second stage, after the development of high-efficiency productivity, special anomaly detection equipment based on sensing technology was produced, and the equipment was detected through scientific detection equipment. We obtain the operation status information of the system, analyze and determine specific abnormalities through analysis and comparison, and formulate a more scientific and effective abnormal maintenance plan according to the obtained equipment status information so as to improve the elimination of abnormalities and ensure the reliable operation of mechanical equipment. The third stage is to create intelligent technology in the context of greatly improved productivity. Inference engines and expert systems are developed by intelligent technology and traditional sensor signal acquisition methods. Expert knowledge is required to analyze and classify other diagnostic methods, as well as to diagnose and analyze abnormal information throughout the diagnosis process. The early economic and technological development of a certain place lags behind many advanced countries in the world, so the research and theoretical practice of mechanical equipment diagnosis are relatively late. With the development of technology and applications, the connotation of the Internet of things has undergone a major funding project: the funding of NSFC projects has changed. According to the Internet report released by the International Telecommunication Union, the current three major networks, including the Internet, telecommunication network, and radio and television network, are the basis for the realization and development of the Internet of things, which is an extension and expansion of the basis of the three networks. We examine and evaluate the current state of smart device-based energy management based on current research and complete the use of Internet technology in accordance with the should-do intelligent energy system. As a result, intelligent power management based on Internet technology has been achieved [5]. As a large group of aircraft knowers, the system can record and send a variety of data to the top application using a variety of communication interfaces for intelligent control and identification to support smart levels of energy.

3. Method

3.1. Intelligent Power Monitoring System Architecture Based on Internet of Things Technology.

Based on the Internet of things technology, this paper makes an in-depth and detailed analysis of the actual functions and internal architecture of the intelligent power monitoring system, fully integrates some functional modules that are closely related to the Internet of things technology into the system, and develops the intelligent power monitoring system based on the scientific and advanced Internet of things technology. The research focuses on the development and utilization of equipment for video monitoring.

3.1.1. Structure of the Intelligent Power Monitoring System.

Taking the internal technical framework as the standard, the IOT technology can be divided into three different levels: perception layer, network layer, and application layer (as shown in Figure 1). The sensing layer realizes the collection of relevant data through a series of terminal devices, base stations, and other infrastructure. The sensing layer is at the lowest level of the IOT system in the overall structure and is an essential part to help the IOT to carry out comprehensive sensing. The network layer is based on the Internet and related LAN and other network systems to transmit the collected relevant data in real time and accurately. Its existence has greatly improved the reliability of the Internet of things on the original basis. The role of the application layer is to use scientific and intelligent methods to process relevant data and then design corresponding personalized services according to the actual needs of customers [6, 7].

3.1.2. Research on the Intelligent Power Monitoring System.

With the accelerating development of the modern power industry, large units, large capacity power equipment, and related power facilities have occupied the vast majority, resulting in stricter technical requirements for their normal operation. The failure rate is increasing on the original basis, and the time required for maintenance and treatment of related failures is also increasing, resulting in unnecessary economic losses. In order to ensure that the power transmission and transformation system can be in a safe and stable operation mode for a long time, the international power industry has also successively introduced more stringent relevant standards [8].

In power facilities, many factors, such as excessive load-bearing and failure to timely heat dissipation, can cause damage to cable joints, knife switch contacts, and other important node connections, thus causing the equipment to fail to operate normally. Therefore, the smart integration of scientific and reasonable Internet of things technology into the intelligent maintenance system can greatly improve the actual effect of monitoring and early warning functions, timely find potential faults, and repair them.

Because many important points in the power equipment are in a dangerous environment with high voltage and continuous electromagnetic interference, the temperature monitoring methods used in the past have been unable to
meet the current actual needs [9]. At the same time, the number of hot spots is large and the price needs to be controlled within a reasonable range. Therefore, when selecting the most appropriate temperature monitoring method, it is necessary to comprehensively consider the voltage, the specific price of the equipment, and other factors. At present, the international research on real-time temperature monitoring of some important points of power equipment mostly focuses on the means of real-world temperature measurement. Common measuring tools mainly include:

(1) **Infrared Thermal Imager.** This technology mainly draws relevant images based on the differential response of the relevant parts of different objects to the infrared thermal radiation intensity, and then finds the location of the target according to the actual temperature difference between the target and its background [10]. It can span a long distance and can be monitored without contact. It has superb characteristics but is expensive. Therefore, it is mainly used in large transformers at present.

(2) **Optical Fiber Temperature Sensor.** The working principle of the optical fiber temperature sensor is to use its internal multiple optical fibers to realize the rapid and accurate transmission of temperature signals. Optical fibers have an incomparable insulation effect compared with other materials and can play a good isolation role for the high voltage in high-voltage equipment. Because of their isolation effect, they can be installed on the surface of high-voltage equipment [11]. However, the optical fiber is also prone to fracture and cannot withstand high temperatures. In the actual installation process, strict requirements are put forward for the surrounding environment, which is also the reason that restricts its further wide application. At the same time, it often needs to invest more money in the manufacturing process, which also limits the development of optical fiber to a certain extent.

(3) **Digital Wireless Temperature Sensor.** [12]. The principle of this sensor is to lay several independent temperature sensing modules on the surface of the equipment in turn, collect the real-time temperature of the equipment, and send this temperature data to the receiving end in real-time by means of wireless communication for further processing. The great advantage of the digital wireless temperature sensor lies in its good insulation effect and moderate price.

(4) **Video Analysis.** The research focus of video surveillance is how to extract information and alarm violations in the video. Currently, video surveillance is mainly used through end-node and cloud video analysis and processing. The Internet of things is an obvious successful demonstration of the extensive use of wireless communication in relevant end nodes [13].

3.1.3. **Deep Convolution Neural Network Training Algorithm.**

Figure 2 shows the training steps of a deep convolution neural network. In essence, this training is a cycle from feedforward propagation to response propagation. From the input layer, the image data is transmitted to the convolution layer and the hidden layer in turn. In this process, it is analyzed and processed until it reaches the output layer and the final output result. Forward propagation refers to this output process [14]. Once the forward propagation is over, the output results will be compared with the data accuracy, and the network state will be evaluated in the form of error comparison. The purpose of backpropagation is to transmit the error to the upper layer, and all units in the previous layer can update their own weights.

Training process learning can effectively explain the conduction mode and calculation in the training process. For example, the Softmax classifier is connected based on the Softmax classifier, the deep convolution neural network can classify and process specific target objects, and the logistic regression model is popularized based on the classification, so the Softmax regression is obtained. The marked \( m \) samples constitute the logistic regression training set [15].
\{(x^{(1)}, y^{(1)}), \ldots, (x^{(m)}, y^{(m)})\}, \text{ where } x^{(i)} \in \mathbb{R}^{n+1} \text{ is the input characteristic. } N+1 \text{ is the } x \text{ dimension of the eigenvector, and } x_0 = 1 \text{ corresponds to the intercept term. Because binary classification is the goal of logistic regression, there is } y^{(i)} \in \{0, 1\}. \text{ The following functions exist:}

\[ h_{\theta}(x) = \frac{1}{1 + \exp(-\theta^T x)} \quad (1) \]

In essence, the training model parameters are functions that can minimize the loss.

\[ J(\theta) = \frac{1}{m} \sum_{i=1}^{m} y^{(i)} \log h_{\theta}(x^{(i)}) + (1 - y^{(i)}) \log(1 - h_{\theta}(x^{(i)})) \quad (2) \]

The number of \( y \) (category label) values is different from \( k \), which is mainly because it needs to deal with a multi-classification problem. So, for \( \{(x^{(1)}, y^{(1)}), \ldots, (x^{(m)}, y^{(m)})\} \), there is a class \( i \) \( \in \{1, 2, \ldots, k\} \) marker. For the sample input (given) \( X \), the occurrence probability \( p(y = i|x) \) of each classification result can be expressed by a \( k \)-dimensional vector output.

3.1.4. Structure of the Intelligent Power Monitoring System. The monitoring system structure of wireless sensor network is shown in Figure 3.

The system includes many nodes and transfer nodes arranged at the end of the security monitoring network [16]. In the figure, the camera module and the front-end image processing module contained in the end node are hidden on the device, in which the sensor network is wired with the front-end image processing module; the equipment in the transfer node is placed in a more hidden place about 10 meters away from the end node. The dotted line in the figure represents WiFi wireless communication, and the solid line represents 4G network communication. The end node detects the data from the temperature sensor and other operating environment monitoring and intelligent maintenance auxiliary sensors in real-time and sends an alarm signal to the transfer node in case of any abnormality. When pedestrians and vehicles pass by, the front-end image processing module detects objects in the video captured by the camera in real-time and sends the detection results to the transfer node. The transfer node compresses the pictures, integrates the information with other end nodes connected to the transfer node, and finally transmits them to the Internet monitoring management system through the 4G wireless network [17]. On the contrary, the transfer node also receives instructions from the monitoring management system through the 4G network, takes photos, and uploads them through the control end node.

Through the construction of a power grid energy efficiency management system based on the Internet of things, the selected neural network optimization algorithm is simulated and analyzed by a computer to process the data of a power grid energy efficiency management system. Using MATLAB simulation software, the corresponding genetic algorithm is designed to optimize the line loss and line loss rate in the power grid system, and the change of line loss rate before and after optimization can be obtained.

According to the change in the line loss rate in Figure 4, the average line loss rate in the power grid energy efficiency management system is reduced by 48% after genetic optimization using MATLAB simulation software. Therefore, the grid energy efficiency management technology based on the Internet of things can better realize the optimization of grid energy efficiency in the system by using genetic algorithms.

3.1.5. Transit Node System Design

1) Hardware Design of Transfer Node. The platform hardware used by the transit node in this study is an Android mobile phone with a long standby time. The main modules of this system include the main processor, a 4G wireless module, and a WiFi module. The hardware structure of the system is shown in Figure 5. In the experiment, the Android mobile phone of the transfer node is placed in a hidden place 10 meters away from the end node.

2) Workflow of Transfer Node. First, the transfer node receives the picture by sending a request from the end node. If the data sent by the end node is really valid picture data rather than an interference signal, the transfer node will automatically store the picture in the storage medium of the transfer node when it receives the information sent by the end node and compress the picture on the hardware platform of the transfer node. The algorithm used is the wavelet transform compression algorithm. Then the management system server successfully establishes socket communication and transmits the processed pictures to the management system server through the 4G wireless network. At the same time, it notifies the designated user to obtain the pictures.

After receiving the picture, the server of the management system saves it, and then automatically decompresses the file to get the picture in its normal format. As long as the monitoring personnel want to display the picture in the middle of the page, they can directly click the “get picture” button to browse the picture. In addition, the server side of the management system can also take “remote photos.” After receiving the set of words, you can click the button to send a
photo request to the end node, and then repeat the node photo-taking process. If the server side of the management system wants to cancel the monitoring of socket links, it only needs to press the "stop listening" button, and the end node will shut down the monitoring system by itself.

(3) Function Design of Transfer Node. The client program design should complete the following parts: Open the monitoring system to automatically capture pictures and information of human beings and vehicles within the monitoring range; Then, the camera function is used to complete the picture acquisition, filter and compress the collected pictures, transmit them to the front-end server at the same time, and finally wait for the call instruction from the server. These parts should not only complete their own work independently but also complement each other, cooperate with each other, and "help" each other. For example, the trigger signal of the waiting end node and the command sent by the waiting management server are carried out in the same time period. When uploading pictures, the management system server not only accepts the upload work but also monitors whether it receives the server’s command and the next round of opening instructions. Therefore, a thread concept commonly used in the Android system is involved [18].

(4) End Node Object Detection Effect. Object detection mainly uses neural networks for training. Before the work of the neural network begins, it is necessary to update the training model parameters, that is, the new weights after initialization. The update method is to first evaluate the network training through the cross mutual loss function and then update the weights with the random gradient descent [19]. Figure 6 is the calculation flow chart. First, use the trained learning model to initialize the parameters. Then, the neural network starts to read the data set, selects the object detection model from the training set, and gradually calculates the network output through the forward propagation network.

Coco data sets have developed rapidly in recent years. It is sponsored by Microsoft and has powerful functions. It has a wide range of image annotation information, including category, location, and even text information. Moreover, coco data sets provide great help for image segmentation semantics and achieve a high level of results. In recent years, many image semantic understanding algorithms use it as an evaluation standard [20].

4. Results and Discussion

Randomly select a test sample from the test set as the input of the neural network, then start forward propagation through the neural network, calculate layer by layer, and obtain the output of the neural network. Then compare the selected test samples with the output of the neural network, judge whether the results are correct, and sort out the results. Finally, judge whether all the tests are completed. If they are completed, stop the network test. If not, continue working until all tests are completed. Due to the advantages of various types of coco data sets, the internal scenes of their pictures...
are also extremely complex. Therefore, compared with the Pascal VOC data sets, the neural network is trained with coco data sets, and then the new network weights are fine tuned. Then, the neural network is trained with the Pascal VOC data sets. Finally, after the training is completed, the comparison model is selected and the performance is evaluated under the test set. According to the scenes involved in this study, objects are classified into three categories: animals, humans, and vehicles. The test accuracy of an SSD300 is shown in Table 1.

The accuracy of animals measured by this method can reach up to 81%; human accuracy can reach 76% at most. The accuracy of the vehicle can reach up to 87%, and the detection effect of end node objects can reach a high accuracy under the neural network, so that the scheme of the perception layer of the Internet of things can be realized, so that the Internet of things can work well in its complex environment with excellent anti-interference, simple and convenient application, and high-cost performance.

This research discards the bandwidth limitation problem encountered in the video transmission process of traditional power monitoring system-related technologies, carries out image recognition and processing in the front end, only uploads useful picture data, greatly reduces the amount of data, and applies it to the smart grid monitoring system through the Android mobile phone operating system. At the same time, it also realizes the full-automatic call function in this system, with low development cost and simple technology.

### 5. Conclusion

This paper presents a method for an intelligent power monitoring system based on the Internet of things technology based on the current social development needs. Then,
this paper further analyzes the advantages and disadvantages of the existing smart grid monitoring technology and puts forward a way to improve the smart grid monitoring technology in combination with the current actual situation; that is, the smart power monitoring system technology scheme based on the Internet of things technology, 4G technology, the Android operating system, and WiFi wireless transmission technology, as well as the machine vision technology based on in-depth learning. The research abandons the bandwidth limitation problems encountered in the video transmission process of traditional power monitoring system-related technologies, carries out image recognition and processing in the front end, only uploads useful picture data, greatly reduces the amount of data, and is applied to the smart grid monitoring system through the Android mobile phone operating system. At the same time, the system also realizes a full-automatic call function, with low development cost and simple technology. The analysis shows that the application of Internet of things technology in the optimization of process parameters of electronic assembly can quickly and effectively reflect the information in the practical application so as to achieve the goal of seamless link and information exchange between things and people.

Data Availability
The data used to support the findings of this study are available from the author upon request.

Conflicts of Interest
The author declares no conflicts of interest.

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