Research Article

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Design of visual symbol-aided system based on wireless network sensor and embedded system

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Abstract: In order to solve the problem of the low transmission rate of wireless network sensors (WNSs), this article proposes a WNS visual assistance system based on embedded systems. The system uses WNSs instead of traditional wired sensors, which can achieve synchronous transmission of multi-node data, enabling nodes to work together better, thereby improving the real-time and reliability of the entire system. This article conducts in-depth research on feature extraction algorithms and tests the visual assistance system in the experimental section. The results show that the recognition rate and stability of the visual symbol assistance system implemented using WNSs are higher than those of ordinary systems. In the satisfaction survey, it was found that 87 people were very satisfied with the visual symbol assistance system, accounting for 87%, while only 57 people were very satisfied with the traditional visual symbol assistance system, accounting for 57%. The experimental results show that the system output stability of the design method is good, and the response time and reliability are better.

Keywords: visual symbols, wireless network sensor, embedded operating system, autocorrelation function, feature extraction

1 Introduction

The design of a visual symbol recognition system is the most external, direct, and contagious design. The operator's concept and spirit can be designed through visual symbols to effectively promote the popularity and image of the enterprise and its products. Wireless network sensor (WNS) is a new type of wireless network technology with the characteristics of large range, high density, low cost, and self-recovery. At present, this technology has been widely used in environmental monitoring, power fault diagnosis, smart home, and other fields. However, one of the main problems of WNSs is their low transmission rate. To solve this problem, this article proposes a WNS vision assistant system based on an embedded system. The system uses WNSs instead of traditional wired sensors, allowing for the synchronous transmission of multi-node data and making nodes work better together, thus improving the real-time and reliability of the whole system. This method has the characteristics of low cost, low power consumption, high transmission rate, and has broad application prospects in the field of industrial control. The visual symbol auxiliary system can transform the abstract semantics of the enterprise concept, cultural characteristics, service content, and enterprise norms into the concept of specific symbols and create a unique enterprise image.

In order to explore the application of the visual symbol assistance system in all aspects, many scholars have conducted in-depth research on it. Due to the limited processing speed of the embedded processor, the

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image recognition processing module should be optimized, and the image pre-processing circuit can be added to the embedded processor. The date of the unique symbolic carving from different backgrounds in northern and eastern Scotland has been debated for more than a century. These symbols excavated by Noble et al. at key locations may be a complex non-alphabetic writing system, expressing the Picts' response to the changes in European power and identity during the transition period from the Roman Empire to the early Middle Ages [1]. In order to improve the weakness of model checking, Souri et al. proposed a graphical symbol modeling tool package to design and verify the behavior model of distributed systems. They proposed a behavior modeling framework to design system behavior in the form of a Kripke structure and a tag transformation system [2]. Symbol execution systematically explores many possible execution paths at the same time without necessarily requiring specific input. This technology does not use fully specified input values, but abstractly represents them as symbols, and resorting to constraint solvers to construct would cause attribute conflicts. In the past 40 years, symbol execution has been incubated in dozens of developed tools, which have made significant practical breakthroughs in some famous software reliability applications. The purpose of Baldoni et al.'s study was to summarize the main ideas, challenges, and solutions in this field and extract them for use by a broad audience [3]. The WNS node is used as the visual signal acquisition unit. During image recognition, the embedded processor receives the image data sent by the WNS node and converts it into digital signals.

The visual symbol assistant system of WNS and embedded system mainly includes two parts: a data acquisition control module and a human–computer interaction module. Zhu et al. showed that the model based on long- and short-term memory could well change the interest rate of modulated signals with different symbols in the long-time domain sequence. In order to reduce the cost of distributed sensors in data communication, they studied the performance of low-cost spectral sensors using average magnitude spectrum data and online classification methods [4]. Jiang et al. designed a framework based on edge artificial intelligence (AI) to perform object detection tasks. They proposed a new learning classification algorithm to achieve the interpretability and robustness of AI in the system. Compared with existing technologies, the proposed recognition classification algorithm has high accuracy, interpretability, and strong robustness [5]. Mehmood et al. have proposed an efficient QoS-based multi-path routing (MPR) scheme for a wireless body area network (WBAN). In MPR, the incoming traffic is categorized into normal and emergency. Emergency traffic has been given high priority and routed on the best path within the network that improves the reliability and throughput of a WBAN [6]. Scalvini et al. proposed a new navigation aid to help people with severe blindness reach their destination. Blind people are guided by a short 3D spatialized sound that indicates the target point to follow. This sound is combined with other sonified information on potential obstacles in the vicinity. The proposed system is based on inertial sensors, GPS data, and the cartographic knowledge of pedestrian paths to define the trajectory [7]. Haq et al. proposed a new topology management and connectivity maintenance scheme called a tolerating fault and maintaining network connectivity using array antenna (ToMaCAA) for WNSs. ToMaCAA is a system designed to adapt to dynamic structures and maintain network connectivity while consuming fewer network resources. Thereafter, he incorporated a phase array antenna into the existing topology management technologies, proving ToMaCAA to be a novel contribution [8]. However, they did not investigate the stability and satisfaction of the visual symbol assistance system of the embedded system.

Aiming at the problems of inaccurate feature extraction and difficult feature selection in the process of visual symbol recognition, this article proposed a design method for a visual symbol assistant system based on a WNS and embedded system. The system took the embedded processor S3C44B0 as the core and used WNSs and embedded operating system for visual recognition control. A visual symbol assistant system based on WNSs and embedded systems was developed, and the system has good stability and accuracy of classification and recognition through experiments. The innovation of this article was that three kinds of visual symbol assistant systems were studied separately, which made it easier to highlight the authenticity of the article.

2 Feature extraction algorithm of visual symbol assistant system based on wireless sensor

2.1 WNS and embedded system

With the rapid development of microelectronics, computers, information technology, and other fields, sensing technology has been rapidly developed. Many application systems have adopted a variety of sensing methods. In short, a network sensor is a sensor that can be connected to a network or connected to a microprocessor, computer, or instrument system through a network. Therefore, how to give full play to the rich information contained in multiple sensors to ensure the reliability and performance of the system has become an important topic at present. The information contained by multiple sensors is characterized by diversity, complexity, and redundancy, and most application environments require real-time processing of information. It is difficult to do this by manpower alone, so people need to use computers to calculate to complete the feature fusion.

Multi-source information fusion is based on multiple information sources and combined in space or time according to a specific standard to obtain a consistent interpretation or description of the tested object. It can make the information system have better performance. The basic idea of multi-sensor image feature fusion is to make full use of the redundancy and complementarity of different input channel images. Through a specific feature extraction method, this article carries out feature extraction and fusion for more than two different sensor images. This can enable the fused target feature vector to represent it more completely, thus improving the credibility of target recognition. For example, the visual sensor can be used to be sensitive to the changes in the brightness of the image, which can better reflect the contrast and texture of the image and can extract the edge and texture of the image from the image. The infrared detector can reflect the thermal radiation characteristics of the object and the scene, monitor the object all the time, and extract the morphological features of the object. On this basis, based on the complementary characteristics of visible light and infrared images, specific images can be extracted from two different images, so as to obtain a series of image fusion features and then achieve image classification and recognition.

WNS is composed of several sensor nodes distributed in the network area. Each sensor node can detect information in a specific area. WNS is a kind of distributed sensor network. Its terminal is a sensor that can sense and inspect the outside world. By fusing these data, more information about the region can be obtained, and the information can be further processed, analyzed, and judged. WNS is a new type of multifunctional distributed embedded system. It has the characteristics of low power consumption, small size, and low cost. At the same time, it can support the synchronous transmission of network data according to different parameters of the application environment. The embedded system is a system that separates system software and hardware resources. It can be directly transplanted to the hardware platform and complete specific functions through corresponding application software. On this basis, the combination of WNSs and embedded systems can improve the real-time and reliability of the whole system. Its working principle and classification are shown in Figure 1.

Figure 1 shows the types and working principles of sensors, which generally consist of four parts: sensitive components, conversion components, conversion circuits, and auxiliary power supplies. Sensitive components directly sense the measured object and output physical quantity signals that have a definite relationship with the measured object. The conversion element converts the physical quantity signal output by the sensitive element into an electrical signal. The conversion circuit is responsible for amplifying and modulating the electrical signal output by the conversion element. Conversion components and conversion circuits generally require an auxiliary power supply.

The WNS vision assistance system includes multiple nodes, as shown in Figure 2. In order to meet the real-time requirements of the system, two different types of WNSs are used to collect and process data. In the visual aid system, the data collected can be transmitted in the form of images. In embedded systems, multiple nodes transmit data through Ethernet connections [9,10]. In order to enable all nodes to receive image information synchronously, the dual-computer mechanism is adopted in this article. Because each node needs to process

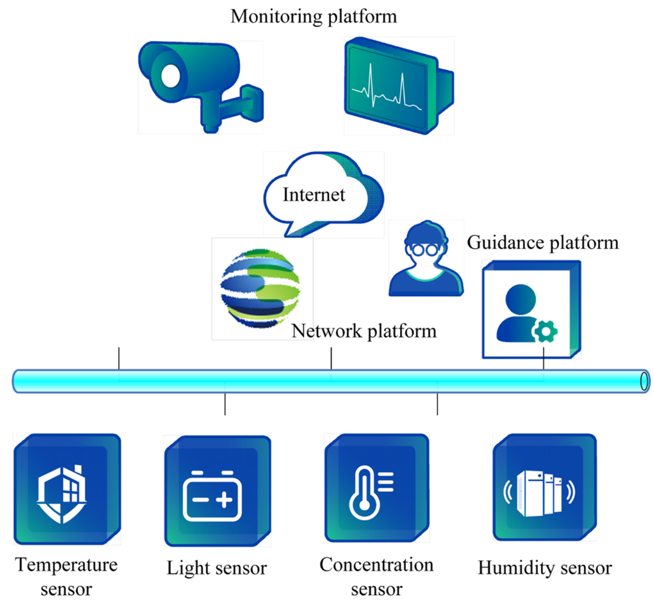

Figure 1: Sensor category and principle.

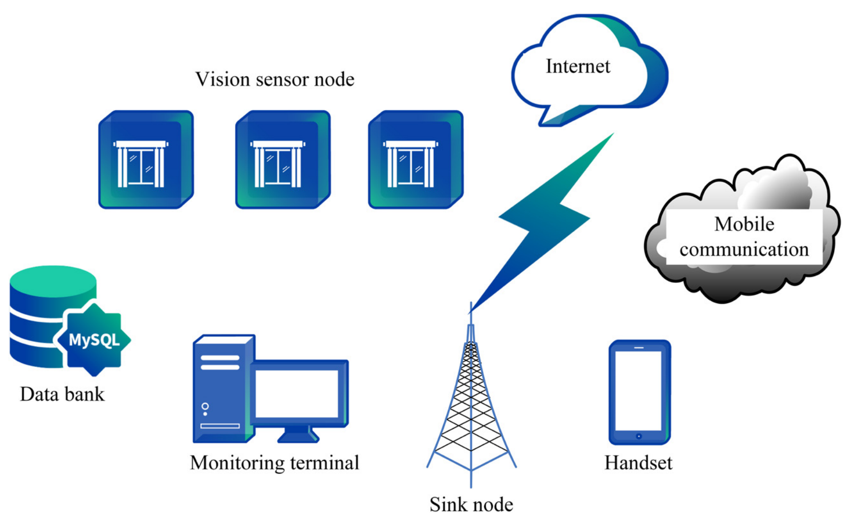

Figure 2: WNS vision assistance system.

image data, the processing time of each node is very long. Therefore, in this article, the received image data can be packaged and sent to a specific network. This method is called multi-point transmission. The multi-point transmission mechanism is a very complex process, and it is necessary to analyze, simulate, and verify it.

Figure 2 shows a WNS visual assistance system. The WNS is mainly composed of three parts, including nodes, sensor networks, and users. Among them, nodes are generally covered within a certain range through certain means, and the entire range can meet the monitoring range according to certain requirements; sensor networks are the most important part. It collects all node information through fixed channels, analyzes and calculates these node information, summarizes the analyzed results to a base station, and finally transmits them to the designated user end through satellite communication to meet the requirements of wireless sensing.

2.2 Distributed algorithm for target classification in WNSs

Because of its low-cost wireless sensor nodes, WNSs can more easily monitor the real world. This sensor can sense the external environment through sound wave, vibration, and infrared. A sensor node with sensing and communication functions is responsible for monitoring the target area and acquiring data in the sensor network, as well as completing communication with other sensor nodes, which enables simple processing of data. Wireless sensors can be applied to distributed decision problems such as target detection and recognition in the sensing area. In a complex and changeable environment, cooperative processing between the observation data of multiple nodes is necessary to achieve robust decision-making. In practical operation, the cooperative work between the sensing nodes and the unified work of the superior nodes is a typical parallel work. Considering the limited communication capacity of the sensing node (transmission power, energy consumption, and other factors), reducing the traffic between the sensing node and the parent node is the key to improve cooperative signal processing. All the methods proposed in this article take the target as the source node. Zero-mean Gaussian processing can be used to simulate the time-domain signal characteristics of the object. Each target generates a Gaussian spatial–temporal signal region with good statistical properties. On this basis, the research object can be divided into several spatial consistency regions with certain relevance.

There are many kinds of targets. It is the key to achieve target recognition to find target features that can accurately and comprehensively describe target characteristics and have a good classification effect. In general, because different sensors use different methods of feature expression, the methods of feature extraction are also different. Feature extraction and selection is to reduce the dimension of existing image objects and remove their shortcomings and defects. In a large number of original image data, in order to quickly calculate the object recognition effect, it is necessary to convert it into multiple feature quantities, namely the so-called feature extraction. On this basis, it is necessary to further reduce the dimension of the proposed feature, select the feature quantity with less information redundancy, and make it have the invariability of scale, rotation, offset, etc., so as to further improve the robustness of the proposed method.

2.2.1 Spectral feature extraction

Power spectrum is the abbreviation of power spectral density function, which is defined as the signal power in the unit frequency band. It shows the change of signal power with frequency, that is, the distribution of signal power in the frequency domain. The estimation of signal power spectral density is an important branch of signal processing. Its purpose is to extract effective signals from the frequency domain and estimate and eliminate them. The spectrum estimation of the signal has very important application value in speech, sonar, radar, and other fields. In recent years, it has been widely used in communication, control, geophysics, and other fields and has received more and more attention. Generally, the estimation of signal spectral density can be divided into traditional non-parametric and band-parametric methods. On this basis, this article focuses on the traditional spectrum estimation algorithm and carries out systematic theoretical research on it.

2.2.2 Classical spectral estimation

Fourier transform means that a function satisfying certain conditions can be expressed as a trigonometric function (sine and/or cosine function) or a linear combination of their integrals. The traditional spectral estimation method is based on the Fourier transform. Through Fourier analysis of time-domain signal, its spectrum information can be obtained. The construction of classical spectral estimation is inseparable from the following two aspects. First of all, at the beginning of the nineteenth century, scholars demonstrated that in a limited time period, any function could be expressed by an infinite number of sine and cosine components. Second, someone drew up an accurate definition of the autocorrelation function and its power spectrum in 1936. They associate it with the Fourier transform of the autocorrelation function and power spectrum, making it a pair of Fourier transform pairs with autocorrelation. This can further obtain the autocorrelation function and its energy spectrum, providing a reliable statistical basis for the study of autocorrelation equations.

2.2.3 Correlation function method

The power spectral density of any generalized stationary random process with constant mean is the Fourier transform of its autocorrelation function. According to the Wiener–Khintchine theorem, the autocorrelation function $(m)a$ of stationary discrete random signals can be expressed as

$$K_{aa}(n) = C[a^*(m)a(n+m)]. \tag{1}$$

If the power spectrum is defined as there is a transformation relationship between $K_{aa}(n)$ and $W_{aa}(s)$ (Fourier transform):

$$W_{aa}(s) = \sum_{n=-\infty}^{\infty} K_{aa}(n)c^{-\mathrm{ism}}, \tag{2}$$

$$K_{aa}(n) = \frac{1}{2\pi}\int_{-\pi}^{\pi} W_{aa}(s)c^{-\mathrm{ism}}ts. \tag{3}$$

If $(m)a$ is ergodic in all states, its autocorrelation function can be obtained by extracting a time series and using the time average method, including

$$K_{aa}(n) = \lim_{M=-\infty}\frac{1}{2M+1}\sum_{m=-M}^{M} a^*(m)a(m+n). \tag{4}$$

Since $(m)a$ in most applications is a real signal, the formula can be replaced by

$$K_{aa}(n) = \lim_{M=-\infty}\frac{1}{2M+1}\sum_{m=-M}^{M} a(m)a(m+n). \tag{5}$$

In practical applications, the observable values of a sampling time series of random signals are limited, such as M values, which are

$$a_M(m) = \{a(0), a(1), \ldots, a(M-1)\} = \{a(m), m = 0, 1, \ldots, M-1\}. \tag{6}$$

Therefore, its autocorrelation function can only be estimated with these M sampling data, and there are

$$\hat{K}_{aa}(n) = \frac{1}{M}\sum_{m=0}^{M-1-|n|} a(m)a(m+n), |n| \leq M-1. \tag{7}$$

The formula is a so-called asymptotic unbiased estimation of sampling autocorrelation function. The sampled autocorrelation function is Fourier transformed and replaced with formula (2). This method is called autocorrelation function method of spectrum estimation. In general, spectrum analysis refers to the analysis of signals by Fourier transform. Spectrum analysis includes amplitude spectrum and phase spectrum, but the most commonly used is amplitude spectrum. Before the advent of fast Fourier transform, this method was the most commonly used spectrum estimation technology.

Because the research field of visual assistant systems involves many fields, such as traffic, security, industry, etc., this article mainly studies a visual assistant system based on WNSs and embedded systems. The system replaces the traditional wired sensor with WNSs, receives the image information collected by the visual sensor through the node, and transmits the data to the network center computer through the wireless network.

3 Design and inspection of visual symbol auxiliary system

3.1 Experimental design

The input image is collected by WNSs, and the collected data are sent to the host through a serial port. The sensors required in this article include two: WNSs used by a conventional system (X) and a visual symbol recognition system (Y), both of which are installed on the S3C44B0 hardware platform [11,12]. This module mainly includes three sub-modules. Image pre-processing module: The image collected by WNSs is pre-processed to improve image quality, such as denoising and enhancement. The median filtering method and the mean filtering method can be used for noise removal. In the aspect of enhancement, histogram equalization, image sharpening, and other processing methods are used. Feature extraction module: It can extract features of visual symbols and select feature points in the image. This article uses the autocorrelation function to extract feature points. Human–computer interaction module: It can be realized according to the recognition results of visual symbols. The serial port data can be read from the embedded operating system and sent to S3C44B0. According to the data obtained by WNSs, people can determine whether there is a feature point. If there are feature points, the direction and speed of visual symbol movement are controlled according to the recognition results. Otherwise, the information uploaded by WNSs is sent to the host through the serial port [13,14]. This subroutine completes the task of visual symbol motion control and realizes the function of the auxiliary system. The multi-frame averaging method is used when WNSs collect images. Due to the large amount of calculation, this article adopts a non-uniform sampling method to ensure the speed and quality of image processing.

Five visual symbols need to be added during the system test. Visual symbols can be divided into image symbols, index symbols, and symbol symbols. The image symbol (A) includes mirror image (A1), photo (A2), sculpture (A3), model (A4), pattern (A5), etc. The index sign (B) includes the road sign (B1), station sign (B2), wind vane (B3), trademark (B4), signboard (B5), etc. The symbol (C) includes the expression (C1), action (C2), clothing (C3), clothing (C4), and orientation (C5) [15,16]. First, this article obtains the image information of five visual symbols through WNSs on the experimental device and then uses the visual recognition algorithm based on WNSs to process the image. In this article, the timer of advanced rise machine processor S3C44B0 is used for timing collection during WNS operation. In this article, the program is used to process the collected image information on the experimental device to obtain the characteristic parameters of visual symbols [17,18]. In the process of experiment, this article divides each group of data into different color regions with different thresholds and extracts feature values for each region. In this article, a classification recognition algorithm is used to classify and recognize each eigenvalue, and its recognition accuracy and system stability are as follows.

3.2 Experiment

3.2.1 Image symbol

How their rune shapes represent the symbol of the rune image is the similarity between the symbolic form and the symbolic object. In other words, the runic form of image symbols describes things in a way of "Xiao Hua." For example, a portrait is a typical image symbol, which is the realism and imitation of the symbol object. In addition, mirror images, photos, sculptures, models, patterns, and so on have also used the means of expression of portraits and become symbols of images. In the world of symbols, real things can have their own visual symbols, and imagined things can also have their own visual symbols. For example, the statues of Buddhas and ghosts in the monasteries are similar to the imaginary objects in people's minds, so they are also an image symbol. This article tests the image symbol auxiliary system of WNS and embedded system, and its system stability and classification recognition accuracy are shown in Figure 3.

Figure 3(a) shows the recognition accuracy and stability of the X system, and Figure 3(b) shows the recognition accuracy and stability of the Y system. It can be seen from the figure that the classification and recognition accuracy of the X system remains between 74 and 82%, with a maximum of 81.4%. The stability is kept between 83 and 90%, with a maximum of 89.2%. The classification and recognition accuracy of the Y system is maintained between 87 and 99%, with a maximum of 98.1%. The stability is maintained at 94–100%, up to 99.9%. It can be seen that the classification recognition rate and system stability of the Y system are better than that of the X system and can also better reflect the advantages of the image symbol assistance system.

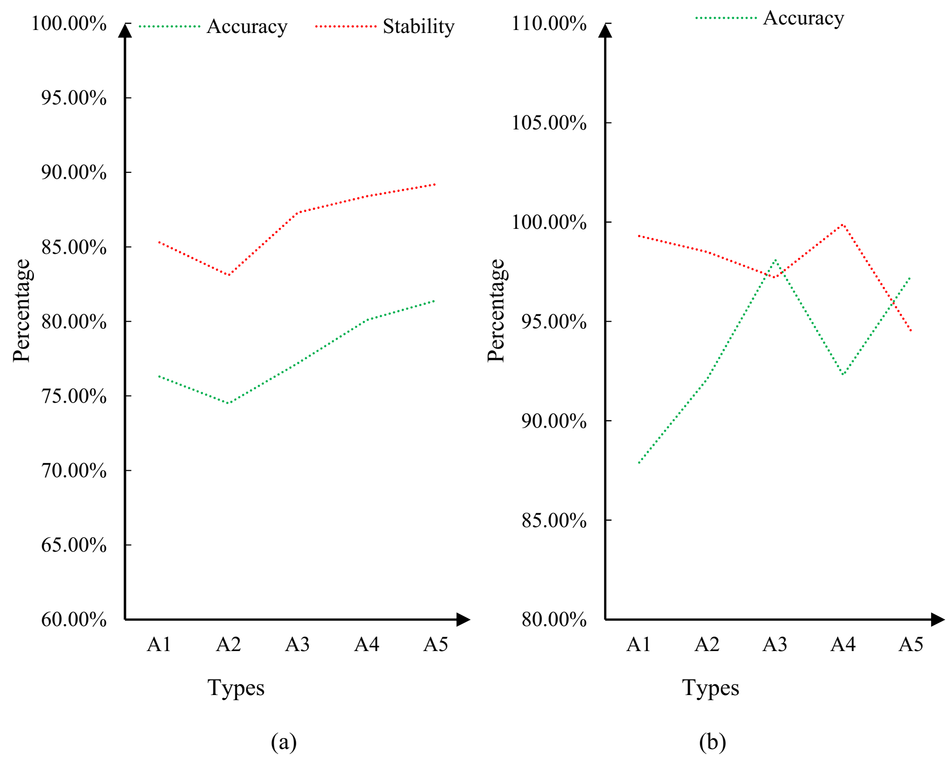

Figure 3: Recognition accuracy and stability of image symbol auxiliary system. (a) The accuracy and stability of X system's image symbol recognition. (b) The accuracy and stability of Y system's image symbol recognition.

3.2.2 Index sign

The expression form of the index sign is that there is a direct causal relationship between the symbol body and the object to be represented, so that the symbol body can indicate or mark the existence of the object to be represented. Because of this feature, its symbol object would always be a certain entity or event related to time and space, just like the indicator in the zoo, which is the indicator of those animals. If one can see an iron cage of "northeast tiger," it means that it is a northeast tiger, not an ordinary tiger. In another case, the signal lights installed on the top of tall buildings are used to remind people who fly at night. Similarly, there are signs of "construction ahead, please detour" on the road construction site, as well as road signs, stop signs, wind vanes, trademarks, signs, etc., which are the index marks of relevant things and are all index signs. In addition, the occurrence of some phenomena often accompanies or affects the occurrence of other phenomena. Among these phenomena, one phenomenon can become the index sign of another due to the proximity of time and space. For example, for the natural phenomenon of lightning, people usually see lightning first and then hear thunder. Although there is no causal relationship between lightning and thunder, people still regard lightning as the index sign of thunder. In short, as long as something can predict or mark the existence or past existence of a certain time, place, or thing, it can be regarded as a referential symbol. This article tests the index symbol auxiliary system of WNS and embedded system, and its system stability and classification recognition accuracy are shown in Figure 4.

Figure 4(a) shows the recognition accuracy and stability of the X system, and Figure 4(b) shows the recognition accuracy and stability of the Y system. It can be seen from the figure that the classification and recognition accuracy of the X system remains between 63 and 76%, with a maximum of 75.2%, while the stability remains between 70 and 78%, with a maximum of 77.4%. However, the classification and recognition accuracy of the Y system remains between 87 and 94%, up to 93.5%, and the stability remains between 93 and 100%, up to 99.1%. It can be seen that the classification recognition rate and stability of the Y system are better than that of the X system and can also better reflect the advantages of the index symbol auxiliary system.

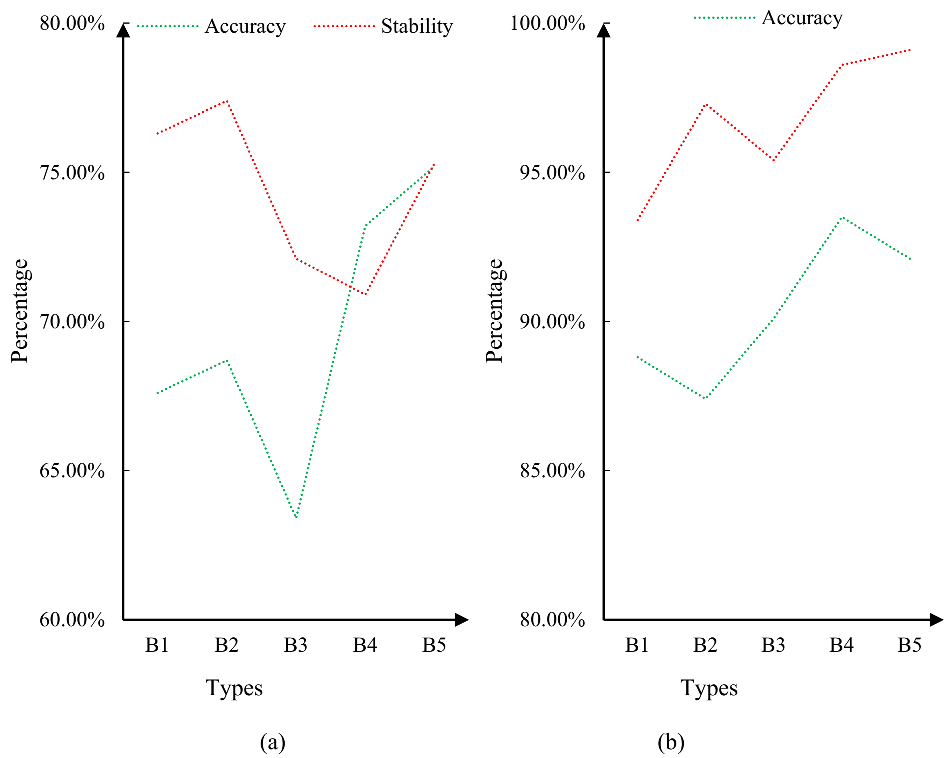

Figure 4: Identification of accuracy and stability of the auxiliary system of the index sign. (a) The accuracy and stability of X system's the index sign identification. (b) The accuracy and stability of Y system's the index sign identification.

3.2.3 Symbol

There is no similarity or connection between the symbolic form of the symbol and the object to be represented, and their expression is only based on social conventions. For example, language is a good symbol. There is no relationship between language and what it represents. What language is used to represent what is just the result of a social group. Different people would have their own habits, thus forming a symbol system of Chinese, English, Mongolian, Arabic, and other languages. The related characters, sign language, flag language, and drum language are all symbols. Some abstract concepts, such as feelings, are difficult to imitate and have a direct relationship with. Therefore, it is usually expressed in a symbolic way. For example, roses represent love, pigeons represent peace, and red represents joy. White represents purity, flag represents nation, city gate represents a city, and so on. For example, there are gestures, expressions, actions, clothes, directions, numbers, etc. If they are connected with other things and recognized by specific social groups, they can also be regarded as a symbol. This article tests the symbol auxiliary system of WNS and embedded system, and its system stability and classification recognition accuracy are shown in Figure 5.

Figure 5(a) shows the recognition accuracy and stability of the X system, and Figure 5(b) shows the recognition accuracy and stability of the Y system. It can be seen from the figure that the classification and recognition accuracy of the X system remains between 58 and 69%, with a maximum of 68.4%, while the stability remains between 67 and 74%, with a maximum of 73.5%. However, the classification and recognition accuracy of the Y system remains between 89 and 96%, up to 95.3%, and the stability remains between 90 and 99%, up to 98.3%. It can be seen that the classification recognition rate and system stability of the Y system is better than that of the X system, and it can also better reflect the advantages of the symbol auxiliary system.

3.2.4 System satisfaction

This article has verified the recognition efficiency and stability of the symbol assistance system and has learned the advantages of the wireless sensor symbol assistance system. Therefore, this article has conducted a survey on user satisfaction, and the number of users is 100, as shown in Figure 6.

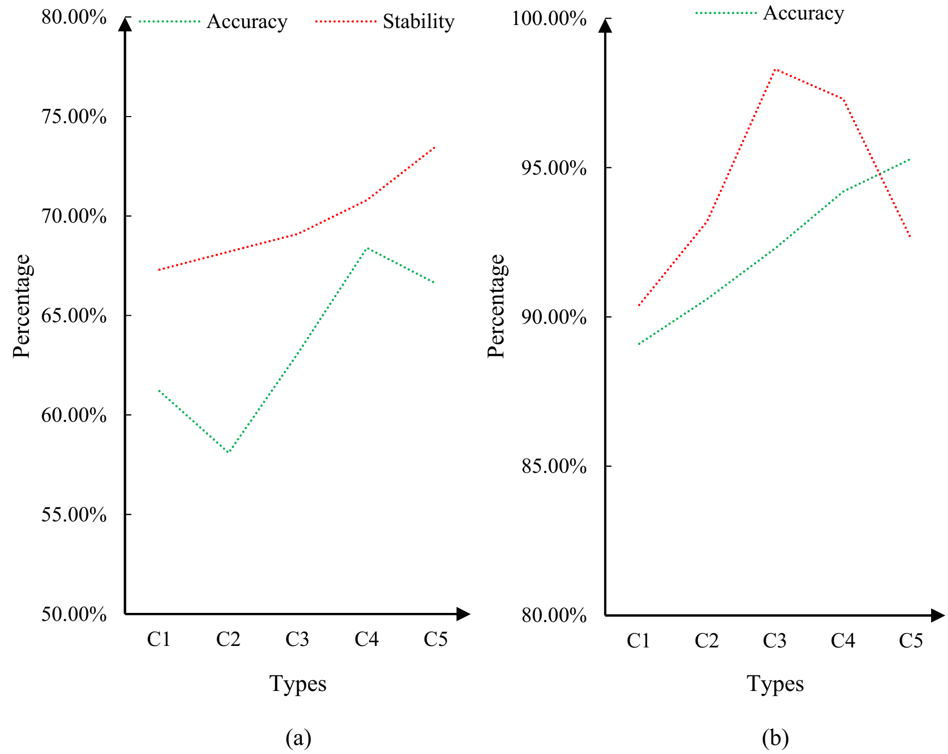

Figure 5: Recognition accuracy and stability of symbol auxiliary system. (a) The accuracy and stability of symbol recognition in the X system. (b) The accuracy and stability of symbol recognition in the Y system.

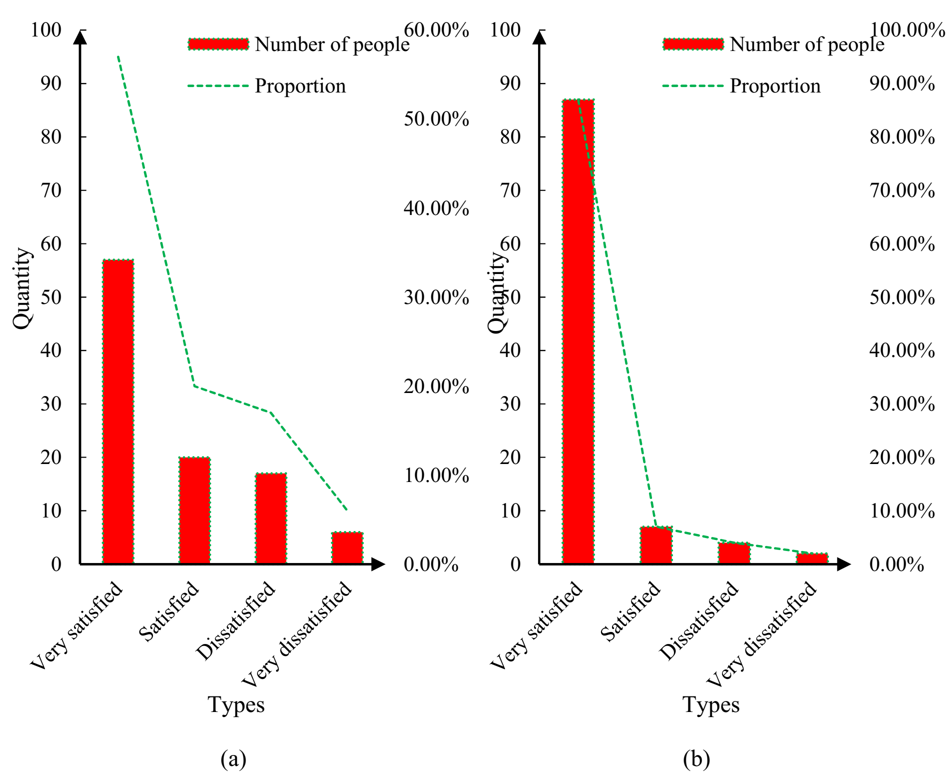

Figure 6: System satisfaction survey. (a) Satisfaction survey of system X. (b) Satisfaction survey of system Y.

Figure 6(a) shows the satisfaction survey of system X, and Figure 6(b) shows the satisfaction survey of system Y. According to the figure, 57 people are very satisfied with the X system, accounting for 57%, 20 people are satisfied, accounting for 20%, and 17 people are dissatisfied, accounting for 17%. The number of people who are very dissatisfied is 6, accounting for 6%. Totally 87 people were very satisfied with the Y system, accounting for 87%, and 7 people were satisfied, accounting for 7%. There are four dissatisfied people, accounting for 4%, and two very dissatisfied people, accounting for 2%. It can be seen that the satisfaction of system Y is significantly higher than that of system X.

In order to further verify the application performance of the method proposed in this article in visual symbol assistance systems based on WNSs and embedded systems, this article will use statistical fusion processing-based methods and fuzzy state parameter recognition-based methods as control methods to ensure that different methods are tested in the same experimental environment. They conducted a comparative analysis of system response time and system reliability, and the comparison results are shown in Figures 7 and 8, respectively.

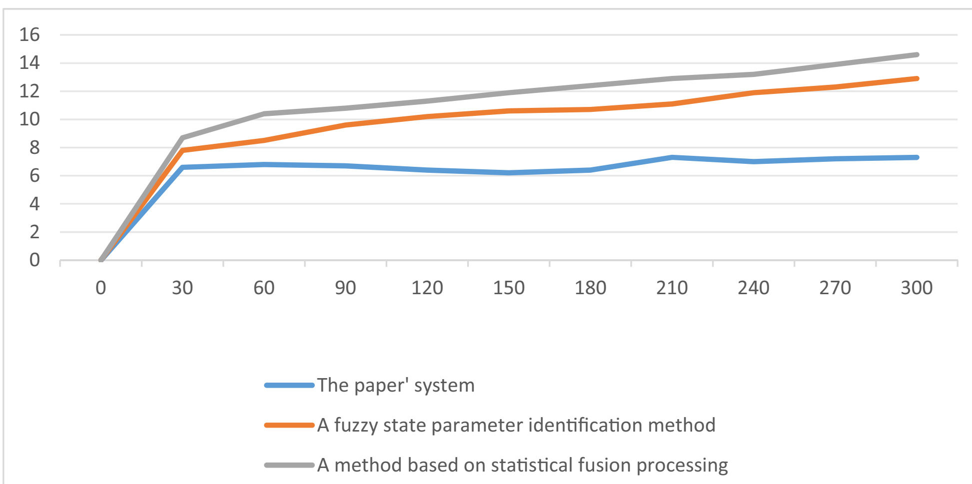

Figure 7: Comparison results of system response time (the horizontal axis represents the number of iterations [time], and the vertical axis represents the response time [s]).

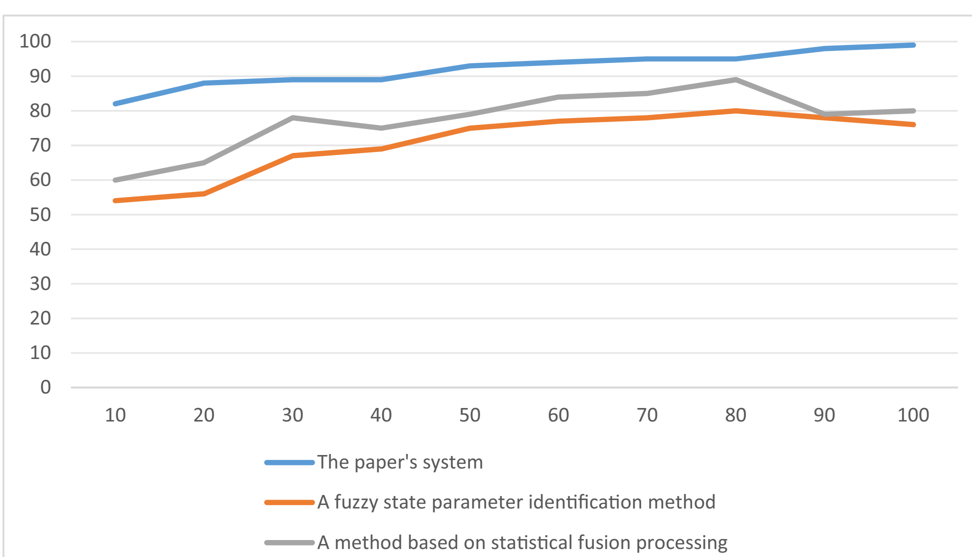

Figure 8: Comparison results of system reliability (the horizontal axis represents time [s], and the vertical axis represents system reliability [%]).

By analyzing Figure 7, it can be seen that compared with traditional methods, the proposed method has a shorter response time and can generally complete the response within 8 s. When other methods reach 90 iterations, their response time is higher than 10 s, indicating that the system designed by this method has better application performance. By analyzing Figure 8, it can be seen that in terms of system reliability, the system designed in this article has maintained a reliability of over 80%, which is significantly higher than other traditional methods. In addition, the system reliability of this article is relatively stable, while the system reliability of other traditional methods has significant fluctuations. It can be seen that the system designed by the method in this article has the ability to improve its information processing.

In summary, the visual symbol assistance system designed in this article based on WNSs and embedded systems has better application performance and higher output stability.

To sum up, the visual symbol assistant system based on wireless sensors is not only higher than the ordinary wireless sensor system in recognition rate, but also far higher than the ordinary wireless sensor system in stability and user satisfaction, which can highlight the advantages of this system.

4 Conclusions

This article proposes a visual symbol assistance system method using WNSs, which provides a modeled computing mode for the application of WNSs. Due to the consideration of isolated or local energy function analysis and output accuracy analysis, a globally adaptable scheduling system can be obtained by adjusting parameters or updating the system control matrix in different application contexts. In fact, completing global optimization by configuring the topology composition of nodes is a dynamic process, and the examples provided in this article also demonstrate that this method has better response time and reliability. The next step of work will focus on solving the following problems. First, there is a need for a more systematic model that includes an input matrix. How to incorporate a system tuning matrix to improve the automation and intelligence of the system. Second, for the source nodes within a monitoring area, it is necessary to consider how to collect and distribute multiple types of data, while also considering how to respond quickly in case of system failure (such as the harm of sudden changes in certain monitoring items to the system in real-time environment, and the need to quickly report sensitive data items). Large-scale parallel computing algorithms can better reduce redundancy, but they bring about increased network costs and network latency, which need to be comprehensively considered.

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