Design of Urban Sculpture Artwork Pattern on Account of Smart Sensor Network from the Artistic Perspective

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Abstract

As a combination of the three elements of modern information technology, smart sensor network is a brand-new information collection and management technology. The smart sensor network is composed of a large number of smart sensor nodes with low energy consumption. In order to improve the performance of pattern design, this paper proposes an urban sculpture artwork pattern design framework based on intelligent sensor network. It uses intelligent sensor network technology to build design models and design patterns for urban sculptures. Based on the introduction of intelligent sensor network technology, various computer software and pattern texture calculation methods are used to process the urban sculpture pattern in the design process, and the construction of the urban sculpture pattern model is completed through the construction process of the urban sculpture pattern intelligent sensor network mode. Experimental results show that the average design time of urban sculpture patterns based on smart sensor network technology is 0.42 s, the average resolution is 7200 pixels, and the average dot pitch is 0.27mm. Compared with traditional 3D technology pattern design methods, the design performance of urban sculpture patterns based on intelligent sensor network technology is better, and it meets the design requirements of urban sculpture patterns.

Keywords: Smart sensor network, Urban sculpture, Pattern design, Art perspective

1 Introduction

As the foundation of modern information technology, sensor technology is a multidisciplinary integrated modern science and engineering technology that includes sensor design, information processing and development, production, implementation, evaluation and improvement. Compared with traditional sensors, smart sensors combine integration technology, micro-processing technology and sensor technology, and have strong intelligence. It conforms to the concept of intelligent design, and has been widely used in many fields such as education, medical care, security, finance and autonomous driving, such as RFID sensors, gas intelligent sensors, inertial intelligent sensors, etc. It brings great convenience to people's lives. The intelligent sensor network is a distributed intelligent network system created by the intelligent sensor processing unit for network communication. In this system, the sensor becomes an accessible node, and the smart sensor network can remotely access the data and information from the smart sensor, and edit the functions of each sensor online.

For the application of smart sensor technology in various fields, experts at home and abroad have done a lot of research. Garcia M R has designed a smart sensor that can predict the quality of retail fish under the ice store. It combines information on biochemical and microbial spoilage indicators (psychrophilic count and total volatile alkali nitrogen content) with dynamic models to predict quality based on QIM and EU grading standards [1]. S. Dissanayake used colorimetric smart sensors to measure the quality of drinking water in an area, used an automated mechanism to measure fluoride and hardness in well water, and adds conductivity and pH measurements. This colorimetric method is suitable for the use of SPADNS reagents and complexometric titration color change procedures to develop the proposed optical sensor [2]. X. Wu proposed a discontinuous collection technology for switched capacitor DC-DC conversion. The switching and leakage losses of the DC-DC converter can be best compromised with the losses caused by the non-ideal maximum power point tracking operation. To obtain a better trade-off between energy efficiency and charge pump efficiency [3]. L. Chong constructed a network control system with a continuous-time system of random measurement, where it is assumed that the measurement channel is affected by the delay of the random sensor. The design is realized by solving linear matrix inequalities and numerical formulas are used to test the feasibility and effectiveness of the system [4]. S. Famila uses the advantages of the grenade explosion method (GEM) and the Cauchy algorithm to propose a smart sensor environment clustering algorithm based on improved artificial bee colony optimization. It includes CH election based on hierarchical clustering (HCCHE), enhanced particle swarm optimization technology (EPSOCT) and competitive clustering technology (CCT) [5]. A. D. Graziano uses intelligent sensor networks to monitor the health of asphalt pavements, and introduces the basic characteristics of wireless sensor networks used for road surface monitoring for damage detection. And he provided a brief analysis of other possible supplementary applications of smart sensor networks, such as traffic and surface condition monitoring [6]. A. Bono-Nuez combines inductor and household induction cooker material identification. In a simple R-L equivalent circuit, he proposed a new method for

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online inspection of pot materials. In this method, the inductor contained in the stove is used as a heating element and a sensor at the same time. The material recognition system is implemented on the embedded processor, without the use of additional sensors, the intelligent sensing function is integrated into the household cooking utensils [7].

In recent years, with the rapid development of network information technology, the intelligent design of urban sculpture artwork patterns is no longer limited to a specific aesthetic design mode. It can create a more refined aesthetic design based on sculpture materials, model structure, and pattern lines. This article will take the application of smart sensor network in urban sculpture art pattern design as the research direction, and use smart sensor network to realize the pattern design of urban sculpture.

2 Urban Sculpture Artwork Pattern and Intelligent Sensor Network

2.1 Urban Sculpture Artwork Pattern

The concept of urban sculpture originated in the early 1980s and was put forward under a certain social and historical background at that time. It is different from "outdoor sculpture", "environmental sculpture" and "urban landscape sculpture" [8]. Sculptor Liu Kaiqu once pointed out that urban sculpture is an important part of the urban landscape. It depicts the historical background and cultural connotation of a city with artistic expressions. It is an important element of modern urban civilization and an important symbol of cultural level [9].

In recent years, with the increase in urban construction, urban sculpture has become an indispensable part of urban landscape construction. Whether it is in the content of the pattern, the shape of the pattern, or the color and meaning, it highlights the visual image of the sculpture and contains its unique meaning [10].

(1) Construction of memorial sculptures of ancient figures

The statue of Confucius is a memorial sculpture of ancient people often seen in schools, as shown in Figure 1. The material is made of stone, the whole body is white, without distractions, suitable for the image of Confucius teaching and educating people. It creates a strong cultural atmosphere in the school. And with facial expressions "warm and fierce, mighty but not fierce, respectful and peaceful", it embodies the image of a solemn, peaceful, humble, and wise man of the world, and promotes traditional Chinese culture to countless students of later generations [11]. The Confucian spirit represented by Confucius' educational thoughts conveys to teachers the spirit of educating people with virtue and learning as a teacher. It conveys to the students the spirit of striving for self-improvement, loyalty and ethics.

Figure 1. The Confucius sculpture

(2) Urban sculpture construction with modern themes

Nanchang Wanda Mall is a modern commercial complex built with "blue and white porcelain" buildings, as shown in Figure 2. The theme is bright, fashionable, and full of humanistic charm, making this project a new urban landmark in Nanchang [12]. Wanda Mao Building is composed of 26 "blue and white porcelain" vases of various shapes, 400 meters long and 200 meters wide, with an overall construction area of 191,500 square meters. "Flowers blooming rich and honorable", "Golden jade full hall", "Birds and Flowers", "Flowers and butterflies celebrate spring", "Dragon and phoenix are prosperous"... Each porcelain jar has been given a different auspicious theme. It is rich in traditional Chinese culture and Jiangxi regional characteristics, thus extending the creative story line of the entire Wanda City [13].

Figure 2. Nanchang Wanda Mall

2.2 Smart Sensor Network

2.2.1 Smart Sensor Structure

Smart sensors are mainly composed of sensors, microprocessors, corresponding input and output circuits, and power supplies. The structure diagram is shown in Figure 3. The sensor module is responsible for detecting, sensing, and receiving information from the outside world, and converting it into digital information. The microprocessor module is responsible for processing various data from the sensor and transforming these data into the required target data. The input and output circuit is combined with the software in the microprocessor to receive the data in the microprocessor and transmit various information in the sensor node. The power module is the power supply system of several other modules [14].

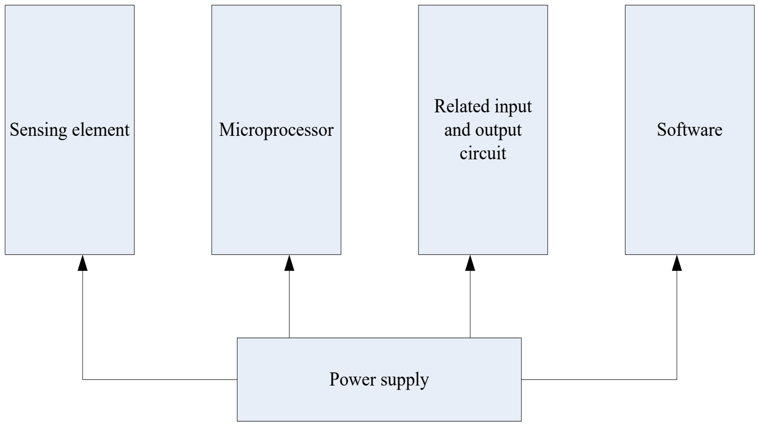


Figure 3. Intelligent sensor structure diagram

Its working process is shown in Figure 4: The sensor converts the measured information into corresponding digital information, and then enters the signal processing circuit to prepare for data input, including data selection and adjustment [15]. The microprocessor is the core of the smart sensor, it can save, analyze and process data. The input and output circuit is combined with the software module in the microprocessor for information exchange and data collection. Finally, it can be output in the form of a digital quantity [16].

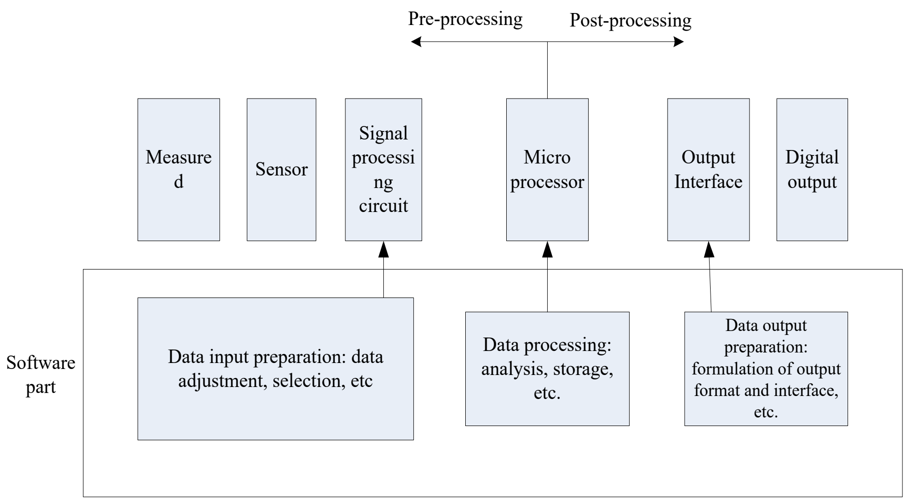


Figure 4. Intelligent sensor working diagram

2.2.2 Smart Sensor Network

As a new type of network system, smart sensor network is composed of many smart sensor nodes. It can realize the unified coordination of information collection, processing and transmission [17-18]. It can collaboratively monitor, perceive and collect various information in the network distribution area in real time, process the information, and transmit it to the users who need the information, so that people can obtain a large amount of detailed and reliable information at any time, place and under any environmental conditions.

Compared with the traditional system, it has many new features: It has self-diagnosis and self-calibration functions, and can perform self-checking during work to determine which link fails, which increases work reliability [19].

2.2.3 Intelligent Algorithm

In some cases, it is necessary to make mathematical descriptions of specific intelligent algorithms for the characteristics of these smart sensors, and to describe the characteristics of the smart sensors by adjusting the circuit network.

(1) Regression analysis method

Regression analysis is a mathematical statistical analysis and processing of causal influencing factors (independent variables) and predicted objects (dependent variables) [20]. A regression model is established:

$$y = \alpha + \beta x + \varepsilon_i. \quad \textbf{(1)}$$

Among them, α and β are constants, and ε_i is a random variable, also called residual error. For regression analysis, it is usually assumed that ε_i is zero mean. Same variance, independent of each other, and obey a normal distribution.

Find the mean value of equation (1) and linear regression equation:

$$E(y) = \alpha + \beta x. \quad \textbf{(2)}$$

But in reality, Replace α and β in the linear regression equation with $\hat{\alpha}$ and $\hat{\beta}$ respectively to get the estimated regression equation:

$$\hat{y} = \hat{\alpha} + \hat{\beta} x. \quad \textbf{(3)}$$

The fluctuation of the value of y is called the variation $y - \overline{y}$.

$$y - \overline{y} = (y - \hat{y} + (y - \overline{y})). \quad \textbf{(4)}$$

The total sum of squares SST is the sum of squares of the difference between the actual value of each dependent variable and the mean of the dependent variable. Its formula is:

$$SST = \sum (y_i - \overline{y})^2. \quad \textbf{(5)}$$

Regression Sum of Squares SSR The sum of squares of the difference between the regression value of the dependent variable (y values on the line) and its mean (the average of the y values at a given point), i.e. it is the change in y due to the change in the independent variable x, reflecting the y The portion of the total deviation of y due to the linear relationship between x and y can be explained by the regression line. Its formula is:

$$\sum (y_i - \overline{y})^2 = \sum (y_i - \hat{y})^2 + \sum (\hat{y} - \overline{y})^2 + 2\sum (y_i - \hat{y}_1)(\hat{y}_1 - \overline{y}). \quad \textbf{(6)}$$

Residual sum of squares SSE The effect on the change in y cannot be explained by the regression line. Its formula is:

$$\sum (y_i - \overline{y})^2 = \sum (y_i - \hat{y})^2 + \sum (\hat{y} - \overline{y})^2. \quad \textbf{(7)}$$

The ratio of the regression sum of squares to the total sum of squares is called the coefficient of determination (R^2):

$$R^2 = \frac{SSR}{SST} = \frac{\sum (\hat{y} - \overline{y})^2}{\sum (y_i - \overline{y})^2}. \quad \textbf{(8)}$$

The value range of R^2 is [0,1]. The closer to 1, the better the fit.

If all the points are on the regression line, it means that the SSE is 0, then =1, which means that 100% of the change in y is caused by the change in x, and no other factors will affect y, and the regression line can completely explain the change in y. If it is low, there may not be a linear relationship between x and y.

Estimated standard error S_e is an estimate of the error term ε_i standard deviation, it is the square root of the mean square error (MSE), and it is a statistic that measures the spread of observation points around a straight line:

$$MSE = \frac{SSE}{n} = \frac{\sum (y_i - \hat{y}_1)^2}{n}. \quad \textbf{(9)}$$

$$S_e = \sqrt{MSE} = \sqrt{\frac{SSE}{n}} = \sqrt{\frac{\sum (y_i - \hat{y}_1)^2}{n}}. \quad \textbf{(10)}$$

The average absolute error MAE calculates not the sum of squares, but the sum of absolute values:

$$MAE = \frac{\sum |y_i - \hat{y}_1|}{n}. \quad \textbf{(11)}$$

The regression analysis method can be combined with the mathematical model of the smart sensor, and the input value or output value measured by the sensor is used as the independent variable in the corresponding polynomial.

(2) Artificial neural network

Artificial neural networks are derived from important discoveries in physiology, and are processors composed of a large number of simple processing units (neurons) distributed in parallel. In the BP neural network, information is propagated forward, and errors are propagated backward. BP neural network is used to integrate multi-sensor data in sensor technology. The structure diagram is shown in Figure 5.

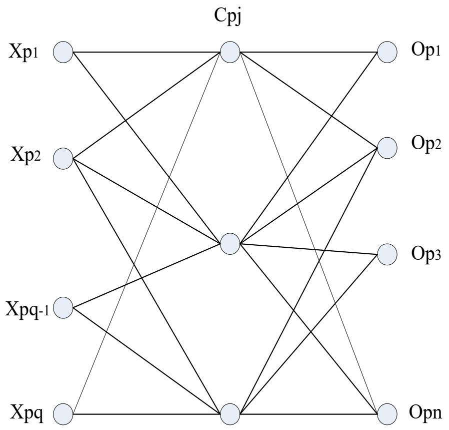


Figure 5. BP network structure diagram

The algorithm process of BP network is as follows :

a. Initialize the weight (w_{ji}^h, w_{ki}^o) and bias (θ_j^h, θ_k^o) .

b. Add the input variable $X_p = [x_{p1}, x_{p2}, ..., x_{pq}]$ to the input unit.

c. Calculate the net input of the hidden layer:

$$net_{pj}^h = \sum_{i=1}^{q} w_{ji}^h x_{pi} + \theta_j^h. \tag{12}$$

d. Calculate the output value from the sigmoid function defined in the hidden layer:

$$f_j^h(net_{pj}^h) = (1 + e^{-net_{pj}^h})^{-1}. \tag{13}$$

$$c_{pj} = f_j^h(net_{pj}^h). \tag{14}$$

e. Go to the output layer and calculate the net input value of each unit in the output layer:

$$net_{pk}^o = \sum_{j=1}^{K} w_{kj}^o c_{pj} + \theta_k^o. \tag{15}$$

f. Calculate the output, using the same S function, it can get the output:

$$O_{pk} = f_k^o(net_{pk}^o). \tag{16}$$

g. Calculate the error term of the output unit:

$$\delta_{pk}^o = (d_{pk} - o_{pk}) \frac{\partial f_k^o(net_{pk}^o)}{\partial(net_{pk}^o)}. \tag{17}$$

h. Calculate the error term of the hidden unit:

$$\delta_{pj}^h = \frac{\partial f_j^h(net_{pj}^h)}{\partial(net_{pj}^h)} \sum_k \delta_{pk}^o w_{kj}^o. \tag{18}$$

i. Update the weight of the (n+1)th iteration of the output layer, where Ω is a bias value.

$$w_{kj}^o(n+1) = w_{kj}^o(n) + \alpha \Delta w_{kj}^o(n-1) + \eta \delta_{pk}^o c_{pj} + \Omega. \tag{19}$$

j. Update the weights of the (n+1)th iteration of the hidden layer:

$$w_{ji}^h(n+1) = w_{ji}^h(n) + \alpha \Delta w_{ji}^h(n-1) + \eta \delta_{pj}^h x_i + \Omega. \tag{20}$$

When the neural network starts to run, the output value of the neural network is compared with the target value in order. According to the back propagation algorithm, the weights are updated step by step, repeating steps b to j until the network converges to an acceptable error.

The standard BP neural network still has some defects, such as easy to form local minima but not global optimal value, low learning efficiency due to many training times, slow convergence speed, and lack of theoretical guidance for the selection of hidden layers [21]. This requires that the initial weights and thresholds have requirements. To make the randomness of the initial weights and thresholds good enough, it can be implemented randomly for many times.

3 System Verification

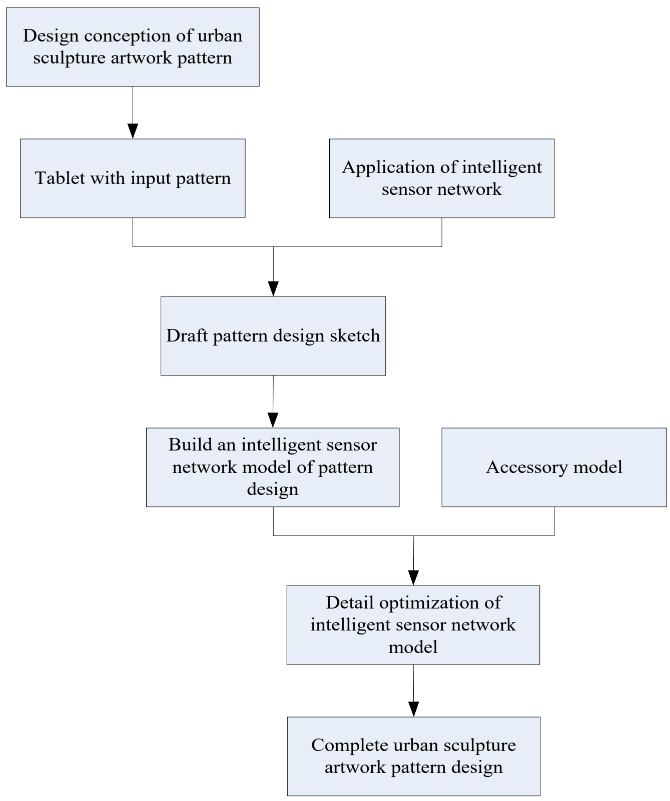


Figure 6. Frame of urban sculpture artwork pattern design

The basic design part of the urban sculpture artwork pattern can be completed by traditional software. The pattern design framework is shown in Figure 6.

On the basis of the urban sculpture pattern design framework, the intelligent sensor network design of the pattern is completed. In order to ensure the accuracy of the urban sculpture pattern design, the optimization part of the pattern model is added to the whole pattern design process, and the details of the pattern model are optimized by using the intelligent sensor network technology to ensure that the urban sculpture pattern design results are more in line with the design requirements of the pattern.

3.1 Draft the Design Sketch

Using Photoshop image software can simulate various painting effects such as Chinese ink painting and watercolor painting. ZBrush software can use traditional sculpture tools and realistic clay materials to simulate the traditional sculpture production process.

3.2 Build Design Model

The establishment of urban sculpture artwork pattern design model is divided into three stages: parameterization of pattern design elements, construction of perceptual neural network prediction model, and detailed pattern design. The design information involves line density, curvature, basic pattern shape, structure type, centripetal degree, pattern type, and semantics, as shown in Tables 1 and Table 2.

If a sample has a certain characteristic attribute under a certain category, it will be coded as 1, and if it does not possess the characteristic attribute, it will be coded as 0. Then, the design element characteristics of the sample are transformed into quantitative description characteristics, as shown in Table 3. Common perceptual evaluation values are: bright, bright, agile, ingenious, vivid and so on.

3.3 Detail Optimization Processing

The urban sculpture artwork pattern design model constructed by using intelligent sensor network technology may have a small amount of error between the original design sketch. After optimizing these details, smart sensor technology is used to correct the accuracy of the model design until the accuracy of the model is consistent with the accuracy of the original pattern sketch.

Table 1. Pattern design information sheet

Type	Design elements	Category 1	Category 2	Category 3	Category 4
Local pattern features	Density of the line	Sparse	Dense	--	--
	Curvature of the line	Large	Small	--	--
Overall configuration relationship	Pattern configuration type	Spiral	Balanced	Symmetrical	Multi-layered
	Basic pattern	Square	Round	Polygon	Natural
	Degree of eccentricity	Centrifugal	Radial	Moderate	--
Pattern content	Pattern type	Animal pattern	Plant pattern	Geometric pattern	Combination pattern
	Meaning of the pattern	Commemorate ancestors	Protect environment	Harmonious society	--

Table 2. Meaning table of the pattern

Pattern shape	Pattern type	Meaning of the pattern
Fish pattern	Animal pattern	Prosperity in the new year
Dragon pattern	Animal pattern	Honorable and respectable
Bird pattern	Animal pattern	Be free
Floral pattern	Plant pattern	Respect for nature
Ancient characters pattern	Character pattern	Commemorating historical figures
Character activity pattern	Combination pattern	Different meanings of different scenarios

Table 3. Parameterization table of pattern information

Type	Element	Sample				
		1	2	3	.....	n
Density of the line	Sparse	1	0	1	.....	1
	Dense	0	1	0	.....	0
Curvature of the line	Large	1	0	0	.....	0
	Small	1	1	0	.....	1
Pattern configuration type	Spiral	0	0	1	.....	0
	Balanced	1	0	0	.....	1
	Symmetrical	1	0	1	.....	1
	Multi-layered	1	0	1	.....	0
Basic pattern	Square	0	1	1	.....	0
	Round	1	1	0	.....	1
	Polygon	1	0	0	.....	1
Degree of eccentricity	Centrifugal	0	1	1	.....	0
	Radial	1	0	1	.....	1
	Moderate	0	0	1	.....	0
Pattern type	Animal pattern	1	1	0	.....	0
	Plant pattern	0	0	1	.....	1
	Geometric pattern	1	1	0	.....	0
	Combination pattern	0	1	1	.....	0
Meaning of the pattern	Commemorate ancestors	1	0	0	.....	1
	Protect environment	0	1	0	.....	0
	Harmonious society	0	0	1	.....	1

4 Sculpture Artwork Pattern Experimental Design

In order to verify the operating performance of the smart sensor network, the speed, resolution, color difference, and dot pitch of the smart sensor network and 3D technology in the design of urban sculpture patterns were compared and tested through experiments.

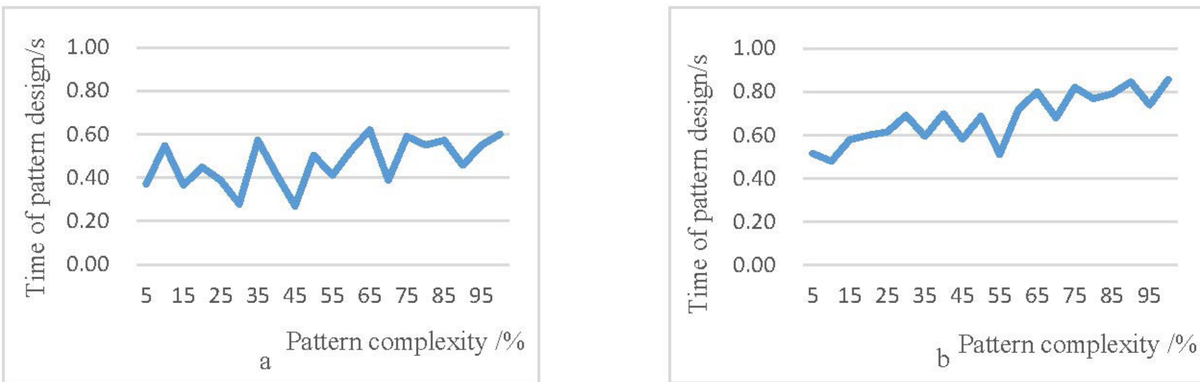
(1) Rate comparison experiment

Use the framework of urban sculpture artwork design based on intelligent sensor network proposed in the system verification to complete the urban sculpture pattern design. By comparing the design time of the two technologies in the urban sculpture pattern design rate, the design time comparison chart is obtained, as shown in Figure 7(a) and Figure 7(b).

Figure 7 shows that whether it is to design patterns using smart sensor network technology or 3D technology, as the complexity of the pattern gradually increases, the pattern design time also becomes longer. The average design time of urban sculpture patterns based on 3D technology is 0.64 s, while the average design time of urban sculpture patterns based on smart sensor network technology is 0.42 s.

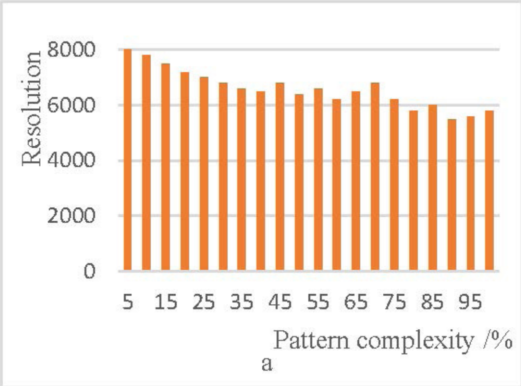
(2) Resolution comparison experiment

By comparing the resolutions of the two technologies in the design of urban sculpture patterns, a resolution comparison chart is obtained, as shown in Figure 8(a) and Figure 8(b).

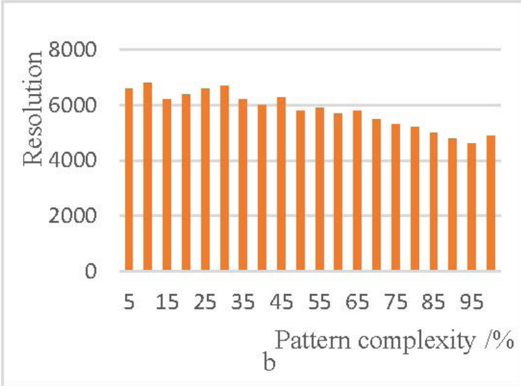


(a) A time chart of pattern design based on smart sensor network (b)A time chart of pattern design based on 3D technology

Figure 7. Pattern design time chart



(a) A pattern design resolution map based on the smart sensor network



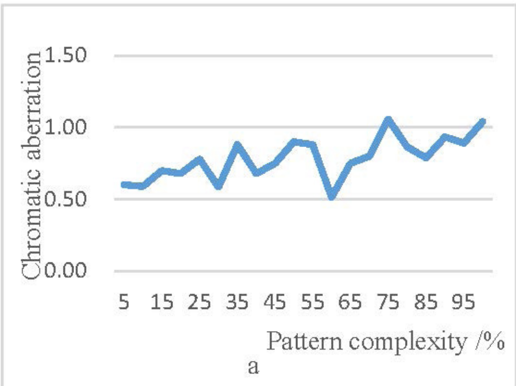
(b) A pattern design resolution map based on 3D technology

Figure 8. Pattern design resolution chart

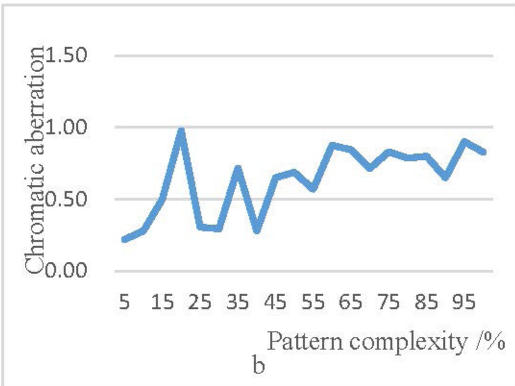
Figure 8 shows that when designing patterns using smart sensor network technology or 3D technology, as the complexity of the pattern gradually increases, the resolution of the pattern also continues to decrease. The average design resolution of urban sculpture patterns based on 3D technology is 5800 pixels, while the average design resolution of urban sculpture patterns based on smart sensor network technology is 7200 pixels. When the complexity of the pattern reaches 100%, the resolution of the 3D technology pattern is only 4900 pixels, which is less than 5000 pixels, and the degree of blurring of the pattern will be greatly increased. The pattern resolution under the smart sensor network technology has reached 5800 pixels.

(3) Chromatic aberration contrast experiment

By comparing the color difference between the two technologies in the design of urban sculpture patterns, as shown in Figure 9(a) and Figure 9(b).



(a) A color difference diagram of pattern design based on smart sensor network



(b) A color difference diagram of pattern design based on 3D technology

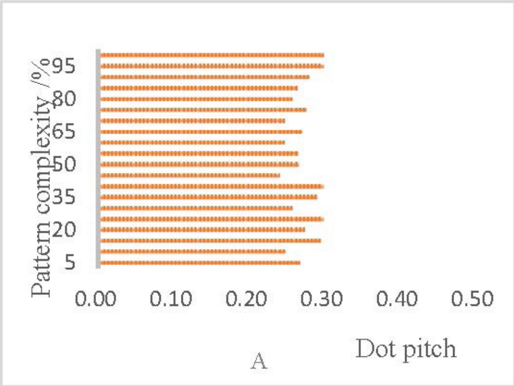
Figure 9. Chromatic aberration chart for pattern designs

Figure 9 shows that when designing patterns with smart sensor network technology or 3D technology, as the complexity of the pattern gradually increases, the color difference of the pattern design also increases. In general, the color difference of pattern design based on 3D technology is smaller than that of pattern design based on smart sensor network technology, but the stability of color difference is not as high as that of smart sensor network technology.

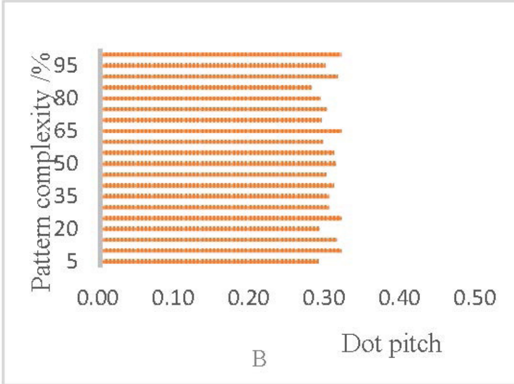
(4) Point distance comparison experiment

By comparing the dot pitches of the two technologies in the urban sculpture pattern design, the comparison result of the pattern design dot pitch is obtained, as shown in Figure 10(a) and Figure 10(b).

Figure 10 shows that when patterns are designed using smart sensor network technology or 3D technology, as the complexity of the patterns gradually increases, the degree of change in dot pitch is relatively small.The average design point distance of urban sculpture patterns based on 3D technology is 0.30mm, while the average design point distance of urban sculpture patterns based on smart sensor network technology is 0.27mm.



(a) A pattern design dot pitch diagram based on a smart sensor network



(b) A pattern design dot pitch diagram based on 3D technology

Figure 10. Dot pitch chart for pattern designs

Table 4. Experiment result graph of Intelligent sensor network technology and 3D technology

	Intelligent Sensor Network Technology	3D technology
Time of pattern design /s	0.42	0.64
Resolution /ppi	7200	5800
Chromatic aberration	0.70	0.56
Dot pitch /mm	0.27	0.30

Based on the experimental results, the average design time of urban sculpture patterns based on smart sensor network technology is 0.42 s, the average resolution is 7200 pixels, and the average dot pitch is 0.27mm. The average design time of the urban sculpture pattern based on 3D technology is 0.64 s, the average resolution is 5800 pixels, and the average point distance is 0.30mm. The experimental results are shown in Table 4. However, the color difference is not as small as the 3D technology pattern design method, but it is also in the acceptable range (0.6~1.0).

5 Conclusion

This paper proposes a framework for urban sculpture pattern design based on smart sensor network technology. First, this article draws up a design sketch, then uses smart sensor technology to build a pattern design model, then optimizes the details to improve the accuracy of the model, and finally uses a pattern design program to realize the design of the urban sculpture pattern. And through experiments, the speed, resolution, color difference and dot pitch of the smart sensor network and 3D technology in the design of urban sculpture patterns are compared. Of course, there are some deficiencies in this study. At present, the information technology that can be applied to pattern design is not only intelligent sensor network technology and 3D technology, but also some information technologies such as multimedia technology, genetic algorithm and digital technology, so comparison experiments of various technologies can also be carried out.

References

[1] M. R. Garcia, M. L. Cabo, J. R. Herrera, G. Ramilo-Fernández, A. A. Alonso, E. Balsa-Canto, Smart sensor to predict retail fresh fish quality under ice storage, *Journal of Food Engineering*, Vol. 197, No. 3, pp. 87-97, March, 2017.

[2] S. Dissanayake, H. Pasqual, B. Athapattu, Economical Colorimetric Smart Sensor to Measure Water Quality of Drinking Water in CKDu Prevalence Areas, *IEEE Sensors Journal*, Vol. 17, No. 18, pp. 5885-5891, September, 2017.

[3] X. Wu, Y. Shi, S. Jeloka, K. Yang, I. Lee, Y. Lee, D. Sylvester, D. Blaauw, A 20-pW Discontinuous Switched-Capacitor Energy Harvester for Smart Sensor Applications, *IEEE Journal of Solid-State Circuits*, Vol. 52, No. 4, pp. 972-984, April, 2017.

[4] C. Lin, Z. Wang, F. Yang, Observer-based networked control for continuous-time systems with random sensor delays, *Automatica*, Vol. 45, No. 2, pp. 578-584, February, 2009.

[5] S. Famila, A. Jawahar, A. Sariga, Improved artificial bee colony optimization based clustering algorithm for SMART sensor environments, *Peer-to-Peer Networking and Applications*, Vol. 13, No. 4, pp. 1071-1079, July, 2020.

[6] A. D. Graziano, V. Marchetta, S. Cafiso, Structural health monitoring of asphalt pavements using smart sensor networks: A comprehensive review, *Journal of Traffic and Transportation Engineering (English Edition)*, Vol. 7, No. 5, pp. 639-651, October, 2020.

[7] A. Bono-Nuez, B. Martin-Del-Brio, C. Bernal-Ruiz, F. J.

Perez-Cebolla, A. Martinez-Iturbe, I. Sanz-Gorrachategui, The Inductor as a Smart Sensor for Material Identification in Domestic Induction Cooking, *IEEE Sensors Journal*, Vol. 18, No. 6, pp. 2462-2470, March, 2018.
[8] X. Tan, Z. Ji, Y. Zhang, Non-invasive continuous blood pressure measurement based on mean impact value method, BP neural network, and genetic algorithm, *Technology and health care: official journal of the European Society for Engineering and Medicine*, Vol. 26, No. S1, pp. 87-101, May, 2018.
[9] J. Zheng, Contextualizing public art production in China: The urban sculpture planning system in Shanghai, *Geoforum*, Vol. 82, pp.89-101, June, 2017.
[10] B. Lin, M. Yang, Research on sculpture plan and development in Chinese cities with sculpture plan and scheme of Xi'an a famous historical city, as example, *Xi'an Jianzhu Keji Daxue Xuebao/Journal of Xi'an University of Architecture & Technology*, Vol. 49, No. 4, pp. 497-502, August, 2017.
[11] J. Wang, K. Fang, W. Pang, J. Sun, Wind Power Interval Prediction Based on Improved PSO and BP Neural Network, *Journal of Electrical Engineering & Technology*, Vol. 12, No. 3, pp. 989-995, May, 2017.
[12] R. Toni, L. Ceglia, A likely cranial osteodystrophy (Paget's disease of bone) in a Precolumbian, Mesoamerican stone sculpture, *Journal of endocrinological investigation*, Vol. 40, No. 7, pp. 787-788, July, 2017.
[13] R. H. Cobean, D. M. Healan, M. E. Suárez, RECENT Investigations at Tula Chico, Tula, Hidalgo, Ancient Mesoamerica, Vol. 32, No. 1, pp. 41-55, May, 2021.
[14] S. Naha, S. P. Wu, S. Velmathi, Naphthalimide based smart sensor for CN- /Fe 3+ and H 2 S. Synthesis and application in RAW264.7 cells and zebrafish imaging, *RSC Advances*, Vol. 10, No. 15, pp. 8751-8759, February, 2020.
[15] C. Jaeik, N. Chilamkurti, S. J. Wang, Editorial of special section on enabling technologies for industrial and smart sensor internet of things systems, *The Journal of Supercomputing*, Vol. 74, No. 9, pp. 4171-4172, September, 2018.
[16] A. Menon, M. Rafi, G. Schirmer, T. Tran, J. Whitford, N. Yodo, Y. Kostogorova-Beller, J. Steck, A. Chakravarthy, S. Keshavanarayana, Measurement of wing deflections in flexible aircraft using the sansec smart sensor, *IEEE Aerospace & Electronic Systems Magazine*, Vol. 32, No. 10, pp. 14-23, October, 2017.
[17] A. Y. Alanis, Electricity Prices Forecasting using Artificial Neural Networks, *IEEE Latin America Transactions*, Vol. 16, No. 1, pp. 105-111, January, 2018.
[18] O. I. Khalaf, G. M. Abdulsahib, Optimized dynamic storage of data (ODSD) in IoT based on blockchain for wireless sensor networks, *Peer-to-Peer Networking and Applications*, Vol. 14, No. 5, pp. 2858-2873, September, 2021.
[19] F. Solina, B. Meden, Light fountain–a virtually enhanced stone sculpture, *Digital creativity*, Vol. 28, No. 2, pp. 89-102, 2017.
[20] M. J. Awan, M. S. M. Rahim, H. Nobanee, A. Yasin, O. I. Khalaf, U. Ishfaq, A big data approach to black Friday sales, *Intelligent Automation and Soft Computing*, Vol. 27, No. 3, pp. 785-797, 2021.
[21] Z. Lv, S. Zhang, W. Xiu, Solving the Security Problem of Intelligent Transportation System with Deep Learning, *IEEE Transactions on Intelligent Transportation Systems*, Vol. 22, No. 7, pp. 4281-4290, July, 2021.

Biography

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