Wireless Multifunctional Display Platform for Visual Communication Design Based on IoT Big Data

Baoqing Wang

ZWU Faculty of Design and Architecture, Zhejiang Wanli University, Ningbo 315100, Zhejiang, China

Correspondence should be addressed to Baoqing Wang; wangbaoqing@zwu.edu.cn

Received 12 August 2022; Revised 12 September 2022; Accepted 16 September 2022; Published 30 September 2022

Copyright © 2022 Baoqing Wang. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

An important role of display visual design is advertising and advertising communication, which is an integrated medium, that is, a medium for communicating information. Visual communication design is the most direct way of information transmission in modern society. In today’s increasingly complex and diversified information, visual communication design has been more and more widely used in terms of form and function. On the display platform, the use of visual elements and the expression of visual communication design allows us to examine the different spatial experiences that visual communication design brings to people from a new perspective and adjust the way it is communicated, so as to find a scientific expression. This paper focused on the role of visual communication in display design and discussed its specific application in display design. The use of visual elements in the display space provides a new visual platform for spatial information, making the space design more connotative and cultural. For the smooth experience of media fusion design, it is necessary to ensure that information can be transmitted quickly and smoothly in every link of its processing. In the data write throughput experiment of the microperceptual data layer, the maximum write speed increased by 85.2% compared with the direct write method using the TSBPS method. The findings demonstrated that the IOT-HSQM model’s strategy of first queuing and then segmentation writes may more effectively fulfill the demands of high bandwidth than straight data transmission to HDFS (Hadoop Distributed File System).

1. Introduction

The Internet of things (IoT) refers to the use of various proprietary networks such as communication networks, sensor networks, and industry-specific networks to connect people with people, people with things, and things with things, so as to achieve the purpose of information exchange. To improve the portability, connectivity, and accessibility of the Internet of things, the World Wide Web Consortium (W3C) created a group of specifications described as the Web of Things (WoT). In order to facilitate compatibility between IoT systems and software categories, the W3C Web of Things (WoT) was created. The WoT’s overarching objective is to maintain and enhance current IoT protocols and technologies. The Web of Everything is the next wave of computer intelligence, and it is another revolution in the information industry after computers and modern communications. Transfer of data has become quicker, cheaper, simpler, and greater effective thanks to modern technology. One should not forget about cybercrime and the dangers they pose to our well-being. Visual design has become an important element for people to recognize, appreciate, and realize their own needs. Utilizing the fundamentals of effective graphic arts in images may boost accessibility and enhance learning. The concepts of production appearance explain how components such as contour, structure, color, grid, and area combine to produce well-rounded and meaningful graphics. Particularly, in today’s era of rapid development of interaction design, designers need to achieve a harmonious “realm” between people to meet people’s growing visual needs. People are no longer satisfied with the visual effects displayed by plane images, and the visual design of realistic, three-dimensional, interactive, experiential, and human-computer interaction is more in line with the needs of the times. The existence, development, and basic principles of visual space are of great significance to the current and future visual communication design.
The show system’s pictorial structure should be contemporary. The upgradation has significantly improved the quality of life for humans. The quality of life for most people has been significantly improved by the integration of science, technologies, and market mechanisms. Using simulators as a foundation, online advertising seeks a fusion of “virtual” and “real.” Network virtual display advertising is a new type of visual communication, and its development has brought it to a new level. Wu conducted an in-depth discussion on the characteristics of online advertising and virtual display, analysed its design elements, and summarized its characteristics and laws. The research has certain practical significance, which can provide new ideas for the development of virtual advertising in the future, and add new vitality to the harmonious e-commerce era [1]. The role of British graphic designers and authors in the international dissemination of “Swiss style,” “Swiss graphic design,” or “Swiss typography” is obvious, but little is known about the process and effects of cross-border communication of design. Lzicar followed the trajectory of objects and texts, revealing how they created and disseminated labels in the UK and abroad, thereby contributing to the current understanding of “Swiss graphic design.” Its conclusion was an example of an alternative historiography of modern visual communication as an ongoing process of communication that revealed the complex international interactions of design discourse [2]. As modern scientific techniques develop incessantly, the industry of media advertising has experienced enormous changes, and the forms of traditional printing have been transformed into digital printing gradually. Different from conventional ones, digital advertising has greater flexibility and can be created in different forms according to the feature of the product itself. In addition, visual communicative design also plays a crucial role, and it is an essential way to strengthen digital commercials. Consequently, it is imperative to optimize the visual communication design to improve the quality of digital advertising. To further advance the growth of the commercial digital economy, Li undertook an extensive investigation and examination of both the graphical development of embedded news in Google AdWords [3]. Manufacturers can produce more inspiration and increase the author’s capacity for invention in order to enhance the present computer image technology of image processing. Fan and Li used data in the area of aesthetic and partner services as the focus of their study. He looked into the significance of visual effects becoming a cost-effective and efficient way to transmit real info to the design of mobile media interface through the clarification of graphic data to develop, the technical implementation, and the investigation of clinical science, linguistics, and other concepts that are relevant to digital editing data visualization. In 2022, the field for feature extraction and illustrations will grow to 755.5 million yuan in size. It is certain that, as a future evolution, the broadcast technique of material and picture fusion will also be used in more domains and play a bigger role [4].

In the near future, self-driving cars are an emerging technology to provide a safe and efficient transportation experience. Driverless cars must have in-vehicle channels to wirelessly share road markings. Current new networks are initially demonstrating their limitations due to the explosive growth of traffic patterns. Kong et al. talked about narrowband technology’s potential for use with driverless vehicles. With its number of cosignal strength and channel estimation technologies, mmWave is the next level of wireless technology. Based on these traits, a unique architecture for a vehicle mmWave system is devised that incorporates the benefits of the cloud and IoT. Radar systems that operate at millimetre waves (mmWave) send and collect incident radiation impulses. A radar system can identify the proximity to objects, their solution that can be applied, and their arrival angle by analysing the duration of passage of such radiation impulses through a number of frequencies. Through cloud computing, this underwater acoustic technology enables vehicles to distribute a number of codata about their environment and recognize things in real time. As a result, robot cars can decide on the best driving approach right away [5, 6]. Saxena studied and showed that banks in Oman can use big data analytics and IoT technologies to help them “predict” and “predict now” what it means and can better manage their customers by improving and making their services more efficient. Stergiou combined mobile cloud computing and IoT with big data technologies to study their common features and discover which of the advantages can improve the application of big data. Finally, the respective contributions of mobile cloud computing and IoT to big data technologies are presented [7].

These approaches provided some references for study, but this research has not been recognized by the general population due to the short duration of the related research and the small sample size.

This paper conducted an experiment of microperception data layer data write throughput, and found that the maximum write speed of the TSBPS method increased by 85.2% and the average write speed increased by 41.2%. HDFS write operations can better meet the requirements of high throughput. The data generated by a SensorId in a certain period of time were queried in the HDFS sensor data directory, and it was found that in a 10-minute period, the index-based query time was 7.2 times that of an index-free query. The data locations of different states in a certain period of time on HBase were queried, and it was found that the query based on the cached index is better than the query without the cached index. In the 80 min time period, the query time was 1.88 times that of the uncached. It was verified that the index server caches the index data in the model to improve the query, the hit rate of different strategies with different cache capacity ratios was explored, and it was found that when the cache capacity accounted for 20% of the total data, the HRPB cache hit rate increased by about 30% compared with the LRU cache hit rate.

The rest of the structure is organized as follows: Section 2 presents the method of wireless multifunctional display platform for visual communication design; Section 3 illustrates the experimental design of wireless multifunctional display platform based on IoT big data; Section 4 depicts the data of wireless multifunctional display; and finally, Section 5 concludes the study.

Vision is the most developed and most important of human functions, and it is superior to other senses. In daily life, the environment is observed through our eyes, and our eyes are used to identify things to obtain information [8]. Words, graphics, and images are settled on the retina through the eyeball so that they can be perceived, which is related to the constancy and attraction of vision. The advantages of big data are as follows: it provides instantaneous reaction and improves a deeper comprehension of information; trends are discovered at a large scale; it detects faults and measures risk; better items and services are created; it provides direct power and surveillance, etc.

The constancy of vision means that our eyes have formed a fixed concept in the long-term cognition. Regardless of whether the distance has changed or the viewing angle has changed, it will be regarded as an eternal thing. In visual constancy, the eyeball is also subject to a series of constancy, such as size, color, and shape constancy [9].

When it comes to visual communication, some flat graphics, symbols, etc., will come to mind. If the literal meaning of the word “visual communication” is understood, it is difficult to give a clear definition, because the scope of visual communication is too wide. Everything that can be seen contains more or less elements of visual communication [10].

With the development of the times and people’s in-depth research on visual communication, the most basic elements of visual communication are given academically, namely, “vision” and “communication” [11]. “Vision,” as the name suggests, refers to the images that the eyes can see, such as text, pictures, videos, buildings, abstract light, shadow, electro-optic symbols, and music symbols. “Communication” refers to the process of transmitting information from one party to another. This process can be either within the individual or between the individual and the outside world, such as the information transmission within the human body, between people, and between people and the natural environment [12]. In short, when people see something and react to it and get some information from it, this is the most basic visual communication.

Eye imaging is a very complex process. The physician can now discover indications of eye diseases that were previously undetectable thanks to imaging technology. Retinal imaging can be used to identify eye disorders including diabetic retinopathy, hypertension, age-related vision problems, and damaged optic. Each of these eye conditions requires prompt professional attention to avoid loss of vision. After the light refracted by the object itself enters the eyeball, the pupil starts to adjust its size according to the information of the incoming light, and the lens judges the distance and adjusts the focal length according to the information transmitted by the object, forming an object image on the retina. The retina’s important transmission units are ganglion cells. At the eye region, wherein their neurons congregate, the olfactory nerves are formed through myelinization. Streams of peaks, sometimes referred to as nerve impulses or input features, are used to encrypt their information because it must travel a great distance. A chemical process considered a photochemical reaction is one that is started by the sunlight’s energy being absorbed. As a result of atoms collecting sunlight, transitory stimulated phases are produced, which have very different biochemical and physiological characteristics from the initial atoms. After rods and cones receive information, they undergo photochemical reactions to generate bioelectricity, which makes nerve cells generate impulses, which are then transmitted to the cerebral cortex through the bivel level cell layer and ganglion cell layer to form a visual image (Figure 1) [13].

By understanding the complex mechanisms of eye imaging, causes of dilated pupils and how the eye works will be understood. The causes of dilated pupils are using drugs recreationally, head trauma, tumescence of sexuality, vision test, epinephrine, etc. Some people are insensitive to certain colors because of the lack of several color-sensing cone cells in the retina [14]. When two eyes of a person look at an object at the same time, the spatial position of the object can be obtained from the visual information. It is very helpful to understand the visual elements and display the modeling language of spatial art by understanding the formation mechanism of human vision.

Visual communication design is the use of visual symbols by designers for various forms of design. The designer is the person who transmits the information, and the transmitter is the person who receives the information [15]. “Looking” is a form of communication between people in visual communication design. People who come from different countries, different fields, and languages can communicate culturally and emotionally through visual communication. “Visual symbol” and “communication” are two basic concepts, and “visual symbol” is the visual organ, that is, what people see through vision. Books, posters, architecture, and movies can be used as a visual symbol here. The fact that symbolism is mostly ubiquitous, recognized, and acknowledged on a global scale makes it crucial in visual language. Because of this, many symbol and icon concepts are meaningful. Symbols are used in various types of vector illustrations as well, including advertising, posters, and webpages, to guide people and convey information. “Conveying” refers to the use of symbols by the sender of information to convey the information to the receiver [16]. Individual-to-individual communication is expressed in visual form. As a branch of design, visual communication design, the basic principles of design must be mastered by every well-educated visual designer, namely, plane composition, color composition, and three-dimensional composition [17]. As an important component in the field of visual communication, visual communication design elements have been developed from two-dimensional space form to three-dimensional or even four-dimensional wireless space environmental design, and its principles and methods are constantly changing and expanding in practical applications [18]. The design flow chart is shown in Figure 2.
Wireless multifunctional display refers to the unlimited transmission of information to people in a limited space. Its communication language has the characteristics of representativeness of the times, communication efficiency, persuasion, etc. It has strong memory and far-reaching influence [19]. With the advancement of science and technology, many industries have been successfully applied to their respective fields and achieved good results. On the display platform, due to the constraints of various objective factors, such as various functions, the development of IoT technology in this field is slow, as shown in Figure 3 [20].

Individuals can preserve aids in identifying, information, and programmes in nonpersistent VDI systems using user layers, which are levels that are viscoelastic provided. The common communicating techniques and interface techniques utilized by guests in a network infrastructure are specified at the protocol stack, which is an intermediate level. Application logic and regulations are upheld by the client side. The user experience and associated presenting software are stored in the presentation layer. The transport layer offers dependable data transmission services to the surface layer by facilitating explicit transmission of data among end customers. By control valves, categorization and lack of discipline, and error management, the transportation layer manages the dependability of a direct source. A sensing layer denotes a certain data kind that originates from a specific

Figure 1: Schematic diagram of the function of the optic nervous system.

Figure 2: Design flow chart.
information resource, including cloud services, conventional wireless sensor systems, or PSNs. The display design architecture includes the core content of the display, the communication of the display content, the interactive experience, and the environmental space. This process requires a systematic arrangement of the structure of the display content, space division, streamlined layout, prop selection, and interface settings for the platform. In this process, it is not only necessary to complete the display theme established before, but also necessary to carry out display design on this basis, and to create the atmosphere of the display space [21].

Model establishment is divided into four steps: training set calibration, shape alignment, shape and texture modeling, and appearance model establishment. In order to reduce the disparity among an occurrence of a modeling that is generated and the subject of concern in an image, active appearance models (AAMs) outline an optimizing issue. The process of locating texture boundary via background subtraction is referred as pattern segment. Whenever typical adaptive threshold approaches are ineffective because an organism’s roughness rather than brightness best describes it, texture analysis might be useful.

(1) The shape model refers to the geometric information that is retained after the training samples and reflects the changing laws of the target shape. The establishment process of the shape model is divided into feature point calibration, shape alignment, and model establishment. The n marked points in the image are linearly combined, and several vertices are triangulated to obtain a 2n-dimensional face shape model $R$, as shown in formula (1). Among them, $(x_i, y_i)$ represents the coordinates of the marker point on the image.

$$R = (x_1, x_2, \cdots, x_n, y_1, y_2, \cdots, y_n)^T. \quad (1)$$

The face shape model $S$ is calculated using the covariance formula of shape samples, as shown in the following formula:

$$r = \bar{r} + b_r p_r. \quad (2)$$

In the formula, $\bar{r}$ is the average shape obtained from the training set; $p_r$ is the shape transformation matrix; and $b_r$ is variable shape model parameters.

(2) Establishment of a texture model is divided into texture feature extraction and model establishment.

Extraction of texture features: the texture part uses RGB images. First, the corresponding shape model is triangulated by Delaunay, the entire texture is divided into several triangular patches to obtain the benchmark network, and then, the texture feature information is mapped to the piecewise linear affine method. In the average shape, the extraction of texture features is realized. By generating or originating additional factors, PCA uses this strategy to eliminate the extraneous characteristics that are found in the data. The underlying factors are combined linearly to form these elements. Using a minimal group of “basic indexes” that are
simpler to display and understand, PCA is an analytical package that lets you condense the data contained in huge information sets. A well-liked unsupervised learning method for lowering the dimensions of data is principal component analysis. While minimizing data redundancy, it simultaneously improves comprehensibility. It helps to make easier to display in 2D and 3D and aids in identifying the dataset’s key important properties. PCA is used to reduce the texture information, and the unified standardized model g is obtained, as shown in the following formula:

\[ g = \mathcal{G} + b_g p_g. \]  

In the formula, \( g \) is the average texture model; \( p_g \) is the texture transformation matrix composed of PCA; and \( b_g \) is variable texture model parameters.

The appearance model is obtained by integrating the shape model and the texture model in a unified dimension. To enable quadratic transformations intelligible, eigenvectors can be compared with X-Y line charts that have been compressed or stretched without affecting their orientation. In order to better adjust the newly formed apparent model, a new apparent eigenvector b is obtained by passing \( b_g \) through a certain weight, as shown in the following formula:

\[ b = \begin{pmatrix} w_r b_g \\ b_g \end{pmatrix} + \begin{pmatrix} w_r \varphi_g^T (r - \mathcal{G}) \\ \varphi_g^T (g - \mathcal{G}) \end{pmatrix}. \]  

In the formula, \( w_r \) is the diagonal matrix to adjust the weights.

By adjusting the variable parameter \( p \), the difference between the input image \( I(x) \) and the average texture \( A_0(x) \) is minimized. That is, the energy-optimized nonlinear iterative solution is obtained as shown in formula (5), and the appearance coefficient \( Y \) that minimizes the matching error is obtained to complete the model matching.

\[ \arg\min \left( \sum_{x \in R_q} \left( A_0(x) + \sum_{i=1}^{m} q_i A_i(x) - I(N(W(x; p); u)) \right)^2 \right). \]  

Among them, \( A_0(x) + \sum_{i=1}^{m} q_i A_i(x) \) (6) represents the estimated texture, \( I(N(W(x; p); u)) \) represents the texture obtained by mapping the input image into the average shape, and \( u \) is translation and rotation scaling parameters.

The concept of the Internet of things was originally proposed by radiofrequency identification technology (RFID), which allows everything in daily life to be connected through the Internet, thus becoming a major trend in the field of logistics. Tags and readers are the two halves of the wireless technology recognized as radiofrequency identification (RFID). The scanner is an electronic gadget including one or more transmitters that transmit electromagnetic radiation and take in information from RFID tags. The scanning distance specifications, sensing demands, pricing, shape, mass, and the nature of the application all have an impact on the choice of qualities. Reading range, length, and price are the main differences among resistive and capacitive labels. The current consumption of RFID in repositories and leveraging the information to release workers for tasks that entail greater engagement with users are two of the mankind’s several benefits. With the growth of sensing technologies such as infrared, 4G, and IoT, IoT is defined as a number of networks that connect various objects to the Internet. The present “IoT architecture” normally involves three levels: sensing layer, cyber layer, and applying layer, illustrated in Figure 4.

The main sense tier is made up of sensitive instruments, such as RFID labels and cameras. Their main features are to gather and transport controlled signals. The specific implementation procedure of the perceptual layer is classified into two stages: the communication modem must be authenticated to connect to the LAN; and once the connectivity is succeeded, the perceptual layer can transmit data by the portal or accept information such as control instruction from the terminal to accomplish relative operations.

The least recently used (LRU) caching is a popular technique. Whenever the database is filled, it specifies the strategy to remove pieces in order to create a place for new ones, with the lowest frequently used things being removed initially. As the cache server of the meso-aware data layer, Redis itself supports the LRU cache strategy, and the expiration time can be set for the cached data. Redis will follow the volatile-lru strategy. When triggering the cache replacement strategy, Redis selected the least recent data from the expired data. The accessed data were deleted. However, the core idea of this LRU strategy is that recently accessed data have a high possibility of being accessed in the future. If the data belong to hot data for a long time, the LRU strategy is used very effectively. However, in the case of frequent queries with periodic characteristics, the hit rate will decrease, resulting in serious cache pollution.

The HRPB method proposed a way to score the cached data by weights. The weights represent the possibility of future access. Data with a larger weight are the data most likely to be reused recently, and data with a smaller weight will be preferentially replaced when the cache exceeds the threshold and new data need to be cached. When the access to the data in the cache increases, the weight of the hit data is increased. On the contrary, when the access to a certain block of data decreases, the weight of the data is decreased.

\[ w = tv \cdot k + (1 - k) \cdot \frac{a \cdot f}{\text{size}} \]  

The formula for calculating the weight in the HRPB method is shown in the above formula, which is calculated based on the predicted value of the access frequency trend, the data size, and the data validity period. In the formula, \( w \) represents the weight of the data, and \( tv \) represents the validity period of the data, as shown in formula (8); the parameter \( k \) is used to adjust the influence of the data validity period on the weight \( w; f \) is used to represent the frequency trend prediction value, as shown in formula (7); size is the size of the data occupied space; and \( a \) is an adjustable parameter to ensure the range of the weight \( w \) value.
\[ f = \frac{\text{cout}}{t} \cdot (1 - h) + h \cdot f_o. \]  

(7)

In the above formula, \( t \) represents the last fixed time length. The time length is configurable. \( \text{cout} \) represents the number of accesses to resources in this stage. \( f_o \) is the last access frequency value saved last time. \( h \) is an adjustable parameter, indicating the proportion of historical frequency and current frequency in the result.

\[ tv = \frac{(\text{exTime} - \text{curTime})}{(\text{exTime} - \text{addTime})}. \]  

(8)

In the above formula, \( \text{exTime} \) represents the validity period of the data, that is, the expiration time; \( \text{curTime} \) represents the current time, and \( \text{addTime} \) represents the entry time into the cache.

Spatial propagation can transform coarse depth maps into new, finer, and more accurate images. The image space propagation guided by the affinity matrix is equivalent to the standard anisotropic diffusion process. The graph’s beneficial characteristics are related to the Laplacian matrix in numerous ways. It may be utilized in conjunction with Kirchhoff’s theory to determine how many bridging branches there are in a directed sequence. Therefore, LG has orthogonally eigenvalues with eigenvalue nonexistent: \([0 \; I] \) and \([I \; 0] \), in which the directed sequence. \( x_{ij} \) therefore, LG has orthogonally eigenvalues.

Among them, \( d_u \) is a diagonal matrix; among them, element \( d_{ij} (i, i) \) is the sum of all elements of row \( i \).

\[ d_{ij} = \sum_{j=1, j \neq i}^{n} w_{ij} (i, j). \]  

(11)

The matrix \( H \) is updated recursively in a columnwise fashion. For each column, \( h_u \) is a linearly weighted combination of the previous column \( h_{u-1} \) and the corresponding column \( x_u \) in \( X \).

When the whole recursive process is completed, the updated \( H \) can be expressed as follows:

\[ H_d = \begin{bmatrix} I & 0 & \cdots & \cdots & 0 \\ w_2 & a_2 & 0 & \cdots & \cdots \\ w_3a_2 & a_3 & 0 & \cdots & \cdots \\ \vdots & \vdots & \vdots & \ddots & \ddots \\ \vdots & \vdots & \vdots & \cdots & a_n \end{bmatrix}. \]  

(12)

Among them, \( G \) is a \( n^2 \times n^2 \)-dimensional lower triangular matrix, and \( H_d \) and \( X_d \) are the vectorized \( X \) and \( H \), \( a_u \), \( w_u \), \( d_u \), and \( I \) are all \( n \times n \)-dimensional submatrices; among them,

\[ a_u = I - d_u. \]  

(13)

The transformation process represented by formula (12) can be expressed as a spatially anisotropic diffusion process, and the propagation matrix is the affinity matrix composed of all \( w_u \).

IoT sensing data are the data generated by IoT sensors. The sensor data generation cycle is short, and a large amount of data are transmitted to the data center in real time. The IoT perception data include spatiotemporal data and attribute data. The spatiotemporal data are used to describe the time information and location information of the sensor. Attribute data are used to describe the current state of the...
sensor. A large amount of dense IoT sensor data are continuously transmitted to the data center. Since each piece of sensor data is small data, if these data are written in pieces, the number of HDFS files opened at the same time is limited, and the file connection is continuously opened and closed, which slows down the writing speed. Because the order in which the perceived data arrive is not strictly chronological, the written data will be stored out of order in the file. Therefore, the data should be preprocessed and the directory structure of the HDFS file should be designed.

Since the queries related to the Internet of things are often related to space and time, the HDFS directory structure based on space and time characteristics is designed in the IOT-HSQM system model, and the TSBPS writing method is used to preprocess the data. The specific process is described as follows:

1. The received sensory data by space-time blocks, and the data according to the space-time block classification numbers are classified.
2. The classified original sensory data in combination with the space-time block where it is located and the characteristics of the dataset itself are compressed and cached.
3. When the data cached in the space-time block meet the write data volume threshold and duration threshold, the content of the space-time block is written out to the corresponding HDFS file.

Data are obtained from the upper layers and subsequently communicated to other systems at the protocol stack, where this function is most important. It also immediately sends to the user devices at the same time. One way is that the node changes the format of the data gathered first from network layers so that it may be transmitted easily over the World Wide Web, and 2G, 3G, and 4G networks, among others. Additionally, it is organized after being collected from other connections and given back towards the network layers. The transceiver, broad connection, GPRS, MH network, ZigBee, Gigabit, and other technologies make up the majority of the network layer. In order to combine with the existing system and big data environment, this paper proposed a cloud computing model deployment scheme based on cloud computing, as shown in Figure 5.

Remote Dictionary Server is abbreviated as Redis. It is a storage solution that operates by collecting information in a critical data format for short-term storage. Since it is supported by practically all common computing platforms, Redis cache is well liked. The web browser delivers queries towards the WebSEAL centralized server, where it then communicates with the Redis host to handle sessions in a Redis transaction caching scenario. After receiving the original sensory data in the Redis cache, the sensory data are cleaned asynchronously, and the data items that may be used by the upper-layer application are retained, and converted into a format that is convenient for processing. The cleaned microscopic sensory data are called valid data. After accumulating a certain amount of data in the Redis cluster, these data are written out to HBase in batches. Column-oriented, nonrelational databases such as HBase are common. This indicates that information is organized into categorical variables and referenced using a special column keyword. Using this design, it is possible to efficiently scan through specific fields in a database and quickly get certain rows or columns. Since HBase searches on the row key most efficiently, the row key for storing awareness data should be reasonably designed, and relevant auxiliary indexes should be established.

The broadband connection acts as a transmitter and the receiver function to the application layer. These data are transferred into CVS services and XiInsight-PDS, which are further divided into three different protocols, namely, industrial control communication protocol 1, industrial control communication protocol 2, and industrial control communication protocol 3. The application tier is a collection terminal for data. The application layer gathers sensor data first, then carries out memory, analysis, and computation to deliver particular kinds of services to users. Or in a specific case, in order to meet the corresponding control requirements, the actual control command is transmitted to the object of the perception layer.

### 3. Experimental Design of Wireless Multifunctional Display Platform Based on IoT Big Data

This data cloud platform provides data management services for massive sensor devices, realizes the collection, identification, storage, and display of sensor device resources, and ultimately achieves the goal of providing stable and efficient sensor data management services. The benefits of the cloud platform are durability, reduction in the IT system management and upkeep costs, cooperation effectiveness, lower IT expenses, and accessibility to automated upgrades, which are all desirable qualities. The relevant basic functions of the IoT data cloud platform design are shown in Figure 6.

The sensor device collects data and uploads it to the data management server through the data interface. The user can view the data information of the corresponding sensor device through the client. The functions of the entire cloud platform include four parts: user management function, sensor management function, sensor data query function (chart display), and setting management:

1. **User management function**: the data cloud platform provides sensor data management services for multiple different roles independently, and needs to save the basic information of the user, including the user’s permission information, registration information, and description information. In the process of data processing, storage, and viewing, it is necessary to distinguish according to the corresponding permissions of users.
2. **Sensor management function**: sensor management is the basic function of the data cloud platform. Different types of sensors, including their geographic
location information, sensor description information, and sensor status information, are stored in the database. Some of these data are classified according to user permissions, some are shared information, and different sensor gateways and users need to be stored separately. The system can collect data through sensors, and then, users can add, delete, modify, and query the data through the database.

(3) Sensor data query function: the data of the data cloud platform are open to accounts with different permissions. These accounts can view the basic information and data collection information of various types of sensors in the form of chart display through the client according to their respective permissions, and it is necessary to provide them with a unified data interface API.

(4) Setting management function: this module can set the user’s personal information under this account, such as changing the password and user name.

The experimental environment is a cluster composed of 6 servers. The CPU, memory, and hard disk size of the 4 machines are shown in Tables 1 and 2, and the experimental data are shown in Table 3.

4. Data of Wireless Multifunctional Display Platform Based on IoT Big Data

For the experiment of microperceived data layer data writing throughput, different amounts of data are taken out for writing experiments. For writing, HDFS makes use of the catalog hierarchy and filename approach of the IOT-HSQM model. The average data writing speed and the maximum data writing speed between directly storing data in HDFS and the method of first caching and then clustering write based on space-time blocks are compared. In order to ensure the accuracy of the test results, most of the original sensory data are cached in the memory in advance, and when writing out, the occurrence time of the data is modified in advance to the current time. Figure 7 is a comparison chart of writing speed.

It is clear from Figure 7 that the written speed increases by 85.2% for the maximum write speed and 41.2% for the average write speed compared with the direct write method. The write speed of the TSBPS methodology is significantly better than the direct write speed. Consequently, the method of caching first and then writing in clusters in the sample model can fulfill the demand of high capacity better than direct writing to HDFS.

Query 1: The data generated by a SensorId in a certain period of time in the HDFS sensor data directory are queried. The results are shown in Figure 8.

As can be seen from Figure 8, the index-based HDFS query is significantly better than the nonindexed HDFS query. In the 10 min time period, the index-based query time is 7.2 times that of the nonindexed query.

Query 2: The data location of different states in a certain period of time on HBase is queried. The results are shown in Figure 9.

According to the comparison chart of the experimental results, it can be seen that the query based on the index is obviously better than the query without the index, and the query based on the cached index is better than the query without the cached index. In the 80 min time period, the query time is 1.88

---

Table 1: Hardware and software information.

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU</td>
<td>Intel (R) Core (TM) i5-3470</td>
</tr>
<tr>
<td>Memory</td>
<td>8 GB</td>
</tr>
<tr>
<td>Operating system</td>
<td>Windows 7</td>
</tr>
<tr>
<td>Available hard drive capacity</td>
<td>120 GB</td>
</tr>
<tr>
<td>Network</td>
<td>50 M</td>
</tr>
<tr>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

---

Figure 5: Cloud mode deployment.

Figure 6: Cloud platform system functional design module diagram.
times that of no cache. It is verified that the index server caches the index data in the model to improve the query.

Table 2: Server configuration information.

<table>
<thead>
<tr>
<th>Serial number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server address</td>
<td>172.21.20.147</td>
<td>172.21.20.10</td>
<td>172.21.20.107</td>
<td>172.21.20.111</td>
</tr>
<tr>
<td>Name</td>
<td>Node1</td>
<td>Node2</td>
<td>Node3</td>
<td>Node4</td>
</tr>
<tr>
<td>CPU (s)</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Total hard disk memory</td>
<td>1.8 T</td>
<td>1.8 T</td>
<td>1.8 T</td>
<td>1.8 T</td>
</tr>
</tbody>
</table>

Table 3: Experimental data.

<table>
<thead>
<tr>
<th>Serial number</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data volume</td>
<td>10000 MB</td>
<td>5000 MB</td>
</tr>
<tr>
<td>Serial number</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Data volume</td>
<td>10000 MB</td>
<td>5000 MB</td>
</tr>
</tbody>
</table>

Figure 7: Comparison chart of write speed.

Figure 8: Comparison chart of HDFS query experimental results.
According to the size of the experimental data, the Redis cache size to 30%–70% of the total data volume is set, and the hit rates of different strategies with different cache capacity ratios are recorded. The experimental results are shown in Figure 10.

As can be seen from Figure 10, the HRPB cache replacement strategy has a significantly higher cache hit rate than the LRU replacement strategy. The smaller the cache capacity, the greater the difference in the hit rate between the two strategies. When the cache capacity accounts for 20% of the total data, the HRPB cache hit rate is about 30% higher than the LRU cache hit rate.

5. Conclusion

There are many types of IoT sensing data, and the data with mobile sensors and the sensor data with fixed positions are distinguished by whether the sensor position moves. Aiming at the high-throughput capacity and efficient query and statistical analysis requirements of massive data in the Internet of things, a large-scale data storage and query model IOT-HSQM based on the perception of the Internet of things was proposed to achieve efficient retrieval purposes. With the development of the economy and the frequent foreign trade exchanges, more and more traditional enterprises have become aware of the crisis and realize that the future development trend is bound to be the rapid development of network coverage and globalization, which needs to be combined with the big data technology of the Internet of things. This is not only to promote their own products, but more importantly to display and disseminate culture. Users can understand the functions of the multifunctional display platform through interaction, breaking the traditional display effect of a single picture and text. In the era of the
Internet of things, visual communication design has been carried out from a single medium, and more and more attention is paid to the use of various media in design. The redesign of multimedia fusion is a new design content of it. It focuses on diversified design experience, communication across time and space, nonlinear narration, and personalization of information, making the interaction and experience of information more fluid.

**Abbreviations**

HDFS: Hadoop Distributed File System  
IoT: Internet of things  
WoT: Web of Things  
LRU: least recently used  
PCA: principal component analysis  
AAM: active appearance model  
RGB: red, blue, green images  
RFID: radiofrequency identification technology  
LAN: local area network  
GPRS: General Packet Radio Services.

**Data Availability**

All data generated or analysed during this study are included in the manuscript.

**Conflicts of Interest**

The author declares no conflicts of interest.

**Authors’ Contributions**

Baoqing Wang contributed to the design and methodology of this study, the assessment of the outcomes, and the writing of the manuscript.

**References**