Design of Data Visualization System for Mobile Social Web Front End Development Based on HTML5

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Abstract. In view of the low efficiency of data visualization and the slow speed of database reading and writing when the current data visualization system is dealing with the front-end development data of mobile social Web, a data visualization system for front-end development of mobile social Web based on HTML5 is designed. The data collector is used to collect and store the front-end development data of mobile social Web, and the visual controller is used to communicate with the visual external devices to complete the hardware design of the system. Preprocess the Web front-end development data to ensure the data dimension differences within a reasonable range, divide the data into HTML5, JavaScript, CSS three different forms of files, classify low dimensional data and high-dimensional data, design two types of data visualization interface, complete the system software design. The experimental results show that the reading and writing speed of the database of the design system is accelerated, the data insertion time, query time and visualization time are effectively shortened, and the efficiency of information visualization is improved.

Keywords: HTML5 · Mobile social · Web front end · Development data · Visualization system

1 Introduction

As a new subject, data visualization plays an important role in people's intuitive observation of data, insight into the connotation of data, understanding the law of data, and exploring the knowledge behind data. At present, Internet technology, represented by Web front-end technology, provides technical support for data visualization on display platforms such as PC and mobile terminals. With the help of Web front-end technology, people can visually display and analyze data on computers, mobile phones, tablets and

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other terminal devices, improving the accessibility and comprehensibility of data. Therefore, it is of great practical value and practical significance to study the data visualization system of mobile social Web front-end development.

Since the establishment of the Department of visual chemistry, great progress has been made in the research of data visualization in theory, technology and application. Reference [1] analyzes the semantics of high-dimensional time-varying data, allowing users to change the color, brightness, contrast and other attributes of visual graphics according to their own requirements. It meets the needs of developers and commercial companies for multiple data types visualization, and solves the visualization problems caused by high dimension and large amount of data in parallel coordinate visualization, but the efficiency of data visualization is low. Reference [2] according to the parallel coordinate visualization technology, a parallel coordinate visualization method based on principal component analysis is proposed. This paper defines the parallel coordinates of principal component analysis and cluster analysis, aiming at the problem that the dimension of multi-dimensional data is too high, resulting in the limited width plane, the space between coordinate axes is too narrow, and the visualization lines are dense and crowded. Principal component analysis is used to reduce the dimension of the data, and the parallel coordinates of the processed data are visualized, but the reading and writing speed of the database is slow.

In order to solve the problems of low efficiency of data visualization and slow speed of database reading and writing, a data visualization system based on HTML5 is designed. Through the data collector of visualization system to collect and store the front-end development data of mobile social network, a web front-end data visualization controller is designed with PLC controller as the core hardware. RFID technology is used to identify multi-dimensional web front-end development data. Based on HTML5, the visualization development process of Web front-end is optimized. Taking the web front-end development data of HTML5 file as low dimensional data, the multi-dimensional visualization prototype interface and low dimensional visualization prototype interface are designed. It solves the problems of low efficiency of data visualization and slow speed of database reading and writing.

2 Mobile Social Web Front-End Development Data Visualization System Hardware Design

2.1 Data Collector

The data collector of the visualization system is designed to collect and store the front-end development data of mobile social Web. The data acquisition channel, communication interface, system operation conditions and human-computer interaction are the main components of the data collector. The overall framework of the data collector is as Fig. 1.

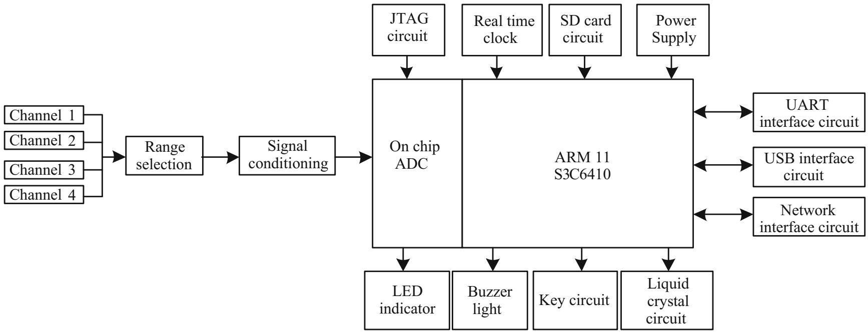

Fig. 1. Overall framework of data collector

As shown in Fig. 1, before the voltage signal is input into the ADC interface, the internal ADC of S3C6410 is used to carry out analog-to-digital conversion on the data acquisition channel, so as to complete signal conditioning, range selection and isolation protection, so that each channel can be compatible with current and voltage. SD card circuit, JTAG circuit, power supply and real-time clock are selected to provide clock source, current and voltage, Linux kernel image and bootloader for the visualization system [3]. Human-computer interaction selects key circuit, liquid crystal circuit, buzzer and LED indicator, and communication interface selects USB interface circuit, UART interface circuit and network interface circuit to provide support for LXI bus LAN specification, system function interface, and peripheral equipment. The circuit of the data acquisition channel is designed by using the backplane and core board. The core board uses two Samsung K4X1G163PE chips, omitting external components, using DDR SDRAM memory, and reading the startup code through the reset address [4]. The power circuit structure of the data collector is as Fig. 2.

After the voltage is introduced through the backplane, after voltage stabilization, denoising, filtering, and DC/DC isolation, the Web front-end development data and user stack are stored in DDR SDRAM, the input voltage is reduced to a fixed limit, and a low-level reset signal is output [5]. Furthermore, it provides a stable input voltage and realizes the design of a data collector for Web front-end development data.

2.2 Visual Controller

Taking PLC controller as the core hardware, the Web front-end data visualization controller is designed. The model of the SCM is selected as F8LE52-0S, which uses Ethernet interface, communication mobile phone, computer and other visual display external devices to provide output signals for external devices, and control the conversion of high and low signal levels, so as to realize the DC input and output of the system power circuit [6]. The visual controller develops multiple peripheral interfaces. Through the FA-M3 PLC controller, it programs each visual scheduled task, outputs the visual control instructions of the Web front-end development data, gradually issues the visual operation commands, communicates the signal transmission circuit, responds to the transmitted command signals, and then drives the visual equipment [7]. The basic peripheral circuit structure of the visual controller is as Fig. 3.

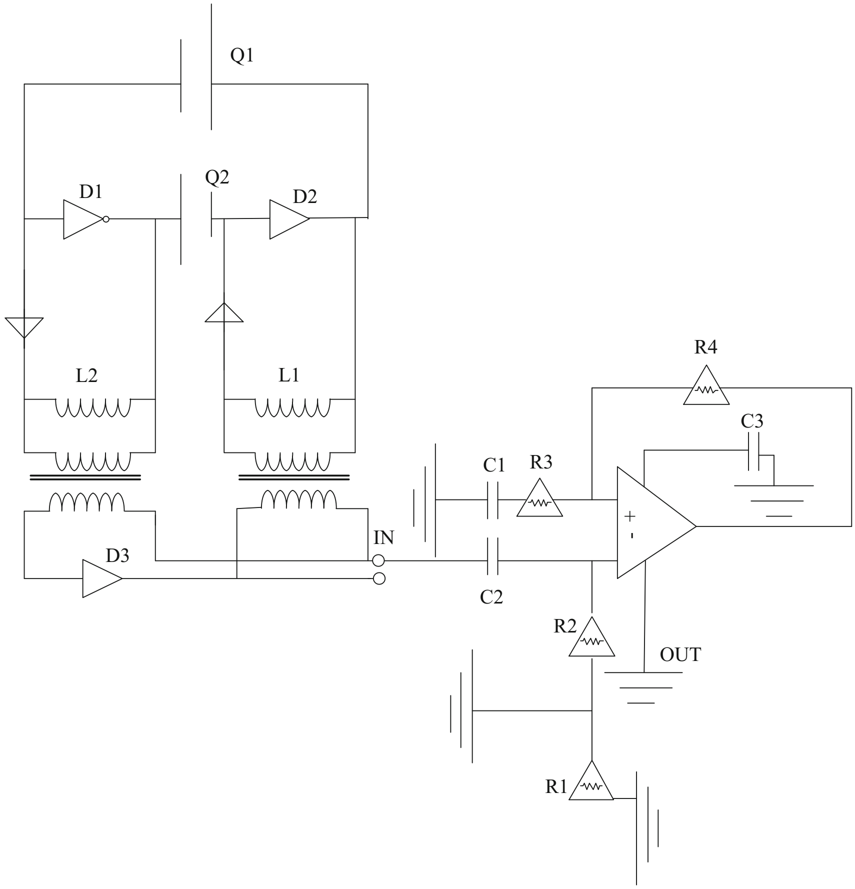

Fig. 2. Power circuit structure of data collector

The circuit is equipped with multiple analog comparators, supports multiple communication modes, and centrally processes the communication data of visualization devices. The driver chip of the circuit is TH83872S, which turns the reset signal to the low level to control the power switch, amplify and shape the collected data of the sensor, and respond to the visualization information after A/D conversion to ensure the normal operation of the visualization controller. So far, the design of data visualization controller for Web front-end development is completed, and the hardware design of the system is completed.

3 Software Design of Data Visualization System for Mobile Social Web Front End Development

3.1 Preprocessing Mobile Social Web Front End Development Data

On the basis of hardware design, the software is designed. RFID identification technology is used to identify the multi-dimensional Web front-end development data, and

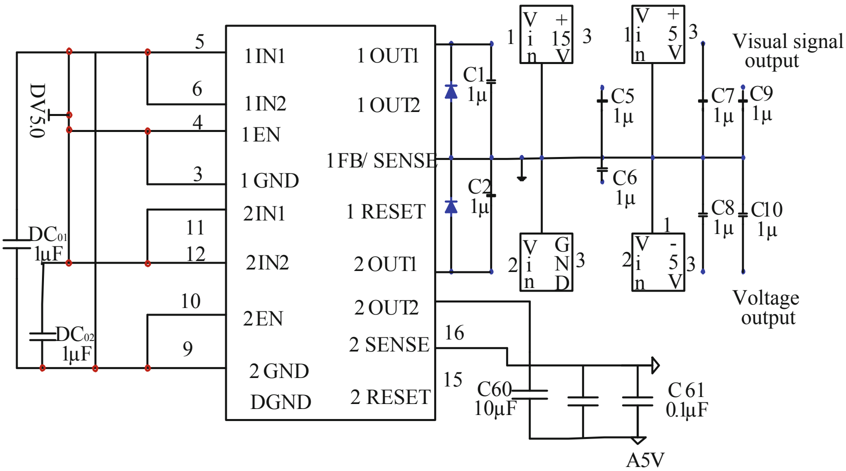

Fig. 3. Basic peripheral circuit structure of visual controller

then mobile information technology, computer, network and mobile devices are used to establish a computer supported collaborative environment, form a sensor network, and screen the Visual Web front-end development data, including the state quantity of development data and the quantity measurement of development data [8]. The error square sum criterion function is used as the clustering criterion function. The Web front-end development data set is divided into clusters composed of multiple types of objects, and then the connection rules between the development data are mined to achieve the accurate division of data dimensions. The clustering formula is as follows:

$$E = \sum_{j=1}^{K} \sum_{x \in C} \left| x_j - \overline{x_j} \right|^2 \tag{1}$$

In formula (1), E is the clustering function of Web front-end development data, x_j is the data set of the j cluster, $\overline{x_j}$ is the mean of the data set, C is the cluster center of the data set, and K is the cluster set. Through formula (1), the same set of Web front-end development data is divided into different sets. This paper uses statistics to clean the Web front-end development data, uses k-nearest neighbor algorithm to remove the default value in the original Web front-end development data, and counts the information data with the highest frequency as the replacement value of the default value [9]. The formula for calculating the encoding width B of substitution value is as follows:

$$B = \frac{V}{2(\xi \times F)} \tag{2}$$

In formula (2), V is the range available for Web front-end development data, F is the selectable gain for data acquisition, and ξ is the resolution of the collector. Through smooth filtering, the high-frequency part corresponds to the noise component, and the Web front-end development data is denoised. Through linear interpolation technology, the lost Web front-end development data is recovered. Finally, the data comparison work is carried out to detect the retention, error and expiration rate of Web front-end development, so as to ensure that the overall state of Web front-end development data set is good, so as to ensure that the dimension difference of Web front-end development data is within a reasonable range, so that a large number of Web front-end development data can be transformed into an easy to understand mode. So far, the preprocessing of mobile social Web front-end development data is completed.

3.2 Optimize Web Front End Visualization Development Process Based on HTML5

Optimize the Web front-end visual development process, and divide the preprocessed Web front-end development data into three different forms of files: HTML5, JavaScript and CSS. When developing Web front-end and data visualization Web page, we first write HTML structure document, add header, navigation, content and footers, etc. In W3C style specification, the use of abbreviated attributes, including font, background and border, etc., in which the background location of HTML file can obtain images, which can reduce the number of HTTP requests, save bandwidth, but also speed up the loading process, reasonably plan the image background, and facilitate the current visual file design and maintenance. Then add more detailed HTML tags, before completing all the document structure, write the performance code to ensure that the HTML page structure is good, and can be displayed through any style.

CSS belongs to both design and development. Like other languages, its syntax also needs to be standardized, and the parsing performance of CSS needs to be improved while maintaining clear structure [10]. First of all, the Web front-end development data is abbreviated, CSS attribute abbreviated can effectively reduce the data style, through the repeated use of style class, can control the number of ID and class, flexible use of HTML tags for image merging, deep understanding of CSS priority rules, mining Web front-end development data deep style attribute, ensure the data style attribute mode. In order to ensure the writing of standard CSS, we need to verify it. W3C provides an online verification tool to ensure that the writing of verification style meets the standard and solve the problem of Web standard.

JavaScript file format is compatible with the Web development environment, which needs to be comprehensively considered in combination with the technical level of developers, the applicability of visualization requirements, and the applicability of Web front-end development data [11]. JavaScript Mobile is used to assist the development of visualization, such as sliding, click events, AJAX requirements and other visual effects. For the applicability of Web front-end development data, A-level browser is used to provide support to detect whether the document quality is perfect, the framework scalability, framework size, visual performance, execution speed, visual code modularity, code reusability, etc. In view of the good code structure of the visualization module, the ready method is used to initialize it, and the data document of the Web front-end development and the use method of the visualization module are described in detail, so as to improve the maintainability of the front-end development. So far, the Web front-end visualization development process optimization based on HTML5 has been completed.

3.3 Design Web Front End and Develop Data Visualization Interface

Taking the Web front-end development data in the form of HTML5 file as the low dimensional data, and the development data in the form of JavaScript and CSS file as the high dimensional data, the multi-dimensional visual prototype interface and the low dimensional visual prototype interface are designed respectively. According to different data dimensions, different data visualization processing methods are adopted [12].

When the Web front-end data is low dimensional data, enter the low dimensional data visualization module to analyze and study the data. The low dimensional data visualization prototype interface is as Fig. 4.

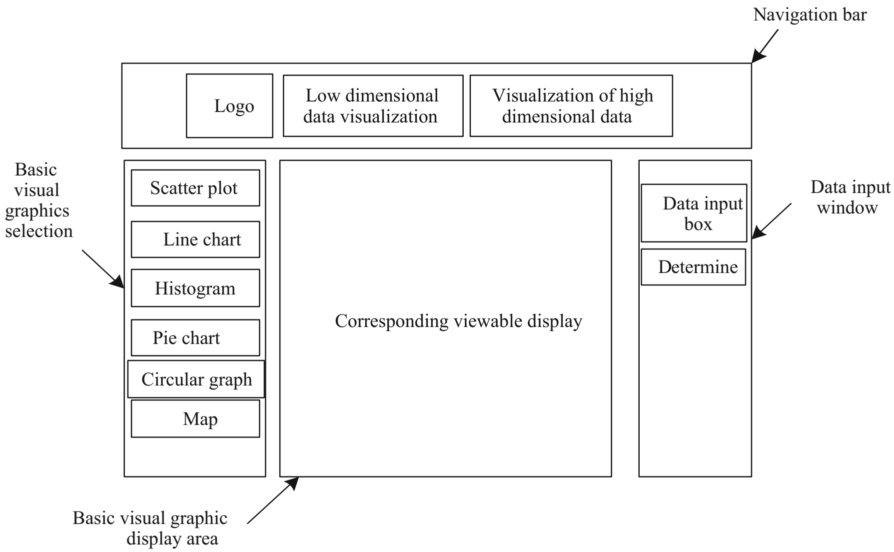

Fig. 4. Low dimensional data visualization prototype interface

The Web interface mainly includes four parts: navigation bar, basic visual graphics selection bar, graphics display area bar and data input window bar. In the visualization graph selection area, there are basic types of data visualization charts, and different types of basic charts can be selected. The graph display area is used to display the visualization results of low dimensional data, and the data input window area is used to input low dimensional data [13].

For multi-dimensional web front-end development data, K-means clustering algorithm is used to process the data. A large amount of data is divided into groups, that is, the data is divided into multiple categories, and the parallel coordinates of the clustering results are visualized. The multi-dimensional data visualization prototype interface is as Fig. 5.

The interface is composed of four parts: navigation bar, interaction bar, graphic display area and data input window. The upper side of the interface is the navigation bar, which has a logo, low dimensional data visualization and multi-dimensional data visualization module selection button [14]. Click the button to switch to the corresponding

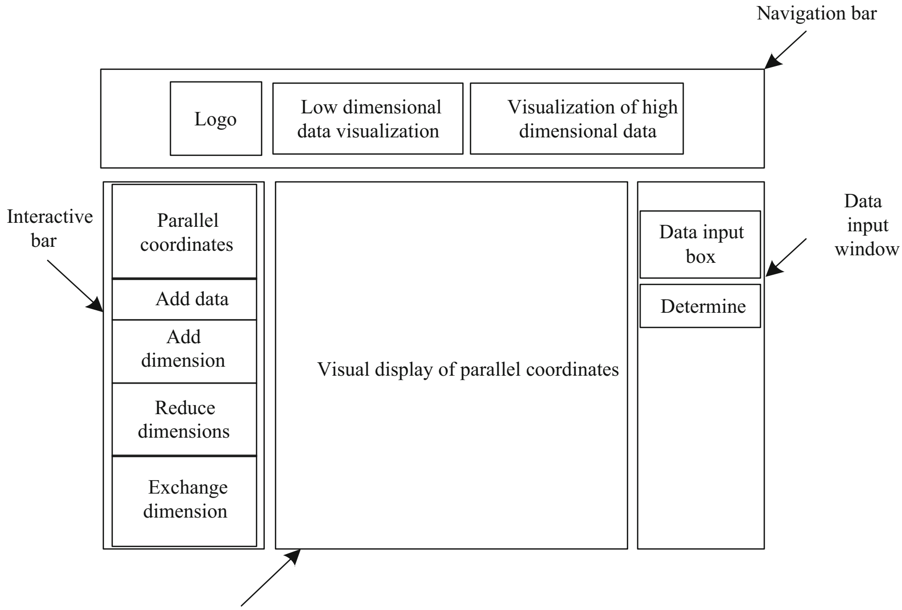

Fig. 5. Multi dimensional data visualization prototype interface

function module. The interactive column area mainly includes parallel coordinate graph, add data, add dimension, reduce dimension and other interactive operation types. The graphic display area is mainly used to display the parallel coordinate map. The parallel coordinate map is obtained through interactive operation and displayed in this area. The data input window is responsible for data input [15]. In the web front-end interface of visualization system, the navigation bar of low dimensional data and high-dimensional data has the same function and can be regarded as a public module, while the other three parts are slightly different according to the specific function division. So far, the design of data visualization interface for web front-end development is realized, and the system software design is completed. Combined with hardware design and software design [16], the design of data visualization system for mobile social web front-end development based on HTML5 is completed.

4 Experiment and Analysis

The design system is compared with reference [1] and reference [2] mobile social web front-end development data visualization system, and the visualization efficiency and database reading and writing speed of the three groups of system Web front-end development data are compared.

4.1 Experimental Preparation

Set up the experimental environment as the client computer is the s530i3-41304G1T host, the T410 G645 host, the hard disk is 1000G, the memory is 60 GB, the server host is a 2G/300AN rack-mount host, the host device CPU is PowerEdge 2900, and two GHSK 7283 processing are configured. The CPU cache is 8M, the frequency is 1700 MHz, the hard disk is 400 GB, and the network environment is 150 Mb/s of the power internal private network. The deployment architecture built is as Fig. 6.

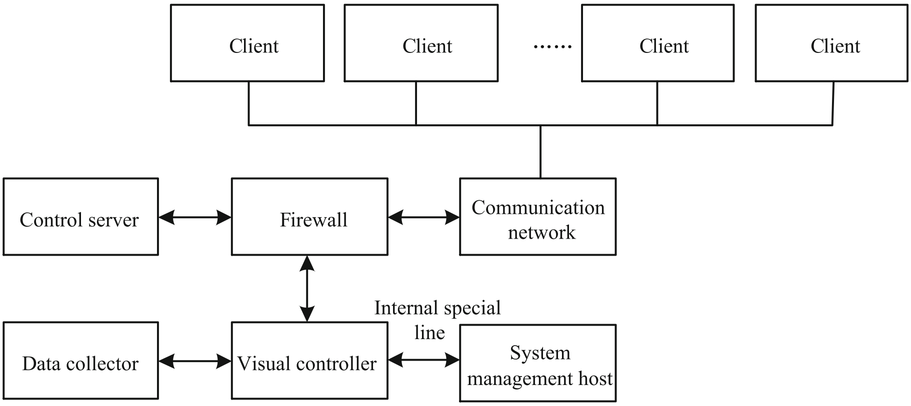

Fig. 6. Visualization system deployment architecture

Select the appropriate load balancer, forward the front-end development data of mobile social web to the front-end cluster, buffer and send it to the visualization system for data analysis and processing, and the manager completes the management operation of the system through the host.

4.2 Experimental Results

Data Visualization Efficiency Test
Set the amount of information data to 5000 MB, compare the data visualization efficiency of the three groups of systems, set the data insertion to single thread execution, change the number of data import, and compare the data insertion time of the three groups of systems. The experimental results are as Table 1.

It can be seen from Table 1 that with the increase of information data, the data insertion time of three groups of systems increases. When the amount of information data is 5000 MB, the data insertion time of the design system is 8.16 s, the data insertion time of reference [1] system and reference [2] system is 29.35 s and 34.92 s respectively. Therefore, compared with the reference [1] system and the reference [2] system, the data insertion time of the design system is shorter. Because the data collector of the visualization system of the system can speed up the speed of data collection and process data faster. This method is obviously superior to the other two data acquisition methods.

On this basis, the visualization time of the three groups of systems is further counted, and the experimental comparison results are as Table 2.

Table 1. Comparison results of data insertion time of three groups of systems

Information data volume/MB	Design system data insertion time/s	Reference [1] System data insertion time/s	Reference [2] System data insertion time/s
500	2.83	10.37	12.74
1000	3.38	11.73	13.74
1500	3.94	12.06	14.02
2000	4.15	12.74	14.72
2500	4.65	13.17	15.38
3000	5.05	13.84	15.73
3500	6.73	16.63	17.18
4000	7.25	20.39	23.73
4500	7.74	24.04	28.03
5000	8.16	29.35	34.92

Table 2. Comparison results of visual display time of three groups of systems

Information data volume/MB	Design the visual display time of the system/s	Reference [1] system visualization time/s	Reference [2] system visualization time/s
500	257	521	622
1000	261	532	643
1500	289	557	672
2000	302	593	702
2500	328	624	731
3000	362	667	769
3500	381	681	791
4000	399	709	827
4500	437	746	872
5000	458	781	906

It can be seen from Table 2 that with the increase of information data, the visualization time of three groups of systems increases. When the amount of information data is 5000 MB, the visual display time of the design system is 458 s, the visual display time of the reference [1] system and the reference [2] system is 781 s and 906 s respectively. Therefore, compared with the reference [1] system and the reference [2] system, the visualization time of the design system is shorter. The system uses RFID technology to identify multi-dimensional web front-end development data, which can quickly transfer information and shorten the visual display time of the system.

Set the number of thread queries to 100, read the front-end development data of mobile social web in the system at the same time, use the server to query the corresponding data in the system according to the visualization request of the client, and compare the data query time of three groups of systems. The experimental comparison results are as Table 3.

Table 3. Comparison results of data query time of three groups of systems

Number of thread queries/pcs	Design system data query time/s	Reference [1] system data query time/s	Reference [2] system data query time/s
10	0.82	3.78	3.98
20	0.89	3.82	4.27
30	0.93	3.91	4.42
40	0.96	4.02	4.68
50	0.99	4.17	4.92
60	1.05	4.33	5.27
70	1.14	4.49	5.74
80	1.22	4.62	5.92
90	1.26	4.89	6.21
100	1.27	5.71	6.39

It can be seen from Table 3 that with the increase of the number of thread queries, the data query time of the three groups of systems increases. When the number of thread queries is 100, the data query time of the design system is 1.27 s, the data query time of the reference [1] system and the reference [2] system is 5.71 s and 6.39 s respectively. Therefore, compared with the reference [1] system and the reference [2] system, the data query time of the design system is shorter. Based on the above analysis, the time of data insertion, query and visualization of the design system is short, which can effectively improve the efficiency of data visualization. Because the system uses the circuit driver chip TH83872S to turn the reset signal to the low level to control the power switch, amplify and shape the data collected by the sensor, so that the data transmission is faster and the data query time is shorter.

Database Reading and Writing Speed Test

On the basis of data visualization efficiency test experiment, unlimited web front-end development data sampling points are set. The databases of the three groups of systems can support the sampling of data points, and the maximum number of records is more than 15 million. 10 experiments are conducted respectively to compare the read-write performance of the database and the read-write speed of direct positioning. The experimental comparison results are as Table 4.

Table 4. Comparison results of database reading and writing speed of three groups of systems

Number of experiments/pcs	Read and write speed of design system database (10000 times/s)	Read and write speed of reference [1] system database (10000 times/s)	Read and write speed of reference [2] system database (10000 times/s)
1	201.3	176.2	162.1
2	200.1	175.9	163.2
3	200.9	175.2	163.0
4	201.5	175.4	163.7
5	200.6	176.2	162.9
6	200.5	176.1	162.5
7	201.8	175.9	162.1
8	200.9	175.9	162.6
9	201.1	176.3	162.7
10	201.3	176.2	162.5

It can be seen from Table 4 that the average reading and writing speed of the database of the design system is 2.01 million times/s, and the database can save 200000 data sampling points within 1–2 s, while the average reading and writing speed of the reference [1] system and the reference [2] system are 1.759 million times/s and 1.627 million times/s respectively, and the database can only save 175000 and 160000 data points within 1–2 s. Therefore, compared with the reference [1] system and the reference [2] system, the reading and writing speed of the design system database is faster. To sum up, the design system shortens the data insertion time, query time and visualization time, improves the efficiency of information visualization, speeds up the reading and writing speed of database, and ensures the throughput performance of Web front-end development data. Compared with the other two systems, the system uses mobile information technology, computers, networks and mobile devices to establish a computer supported collaborative environment, forming a sensor network. The information transmission speed of the system is faster, the transmission content is more accurate, and the reading and writing speed is faster.

5 Conclusion and Outlook

This research designs a visualization system for mobile social web front-end development data, which effectively improves the visualization efficiency and reading and writing speed of Web front-end development data. It can greatly improve the speed of network information circulation, further promote the development of games and e-commerce, speed up the refinement of Internet industry, and strengthen network marketing. However, there are still some shortcomings in this study. The system is not necessarily suitable for non numerical data. Moreover, it has poor applicability in the fields of text, image, sound and other computer applications. In the future research, the initial clustering center will be randomly selected from the data set to realize the visualization of hierarchical data and network log data.

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