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APPLICATION OF HIGH-DIMENSIONAL DATA VISUALIZATION AND VISUAL COMMUNICATION TECHNOLOGY IN VIRTUAL REALITY ENVIRONMENT

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Abstract. How to efficiently find what you want from massive data has become a hot topic. It is precisely because network information is developing so fast that so many data-oriented software systems and pages are used to manage so much network information. Aiming at problems such as insufficient information mining of visual communication websites in ASPNET and poor visual communication effects, a design scheme for integrating high-dimensional data into visual communication websites is proposed. Its working architecture includes high-dimensional data integration, multi-type visual integration, and visual support services. The main functions of the website include comprehensive management, charts, data sources, projects, systems, etc. We have conducted specific design and Implementation of high-dimensional information integration on the website, completed the design and Implementation of integration of high-dimensional data, integration of multiple visualization types, and integrated access to visualization-supported functions. Use a deep web crawler to search the visual site. It uses a search-based approach to filter URLs and crawl valuable web pages. Practice has proved that the intelligent distribution network management page implemented by the solution proposed in this article has good performance. The system shows good performance in visualization implementation and the ability to discover information. The system achieved sound and visual communication effects.

Key words: High-dimensional data; Visual communication; Visualization; Virtual Reality Environment

1. Introduction. In today's society, with the continuous advancement of science and technology, network technology, software and hardware technology are developing rapidly. The amount of information available on the Internet has also increased significantly. How to efficiently find what you want from massive data has become a hot topic. It is precisely because network information is developing so fast that so many data-oriented software systems and pages are used to manage so much network information. The most important of these solutions is visualization. Its most outstanding feature is that it reads data in a form that users can directly receive, providing users with a convenient place for data analysis and learning [1]. Therefore, data visualization has gradually become an essential means of enterprise information management. The design scheme of the visual website based on ASPNET is characterized by rough information mining and poor visualization effects. For this reason, this topic plans to study the visualization page with the support of high-dimensional data to improve the information content and visualization performance of the visualization page.

2. High-dimensional data integration method in Visual Computing .

2.1. Operational Architecture for high-dimensional data integration . Use the JavaEE high-dimensional data integration platform to integrate multi-source data and realize visual expression pages. The integration of high-dimensional data, data visualization technology, and visualization support services integration realize the visualization and visualization of data [2]. When designing the page visualization, according to system integration needs, the visual page based on high-dimensional data can be combined to obtain system data, customize visualization effects and other functions. The web page running architecture is shown in Figure 2.1. The web operating architecture includes the following.

1) Integrate high-dimensional data: The page can integrate high-dimensional data. It provides the integration of various data and solves the integration methods of data files and other functions. The integration of data is completed by the identification and organization of data [3].

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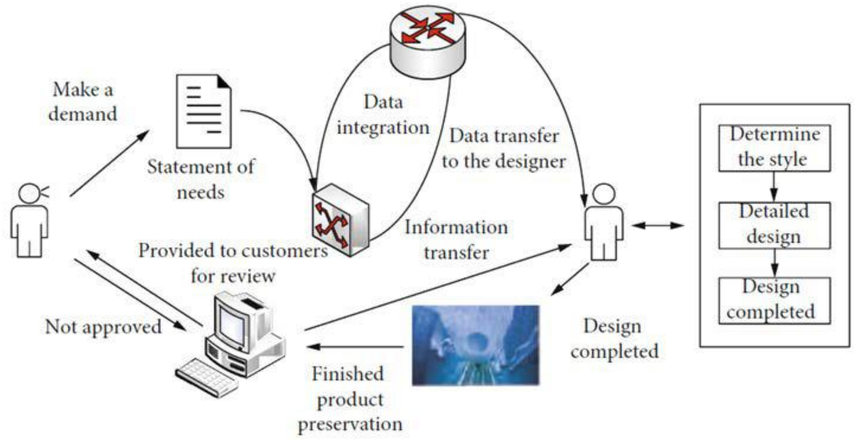

Fig. 2.1: Visual communication web page operation architecture diagram

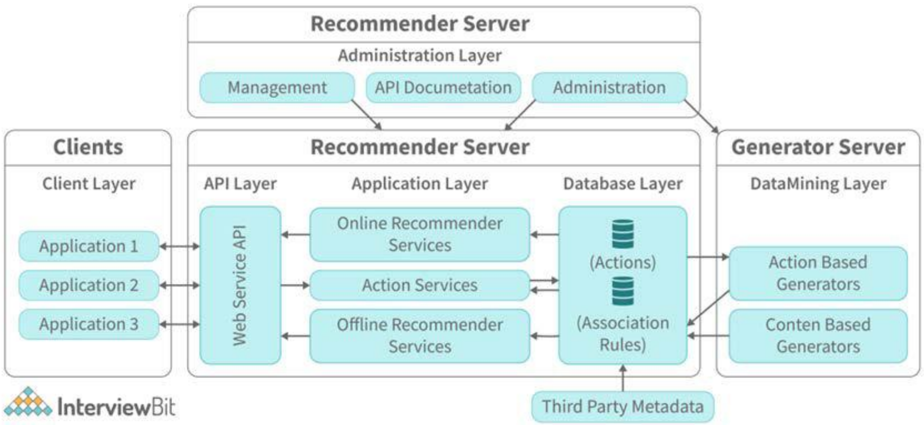

Fig. 2.2: Web page functional architecture diagram

2) Multiple types of visualization integration: It enables the page to display the visualization results of different data so that the visualization technology is consistently integrated. This feature enables the integration of large-scale graphs and data visualizations.
3) Visual support service: It provides a unified visual information integration interface for information exchange between web applications and pages. This facilitates data exchange.

2.2. Web page functional architecture design. The page's overall function has five aspects (Figure 2.2). They are application system integration management, chart management, data source management, project management, and system management.

1) Application system integration management: When users decide on web system integration, data encryption, chart display, etc., online, the web page will summarize the user's various needs. Data can be visualized through a system parameter docking interface, visual comprehensive access and other means.
2) Graphical management: From the four perspectives of visual customization, data visualization and resource visualization integration, it helps users understand the page status presented after integrating data. This is an essential feature.
3) Data source management: Manage databases, files and metadata to determine the scope of use of the website.

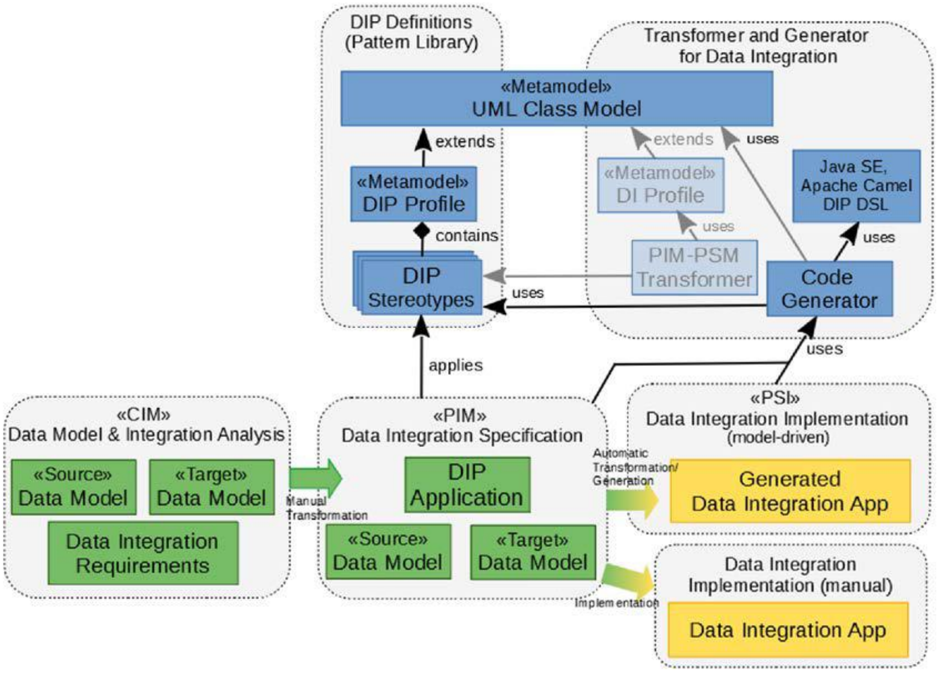

Fig. 2.3: High-dimensional data integration function design

Its operation relies on the integration of data resources and business processing.

4) Entry management: Entry is a Web page's most basic management unit. In the same project, it can build multiple data sources, charts, application systems, etc. Data exchange is only possible within the same project.

5) System management: System Management is the most basic management unit of the Web page. It has a user system, permission system, security management, and system monitoring to support page data management. And ensure that the work of the website can be carried out smoothly.

2.3. Design and Implementation of high-dimensional data integration function based on Web pages.

2.3.1. Integration function design of high-dimensional data. The visual expression page designed in this paper needs to have the function of high-dimensional data integration. The goal is to meet the growing need for data integration. A scalable and unified data fusion rule is proposed based on the characteristics of high-dimensional data fusion. Realized the normalization of online data integration, induction and classification [4]. Visual communication websites should also have the ability to exchange online data. The goal is to integrate various types of databases and to be able to read various types of data. The design of the integration function of high-dimensional data is illustrated in Figure 2.3.

Third-party technology is the technical support for integrating this information. This enables the most basic browsing and retrieval of data files. If you want to perform more difficult operations on data files and improve the utilization efficiency of data files, then introduce table management into the design to complete the table management of the database [5]. Users can perform complex string splitting or splicing operations on the database by sorting the data files into the database and then adding them to the database table.

2.3.2. Implementation of integration functions for high-dimensional data. High-dimensional data integration of web pages can be carried out from three aspects: input information of web pages, underlying data integration applications, and data integration. The page information to be entered includes database

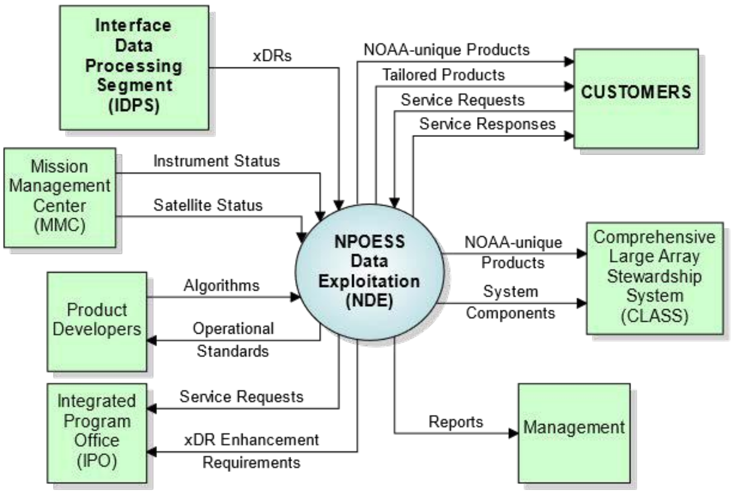

Fig. 2.4: Operation diagram of various visual integration functions

classification, connection address, user name, etc. The primary database application is for creating databases [6]. Data integration is to present data objects in JSON form based on the actions of web page data. High-dimensional data integration uses many input and output operations to complete long-term operations. It can withstand heavy network traffic. Use interface programming ideas and SOA application methods to make various data operations independent modules. Dubbox turns every module into a function in Zookeeper. The above operations further improve the efficiency of integrating high-dimensional data.

2.4. Implementation of multiple types of visualization integration functions. Achieve multiple visualization integrations, realize visualization technology integration, visual customization, visual data visualization and other functions. Various forms of visual integration are oriented to network technology users, network users, and application system users. Visual integration mainly includes visual technology integration services, visual customization services, data visualization, configurable resources, configurable integrated documents, etc. Its functional operation diagram is shown in Figure 2.4. Multi-type visualization integration generates the same integration rules based on integrated files, combining file integration with dynamic loading of services to expand the visualization scope [7]. This function supports visual technical information organization, visualization effect customization, and visual display, thereby expanding the scope of page visualization operations.

2.5. Integrated access design of Visual Service functions. The visibility support function is the most essential thing in the visibility communication of the website. The software can be customized to integrate information on visually communicated pages. The system presents visual data to users [8]. The system's primary functions include integrated management, system parameter interface, visual integrated access, etc. Integrated visibility access allows users to obtain results after processing the visibility page by executing the system parameter interface when receiving user instructions. Then, the data access, query and implementation analysis were carried out. This process is shown in Figure 2.5.

1. Users can use visual Web pages.
2. Visual Integration Access Visual effect check in Cache service based on integrating high-dimensional information.
3. Continue to use cache traffic to access permission information without visual effects being detected in the cache traffic.
4. Explore the various visual interfaces corresponding to it.
5. The results of the operation are visually stored. 6) Provide visual results to users.

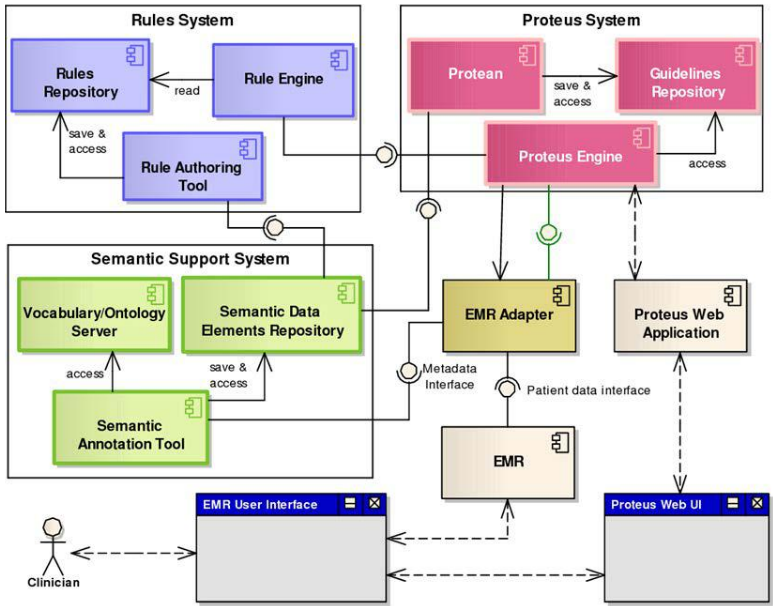

Fig. 2.5: Visual integration access process.

2.6. Workflow of deep web crawler. Dark web scrapers are used to retrieve visual sites. Its crawling method is consistent with other crawlers. It crawls valuable web pages [9] after reducing the links to a list of URLs. Unlike other crawlers, this crawler will only crawl the website's content when crawling. The focus of its work is whether it exists on the Web page. This article uses the following method to change the page content into a crawler form. The whole process is like this:

1. A deep web crawler crawls this URL.
2. Construct a Web site retrieval form ontology through a deep web crawler.
3. Deep web crawler crawls the page in the retrieval form.
4. Download the pages captured by the Deep web crawler and parse the search form.
5. Pre-populate the required search form.
6. Submit pre-populated results.
7. Store the required forms and display results.

3. Visualization and rapid clustering of high-dimensional data. V_{ktij} represents the data block. $k = 1, 2,\ \mathrm{K}, q, q$ represents the number of variants of the category. q represents the number of all variants. $t = 1, 2,\ \mathrm{K}, T, T$ represents a known specific moment. $i = 1, 2,\ \mathrm{K}, m, m$ represents the meaningful number of times in a single variety. $j = 1, 2,\ \mathrm{K}, n, n$ represents the number of sequence values in the data grid [10]. If we only look at a single variety, these data $q = 1$ can be reduced to V_{tij}. If it is $m = 1$, the data can be represented by V_{tj}. At this time, if the calculation is performed in days, the data cube will be reduced to a sequence $\{V_t\}$.

We use $V_{kt} = (V_{ktij})_{m\times n}$ to express this matrix [11]. The vector $V_{kt}\varepsilon_n$ obtained by multiplying the variable ε_n by the righthand side is called a weighted average. For example, taking $\varepsilon_n = \left(\frac{1}{n}, \frac{1}{n},\ \mathrm{L}, \frac{1}{n}\right)'$ as an example, $V_{kt}\varepsilon_n$ is the average of n days. When the left multiplied vector δ'_m corresponds to the left multiplied vector, the intermediate value $\delta'_m V_{kt}$ is obtained.

$$| \ u_{kt} = \delta'_m V_{kt}\varepsilon_n$$

This leads to the order of k and $\{u_{kt}\}$. $\{u_{kt}\}$ sequences can be found in a huge dynamic database. Multidimensional data patterns require analysis of data based on data cubes [12]. Select an orthogonal function system $\{\sin t, \cos t, \sin 2t, \cos 2t,\ \mathrm{L}\}$ on $[-\pi, \pi]$ and establish the following mapping:

$$\begin{aligned}&Z=(z_1, z_2, \cdots, z_m) \rightarrow g_z(t)= \\ &z_1 \sin t+z_2 \cos t+z_3 \sin 2t+ \\ &z_4 \cos 2t+\cdots-\pi \leq t \leq \pi\end{aligned}$$

1. Maintain linearity.
2. Euclidean distance.
3. It represents a oneto-one relationship from D^m to S^m.

If each component of Z has nothing to do with homoskedasticity ε^2, then if m is an even number, there is the following equation

$$\operatorname{zar}\left(g_z(t)\right)=\frac{m \varepsilon^2}{2},-\pi \leq t \leq \pi$$

When m is an odd number

$$\frac{(m-1) \varepsilon^2}{2} \leq \operatorname{zar}\left(g_z(t)\right) \leq \frac{m \varepsilon^2}{2},-\pi \leq t \leq \pi$$

If $Z \sim N_q\left(\lambda, \varepsilon^2 A_q\right)$, then it is possible that $1-\beta$

$$\left|g_z(t)-g_\lambda(t)\right|^2 \leq \frac{\varepsilon^2(m+1)}{2} x_m^2(\beta),-\pi \leq t \leq \pi$$

Here $x_m^2(\beta)$ is the chi-square distribution quantile β. Triangular polynomial graphs with infinitely many projection directions are proposed. That's what makes it unique. If $z, \varphi \in D^m$, then the Euclidean distance between z, φ is

$$d_{z, \varphi}^2=(z-\varphi)^{\prime}(z-\varphi)$$

Because $g_z(t)$ and $g_{\varphi}(t)$ are both multipliable squares on $[-\pi, \pi]$. The following parameters can determine the Euclidean distance

$$\begin{aligned}d_{g_z g_{\varphi}}^2 &=\int_{-\pi}^\pi\left|g_z(t)-g_{\varphi}(t)\right|^2 d t \\ d_{g_z g_{\varphi}}^2 &=\int \pi d_{z \varphi}^2\end{aligned}$$

$d_{g_z g_{\varphi}}^2$ has at most level $W\left(n^2\right)$ complexity. The definition of Euclidean distance is as follows:

$$g_{g_z g_{\varphi}}^0=\int_{-\pi}^\pi\left|g_z(t)-g_{\varphi}(t)\right| d t$$

In specific numerical simulations, two different approximation methods can be used. Its operational complexity is $W\left(n^1\right)$! a. $g_{g_z g_{\varphi}}^0 \approx \sqrt{\pi} \sum_{i=1}^m\left|z_i-\varphi_i\right|$ b. $d_{g_z g_{\varphi}}^0 \approx \frac{2 \pi}{\zeta} \sum_{i=1}^\zeta\left|\sum_{j=1}^m \gamma_{i j}\left(z_i-\varphi_i\right)\right|$

All γ_{ij} here are unchanged. For each i there is the following formula:

$$\begin{aligned}&\left(\gamma_{i 1}, \gamma_{i 2}, \cdots, \gamma_{i m}\right)=(\sin (-\pi+2 \pi i / s), \\ &\cos (-\pi+2 \pi i / s), \\ &\sin 2(-\pi+2 \pi i / s), \\ &\cos 2(-\pi+2 \pi i / s), \cdots)\end{aligned}$$

This equation effectively controls accuracy. Because $d^0_{g_z g_\varphi}$ represents the area of the two curves g_z and g_φ. Compared with the Euclidean distance of g_z and g_φ, it is not only more robust, but its geometric characteristics are also more significant. First divide segment $[-\pi, \pi]$ into ζ segments:

$$\tilde{d}^*_{\substack{g_z g_\varphi \\ n\to\infty}} = \frac{2\pi}{\zeta}\left| g_z\left(-\pi + \frac{2\pi}{\zeta}i\right) - g_\varphi\left(-\pi + \frac{2\pi}{\zeta}i\right)\right|$$

Let z and φ be two points on the $2q$ dimension,

$$\begin{aligned}
& g_z\left(-\pi+\frac{2\pi}{n}i\right) = (z_1, z_2, \cdots, z_{2q})\left(\sin\left(-\pi+\frac{2\pi}{n}i\right),\right. \\
& \cos\left(-\pi+\frac{2\pi}{n}i\right), \cdots, \sin q\left(-\pi+\frac{2\pi}{n}i\right), \\
& \left.\cos q\left(-\pi+\frac{2\pi}{n}i\right)\right)^T \quad i = 1, 2, \cdots, n \\
& g_\varphi\left(-\pi+\frac{2\pi}{n}i\right) = (\varphi_1\varphi_2, \cdots, \varphi_{2q})\left(\sin\left(-\pi+\frac{2\pi}{n}i\right),\right. \\
& \cos\left(-\pi+\frac{2\pi}{n}i\right), \cdots, \sin q\left(-\pi+\frac{2\pi}{n}i\right), \\
& \left.\cos q\left(-\pi+\frac{2\pi}{n}i\right)\right)^T \quad i = 1, 2, \cdots, n \\
& g_x\left(-\pi+\frac{2\pi}{n}i\right) - g_u\left(-\pi+\frac{2\pi}{n}i\right) \\
& \cos\left(-\pi+\frac{2\pi}{n}i\right), \cdots, \sin q\left(-\pi+\frac{2\pi}{n}i\right), \\
& \left.\cos q\left(-\pi+\frac{2\pi}{n}i\right)\right)^T \quad i = 1, 2, \cdots, n \\
& g_x\left(-\pi+\frac{2\pi}{n}i\right) - g_u\left(-\pi+\frac{2\pi}{n}i\right) \\
& = (x_1-u_1, x_2-u_2, \cdots, x_{2q}-u_{2q}) \times \left(\sin\left(-\pi+\frac{2\pi}{n}i\right),\right. \\
& \cos\left(-\pi+\frac{2\pi}{n}i\right), \cdots, \sin q\left(-\pi\left(\frac{2\pi}{n}i\right)\right), \\
& \left.\cos q\left(-\pi+\frac{2\pi}{n}i\right)\right)^T \quad i = 1, 2, \cdots, n \\
& d^0_{g_z g_\varphi} = \frac{2\pi}{\zeta}\sum_{i=1}^{\zeta}\left|\sum_{j=1}^{m}\gamma_{ij}\left(z_i - \varphi_i\right)\right|
\end{aligned}$$

4. Experimental results and analysis.

4.1. Development of intelligent power grid dispatching system in the network environment. This software has been widely used in the operation management, equipment management and user services of electric power enterprises. It has real-time monitoring, calculation analysis, information exchange and other functions [13]. The page has very little traffic. Figure 4.1 illustrates the overall trend effect of the intelligent allocation management page designed in this way through experiments (picture cited in Designs 2022, 6 (5), 88). The entire analysis page can be applied to calculate the company's electricity consumption during each period. Calculation is performed based on the data configured according to the device number, and the overall

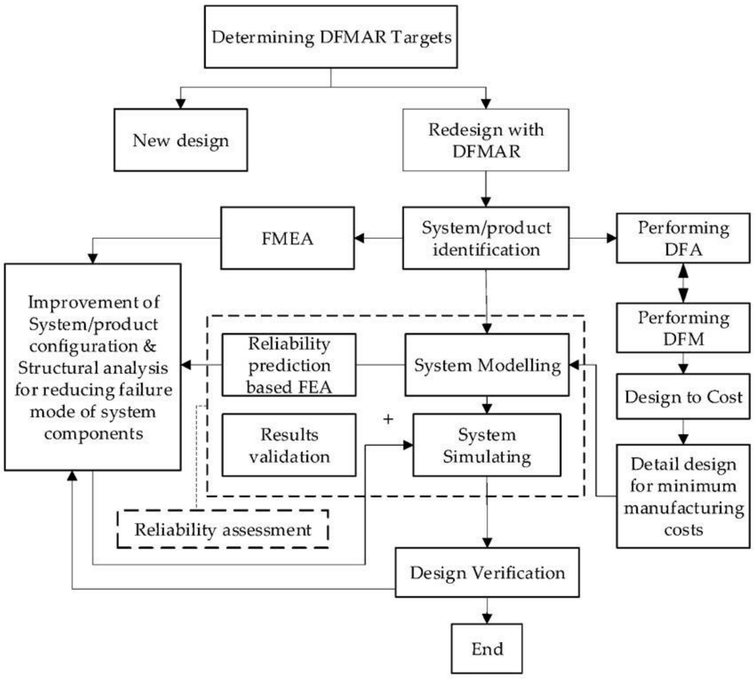

Fig. 4.1: Deep in web crawler operation process.

Table 4.1: Comparison table of visualization tools

Contrast item	**Methods of this article**	**Jaspei Report**	**Pentabo Reporting**	**DataV**
Multiple data sources	support	not support	support	not support
Online customization and maintenance	support	not support	not support	support
Visualization source	Open source	Independent research and development	Open source	Independent research and development
Compatibility with other visualization technology architectures	compatible	Not compatible	Not compatible	Not compatible
Seamless integration	easy	complex	complex	difficulty

power trend is displayed with dynamic data. Through case analysis, it is proved that the intelligent distribution network management page implemented by this method has sound effects in practical applications [14]. It is a compelling power distribution management web page.

4.2. Visualization implementation effect inspection. In this way, when working with other application systems, the operation of other application systems can become more convenient. Among them, high-dimensional data fusion, multi-type visualization fusion, and visualization support are critical [15]. Through experiments, the method in this article and other visualization methods are compared in terms of each function's support, compatibility and difficulty when designing intelligent power distribution management pages. These results are illustrated in Table 4.1. Compared with other visualization methods, we can see that this solution can provide multiple data sources, online customization and maintenance functions. It is compatible with other visualization technology architectures. Easy to seamlessly integrate the system. This method shows good results in page visualization.

Table 4.2: Mining data

Project	The data obtained by this method	Data obtained by ASPNET method
Number of visits to the site	41.7	26.0
Number of forms that have been processed	129.2	102.1
Number of forms submitted	46.9	33.3
Maximum number of forms submitted	78.1	62.5
Minimum form size	2.1	1.0
Minimum assignment merge level	0.6	0.5

Table 4.3: List of websites obtained by this method

Website name	URL
meituan.com	https://www.meituan.com/
Are you hungry	https://www.ele.me/
Ctrip	https://hotels.ctrip.com/
Public comment	https://m.dianping.com/
Tik Tok	https://www.douyin.com/
Taobao	https://taobao.com/
quick worker	https://www.kuaishou.com/

Table 4.4: List of websites obtained by traditional ASPNET method

Website name	URL
meituan.com	https://www.meituan.com/
Are you hungry	https://www.ele.me/
Ctrip	https://hotels.ctrip.com/

4.3. Data mining performance testing. By comparing with the traditional ASPNET algorithm, the application of this algorithm in "food" and "games" is verified [16]. The experimental data are given in Table 4.2. It can be seen that this algorithm obtains more data than the conventional ASPNET algorithm. It shows that this algorithm has a better retrieval effect in food and game retrieval. It can better uncover more helpful information. The list of all sites obtained by experimental statistics is shown in Tables 4.3 and 4.4. The site list obtained this way is more detailed and richer in content. The results show that this algorithm has good results in information mining.

5. Conclusion. A multidimensional fast clustering algorithm is proposed based on the visual processing of multidimensional data. The paper also provides a comprehensive design method for visual communication websites. Then, an improved Web page data analysis method is proposed. The experimental simulation found that this algorithm achieved better results.

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