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Decision-making System Model of Modern Enterprise Management Based on Big Data

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Abstract: *The current era of big data has brought many opportunities for enterprise management, and the use of big data can guide modern enterprise management decisions. Based on this, the decision-making system model of modern enterprise management with big data is studied, with a data visualization system proposed. Based on the development status of the information-based supervision system of the process plant and the actual application requirements of the enterprise, the key technologies of the information-based supervision system of the process plant in view of the contradiction between the two are studied. The practice shows that the experiment has improved the technical level and supervisory ability of the information-based supervision system of the process plant, which can guide the decision-making of the production enterprise.*

Keywords: *big data; enterprise management; decision-making*

1. Introduction

Enterprises face the encirclement of "mass data" in the market activities, and form the impact and subversion of the traditional enterprise management mode. Faced with this situation, enterprises should actively seek innovative approaches to their management mode, so as to establish a survival foundation in the era of "big data" [1]. The big data era tests the ability of enterprises to use data. For traditional enterprises with non-internet attributes, there are still many restrictions on building big data management ideas, including the reconstruction of market supply relationship, unbalanced resource allocation in each link, immature industrial chain, etc. [2]. Among them, the most critical is the failure to effectively collect, mine and analyze data in the traditional enterprise management mode, which leads to poor market adaptability of products and lagging service. Therefore, the advent of the era of big data requires enterprises to reverse traditional management ideas [3]. From the perspective of individual enterprises, the basic idea of big data utilization is "simplification" rather than "mass". The simplification of data that has little or no impact on its own business and the selection of high-performance data also reflect from the side that intangible assets such as technology, innovation and human capital start to dominate [4].

2. State of the Art

The innovation of modern enterprise management mode should mobilize all factors related to the enterprise. From the perspective of innovation, it mainly includes big data management thinking, big data management organization and big data management talents [5]. The key to the formation of big data management thinking is to improve business intelligence. If an enterprise wants to realize the management mode innovation under big data, it needs to lay a good foundation of Internet information processing and cultivate the data awareness of enterprise personnel. In particular, management personnel should fully realize the importance of data in enterprise management and realize the authenticity, timeliness and reliability of data, which leads to the requirement of the ability of big data mining, analysis and utilization of management personnel. The reason is that the formation of business intelligence relies on the effective support of enterprise business data, and the massive characteristics of big data as well as the rapid occurrence of data. For enterprise managers, the lack of data awareness is just like that without tightening the tap; data resources will be lost greatly. Improving business intelligence of enterprises can effectively avoid this problem and realize all-around collection, analysis and sorting, so as to help enterprises gain more knowledge in decision-making [6]. The construction of

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big data management organization is an effective paradigm to innovate enterprise management mode. In recent years, with the continuous enrichment of modern enterprise management ideas, China's enterprise organizational structure has been affected to some extent. On the whole, there is a tendency of "vertical structure" to "flat structure". However, this kind of organization still aims at giving play to the internal management effect of enterprises, including performance, motivation, power and responsibility, etc. Cultivating the big data concept of enterprise employees is a necessary measure to innovate the enterprise management mode. On the premise of not breaking the organizational structure of enterprises in reality, big data management organization is an effective method, which also provides multiple reference paradigms [7]. Increasing the proportion of big data management talents in enterprise management from scratch to existence and from less to more, and realizing progressive management mode innovation, is a feasible path for Chinese enterprises at the present stage [8].

3. Methodology

3.1. Structure design of enterprise files

Enterprise decision-making is a decision made by the relevant organization of the enterprise in order to enhance the enterprise strength and improve the profitability of related production and operation activities. Based on the extensive application of mobile Internet technology, the advantages of social network can be brought into full play to form the "interlocking" effect of enterprise management [9-11]. In traditional management mode, enterprises pay little attention to employees' social life, which is essentially a waste of resources. Big data manager is the sustainable force of the innovation of enterprise management mode at the present stage. The logical structure of the snapshot file determines what the snapshot contains and what it does [12-14]. Therefore, when designing the structure of the snapshot file, the function of the snapshot file needs to be fully considered. According to the definition of snapshot, the snapshot file should contain the screenshot file of the 3D scene and a series of monitoring information. These two parts are used for rendering under different terminal platforms, that is, they are cross-platform shared objects, and also an essential part of the snapshot file structure. However, the snapshot file only contains those two parts, not representing the attributes of the snapshot. The property information of snapshot file will play a very important role in the sharing mechanism. Therefore, additional data structures are needed to store the snapshot's property information.

The logical structure of the snapshot file is shown in figure 1. The snapshot file contains two files, one is the image file of the snapshot and the other is the description file of the snapshot. The snapshot image file provides a 3D scene map for the display of detection point information. The snapshot description file is used to describe the information about the snapshot file itself. It contains the measurement point information and the property information of the snapshot file. Besides, the property information includes the snapshot description, snapshot image information and snapshot parameter information.

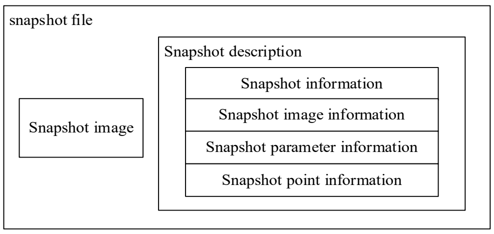

Figure 1: Logical structure of snapshot files

Snapshot description information is composed of a series of structured information modules, each of which needs to be well defined. Snapshot description information is composed of a series of structured information modules, each of which needs to be well defined. Data description language based on XML schema can be used to define legitimate building blocks for XML documents. For example, the elements, attributes, child elements, and the order and number of child elements that appear in the document [15-17]. Besides, it can be used to define the data types of elements and attributes, and so on. Thus, XML defines data structures in an open, self-describing way. The description of the structure can be highlighted while describing the data content, thus reflecting the relationship between the data. Therefore, it is a good choice to use XML files to store snapshot

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description information [18-19].

Firstly, the "snapshot description information" tag element and its custom data type, Snap Shotlnfo, are defined. In this data type, four sub-elements, in turn, are "snapshot description information", "snapshot image information", "snapshot parameter information" and "snapshot measurement point information". Then, these four child elements are defined below [20]. The custom data type for the "snapshot description information" element is SnapShotTotallnfoDef. The general information of the eight parts about the snapshot elements is recorded, including: length of snapshot name and name of the snapshot, the length of the author's name, and the author's name, production date and production time of the snapshot, the length of the scene name of the factory model as well as the scene name of the factory model, number of snapshots, number of measurement points, length of remarks information and content of remarks information. The custom data type for the "snapshot image information" element is SnapShotlmagelnfoDef, which records basic information about the snapshot image, including the image's name length and image name, the length and width of image resolution. The custom data type for the "snapshot parameter information" element is SnapShotParameterlnfoDef, which records a series of necessary parameters that are closely related to the 3D model scene when the snapshot image is generated, including the viewpoint coordinate parameter in the 3D scene, the vector parameter in the direction of sight, the angle parameter of view and the parameter of reverse rotation angle.

The custom data type for the "snapshot point information" element is SnapShotSitelnfoDef, which records the information of the measurement points added within the scope of the snapshot image area during the process of snapshot generation, including measurement point ID, equipment ID under test, station ID belonging to the factory, measurement point name, measurement point type, monitoring type, numerical unit, numerical upper bound, numerical lower bound, rated frequency, snapshot coordinate X, snapshot coordinate Y. Among them, the X and Y parameters of the snapshot coordinates refer to the position of the measurement point model in the 3D scene relative to the lower left corner of the scene image.

3.2. Generation methods of enterprise files

Snapshot files are generated based on rendering a 3D model of the process factory. By setting snapshot parameters, calculating 3D scene parameters, setting image parameters, adding measurement points and other steps, the snapshot description information is generated, and the corresponding snapshot files are generated according to different application terminal types of snapshot. In a snapshot file, different number of measurement points can be added to the contents of the snapshot image. Multiple snapshot files can be made according to specific business needs.

Next, a detailed explanation of the algorithm flow chart of the snapshot file generation is given in figure 2.

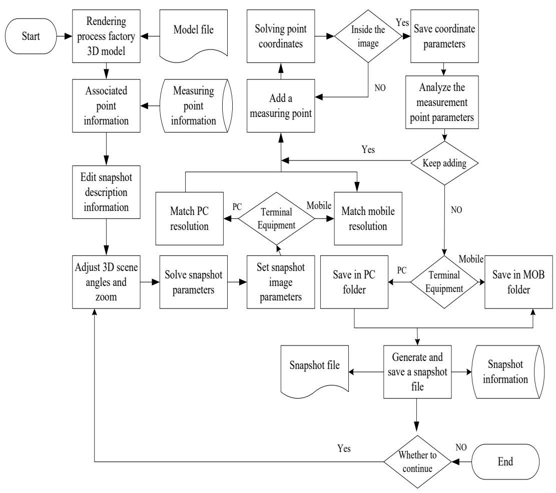

Figure 2: Algorithm flow chart for generating snapshot files

The first is the data preparation of the snapshot, which is divided into two stages: rendering model and point correlation. In the process of rendering the 3D model in the process factory, the system traverses and parses the model file to generate the model node tree. Any local model scene in the 3D scene is a node of this tree. Then, in the correlation stage of the detection point information, the detection point information in the database is associated with the node in the model node tree. STATE OF THE ART includes the content of the detection point information associated binding.

When creating a snapshot file, firstly, it is needed to edit and set snapshot description information and parameters. Among them, the length of snapshot name, author name, the length of factory model scene name and note information are calculated automatically after editing the corresponding content in the interface of snapshot generation in the system, in bytes. The number of measurement points refers to the value automatically calculated by the system after adding the measurement points. Then, in the visual port of 3D scene, the perspective of 3D scene is changed by mouse dragging, and the size of 3D scene is adjusted by mouse wheel. Any local scene in 3D scene can be presented in the visual port of 3D scene with the optimal perspective and size view. At this point, the system calculates snapshot parameters, including viewpoints, views and perspectives. The scene view is used to generate the picture file for the snapshot file.

For business purposes, the snapshot application scenario is not limited to the PC side, but can be extended to the mobile side. At this point, different image resolution needs to be set to match the PC side and the mobile side respectively. After the image resolution is set, the measurement point is selected to add to the snapshot file. At this point, the system first calculates the coordinates of the model nodes corresponding to the selected measurement points in the 3D scene image. Then, the image resolution is used to judge whether the model is in the range of the image. Detection points that are not in the image range cannot be added to the snapshot file. After a measurement point is added successfully, the system saves its coordinate parameters and converts them into percentages relative to the length and width of the picture, as the display position parameters in the snapshot measurement point information. The system then parses the name, type and value parameters of the measurement point based on the added detection point ID. Different images of different scenes contain different number of measurement points, so different number of measurement points can be added to the picture. When the operation of adding the measurement point is finished, according to the image resolution set before, the system will determine which terminal the snapshot file is applied to. And the terminal type includes PC terminal and mobile terminal so as to generate different file saving paths.

Finally, when the snapshot file is generated, the system intercepts the image of the 3d scene viewport as the picture file of the snapshot, and saves the manually edited and set content and parameters automatically parsed by the system as the file in XML format according to the structural definition of the snapshot description file. After the snapshot file is generated, in order to realize file sharing, the system needs to save some metadata of the snapshot file, including the snapshot name, image resolution, native storage path, and so on. This information is stored in the snapshot information database and can be used for both local retrieval of snapshot files and cross-platform sharing of subsequent snapshot information, as detailed in the next section.

3.3. Web sharing mechanism for enterprise data information

The cross-platform sharing of snapshot information refers to the snapshot information generated on a PC, which can be transmitted through the network and displayed in other different types of network display terminals. Depending on the screen resolution of the display terminal, the organization of snapshot information will be adjusted adaptively to maintain the integrity of snapshot information and the rationality of display effect. A schematic diagram of snapshot information sharing across platforms is shown in Figure 3.

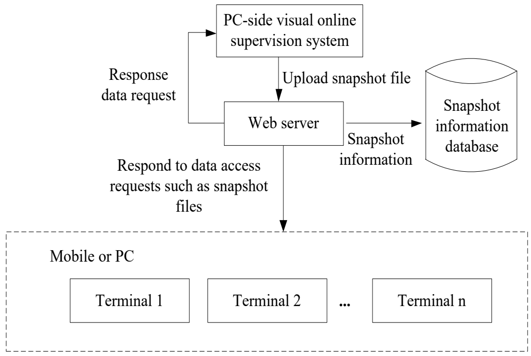

Figure 3: Schematic diagram of snapshot information sharing across platforms

As shown in figure 3, in the cross-platform sharing mechanism of snapshot information, the Web server provides necessary data support for desktop or mobile terminals, including data of user identity authentication, data of factory station matching, detection point information of factory station, monitoring data, and so on. The desktop visual online supervision system generates snapshot files and uploads them to the Web server. The Web server organizes and stores snapshot files by parsing the snapshot description file, writing the snapshot name, snapshot image resolution, and save path of the snapshot file to the snapshot information database, and responding to browser requests of various terminals for access to snapshot information. The processing of these access requested by the Web server constitutes the core of the cross-platform share mechanism for snapshot information.

The user sends an access request for snapshot information to the Web server through a desktop or mobile browser. After receiving the request, the Web server first needs to identify and record the resolution data of the terminal screen sending the request. Then, the query condition of the resolution data is retrieved in the snapshot information database. If the retrieved snapshot information does not exist in the database, a prompt message with the content "currently unmatched snapshot" is returned to the browser. Otherwise, an array of strings whose elements are the names of the snapshots is generated. The resolution of the snapshot images identified by these names is the same. After that, the contents of the array to the initialization Web page template are written, generating an initialization Web page file. This file serves as the first Web page file returned by the Web server to the browser, providing a list of snapshot names that users can access. When the user selects to view a snapshot, click the corresponding snapshot name and the browser sends a request to the Web server to view information about a particular snapshot file.

When the Web server receives the request message, it queries the snapshot information database for the storage path of the corresponding snapshot file. The snapshot file is read, and the content related to the browser side display is extracted to be written to the snapshot's Web page display template. In addition, web page files that can be used for final presentation are generated and returned to the browser for parsing. The snapshot Web page presentation template is a set of HTML formatted files, similar to the visual template file in chapter 3. Each template file contains a fixed content and structure, where the location of specific data is replaced with variable parameters. Different template files can be designed to meet various personalized needs according to the differences between their presentation content and presentation effect.

4. Result Analysis and Discussion

Taking advantage of the visualization and analysis of multi-dimensional data by using the parallel coordinate chart, the water quality indexes and other parameters of sewage treatment plant are visualized. The index parameters obtained by the measurement points mainly include the accumulative flow rate, PH value, CODcr (dichromate index), nitrogen content and phosphorus content. The level of dichromate index reflects the severity of organic pollution in wastewater, while the high content of nitrogen and phosphorus will lead to eutrophication of water.

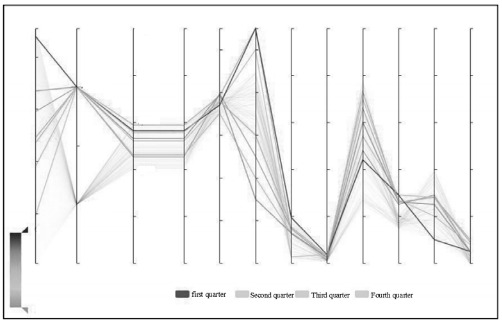

Figure 4: Brush technology for data filtering

The data from four quarters of a year in a sewage treatment plant is used for case study. Data in 91 days are extracted from each quarter. It can be directly observed whether the quality of the water discharged in a season is up to standard. Through the comparison between coordinate axes, the correlation between dimensions can be explored from the horizontal. By switching the data of different quarters, the data of a certain dimension can be compared vertically to find the rule of changing with the quarter. The line representing substandard water quality is highlighted by brush technology (as shown in figure 4). It is not difficult to find that the PH value of substandard water is too acidic or too alkaline. The content of nitrogen and phosphorus in effluent is also relatively high, which may be due

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to the wrong regulation of PH in sewage during the treatment process, which affects sludge activity and reduces the consumption capacity of organic matter in sewage, thus increasing the content of nitrogen and phosphorus in effluent. The fitted curves for the parameter identification are shown in Figure 5.

The sewage treatment plant should strengthen the management of the production process in the season when the inflow is large, or add equipment and instruments, expand the production scale and enhance the sewage treatment capacity. There is no significant difference in PH and dichromate index in the inflow between seasons. The nitrogen content of the inflow varied with the change of seasons, and is negatively correlated with the accumulated water inflow, possibly because the inflow has a dilution effect on the nitrogen content. However, the effect of the inflow on phosphorus content is not obvious. It is therefore established that the sources of nitrogen and phosphorus in the sewage in this plant are different (figure 5).

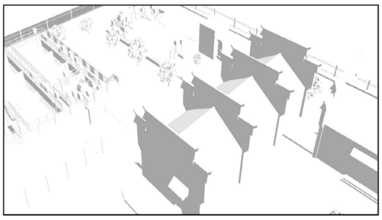

Figure 5: Plant 3D model framework

Under the same experimental conditions, the combined recommendation algorithm and the item-based KNN collaborative filtering recommendation algorithm are respectively used to calculate the values of accuracy and recall rate on the two data sets. The experimental results of accuracy and recall are shown in Figure 6 Figure 7:

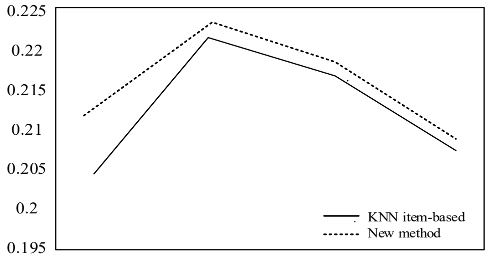

Figure 6: Comparast results of accuracy

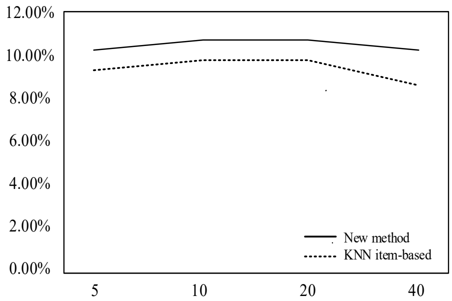

Figure 7: Comparison results of recall rates

Book rating information on an e-commerce site was used as a dataset for experiments. Assuming an N value of 10, accuracy and recall were calculated for this dataset. The experimental results of the accuracy and recall of this dataset are shown in Figure 8.

It can be seen from the above experimental results that the improved combined algorithm can improve the accuracy and recall rate to a certain extent. The higher the value of the accuracy and recall rate is, the better the performance of the algorithm is.

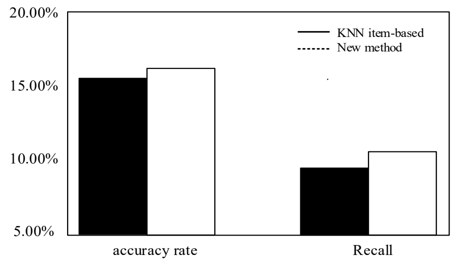

Figure 8: Experimental results on the accuracy and recall of this dataset

5. Conclusion

The decision-making system model of modern enterprise management based on big data is studied. Besides, based on the development status of the information-based supervision system of the process plant and the actual application requirements of the enterprise, the key technologies of the information-based supervision system of the process plant in view of the contradiction between the two are studied. To be specific, this paper consists of three parts: firstly, the fusion method is studied between the multi-source heterogeneous regulatory information of the process factory and the 3D model of the factory, so that the supervisors can master all kinds of regulatory information in the browsing of the 3D scene of the factory. Then, a visualization method for multi-time scale to monitor data of the process factory is designed, which focuses on the visualization presentation and analysis of historical data by the method of parallel coordinate graph. The generation method of monitoring information based on 3d scene and the cloud sharing mechanism of monitoring information are studied to make the 3d scene play a role in the monitoring process. The practice shows that the experiment has improved the technical level and supervisory ability of the information-based supervision system of the process factory and achieved good results.

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