The Development and Application of Enterprise Asset Lifecycle Management System Based on Big Data Technology

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Abstract: In the era of digital economy, the context of enterprise transformation and upgrading is becoming clearer. As an important part of realizing the whole-process digital management in enterprises, the digital construction of enterprise asset management is imperative. Therefore, this paper takes enterprise asset management as the research object, effectively integrates the application advantages of big data technology, network information technology and computer application technology, builds a data analysis and processing server relying on Hadoop cluster, and builds a digital platform for enterprise asset management based on Web by combining J2EE technical specifications. The whole platform adopts B/S architecture design, and completes the development and deployment of various functional modules and API interfaces according to MVC pattern. Aiming at many shortcomings in current enterprise asset management, the platform will introduce the whole life cycle management model, which can not only meet the requirements of enterprise asset overall planning, cost reduction and efficiency increase, but also effectively avoid the disadvantages of data island and long response period. Especially for the maintenance of assets, the system can put forward a prediction model based on C4.5 algorithm and Apriori algorithm according to the data mining theory, which is not only conducive to improving the efficiency and accuracy of asset management, but also provides a real scientific basis for enterprise asset evaluation and decision-making.

Keywords: Big Data Technology, Enterprise Asset Management, Lifecycle Management Model, Hadoop, Computer Application.

1 INTRODUCTION

The prerequisite for asset enterprises to maintain normal production and operation is also the main carrier for enterprises to realize development planning strategy. The essence of assets is the collection of various economic resources that are formed by transactions or events, owned or controlled by enterprises independently, and expected to give certain economic benefits to enterprises. Assets can be divided into current assets, fixed assets, intangible assets and other assets according to different forms. Generally, enterprise assets are mainly inventory, fixed assets and intangible assets, and directly participate in the daily production, operation and management activities of enterprises, forming financial data information, which can intuitively and comprehensively reflect the utilization effect of enterprise assets and its ability to make profits. [1] The value attributes of enterprise assets themselves need to be operated and deployed

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reasonably constantly, so that they can play their role to the greatest extent to reduce the risk of depreciation, thus resulting in enterprise asset management behavior. The enterprise asset management is an effective extension of the enterprise financial management. It is a management tool that enterprises can realize the "real logistics" control through a perfect management system on the basis of grasping the asset characteristics and structure scale, and it is also a practical application efficiency.

With the development of China's economy, the management of enterprise assets has been gradually systematized, and the scope and methods of management have been optimized and improved, and some results have been achieved. However, there are still many problems and shortcomings: firstly, the operating environment of enterprises is complex, and the number of assets is increasing; Secondly, the information of asset data is frequently exchanged, and the data distortion is serious; Thirdly, the business process lacks precise control, and the rights and responsibilities are unequal; Fourthly, the information management means are insufficient, and the efficiency of asset management is low. For this reason, this paper holds that enterprises should accurately grasp the theme of high-quality development era, re-examine the strategic development direction and the construction of internal control system, strive to promote the digital upgrade of enterprise asset management, give full play to the application advantages of big data technology, network information technology and computer application technology, and build an enterprise asset management system with Hadoop cluster as data analysis and processing server and Javaweb as interactive application system. The whole system is presented as a Web application, which can widely support enterprise managers, financial personnel and other business personnel to log in and use. Based on the whole life cycle management model of the system, all business processes have been reshaped. From the perspective of overall planning, it covers all aspects of enterprise asset planning, adding, collecting, allocating, checking, maintaining and disposing. It overcomes the shortcomings of inconvenient user operation and cumbersome business initiation process, effectively avoids the disadvantages of data island and long response period, promotes the circulation and interaction of asset data, realizes resource sharing and utilization, and provides a scientific basis for enterprise management decisions. [2]

2 INTRODUCTION OF KEY TECHNOLOGIES

2.1 Big Data Technology

The Big Data generally refers to a huge amount of data collection that can't be acquired, managed and processed by traditional information technology and software and hardware tools in a tolerable time. [3] The essence of big data is a huge data set, which has the characteristics of huge information scale, diverse data types, fast update speed and low value density. The essence of big data is a huge data set. It has the characteristics of huge information scale, diverse data types, fast updating speed and low value density. It usually refers to a comprehensive field dedicated to storing, analyzing and processing huge amounts of data. The big data has formed a huge and complete ecosystem after years of development since it was put forward, which has realized the transition from single data level to application level.

From the current technical system, big data technology is a collection of technologies covering the whole life cycle of big data. This system covers a series of links, such as data collection, transmission, cleaning, storage, analysis, processing, presentation and application. It provides a

complete processing paradigm for the acquisition and reflection of the value of big data, and also expands the application scenarios of big data. With the wide application of big data, the development speed of big data technology is constantly accelerating, and many technical means are gradually gathering and forming a systematic and ecological big data technology stack.

2.2 Hadoop Technical Framework

The Hadoop is an open source technical framework realized by Java language, and it is also a tool platform for distributed storage and processing of large-scale data sets. [4] The core of Hadoop architecture is distributed file system (HDFS) and distributed computing programming framework (MapReduce), which can be used as the bottom storage and analysis core to provide users with reliable, scalable and distributed computing big data services. The Hadoop cluster deployment is supported, which is convenient for users to quickly complete the design and development of large-scale data analysis applications, and realize the parallel high-speed operation and complex call of big data. In addition, the high scalability of Hadoop framework can support the deployment and installation of various functional components, and they are compatible with each other, forming an independent application system and gradually evolving into Hadoop ecosystem. Among them, the core function of Zookeeper is to realize efficient development while maintaining distributed application coordination services; The Hive is a functional architecture based on data warehouse, which aims at mapping structured data files into a database table and converting SQL statements into MapReduece programs. As a large-scale data analysis platform, Pig can sort, filter, sum and group data through its own Pig Latin scripting language. [5]

2.3 JavaWeb

Java is the sum total of technologies that use Java technology to solve related Web and Internet fields, and it is a comprehensive solution that uses Java language to realize dynamic Web application development. Java is subordinate to J2EE technical specification, and can use Spring+SpringMVC+Mybatis framework or Struts+Spring+Hibernate framework to complete the design and development of Web Server. The development includes functional modules, business logic control and the construction and deployment of database application model. JavaWeb usually supports B/S and C/S development modes, but B/S is more applicable, the development process is relatively concise, and the subsequent maintenance cost is low. In B/S development mode, JavaWeb can be divided into three standard layers, namely presentation layer, business logic layer and data access layer. [6]

2.4 Data Mining

Data Mining (DM), as a kind of computer science and technology, aims at finding hidden and valuable information and knowledge from massive data. [7] The process of data mining can be simply divided into four steps: problem definition, data preparation, data mining and result analysis. The choice of data mining method is the core of the whole data mining work, and it is also the key to build the corresponding data mining model. The common data mining methods include classification analysis, prediction analysis, cluster analysis, valuation analysis and correlation analysis, as shown in Table 1. [8] As for the final result analysis, it is more inclined to the correlation between data, the trend and trend of data and the characteristic expression of specific objects.

Table 1: Types of Common Data Mining Algorithms.

Classify	Data mining method	Data mining model
Guided data mining	Classification analysis	Decision Tree, Random Forest, Neural Network
	Predictive parsing	Regression tree and rough set method
	Valuation analysis	SVM, Bayesian method
Unsupervised data miningd	Correlation analysis	Pearson correlation coefficient and Aprior algorithm
	Cluster analysis	K-means clustering algorithm, pedigree clustering

2.5 Development Process

According to the application requirements of the above related application technologies, complete the configuration and deployment of the development environment of enterprise asset lifecycle management system. The development content of the system is divided into two parts. One is to build Hadoop cluster to complete the collection and storage management of all kinds of enterprise asset data. Two is to complete the development of Web Server with Spring framework under Java development environment, and complete the development and deployment of various lightweight service bus interfaces, forming a standard enterprise asset management business system.

First of all, Hadoop cluster architecture needs the support of hardware and software. The underlying operating system is Linux, CentOS 6.7(x86_64) is the version, and jdk-8u291-linux-x64 is the JDK version. According to the application requirements of the system, Hadoop will be deployed in a completely distributed cluster. There are five nodes in the cluster, named Master1, Slave1, Slave2, Slave3 and Slave4 respectively. Hadoop version is 2.7.7, which is installed in each node, and components such as Yarn, HDFS, Zookeeper, HBase and Kafka are also deployed in each node. In addition, the system will use Sqoop component to import financial data, purchasing data, warehousing data and other data into HDFS system under Hadoop framework to realize distributed storage and form original data.

Secondly, for the development of each functional module of the enterprise asset lifecycle management system, the workflow engine will be introduced to complete the process service control and performance expansion of each function. The system selects Activiti open source workflow engine, and gives the core class ProcessEngine process engine and some Service classes in Activiti to Spring container for management, so as to realize the call and processing of workflow by Web Server. [9] In addition, for the function of data mining and analysis, the system will build different data algorithm models and encapsulate them into classes that can be called directly, as shown in Figure 1, which is the key code to realize the Aprior association algorithm model.

Finally, for the development of Web application server, the basic development environment is Java, JDK version requires 1.6 or above, Java development environment is MyEclipse 2014, Web server is Tomcat 8.0, and database server is MySQL 5.5. And the project object model

(Maven) is used to manage the project structure. Maven chooses Apache-Maven-3.2.1 version. In the process of building the overall development environment, the installation of JDK and the configuration of environment variables are completed first to build the foundation of Java application development. Next is the installation of MyEclipse and Tomcat, the Web server, and the configuration of Tomcat is completed in the Preference option under MyEclipse. Then, based on Spring architecture, the integration and encapsulation of the whole system is completed. Through the introduction of the above key technical theories, the overall environment of system development, the configuration of related software and tools are determined, and the technical feasibility of the whole project of enterprise asset lifecycle management system is also clarified.

```
public class AprioriAlgorithm {
    private static final int THRESHOLD = 2;
    public ArrayList<ArrayList<String>> freq1Gen(ArrayList<ArrayList<String>> list) {
        Map<String, Integer> candItemMap = new HashMap<String, Integer>();
        for(int i = 0; i < list.size(); i++) {
            for(int j = 0; j < list.get(i).size(); j++) {
                if(null != candItemMap.get(list.get(i).get(j))) {
                candItemMap.put(list.get(i).get(j), candItemMap.get(list.get(i).get(j)) + 1);
                } else {
                    candItemMap.put(list.get(i).get(j), 1);    }    }  }
        return dataList;    }
```

Figure 1: Code for building a prior algorithm model (original).

3 FUNCTION REALIZATION

3.1 Asset Ledger

In this function module, the system will comprehensively cover the management content of various types of assets of enterprises. According to the actual situation of the system enterprise, management items such as current assets, fixed assets and intangible assets will be set up, which can truly manage the whole assets of the enterprise. The core function of asset ledger lies in the integration of asset information, that is, relying on Hadoop framework to comprehensively and timely collect and summarize enterprise asset-related data. Compared with the traditional manpower adding and uploading, the system not only improves the work efficiency, but also expands the dimension of asset information. For example, the system can display the basic information, attachment information, floor plan, financial information, purchasing information and logistics information of enterprise assets together, giving users a more intuitive feeling.

3.2 Asset Operation And Maintenance

In this function module, users can initiate asset collection, transfer, inventory, maintenance, repair and other business processes. The system will preset a number of business processes, that is, define the deployment ID and name of each process through activiti.engine. ProcessEngine, and form an example that can be operated graphically. The user only needs to click to view the specific business process and the relevant person in charge.

In addition, the maintenance and repair of some fixed assets will directly affect the service life of the assets, and will also have a great impact on the daily production and operation of enterprises, so it is difficult to make a correct decision quickly. Therefore, the system provides a fault prediction model based on C4.5 decision tree and a fault correlation prediction model based on Apriori. Among them, the fault prediction model of C4.5 decision tree will complete the prediction according to the historical maintenance record data, while Apriori's fault correlation prediction model will combine the relationship between different faults and fault frequency to make inferential prediction. As shown in Table 2, the fault codes are "1" for fault occurrence and "0" for failure not occurrence. Transform the fault data into a 0-1 judgment matrix as shown in formula 1, scan and count the matrix, sum the rows and columns, and reorder it as shown in formula 2, and set the minimum support degree to 40% to get the minimum support count of 0.8. Finally, according to Apriori algorithm, the frequent itemsets of historical fault records are {(fault 2), (fault 3, fault 4), (fault 4, fault 5)}, and the correlation between fault codes in equipment faults can be analyzed by frequent itemsets of fault data. It can provide decision basis for subsequent operation and maintenance of equipment and asset disposal.

Table 2: Failure data record table.

	Fault 1	Fault 2	Fault 3	Fault 4	Fault 5
Maintenance record 1	0	1	0	0	1
Maintenance record 2	1	0	1	1	0
Maintenance record 3	0	0	1	1	0
Maintenance record 4	0	1	0	0	1

$$M = \begin{bmatrix} 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 \end{bmatrix} \tag{1}$$

$$M' = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 & 2 \\ 0 & 0 & 1 & 1 & 1 & 3 \\ 0 & 0 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 & 0 & 3 \\ 2 & 2 & 2 & 2 & 1 & \end{bmatrix} \tag{2}$$

3.3 Asset Disposal

In this function module, system users can select the corresponding assets in the asset list to apply for scrapping, and add the corresponding documents. The system will automatically display the specific situation of the current assets, including information such as storage location, subordinate department and specific person in charge, which is convenient for users to quickly select and complete corresponding operations.

3.4 Asset Statistics

In this function module, users can make data statistics of enterprise assets, and visually display them with graphical contents. It is beneficial for users to grasp the assets of enterprises in real time, so as to guide enterprises to make correct decision analysis. The asset statistics module includes: asset category statistics, asset change statistics, inventory statistics and service life assets statistics, etc. [10] As shown in Figure 2, it is a statistical chart of the value of various assets.

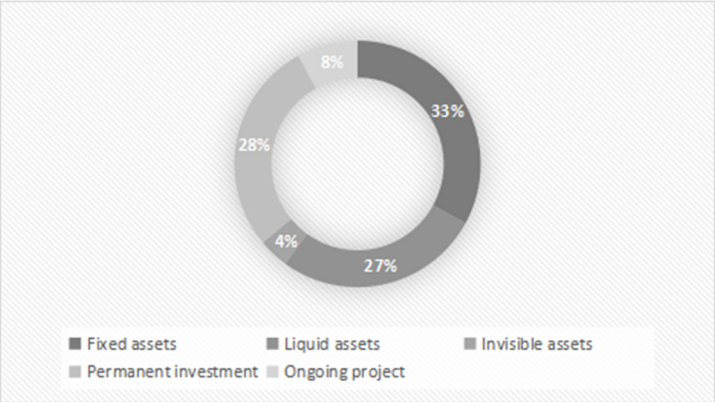

Figure 2: Statistical Chart of Asset Value (original).

4 CONCLUSIONS

In order to promote the informatization construction of enterprise asset management, this paper integrates the application advantages of big data technology, network information technology and computer application technology efficiently, and constructs a Web-based enterprise asset management system. The system innovatively introduces the whole life cycle management model into enterprise asset management, fully considers the actual application requirements of enterprises, and comprehensively covers all aspects of the planning, addition, collection, allocation, inventory, maintenance and disposal of various enterprises' assets. It is convenient for users to improve the processing efficiency of various businesses with simple, convenient and efficient operation, increase the value embodiment and rational application of asset data, strengthen the enterprise asset management ability, and promote the digitalization and intelligence of the internal management and control of enterprises.

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