Design of an Intelligent Financial Report Analysis System under the Background of Big Data

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Abstract. In the big data environment, intelligent financial analysis software needs to integrate technologies such as intelligent algorithms, knowledge engineering, massive information, conceptual semantics, and natural interaction to output visual financial analysis reports to users. By analyzing the design principles of an intelligent financial statement analysis system, the system was designed from three aspects: overall structure, functional modules, and database files. This enabled decision-makers to quickly convert a large amount of cumbersome financial data into text and make corresponding decisions based on the analysis conclusions of financial statements, thereby strengthening management and improving work efficiency.

Keywords: big data, intelligent finance, database，financial statements，financial analysis

1 Introduction

With the rapid development of technologies such as the Internet, the Internet of Things, artificial intelligence, and cloud computing, the new generation of information technology has become the core technological force for various industries to use modern means. The 19th National Congress of the Communist Party of China clearly proposed to promote the deep integration of the Internet[1], big data, artificial intelligence, and the real economy, indicating that the development of big data will be elevated to an important strategic level of the country. In the context of big data, various digital technologies have driven a qualitative leap in content and methods such as financial analysis, financial forecasting, and decision-making. The implementation of financial statement analysis will greatly reduce the amount of manual computation, become increasingly intelligent, and effectively improve financial work efficiency. The continuous and in-depth development of business intelligence, data warehousing, and mining technologies has played a significant supporting role in financial statement analysis and decision support [2]. In future financial software, the financial statement analysis system will introduce an expert system in the decision-making process, which will introduce the problems solved by accounting industry experts in accounting decision-making, as well as the knowledge and experience used, into the computer in a logical judgment form. This will make the computer expert level and serve as an auxiliary tool for accounting personnel and other report users to make decisions [3]. When developing future intelligent financial analysis software, it is necessary to integrate five types of technologies used in intelligent financial software: intelligent algorithms, knowledge engineering, massive information, conceptual semantics, and natural interaction.

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2 Design principles of an intelligent financial statement analysis system

The intelligent financial statement analysis system is a system built on the basis of enterprise informatization, which uses financial data from financial statements to analyze enterprise business activities and provide decision support. This system can provide fast and timely report analysis functions for enterprise managers, investors, creditors and other information demanders. Without specialized training, it can obtain useful financial information for decision-making. This system specifically includes functions such as system management, user management, data management, financial analysis, etc.

The data foundation of this system is financial statements such as balance sheets, income statements, and cash flow statements of small and medium-sized enterprises. Users can manually enter financial statements in the system or import financial statements generated by the financial software used by a certain enterprise. In use, users only need to start the system, select a username, enter a password, or log in; You can set, modify, and delete company information in the window, flexibly manage users and permissions, import, edit, and export report data, utilize the most basic financial analysis indicator system and commonly used financial analysis methods, and combine expert experience to output visual analysis text to users. This text is simple and easy to understand, which can help information seekers avoid reading complex financial statement data. Even if they are not professional financial personnel, they can still understand relevant financial information, providing a basis for their decision-making analysis. In the design, the system is divided into functional modules such as system management, user management, data management, and financial analysis, as shown in Figure 1.

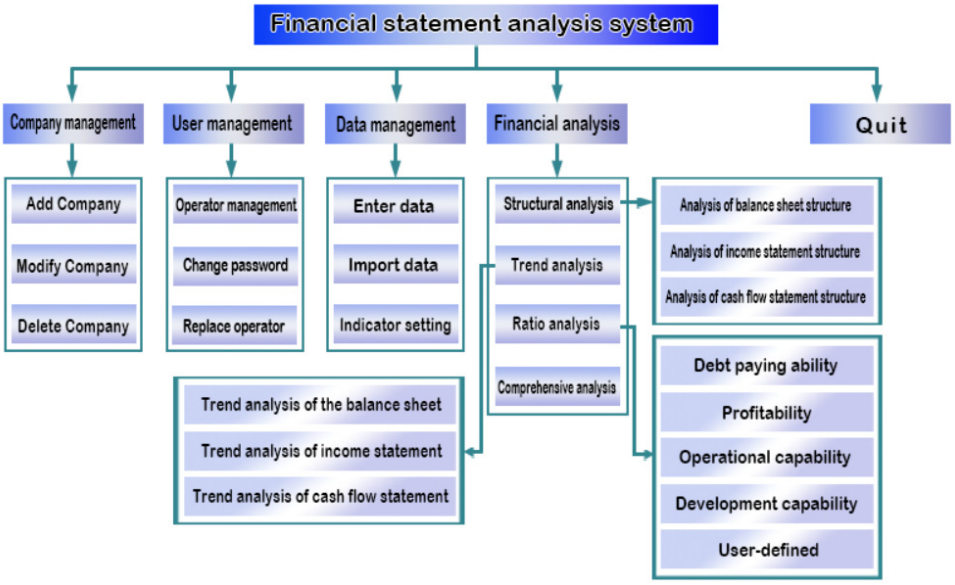

Figure 1. Functional Structure of the Intelligent Financial Report Analysis System

3 Design of an Intelligent Financial Report Analysis System

3.1 Functional module design

The main functions of this system include user management, data management, financial analysis, and exiting the system[3].

3.1.1 User Management

User management mainly implements user settings and permission management functions. Operator management can only be operated by system administrators, and other personnel have no authority to do so. That is, when other operators log in, this menu command is grayed out.

3.1.2 Company Management

The company management function includes creating, modifying, and deleting company information.

3.1.3 Data Management

Data management is based on three commonly used financial statements, namely the balance sheet, income statement, and cash flow statement [4]. By analyzing, comparing, and reasoning the data, it can comprehensively reveal the development ability, operating ability, debt paying ability, and profitability of an enterprise from different perspectives, thus making an overall evaluation of the enterprise and enabling enterprise managers to timely obtain the necessary analysis conclusions. The data management content for these three reports mainly includes: entering data, modifying data, and deleting data[5]. The entered data can be manually entered or directly imported. As shown in Figure 2.

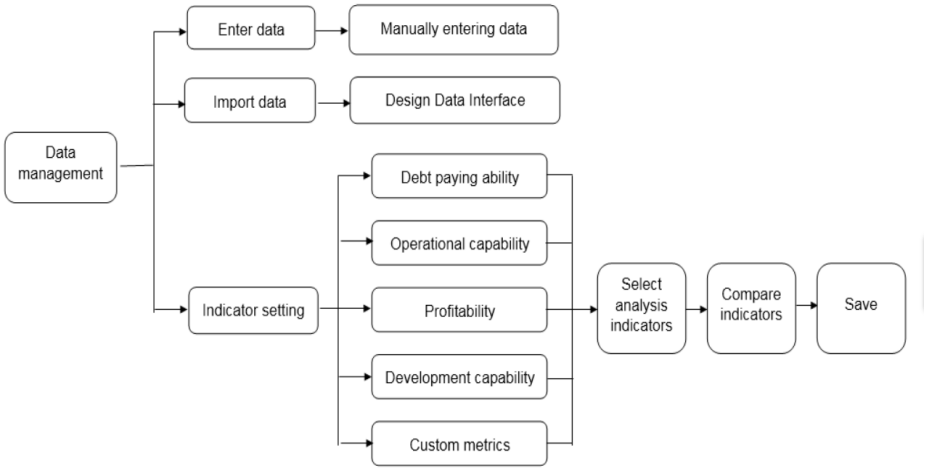

Figure 2. Data Management Module Functions

3.1.4 Financial Analysis

The financial analysis module selects relevant financial indicators, uses financial analysis methods, and forms analytical conclusions through calculation, comparison, and reasoning.[6] As shown in Figure 3.

(1) Routine analysis

1) Structural analysis

Structural analysis mainly takes a certain total item (such as total assets) in the financial statements as 100%, and then calculates the percentage of each specific item (such as current asset items) to the total item, in order to compare the changes in the percentage of each item, analyze the reasons for the changes and the impact of the changes on the enterprise, in order to judge the trend of changes in economic activities and evaluate whether the structure of each item is reasonable[7].

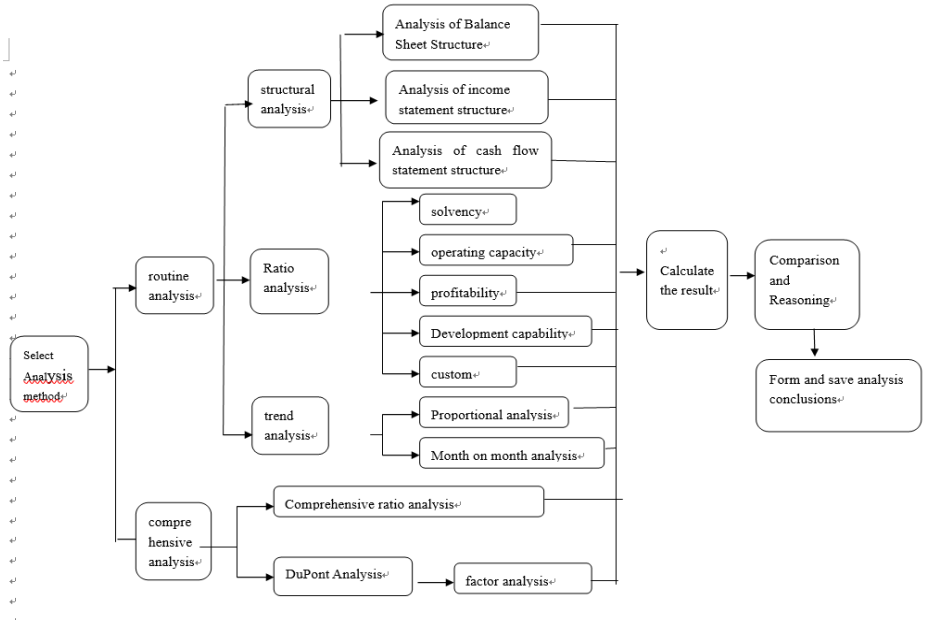

Figure 3. Financial Analysis Module Functions

Mainly including the structural analysis of the balance sheet, income statement, and cash flow statement.

In this system, the analysis of the balance sheet structure is divided into three types: asset structure, liability structure, and owner's equity structure. The basic principle is to compare each item in the balance sheet with its total amount and calculate the proportion of each item to the total amount. The structural analysis of the income statement takes the main business income of the income statement as a whole, that is, the main business income as 100%, and calculates the proportion of each item to its overall proportion. By analyzing the structure of the income statement, we can understand the proportion of each project, identify problematic

projects, and make improvements. The structural analysis of the cash flow statement mainly includes three aspects: cash inflow structure, outflow structure, and inflow outflow structure analysis. The analysis of cash inflow (outflow) structure is to compare each item in the cash inflow (outflow) with the total cash inflow (outflow), and calculate the proportion of each item in the cash inflow (outflow) to the total cash inflow (outflow).

The analysis of cash inflow and outflow structure is to compare cash inflows with cash outflows and calculate the proportion of cash inflows to outflows. By analyzing the structure of the cash flow statement, we can understand the source, destination, and composition of cash, and further analyze the impact of each item on the overall situation, the reasons for changes, and trends.

2) Trend analysis

Trend analysis is the analysis of a company's financial condition and operating results, comparing the changes in various items in financial statements over consecutive accounting periods. During the analysis of this system, fixed ratio and month on month trend analysis are used to analyze the change trend and speed of each project separately.

3) Ratio analysis

Ratio analysis method is a commonly used analysis method in financial analysis, which is mainly calculated and analyzed based on the relevant ratios in the indicator system in this system. Through ratio analysis, various production and business activities of enterprises can be analyzed from different aspects.[8]

(2) Comprehensive analysis

The comprehensive analysis used in this system is the DuPont analysis method and the Wall scoring method.[9]

3.2 Database File Design

Database file design is an essential and important step in system development, and it can provide backend data support for system implementation. The reasonable design of database files directly affects the daily maintenance, updates, and upgrades of the system in the future.[10] Most commonly used database design software types are used, and this system uses Microsoft SQL Server for database file design.

3.2.1 Database Requirements Analysis

Based on the previous analysis of the system, combined with the basic design principles of the database, and closely adhering to the "user centered" design principle, starting from the functions of the internal affairs report analysis system for small and medium-sized enterprises, and to highlight the interactivity of the system and reserve space for further development, the database of this system should store the following information:

1. Balance Sheet Information

Including enterprise code (primary key), time, current assets, long-term investments, fixed assets, intangible assets and other assets, total assets, current liabilities, long-term liabilities, liabilities, shareholder's equity, total liabilities and shareholder's equity.

2. Income Statement Information

Including enterprise code (primary key), time, main business income, main business cost, other business profits, business taxes and surcharges, sales expenses, management expenses, financial expenses, asset impairment losses, gains from changes in fair value, investment income, operating profit, non operating income, non operating expenses, total profit, income tax expenses, and net profit.

3. Cash flow statement information

Including enterprise code (primary key), time, cash inflows from operating activities, cash outflows from operating activities, cash inflows from investing activities, cash outflows from investing activities, cash inflows from financing activities, cash outflows from financing activities, impact of exchange rate changes on cash and equivalents, net increase in cash and cash equivalents, and balance of cash and cash equivalents at the end of the period.

4. Indicator Name Information

Including indicator code (primary key), indicator name, and indicator description.

5. Indicator value information

This includes indicator code (primary key), enterprise code, year, indicator value, and knowledge base code.

6. Knowledge Base Information

Including indicator code (primary key), industry code, standard indicator value, comparative indicator value, description, conclusion, and conclusion label.

7. Enterprise Name Information

This includes enterprise code (primary key), enterprise name, industry code, and enterprise type.

8. Industry name information

This includes industry code (primary key), industry name, and industry description.

9. Enterprise Type Information

This includes type code (primary key), type name, and type description.

3.3.2 Summary of Data Sheets

The database of the financial statement analysis system for small and medium-sized enterprises is implemented using SQL Server 2005, with the database name "db_PMS". According to the system requirements analysis, the system needs to establish 9 tables, which are designed as balance sheet (A_ZcfzTable), income statement (A_LrTable), cash flow statement (AXjllTable), indicator name table (AZbNameTable), indicator value table (AZbValueTable), knowledge base table (AZskTable), enterprise name table (AQyNameTable), industry name table (AHyNameTable), and enterprise type table (AQyTypeTable), Its usage description is shown in Table 1.

Table 1 Data Table of Intelligent Financial Report Analysis System

Serial Number	Number Data Table Name	Datasheet Function Description
1	A ZcfzTable	Used to reflect the assets, liabilities, and owner's equity of a company
2	A LrTable	Used to reflect the composition of corporate income, expenses, and profits
3	A_XjllTable	Used to reflect the cash inflows and outflows of enterprises
4	A_ZbNameTable	Store the indicator names used in financial analysis and the corresponding knowledge base codes for each indicator through the main indicator name file
5	A_ZbValueTable	Used to store the calculation results of various indicators
6	A_ZskTable	Used to store the analysis conclusions corresponding to each indicator
7	A_QyNameTable	Used to store relevant information about the enterprise, such as enterprise code, name, type, etc
8	A_HyNameTable	Name used to store industry
9	A_QyTypeTable	The type used to store the enterprise

3.3 Conceptual Structure Design of Database

The conceptual structure design of a database is based on the analysis of user needs, by designing the required entities and the relationships between entities, laying the foundation for the design of database tables. According to the previous analysis, the entities of the financial statement analysis system for small and medium-sized enterprises include balance sheet entities, income statement entities, cash flow statement entities, corporate entities, and industry entities.

3.4 Database Data Table Design

This article selects some main data tables for design based on the actual situation of users in small and medium-sized enterprises. The key use is the indicator value table, which records the indicator values obtained from financial statement data based on calculation formulas and combines them with other tables to form analytical conclusions. Therefore, there is a one-to-many relationship between the indicator value table and other data tables.

4 Conclusion

The design of an intelligent financial report analysis system is based on the Windows operating system, using Microsoft Visual Studio for system interface design, and using object-oriented methods to design various related classes and code for financial analysis based on system functions. The detailed design of the database is carried out using Microsoft SQL Server. By introducing the design principles of the intelligent financial statement analysis system, and designing the overall system, functional modules, and database files, the foundation has been laid for the construction of the intelligent financial statement analysis system.

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