Development of ERP Financial Statement Evaluation System

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Abstract. With the sustained development of national economy, more and more enterprises begin to transform to informatization. As an important part of enterprise informatization, ERP (Enterprise Resource Planning) makes the demand for ERP talents growing day by day. However, there are many problems in the existing ERP examination system, such as large workload, difficult to guarantee the quality of question-making, low quality of automatic marking. In financial statements, a unit grid of financial statements has both formulas and data. At present, there is no system to evaluate the formulas, which creates great difficulty for automatic setting questions and marking. These problems seriously affect the quality and efficiency of enterprise's talent selection for ERP financial statements. This system is based on Yonyou ERP financial statement module, using MVC framework, C#, SQL Server and python technology to develop ERP financial statement skills evaluation system, which mainly solves the problem that it could not automatically generate test papers and mark the papers in financial statement evaluation system at present.

1. Introduction

With the implementation of national informatization policies such as big data, artificial intelligence and China Intelligent Manufacturing 2025, enterprise information system (EIS) has increasingly become an indispensable part of major companies to improve management efficiency and reduce management costs[1,2], which is the main component of enterprise informatization. Enterprises’ demand for application and talents of EIS is increasing [3,4,5]. Therefore, various skills competition and certification based on EIS software are also developing rapidly. For example, the competition based on Yonyou ERP-U8 software includes the Accounting Skills Competition (Accounting Information Part) sponsored by the Ministry of Education and the “Seentao Cup” (Seentao is a wholly-owned subsidiary company of Yonyou, which is the only company authorized by Yonyou to use Yonyou ERP-U8 system for teaching and competition.) National College Students Accounting Information Skills Competition sponsored by the Ministry of Industry and Information Technology [6]. These skills competitions are held annually, involving nearly a million students. Accounting Skills Competition, as an important platform to reflect the quality of accounting teaching and test the teaching results of accounting specialty, has attracted more and more attention from schools [7,8]. However, in the aspect of financial statements assessment, due to the variety of topics, the complicated formula of statements and the complex process of setting scoring standards, it is difficult to meet the needs of colleges and universities and selection agencies to generate test papers and mark papers efficiently. To
some extent, this affects the effect of selection and the quality of talented people. In the light of this problem, the authors designed and developed an ERP financial statement skills evaluation system, which mainly solves the problem that it could not generate test papers and mark papers automatically. In the process of system development, Python language is used to realize the core functions.

2. Research on the Assessment of Existing Financial Statement Skills

With the sustained and rapid development of China’s national economy, the state-owned enterprise economy has entered a new stage of development [9]. Under this background, business managers are more and more aware of the importance of enterprise resource management in the actual development process of enterprises. Therefore, ERP model has gradually become the focus of business managers’ research in China [10]. ERP can realize the integration of financial business, and enterprise financial statements are an indispensable part of ERP. Therefore, ERP financial statements are an important part of enterprise financial management activities [11]. At present, Yonyou, Kingdee and Tide are the three main ERP software companies in China. The evaluation system based on these ERP software is also relatively mature.

Yonyou ERP-U8 is a set of comprehensive enterprise-level financial and management software [12]. In 1998, U8 V8.0 version was produced. It is the first financial business integration management software based on relational database in China, which better meets the requirements of enterprise management [13]. As the latest product of Yonyou U8, Yonyou ERP-U8 has been developed for more than one year, which meets the management requirements of growing enterprises. Yonyou financial software is the most widely used financial software in China. Its total number of domestic users has reached more than 100,000, the domestic market share has reached 40%, the industry coverage has reached 100%, many indicators rank first in the industry [14]. Yonyou U8-based financial software full-trial simulation test system is simulation test software launched by Seentao official. This software can help users to familiarize themselves with the test content, test-taking methods and adapt to the test environment, and provide users with professional intelligent simulation test content from all aspects. However, the test system has not been fully automated, nor has it solved the problem of generating test papers and grading papers manually.

Kingdee K3 Cloud provides a new ERP application mode for enterprises, and has become a social ERP oriented to enterprise applications [15]. It provides a powerful guarantee for the accuracy of information exchanges within enterprises, and at the same time makes the information timely delivered in place. Business communication of enterprises also tends to be diversified gradually [16]. Based on the easy training of Kingdee K/3, there is a lack of further research on financial statement evaluation.

In summary, although the existing software realizes the docking of teaching platform and enterprise-level ERP, there is no further research on the skills evaluation of financial statements, and it is unable to effectively investigate the candidates’ understanding and application of knowledge such as accounting statements[17].

3. System Design

In Yonyou ERP system, there are four kinds of financial statements that is frequently used to test talents in Seentao test system, which are balance sheet, profit statement, cash flow statement and financial index analysis table. All of the four statements contain data and formulas at the same time, and behind each data there is formula. Take the balance sheet as an example, in the formula G6 = QC (“201”, “201”, “whole year”, “year”), “G6” represents the sixth row of column “G”, indicating the location of the formula and the data corresponding to that location; “QC” represents the data at the beginning of the period, and “whole year” represent extract the balance at the beginning of the year.

Based on Yonyou ERP system, we developed ERP financial statement skills evaluation system. This system adopted MVC framework, because MVC framework has the potential of maintainability and low coupling. On the one hand, it reduces the life cycle of our development system, on the other hand, it enhances the maintainability of the system, so it can be used for a long time.

The system mainly includes three management modules, which are document management, question management and examination management. The key point of this system is to compare teachers’
answers of financial statements, test papers and students’ answer papers, so as to collect test points and score. In order to realize this function, we have carried on the research.

4. System Realization

There are a lot of problems existing in the process of financial statements assessment, such as excessive test workload, the difficulty in guarantying quality, marking difficulty in formula of the financial statements, our system found the way to solve those problems, such as the way of automatic marking in ERP financial reporting skills evaluation system. This system is useful for teachers to efficiently and qualitatively examine students’ application skills in ERP financial statements.

At present, the existing ERP skill evaluation system has the problem that only the data of financial statements can be scored, but not the formula, which may lead to some difficulties both in generating test papers and grading papers. In order to make it clear, we use table 1 to describe those problems.

| Number | Data | Formula | Description          |
|--------|------|---------|----------------------|
| 1      | T(F) | T(F)    | Complete True (or False) |
| 2      | T    | F       | Complete False       |
| 3      | F    | T       | Half True            |

From table 1, we can know that when we are grading, we need to pay attention to some “traps”. For instance, when we intend to mark students’ answer paper, it is obviously not enough to mark the data of financial statements only. The formula marking is necessary. Table 1 tells us that in the process of grading, there are three situations that we need to consider carefully. Firstly, if the data and formula are both right or both wrong, such as Number 1 in table 1, we consider that it is totally the right answer or the wrong answer. Secondly, if the data is right but the formula is wrong, we will consider it is completely wrong, such as Number 2 in table 1. Lastly, if the data is wrong but the formula is right, we consider that it is half true, because the data that used for calculation has been wrong before, but the point had been deducted at that time, so we do not have to deduct twice in terms of data, such as Number 3 in table 1. Above all, we really need to work out how to extract and compare formula.

In order to solve these problems, the authors carried out relevant research. To begin with, we tried to use the secondary development function of the UFO report module in Yonyou ERP system to compare the financial reports in REP format (.rep files), and found that only the differences of data parts can be extracted, but the differences of formulas cannot be extracted, and the existing problems could not be solved. Then we use another method to export financial statements in REP format and compare them with other methods besides Yonyou ERP system. We found that financial statements in REP format cannot be opened without Yonyou ERP system. After carefully studying the UFO report module, we found that financial statements in REP format can be exported in Excel format, but we also found that although the data of the exported report is complete and correct, the formula part is empty and has not been successfully exported. After changing to TXT format (.txt files), we found that formula can be successfully derived. Hence we adopted this method, that is, the data of financial statements are exported to Excel format, and the formula is derived to TXT format. Then we compared them separately and extracted the different points for scoring. Finally, we used Python to implement this comparison function.

4.1. Main Steps of Document Comparison

By extracting and comparing the original files (original test files and answers files) uploaded by teachers, the score points files can be automatically generated. Then student files (students’ answer paper files) uploaded by students can be compared with the original answer (teachers’ answer paper). After that an intermediate document, which is similar to scoring criteria but contain students’ answers, will be generated. Then the system will use this intermediate document to compare with scoring criteria automatically. Then it could extract the different data and store them for the final results, feedback
document (student test results). The above process consists of two procedures, one is responsible for comparing the original answers and test papers (uploaded by teacher), and then scoring criteria files will be generated, this is the process for generating topics; the other is responsible for comparing the students’ answers, scoring criteria and the original answers, and finally generating the students’ test results, this is the process for marking. These two procedures complete the process that begins with generating topics and ends up with giving the test results. The operation of document comparison has thoroughly shown in figure 1.

![Operation flow chart](image)

**Figure 1. Operation flow chart**

4.2. Program Display of File Comparison

The two programs use python’s Tkinter module to visualize the program operation interface [18]. Teachers need to select the type of report forms to upload documents before generating the scoring criteria. After selecting the report type, a new window pops up. The label of the window is called report type name, and the body of the window includes two buttons and two lists. The two buttons are the upload buttons of the formula test paper and the data test paper respectively. The uploaded file name will be displayed in the list so that the user can confirm that the uploaded file is correct. The other three report styles are only changed in the page label, and the contrast interface for students to upload the answer sheet is only changed in the label, so it will not be repeated here.

4.3. Procedures for Document Comparison

The two programs are “StandardForEvaluation” and “StudentsScore”, detailed descriptions will be given below.

4.3.1. Question setting procedure After running “StandardForEvaluation”, the program firstly creates a GUI interface using the Tkinter module and sets four buttons to distinguish the types of uploaded files. After selecting the file’s type, teachers can select formula or data on the report upload interface.

If you upload data, you will first determine whether the format version of the data file Excel is .xls or .xlsx, because the module of Python Excel used is openpyxl, so you cannot operate on the .xls file. If the file version is .xls, a function “excel_change()” could be executed to convert the file type to .xlsx for subsequent comparison operations. Because the file location is composed of root directory, file’s name and file’s suffix, we can use “os.path.dirname()” and “os.basename()” functions. Because the uploaded file’s name is not limited, the file’s name, file’s location and report’s type of test data will be stored after uploading in order to find the test file later.

When we convert the test paper and the original question into .xlsx version, we begin to compare the files and then store the location, content and default score of the difference points in a list, then generate Excel file of the data scoring standard, and then score them.
If the formula is uploaded, the test formula file (uploaded by students) will be compared with the original formula file (uploaded by teachers). The location, content and default score of the difference point will be stored in a “list” variable, and then the Excel file of the formula score standard will be generated. Then the contents of the list will be written into the formula score standard document. Then, the paper formula file’s name, file’s location and report’s type are stored in the “file name storage” file. The pseudo code is shown below.

```python
CompareFormula():
    Upload(Test_file)
    Find(Original_file)
    Open(Original_file)
    FindDifferent(Original_file, Test_file, DifferentFormula)
    RecordDifferent(DifferentFormula, DifferentFormulaPositon)
    CreatStandardFormula()

CompareData():
    Upload(Test_file)
    Find(Original_file)
    Open(Original_file)
    FindDifferent(Original_file, Test_file, DifferentData)
    RecordDifferent(DifferentData, DifferentDataPositon)
    CreatStandardData()
```

4.3.2. Scoring procedure After running “StudentsScore”, the program will first create a GUI interface using the Tkinter module, and set four buttons to distinguish the types of files uploaded. After selecting the file type, the report upload interface is generated, and the upload formula or data are selected. But the difference is that after selecting the uploaded files, the process of file comparison is different. After uploading the data files or formula files, the students’ answers will first compare with the original questions of the test, and then generate the difference file to record the location and content of the students’ mistakes. Then read the “file name storage” file to find the rating standard of the type of the answer sheet report. When we know the scoring standard, we can judge the different point, and finally generate the test result file, the data of each report and the formula answer. The results are stored in the same Excel file in the form of a worksheet. At the same time, in order to facilitate the candidate to know the test score, we put the total score of this test on the first page. The pseudo code is shown below.

```python
CompareScoreFormula():
    Upload(Answer_file)
    Find(StandardFormula)
    Open(StandardFormula)
    FindDifferent(Answer_file, StandardFormula, DifferentFormula)
    RecordDifferent(DifferentFormula, DifferentFormulaPositon)
    RecordScore(DifferentFormula, DifferentFormulaPositon)
    AddResult()

CompareScoreData():
    Upload(Answer_file)
    Find(StandardData)
    Open(StandardData)
    FindDifferent(Answer_file, StandardData, DifferentData)
    RecordDifferent(DifferentData, DifferentDataPositon)
    RecordScore(DifferentData, DifferentDataPositon)
    AddResult()
```
5. Summary
In the skills evaluation system of ERP financial statements, we successfully extracted the data and formulas from teachers’ answer statements and students’ answer statements. Then we compared them by means of document comparison with Python, which is a great step for generating test papers and grading papers. It makes the scoring system more reasonable and more convenient. At the same time, the comparison of documents also greatly reduces the burden of teachers in the process of evaluation, hence teachers have more energy and time to devote themselves to scientific research, and continue to explore and innovate [19].

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