Design and implementation of a socialized medicine reimbursement management system of high school based on Java technology

Weiwei Yang

Sports Institute of Jinan University, Guangzhou 510632, China

Email: 59981503@qq.com

Abstract. In this paper, to improve the office efficiency of public health office and planning finance office, a management system of medical reimbursement management systems of Jinan University was designed and analyzed based on Java technology. Script xml was implemented with JSP + Java Script as a development tool, visualization of the system was realized using UML Unified Modeling Language, and Oracle10g database servers and AIX P570 IBM minicomputer were utilized, the management system of reimbursement in socialized medicine of Jinan University was successfully designed and implemented. This system which managed the work of medical expenses reimbursement was simple to operate, multifunctional and high performing. All of review and limit projects were automatically accomplished by computer, not only reducing the workload, thereby increasing the efficiency and speeding up the reimbursement rate and the level of management, but also increasing standardization and transparency of reimbursement process and reducing conflicts between staff and the person for reimbursement.

Keywords: Design, Implementation, socialized medicine, reimbursement management system, Java technology

1 Introduction

Traditional free medical reimbursement management systems of colleges and universities basically adopt manual document examination and manual clearing. Data of those systems should be inputted manually and can be not synchronous. For example, public health management department can be not real-time query to the operation account of finance department. Meanwhile, those systems usually use C/S mode developed by DELPHI and SQL SERVER for database server, which makes the system become complex, single function, heavy workload and low efficiency[1]. Therefore, the development of a practical, full-featured system is necessary.

However, most of the public health reimbursement management system for colleges and universities were usually designed by three-tier C/S or B/S mode[2]. For example, the free medical reimbursement manual system of Beijing was designed and implemented by using three-tier C/S mode and .NET remoting technology [3], and most of the required function was achieved by using Visual C # 2005 and Microsoft SQL server 2000[4]. JSP technology combined with B/S mode model was carried out by Hong [5] to achieve free medical reimbursement manual system for hospital. What is more, medical reimbursement systems were also developed by the combination of B/S mode and web technology such as B/S mode and ADO.NET technology [6], B/S mode and Visual Studio2008 Team System [7] and B/S mode and ASP. NET technology [8]. However, most of developed systems are based on ASP or .NET platform[9], only a few of them are based on Java technology. The Java technology has been developed nearly 10 years [10], and its community has been active just as .NET community. Java technology has informative open source tools and data, so there are many successful applications in the field of enterprise development[11]. Java technology was used in this work to develop a simple and high efficient public health claims management system[12].

2 Requirement Analysis of System and functional configuration

This system is developed by JSP language. Because the data is huge and various,, it is necessary to design a simple and easy to use system for users. Complete operation is necessary for information update and access so as to keep the operation of system stable and efficient. The system's response

ability should be relatively high to meet with the requirement of synchronous transmission of information and updates. Some of the functions may not be considered comprehensive, and some of the specific functions may be improved and added in the future, so the expansion capacity of the system should be strong. The system is divided into two modules: public health office and planning finance office. Business can be outlined as following. Reimbursement personnel submit settlement documents to public health office, and public health office reviews and confirms the settlement documents and submits to planning finance office. Planning finance office will register and record the results of reimbursement so as all of the reimbursement accounting records can be queried.

During development of the system, the system's main functions menu structure (shown in Fig. 1) is determined according to users` needs. The functions of the public health management system include:

1) Integration of basic information and data of staff, student and campus card;

2) In the public health office, it has function of data management, public health reimbursement management, social insurance management, and other types of management functions such as reimbursements, accounting inquiry, the daily query and statistical reporting;

3) In the planning finance office, it has functions of free medical account management, social insurance reimbursement inquiry, medical reimbursement and hedging management, daily management, reporting query and statistical functions;

4) In addition to agree with special requirements of public health office, data dictionary also can use unified messaging standard of school;

5) Authorization system can adopt a unified authentication platform.

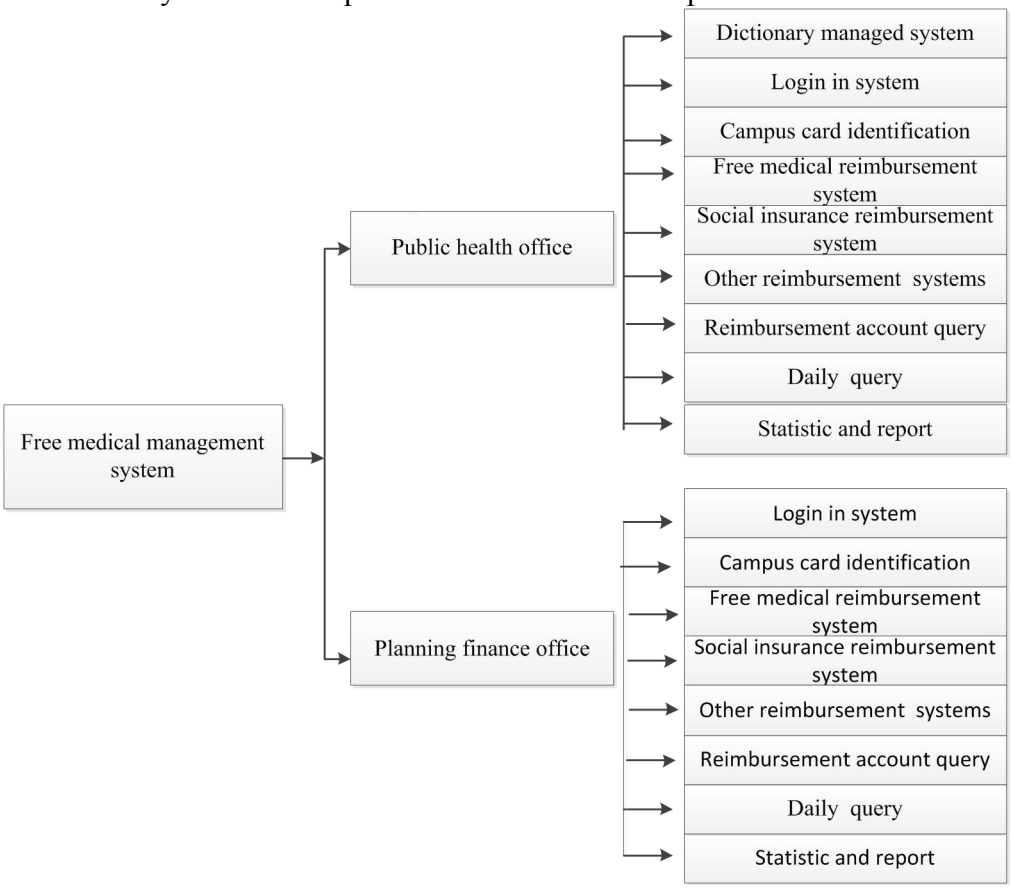

Figure 1 Block diagram of system function

3 System design and implementation

3.1 Selection of hardware and software platforms and development tools

The public health management system is a multi-user system, so the B/S mode was a reasonable choice. The database anf server of our system are Oracle and AIX P570 IBM minicomputer, respectively. In addition, development platform is MyEclipse 10.6, page editing platform is Dreamwaver CS5, and image processing platform is Photoshop CS5.4, respectively.

3.2 Design process of the system

This system is a more complex public health reimbursement management system, and its business processes can be summarized as four stages: Application, Audit, Accounting and payment and Reimbursement query, which is interpreted as follows:

1) Reimbursement documents are submitted to the public health office for audit, the audit will be returned if not passed. The passed reimbursement documents and other public expense reimbursement documents are submitted to planning finance office for settlement. To the receipts for social insurance, public health office will register in the system directly and submit them to planning finance office for inquiry.

2) Planning finance office settles through the documents, registers the settlement result in the system and records on the machine account;

3) Planning finance office can query the messages of social insurance recorded by public health office in the free medical reimbursement management system;

4) When planning finance office makes errors on results of operation settlement, it can strike a balance on the medical accounting management session of the system;

5) Public health office can check with the record of planning finance office in the system.

3.3 Data integration design

This system can classify user`s information on the base of synchronization of the personnel management system, and insert, delete, modify and query the relevant public health data. Therefore, the data of the four systems: personnel management system, educational management system of undergraduate, graduate educational management system and campus card management system needs to be integrated. Medical claims management systems can access to the database of undergraduate teaching management system, graduate educational management system and campus card management system through the data exchange platform.

3.4 Database design

Relational database is the most widely used database for software development, so Oracle relational database is selected by this system for saving data. As shown in Fig. 2, an E-R diagram was obtained after a needs analysis, and original database was designed According to the E-R diagram. The database was then preformed with the third degree of standardized design.

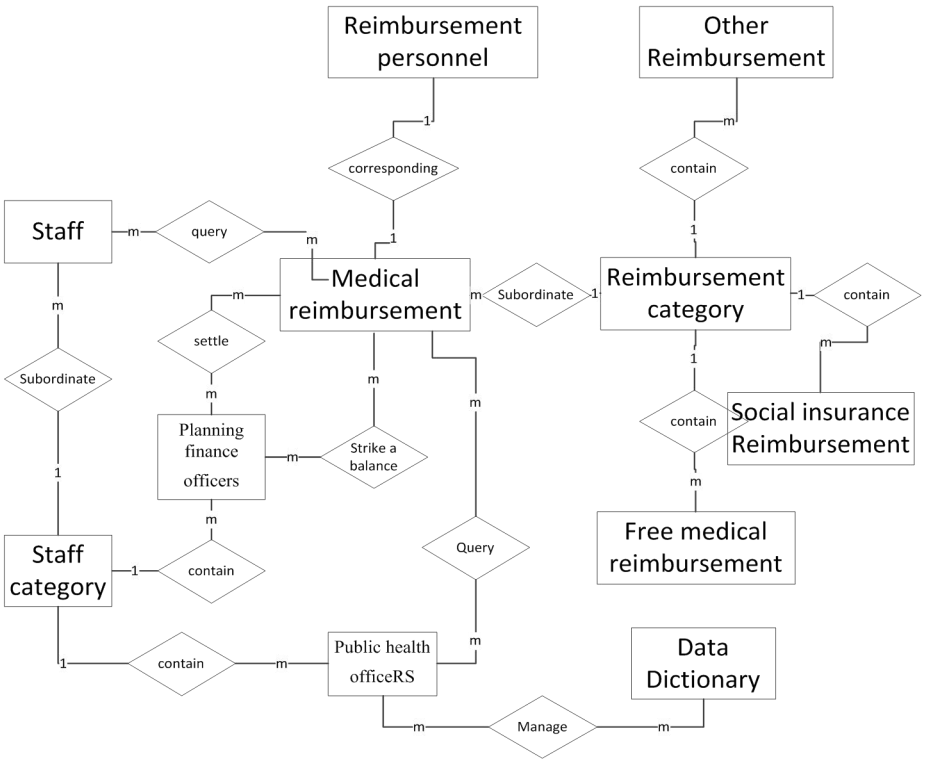

Figure 2 Whole E-R diagram of this system

In the sub-module of the free medical reimbursement management system, as can be shown in Fig. 3, audit for public health reimbursement documents was completed, identity categories of public health was confirmed after swiping campus card, and confirmed documents were submitted directly to the management interface of finance public health reimbursement, and the documents were returned to the original reimbursement personnel.

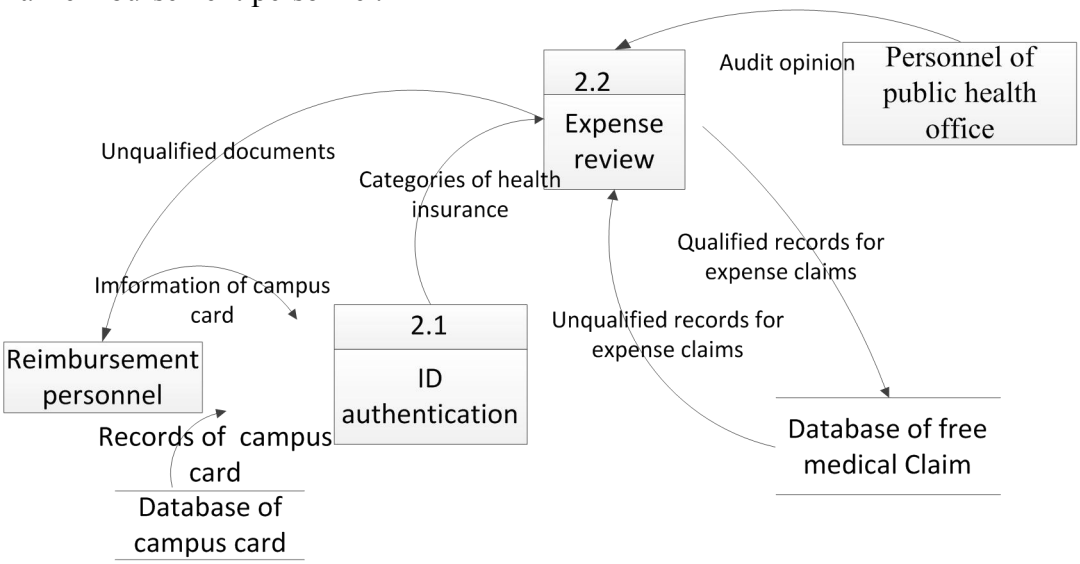

Figure 3 the sub-module of the free medical reimbursement management system

3.5 Interface design

The system interface was designed with frame structure and divided into left and right two functional areas: the left is the menu area which supply function menu with two levels display which can collapse or expand; the right is the operating area with corresponding menu for operation. For example, check results of reimbursement records were shown in Fig. 4, after inputting the conditions of personnel into the conditional input box and clicking the Query button, reimbursed record list of the persons can be obtained.

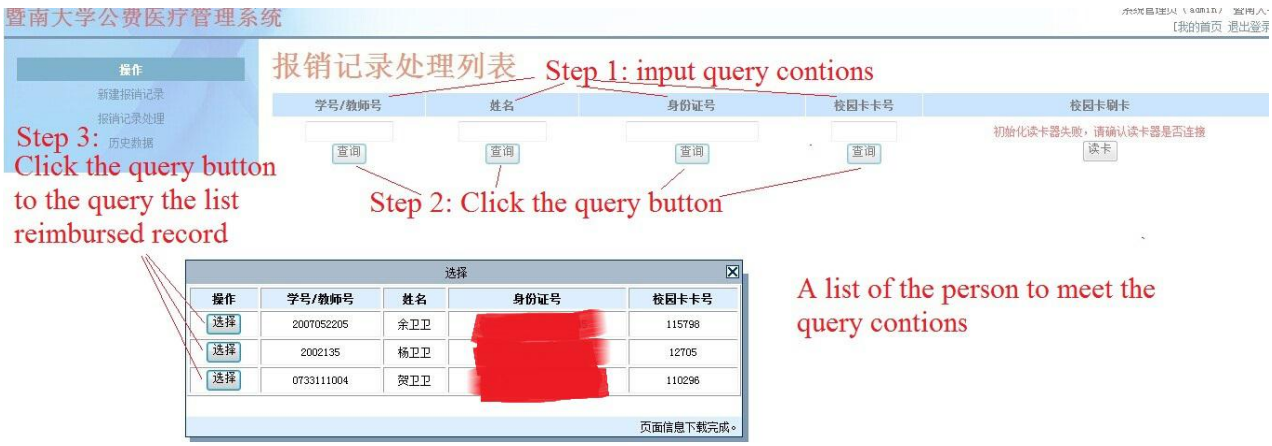

Figure 4 Results for query for reimbursement records (multiple results)

3.6 Code realization

JSP technology uses Java language for xml script and encapsulates some logic of dynamic web pages. It can also access server-side application logic through scriptlets or tags pages. JSP technology which can separate web logic from design is able to support design and application based on various types of elements. Therefore, the development of web-based programs is more simple and quick. For example, the following is a Java-like pseudo-code, displaying how to achieve a workflow shown in Fig. 5:

```
SystemTool sysTool = InitSysTool ();                    // Initialization of System Tools
User user = Session.GetUser ();                         // Fetch user information from dialogue
// Operators must have lawful authority
```

```
If (VerifyPermission (user) == PASS) {
    SearchCondition condition = PageForm.GetSeaCon ();          // Get the query conditions from page form
    // Search the eligible persons of reimbursement in personnel information view of database
    PersonList pList = DBOperator.Search (V_PERSON_INFO, condition);
    If (pList.Size () == 1) {                                   // How to check found that only 1 person
        ID personId = pList.GetByIndex (0).GetPersonId ();      // Get the ID of the only person
        // Record for reimbursement in the database view to query the person's reimbursement claims record
        BXHistoryList hList = DBOperator.Search (V_EXPENSE_YM, personId);
        ForwardTo (BX_HISTORY_PAGE);                            // Jump to reimbursement recording history page
    } Else {
        ForwardTo (PERSON_LIST_PAGE);                           // Jump to page of people list
    }
} Else {
    ForwardTo (ERROR_PAGE);                                     // User identity illegally jump to error page
}
```

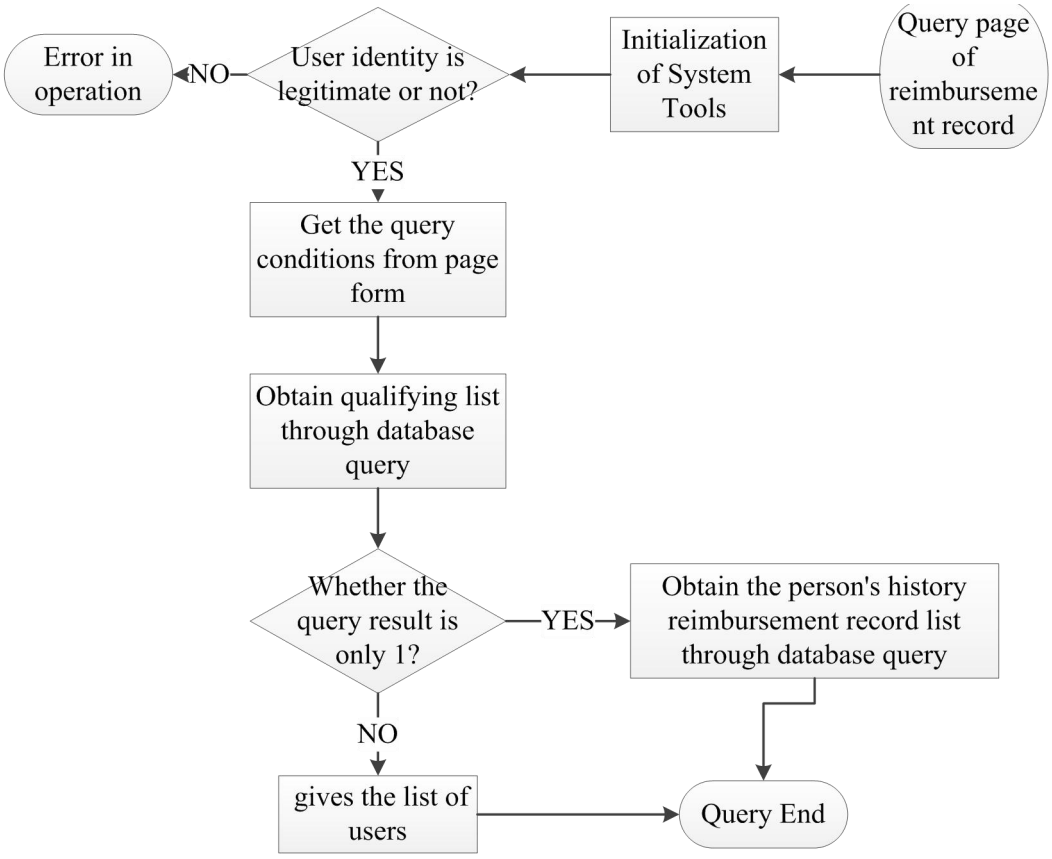

Figure 5 Work flow chart of reimbursement query recording process

3.7 System test

The relative important part of this system adopted in white-box testing method, and the main function module adopted in black box method. Among them, the white-box testing methods used paths testing method that searches all paths traversing program and judge every paths true and false situation to determine test case. Black box testing uses a boundary value analysis method that is achieve every

boundary values of each function, including the value whether can be realized or not, so as to test whether the system is fully functional.

During the development process, all modules of the system had been implemented by functional testing, and some of the key modules had been implemented by structural testing. After completion of system development, the security of the operating system platform was evaluated and tested, simulating the response capacity and anti-pressure capacity under multi-user operating system. What is more, users were organized for system operability test, and adjust the interface elements and parts of the operating processes based on feedback of users. After testing, the test results of the public health system are summarized as follows:

1) The functions of the system are consistent with user requirements.

2) The system with the advantages of robustness can cope with some extreme situations.

3) The system with the advantages of compressive resistance can simultaneously support a number of access requests.

4) The system is with the advantages of short response time, easy interaction and excellent user experience.

4 Conclusions

The system has been come into use in Jinan University since 2012. It is stable and achieves the desired effect. It possesses the functions that are not available in the old medical claims management system based on C/S structure and DELPHI. It is accurate and improves the office efficiency of public health office and planning finance office. Although this system has made some achievements, there are still shortcomings for it to improve. For example, it should further improve the architecture design, reduce coupling degree between modules, and increase the security and maintainability of the system.

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