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DIGITAL CAMPUS INFORMATION SYSTEM BASED ON SOA USING ASPECT ORIENTED SOFTWARE DEVELOPMENT

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ABSTRACT

Digital Campus System has become indispensible in college campus. It is a campus monitoring system which integrates all the departments of the campus reducing the data islands and acts as a unified system comprising all the processes in the campus resulting in effective monitoring of the daily activities within the campus. The system is built upon SOA which allows the system to be loosely coupled and centralized web services. The web services are designed using Aspect Oriented Software Development (AOSD) which encapsulates the scattered concerns and transactions that cross-cut services which facilitate the integration. Each user is provided with highly customized view of data providing more efficiency.

Key words: Service Oriented Architecture (SOA), digital campus, Aspect Oriented Software Development (AOSD), web service.

I.INTRODUCTION

Digital Campus system based on the network, advanced information technology and work tools has achieved all digital arranging from the environment, resources to the activities. But there are some problems in traditional digital campus implementation. Traditional application integration model lacks a unified description method of data format, resulting in different information carrier and data package, so it cannot be guaranteed that source data can be completely accurate expressed after exchange. Most traditional digital campus systems use integration approach by business system re construction, therefore all applications and data integrations are not truly unified.

Most colleges have built application systems based on Internet, such as office automation system, library management system, financial, educational and student management systems, etc. The data of these application systems are independent and cannot be shared to each other, resulting in many information islands. The lack of unified architecture and interface standard in application systems leads each users need to go to different islands for different business, which is laborious and time-consuming. Its basic idea is to realize the connection, interoperability, information sharing and integration among different application systems with a structure platform technology based on standard services, which is the so-called SOA system, short for Service-Oriented Architecture [1]. SOA is currently not able to encapsulate the scattered concerns including policy, security and fault tolerance, quality of service, and transactions that crosscut services which facilitate the integration. Aspect-oriented software development (AOSD) supports the concerns by weaving them into proper locations, eliminating the need for manual adaptation, which can often lead to an error-prone development process. Code weaving in aspect-oriented programming is the encapsulation mechanism that enables the development of crosscutting concerns.

II.SOA AND WEB-SERVICES

Agility, collaboration, and efficiency are the key factors that impact the success of business. These factors determine the capabilities of companies to respond to the evolving business needs. Traditional fixed and centralized infrastructures do not provide companies flexibility to build agile enterprise integration for the needs of the evolving business world and could be complex, inefficient, and costly. The Web is a pervasive distributed

computing infrastructure for enterprise integration where the Internet is used as an integration platform and Web services are used for communication among heterogeneous applications. The Web services based Internet infrastructure can be an IT technology for EAI. Basically, Web services are software systems designed to support software interoperability which is realized through a set of XML (Extensible Markup Language)-based open standards, such as Web Service Definition Language (WSDL), Simple Object Access Protocol (SOAP), and Universal Description Discovery and Integration (UDDI) [2]. These standards provide a common approach for defining, publishing, and using Web services. Due to the standards of XML, Web services support software interoperability in heterogeneous applications. Figure 1 illustrates the concept of Web services.

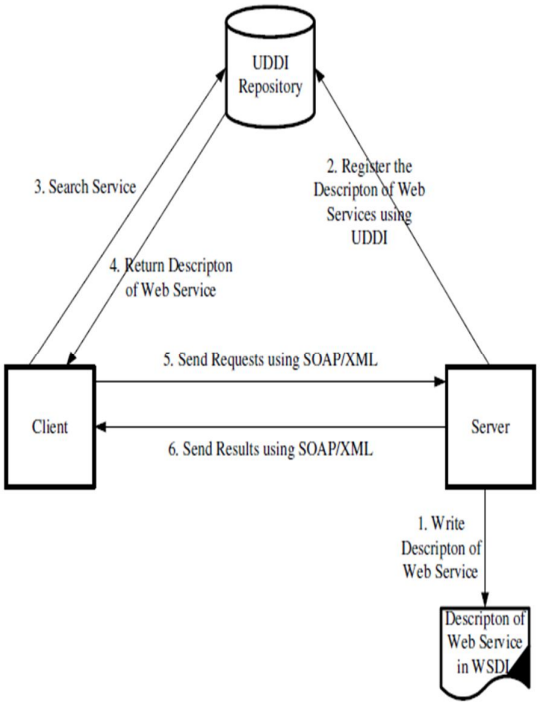

Fig. 1 Web Services

II.ASPECT ORIENTED SOFTWARE DEVELOPMENT

Developing web services using SOA leads to code tangling and scattering of crosscutting concerns when the code for a particular concern is intermixed with code for another concern and scattered across the system. In order to resolve this issue, these crosscutting concerns need to be implemented as services in components that support decoupling of the integration from other services but can be assembled with the other components. The advantage of encapsulating crosscutting concerns is that it enables the non-functional services to be handled in a consistent fashion.

AOSD addresses the crosscutting concerns by providing means for systematic identification, separation, representation and composition [2]. Crosscutting concerns are encapsulated in separate modules, so that localization can be promoted. This results in better conformance to modularization hence reducing development, maintenance and evolution costs.

III.SOA BASED DIGITAL CAMPUS ARCHITECTURE.

The digital campus designed provides integration services in three aspects: user interface integration service, application integration service and data integration service, to solve the connection and interoperation problems of loose coupling in the college information systems [1]. It is compatible with the different technology platforms in different applications and services, reusing the system services and impacting the existing systems minimally. Also, it constructs new services and processes on this basis for fast, efficient service systems construction, greatly reducing the overall system cost. The digital campus system is shown in Figure 2, which can be divided into the following parts:

- The bottom layer is data service, also called as data sharing library, which is the foundation of the digital campus information platform construction.
- The second layer is sharing application service. Business systems provide business processing functions and interfaces of information services for other systems, allowing application systems to share information and services.
- The third layer is enterprise service bus (ESB), which is an important component of the SOA, and is also the core of the whole system. Each business system accesses to ESB through ESB adapters. Message query (MQ) mechanism provides routers for data exchange and content, and process manager realizes integration, monitoring, management and optimization of business processes of the whole system.
- The top layer is information portal platform for different users, such as students, teachers, administrators, alumni and public. It applies portal technology and single sign-on technology to establish a campus information portal which covers all application systems, shows the content, information and function services of each application software.

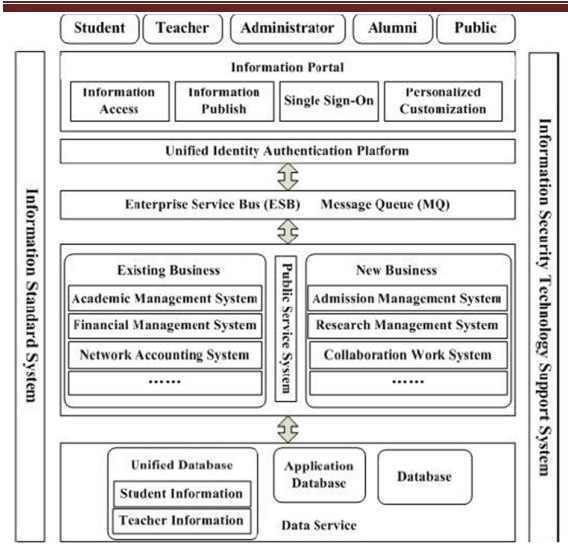

Fig. 2 System Architecture

The features of this system are as follow:

- The application services and business modules can be encapsulated and reused in relatively coarse particles.
- Services are maintained loose coupling.
- Information integration based on unified identity authentication services and personalized customization is provided for different users.

IV.SYSTEM IMPLEMENTATION

A. MODULES

The system consists of the following modules:

1. Administration Module

This module has the control over the entire database of the system. Only this module is provided with the privilege of modifying the database of students and employees.

Figure 3 shows the structure of the database and the tables it consist.

2. Finance Module

It does the process of calculating the salary of the staff for each month by entering their attendance details. The module generates the resulting salary using the CTC details of each person. Another aspect of this module is that it generates the fee and due details of the students.

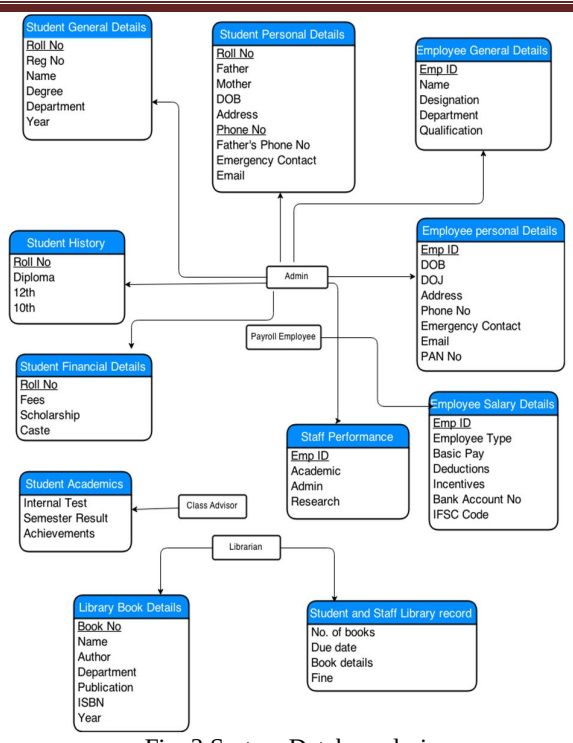

Fig. 3 System Database design

3. College Staff Profiles

Each staff is provided with customized profiles on the portal. Data accessing privilege is given based on their designation.

The Principal of the college is provided with following features:

- Employer appraisal
- Student complaint cell
- Performance analysis

Each Head of the Department has the following:

- SMS alert to parents
- Report generation and mailing

4. Student Profile

Student profile shows all the information about the student and can view their marks after each exam and can access the digital library with allow the students to download and study eBooks.

B. OPERATION PLATFORM

The system running environment includes operating system, database server, Netbeans IDE and J2EE application servers.

Requirements for the servers are:

- Operating systems support: Windows
- Database supports: MySQL 5.5.14 Server, JDBC
- J2EE Application Server: Apache TomEE Web Server which meets J2EE standards, JDK1.7, XML resolver.

Requirements for the clients are:

- Internet Explorer version 6.0 or above 6.0.

V.RESULTS

Figure 4 shows the login form of the Digital campus which has separate login for students and the staff of the college.

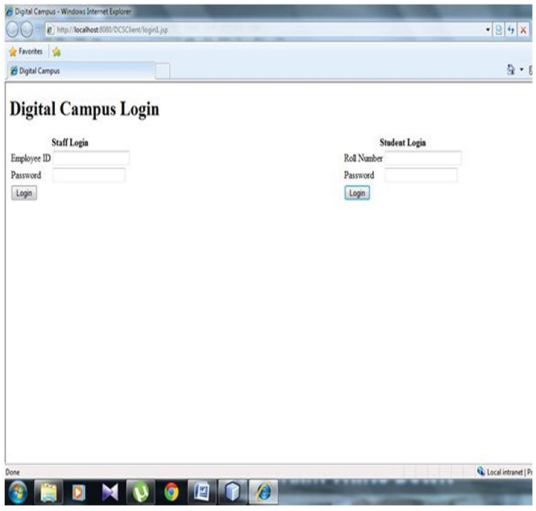

Fig. 4 Login form

A new student entry done in the administrator's profile into database is shown in the below figure.

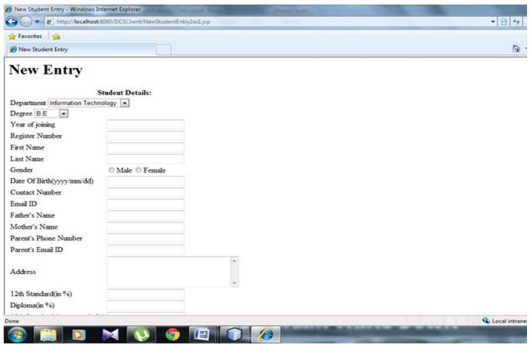

Fig. 5 Student Entry form

VI.CONCLUSION AND FUTURE ENHANCEMENT

The digital campus system is built on the SOA platform which allows the integration and operation of heterogeneous applications built in the college campus. Web services designed using AOSD principles has reduced the scattering concerns and helps in maintaining reusability of the web services. In future the security for the system can be enhanced as the system is working on the internet.

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