Building a Framework for the Integration of School Management Systems (BFISMS)

Romeo E. Balcita and Thelma D. Palaoag

Abstract—**Modernizing school services with the use of technology greatly influences its success. Schools are now required to give the most efficient services not only to the students but also to the students' guardian or parents and to its employees. School services that concerns with attendance, grades, fees, security, tracking of students, files and report generation. Students, parents, teachers, staff, and the school administration all want a good quality service. Building a quality system need a good quality framework. Thus this study aims to build a framework for the integration of School Management System. This study is a qualitative research as well as descriptive research. Literature review, interviewing of school personnel and analysis of existing school management systems successfully implementing such system were conducted to formulate the framework of the study. Integration of Technologies like the use of biometrics for attendance and security, using mobile phones as a tool for teaching, computerization of library system, computerization of student grading system, computerization of faculty evaluation system, computerization of enrollment system, computerization of daily time record system, and providing online services making information queries availability anytime anywhere. The online integration widens School Management System services and extends school operations. Furthermore, it also provides availability of real-time up to date information. Thus, building a framework for the integration of school management systems can give way for improving and providing an efficient school management system. Schools services mainly focuses on student services: enrollment, grades, assessment, providing student reports, library management, student entry monitoring and graduate tracking. Secondary school services include assessment for employees, daily time records, and inventory management and decision support system.**

Index Terms—**School services, school management system, centralized database, information system.**

I. INTRODUCTION

Schools services are continuously in need of a growing pace and aiming to provide good service and for the most efficient result. Collaborations of schools with the Information Technology (IT) sector can result in a good quality service and can satisfy the needs of the people concerned with the services of the school [1]. Performances of student can be improved by using smart classroom. The use of online education systems and school management system can make learning easier and manage school administration effectively and efficiently [2].

The need to adapt to the latest trends in IT will help improve the quality of education and handling various activities of the school. The use of Technology changed the quality of education for the better [3]. It makes procedures and systems, better integrate with factions, departments and various stakeholders. Productivity and performance are enhanced, maximizing employee's potentials or even recognize them using information systems increases managerial effectiveness by directing strategies [4]. But all this is possible only by using an efficient system. System builds with carefully modeled framework which delivers the key functionalities and shows all needed modules for the system. This framework not only helps programmers but also help managers in management purposes [5].

Since school managers does not yet know how powerful information technology is, they use computers but not as effective and efficient like the computer system can provide [6]. School managers' commonly uses software like word processor, presentation software, and spreadsheets. School managers' use these applications since they are already get used to it. Change to them is hard to embrace since it changes the way they managed the school. But other school managers that embraces change and tried to use school management system says that their managerial effectiveness are far better. Information is easily available anytime. Data gathered from the system are much more reliable. Processes become faster and school managers have enough time in decision making with the use of system which proves that manual process surely is an inefficient way [7].

Over the years, the use of software framework in building computer systems change the way programmers interpret software development. A software framework forms a conceptual platform. Framework shows libraries where application program interface (API) can be reused [8]. Systems are becoming more and more efficient as different software frameworks were developed [9]. Software framework was modeled using a developed software architecture patterns like Layered (N-tier) architecture, Mode-View-Controller, Component framework, Event-driven, Microkernel and Space-based architecture. There are other software patterns but programmers must choose what is best for him to describe the framework [10].

The inefficiency of manual system requires the need to computerized School Management System (SMS) in order to efficiently handle services for students', employees, and parents [11]. Building a framework for the integration of School management system is a first step to provide an efficient SMS. A framework gives foundation to build and improve existing framework.

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Thus, the objective of this study is to build a framework for the integration of SMS, identifying standard designs and functionalities that were needed for quality services and interconnection procedure and protocol of the different components or modules must be identified.

II. CONCEPTUAL FRAMEWORK

SMS consist of a large database system with different interconnections of subsystems [12]. SMS allows users to store and share to designated users almost all of their school's information electronically, including information on students, employees, properties, and teaching materials. SMS when build the efficient way provide a life-changing application that makes work easier, from searching records up to printing reports [13]. To build an SMS efficiently, an efficient framework must be done first. A framework built from existing frameworks, carefully analyzed and examined to identify possible improvements.

Building a framework for the integration of SMS requires the analysis of the different parts of school management. The need to identify components and the different functionalities were needed by examining existing systems of different schools that tried using SMS [14]. Then formulate a framework on every module and identify their connectivity to one another. Three common tools were used to represent the framework chosen for their efficiency to display processes, methods and interactions. These are 3-tier architecture, Model-View-Controller (MVC) and Component Framework.

3-tier architecture uses modules which can be independently updated without affecting other parts. Showing the SMS 3-tier architecture together with its independent modules is necessary to identify interaction of modules [15].

Model-View-Controller Architecture shows layers of methods and modules. It is an efficient model for identifying re-usability of code [16].

Component Framework identifies components of system necessary for the integration of sub-systems. Others call this physical architecture and network architecture. Different functionalities are shown here without dependencies to clarify methods to be built [17].

These three frameworks will help to identify Sub-Systems of SMS.

III. DISCUSSION OF FINDINGS

SMS consists of modules for students, employees, administrators and guardians of students. Four necessary components were identified to integrate these modules.

Fig. 1 shows the four key components every SMS should have, the admission, fees, assessment and academics module. These are the services which schools are most likely needed to function effectively and provide quality service [18].

Admissions. Student fees associated with their details and parent details will be processed here along with fee receipts. Modules associated with these includes: admission inquiry, admission form, confirmation of fees, online accounts associated with the school websites.
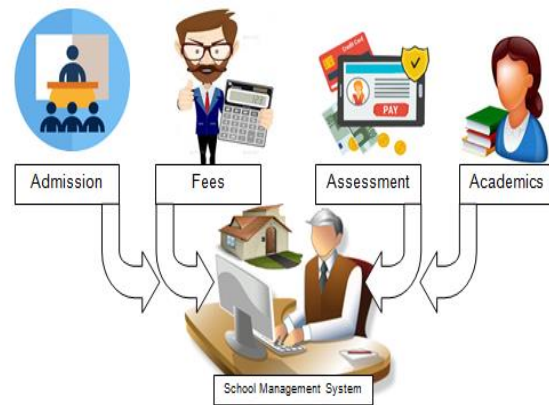

Fig. 1. Key components of SMS.

Fees Management. This includes various transactions concerning payments of students. Providing updated mapping with account and generating comprehensive fee reports.

Student Assessment. This includes ways to assess students as well as recording outputs. It also provides ways for easy communication between student and teacher.

Academic. This includes functions like updating daily classwork, assigning homework, organize lesson plan, syllabus scheduling and updating completed lesson.

SMS must have these four common components. Existing systems were studied and identified to verify these components. Some of the SMS that were studied are Engage, Elcen, Fekara, MySchool, Ascend SMS and School Tool.

Engage. This is an online SMS with modules including school administrators, teachers and leadership teams. It uses a centralized database with Website Admissions module. It also features customizable integration to school website. Parents and students have their accounts. Reports are also featured, offering a global overview of school performance, at-a-glance, with drill-down capability. Engage SMS also feature modules for pupil and student, staff and parent databases, admissions, online parent portal, report creator, document management system, it also has alert notification system, recording of medical data for students, student incidents reporting, and mail merge tool.

ELCEN. This is an interconnected school system. It links teachers, students and parents with standalone capability. It covers students for primary and secondary levels consisting of different modules like registering account for teachers and students, class management modules, fees management, library management, inventory management, ledger accounting and modules for report generation.

FeKara. This is an SMS featuring student academic management, exams and assignments. It is portable software that can run on different devices. It has online platform with modules for student's admission, academic, fees, and assessment. Other modules include Admin, teacher, employees, subject, fees examination, attendance, report, hostel, transport, import, export and parent module.

MySchool. This is an integrated SMS for high School student of all level. It features portal to every users including students online admission, finance monitoring, admission and record management, assessment and report generation.

AscendSMS. This SMS offers features necessary only for basic school management and student performance

management. It mainly features health management system using mobile app and discipline reporting system. Modules include admission, assessment, fees management, comprehensive report generation system, and inventory module.

SchoolTool. This is an SMS in cloud-based form. It is intended for school administration presented as open-source. Modules include admission, assessment, fees management, report generation, and online platform featuring multi-accounts for students, teachers, registrar and administration.

TABLE I: EXISTING SMS COMPONENTS

SMS	Admission	Assessment	Fees	Academic	Inventory	Hostel	Library	Guardian	Teacher	Employee	Transport	Report	Online
ENGAGE	✓	✓	✓	✓				✓	✓			✓	✓
ELCEN	✓	✓	✓	✓	✓				✓			✓	✓
FEKARA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MySchool	✓	✓	✓	✓								✓	✓
Ascend SMS	✓	✓	✓	✓	✓				✓			✓	
School Tool	✓	✓	✓	✓					✓			✓	✓

Table I shows the summary of the modules of existing SMS. Some components are similar and others have unique features to improve services.

SMS also consist of different sub-systems. As shown in Fig. 2, SMS consist of systems like Enrollment System which is run by the registrar's office, Grading System for students which is run by teachers, Academic Affairs Information System which run by academic affairs personnel, Student Services Office Information System which is run by Student Service office personnel, Tracking system for students which is run by the academic affairs personnel, Library System both for employee and students which is run by librarians, Inventory system for school materials which is run by maintenance officers, Security System for students and visitors which is run by security guards, Daily Time Record System for employees which is run by human resource officer, Employee Evaluation System which is run by academic affairs personnel, Student Portal which is run by registrar's office, Decision Support System which is run by managers. Enrollment systems also consist of two sub-systems, Student Information System (SIS) and Student Accounting System (SAS).

The results of the different architecture design below are based on the data gathering conducted. Architecture pattern, model-view-controller and system framework were the framework necessary to build an efficient SMS.

A. SMS Architecture Pattern

Most SMS runs on 3- tier architecture. With Tier 1 as the Data Layer, the use of MySQL Server will be the system's backend repository. For Tier-2 we have the Business Logics, PHP codes will be used providing portability to other platforms and additional security by hiding code modules [19]. And for Tier-3 which is the Presentation model, using Hypertext Markup Language (HTML), Cascading Style Sheets (CSS) and java scripts. Design interface for the

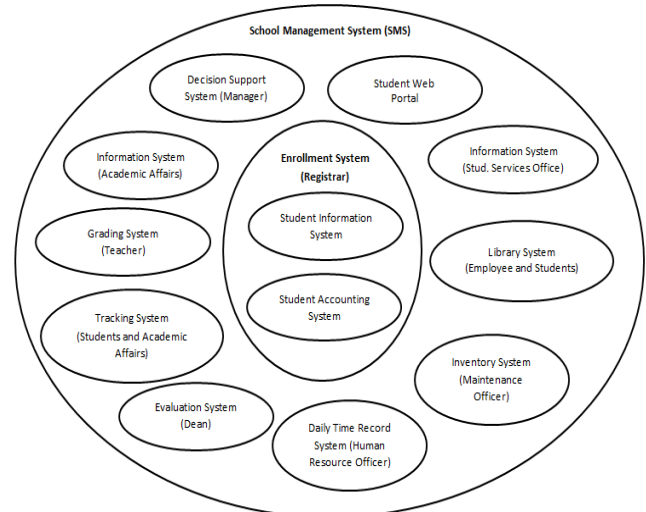interaction of users will be created using these languages.

Fig. 2. Sub-systems of SMS.

Fig. 3 shows the 3 tier architecture of the propose system that comprises of the presentation layer that provides interface to the client and application. Common component in this layer is student and Employee consisting of methods like account module, data entry module, management and report module. The Business Logic Layer provides main services or core features of the system with components like account verification, report validation, account management, manage transactions, manage academics and manage employee records. And the Database Layer provides storage for data consisting of table storage for students, curriculum, payments, schedule, assessment, transactions, and academics. Database normalization was taken and these tables efficiently represent data of SMS.
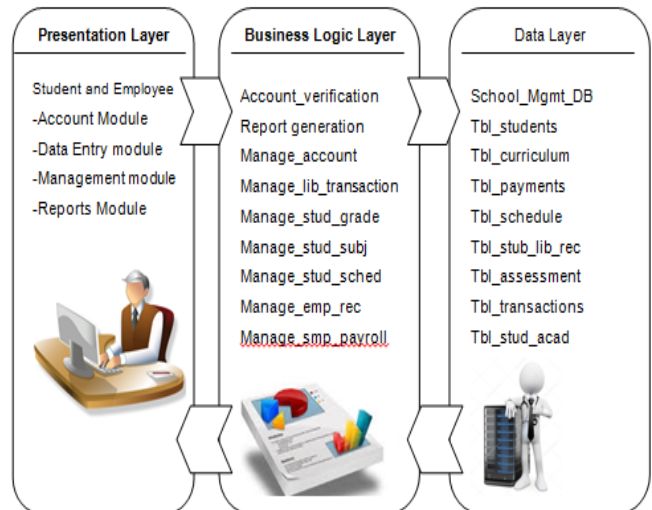

Fig. 3. Three-tier architecture of school management system.

B. SMS Model-View-Controller Architecture

The SMS Model-View-Controller (MVC) architecture design shows the different users together with their controller modules and model modules [20]. This architecture can best represent power users of the system as well as security measures in building SMS. Specific functions must be built to handle confidential data. The users interact by means of the view component in the form of PHP pages and the

controller will manage those inputs calling the model layer for specific processes to handle data. The model layer also handles functions that need interaction with the database. Fig. 4 shows the Model-View-Controller Architecture of the System.
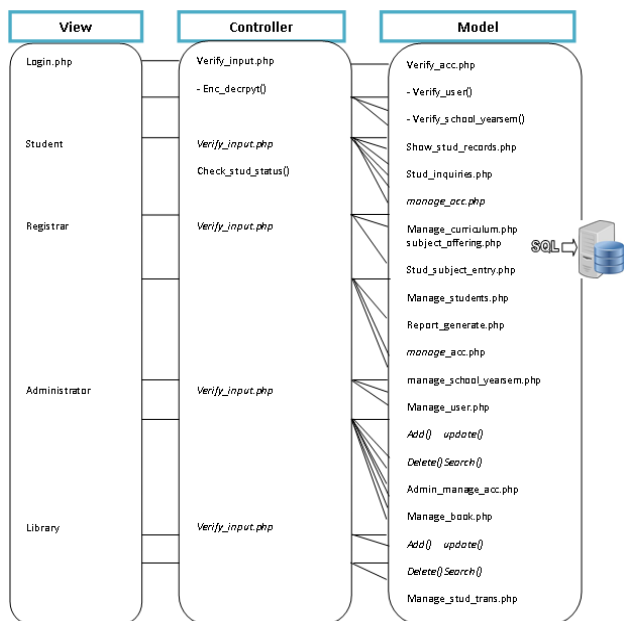

Fig. 4. SMS model-view-controller.

The View layer presents module handling accounts of the different users: students, registrar, administrator and librarian. Controller layer presents methods necessary for the interaction of the different user. Methods here include verifying inputs, encryption and decryption procedures as well as checking user status. The model layer present modules concerning verification of account to the database, managing records of different users and report generation.

C. SMS Framework

School management system consists of different components divided to function specifically for a purpose. Fig. 5 shows the system framework of the school management system consisting of the necessary components like the administrator, registrar, guardian portal, student portal, library, accounting and dean's account. Functionalities of every module were presented that gives clarification to what method will be built for the system as well is integration procedures and protocol to be considered.

Different methods were already assigned to every users considering identification of integrated functionalities. Other components were removed which identified as less priority in building a SMS.

Registrar. This module handles managing departments, degrees, curriculum and subjects. Student records as well as guardians are managed here including the processing of accounts. Since registrar handles enrollment data, subject offerings, class card, enrollment list, and Student Affairs Office (SAO) report are managed here.

Administrator. This module handles accounts of employees. System settings are managed here regarding school year and semester.

Manager. Different analytical reports were presented in this module for decision making. It includes reports like

financial reports, student academic relating to other factor report, examination questionnaire difficulty status, quality assurance report and guardian to student monitoring report.
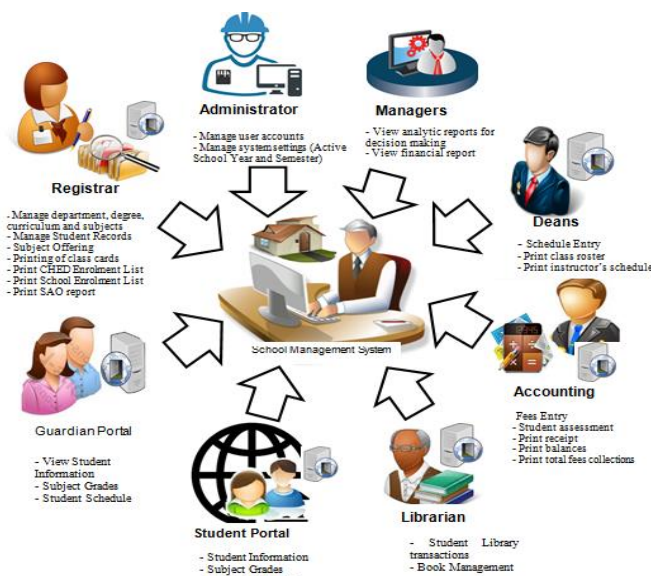

Fig. 5. SMS component framework.

Deans. Subject entry can be handled in this module and also with the registrar module. Student academic inputs are manage here. Reports in this module includes class roster report and subject schedules.

Accounting. This module manages fees both for student and employees. Permits as well as receipts are printed in this module. Reports includes student term fees and student balances.

Guardian Portal. This module handles guardian inquiries. From student payments, grades, appointments, call slips, student attendance and schedule.

Librarian. This module handles borrower's library transactions. Management regarding book inventory is also feature here. Reports include book listing, active borrowers, and data analytic report regarding mostly borrowed books.

Student Portal. This module features management of student inquiries. Grades and schedule are also presented in this module.

These components make up an efficient SMS that will surely satisfy anyone's concerned with the services of the school.

IV. CONCLUSION

Building different SMS framework will help in building an efficient SMS. Framework using different software architectural pattern model will help explain the processes and components of SMS. The more software architecture model designed the better and more efficient a system will be built. This framework can be used by programmers as well as managers. Mangers can use these frameworks in their processes and procedure updates as well as providing guides in their decision making. Building other design or model to show the framework of the system can help to determine further improvement in building SMS. Finding and considering other components of SMS will also make the SMS more efficient.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Romeo Balcita conceived and designed the analysis, collected the data, contributed data or analysis tools, performed the analysis, and wrote the paper. Dr. Therma Palaoag give insights in making the research.

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