Effective Campus Management through Web Enabled Campus-SIA (Student Information Application)

Bishnu Prasad Gautam, Shree Krishna Shrestha, *Member, IAENG*

Abstract— **This paper addresses some of the issues of definition among monolithic management, web enabled campus administration and report management systems. It is difficult to depict the comparative analysis of web enabled management because of the evolutions of diverse models of implementation, especially new commercial tools that are available in the academic communities and Information Technology (IT) industries. We will not analyze the prevailing commercial tools. The paper highlighted the importance of usage of web enabled management system that enhanced the entire performance of the administration on the basis of Campus-SIA (Campus Student Information Application) that we implemented during our research. Furthermore, the purpose of this paper is to discuss the potential of web enabled management system that we hope to enable the entire campus management beyond its monolithic management system. This approach of using web enabled management system in support of all-in-one portal approach is presented, and it is argued that monolithic with modular management systems via single access of point supports a constructivist approach of campus management and further encourage the collaborative management style, thus we introduce Campus-SIA that emphasizes all-in-one management activities of campus staff. This paper further demonstrated that campus staff administrative processes are supported by providing configuration tools for each successive year in order to automate and minimize daily administrative tasks. Performance of administration has been achieved through the introduction of layered architecture of reporting systems.**

Keywords: **Monolithic Management, Transparent Workflow, Role Based User Management, Multilingual System, Social Administrative Software, Operational and Representative Reporting.**

I. Introduction

Campus-SIA (Campus Student Information Application) is a web enabled software application for the management of student data. It enables the administration to enter the academic and financial data related to the student through web enabled browser that ultimately enhances the overall productivity of the administration. Productivity has been enhanced due to its feature of collaborative management at which all campus staff can work together which has created better chance to address the given task in the administration efficiently.

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While definitions of Campus Management in terms of e-Management vary, the main elements tend to include greater focus on "Web or Cloud [1]" the current dimensions of e-Management a more "usability" based view of e-Management and greater recognition of the role of "multi-divisions of the organization" rather than single division environment. While e-Management structure does not exclude single layer of management, it draws attention to a wider range of collaborative multi-divisions management approaches in addition to silo [2] or monolithic approaches, a data management approach assisted with and having monolithic characteristics.

The objective of the paper is to describe the implementation of an effective campus Management system given the name of Campus-SIA. It includes environments for user management, student personal information management, student financial management, student career management and dynamic reporting components as major components while it has numbers of other features by which campus administration can extract maximum utility in order to enhance the productivity. Campus-SIA is inspired by, and entirely implemented in PHP language with other advanced web technology.

The major contributions of this paper are as follows:

1) We presented a component oriented architecture that can be applied for the development of any campus management system. The performance of system in terms of search result has been achieved through utilization of Ajax technology, and identified the key components required for effective and configurable management for successive academic year.
2) We demonstrated additional benefits of our end-to-end tracking of student in grasping the historical records of student required for administrative purposes..
3) We introduced a reporting architecture system that consists of two layers of reports such as operational and representative reporting system by which the administrative and business intelligence of campus can be displayed in agile manner.

B. Campus Administration Management

Campus administration must be safe and well managed in order to maximize quality of service and the performance of administration that can pave the way for the academic success of each student and also the management of the University.

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We believe that academic success of a student is also associated with the quality of service that the campus administration provides. The purpose of this paper is to provide a prototype for supporting the establishment of effective management-focused campus community so that campus may achieve adequate yearly progress, ensuring that all students achieve adequate services in a timely manner. Campus SIA is a distributed system developed with object oriented development approach. The web enabled system comprised of a centralized database that allows users to handle all daily operations of campus administration includes entering new enrollments, tracking student personal information, tracking and monitoring fee payment, processing student's status (e.g. enter, drop, expelled and other). It allows campus staff to update, share, and use student information among academic staff in a secured manner.

C. Problems: Shortcomings of Desktop Oriented Monolithic Management Tools

We termed monolithic management as a management approach through a set of methods and techniques in order to manage sequences of tasks to accomplish a series of results within a well-defined schedule using a single tool. In this sense, monolithic management is not a bad approach of data management; however, the problem of monolithic tools such as Excels and other desktop oriented tools [3] used in the administration has limitations for effective data management such as organizing, sorting, deleting, and version control. In terms of data management, there are lots of campus staffs who still use Microsoft access; however, these tools have lots of difficulties and the campus staffs were compelled to encounter these difficulties as follows:

1) The prevailing monolithic tools are only accessible to limited number of campus staff and could not update the data at the same time
2) It requires numbers of redundant tasks as per the change of each academic year.
3) These tools are entirely static and are very inflexible due to monolithic design and require IT expertise to upgrade and change with business requirements.
4) It involves large paper work to support key business activity such as enrollment, course adjustments, handling records of finance, student information and other reports.
5) The system does not have relations with other software applications used by the university such as financial management, human resource management and schedule systems.

In order to address these limitations that are still persistent in the case of WAKHOK administration; and there are still few campus administrations where monolithic management tool are applied, we developed the web-based Campus-SIA. This has been built using PHP programming language and MySQL database management system. Campus-SIA has been developed in fully object oriented development and has relatively clean separation between presentation, business logic, and data access layers, with transparent set of business processes. These business processes are implemented in transparent manner so that we can extend other modules in the future. This system can be easily accessed by all academic staff through local intranet. In this paper, we furthermore discussed the key properties of the system and its architecture.

II. SOLUTION: WHY CAMPUS-SIA?

Student management through monolithic software as of Excel and Access has been one of the causes of low performance of campus administration. There were repeated tasks that need to be performed on daily basis by the administration, which degrades enthusiasm and productivity of the campus administration..

There are numbers of student management system [4] developed and used in software industries which vary in size, scope and capability, from packages that are implemented in relatively small campuses to cover student records alone, to enterprise-wide solutions that aim to cover most aspects of running large multi-campus organizations with significant local responsibility. Many systems can be scaled to different levels of functionality by purchasing add-on modules and can typically be configured by their home institutions to meet their local needs. However, most of the times, the industry standard tools can't meet the specific requirement of the university due to their inflexibility while configuring the system. We have developed and demonstrated Campus-SIA system, which is dynamic and can be easily customized based on the size and need of the organization (e.g. departments or divisions or the entire university.

A. SAS Application: Social Administrative Software

The term social software [5], [7] in terms of campus administration is a very complex concept to define. Social software includes wide range of IT technologies which incorporate the social aspect into technologies. Social software varies from communication tools aimed for communities in networks to interactive tools between the working groups in the organization. The examples of social software technologies can be named as weblogs, wikis, RSS feeds and social bookmarking. It is, however, important to note that social software is in no way limited to these specific technologies. The prevailing social software, nonetheless, are more concerned with interactive features such as chat, blog, wikis and video conferencing features. However, we do not incorporate all of those features rather introduce new features that were lacked in prevailing social software which could depict the concept of optimization of internal administrative processes of campus through a simple, effective and efficient web enabled application at which all staff can work together in collaborative manner. We admired the functionalities of social software and thus explore to incorporate the features of social software into Campus-SIA so that all the staffs can work together**.**

III. KEY FEATURES AND FUNCTIONS OF CAMPUS-SIA

A. Role based user management

Role-based access control [9], [10] and user management policy has been exercised in most of organizations which support to organize and groups the users and privileges of administration. Campus-SIA has been implemented with supportive feature of role based user management that provides super administrators with the ability to create, delete, identify and control the state of users logged or registered in the application. At the phase of user creation, administrator can define the role to each user (Figure 1).

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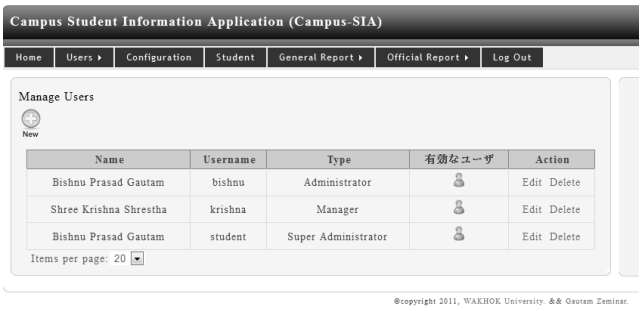

Fig 1. User List View

Particularly, the entire user management of Campus-SIA is done in role based policy [8] categorizing at least consisting of 3 layers user model. We categorized these layers as super admin users, admin users and registered users. Using role based policy, super administrators can define roles of other layers in order to minimize the difference between the role, control [8] and the scope values associated with configured roles. Administrators can define specific role of users such as capability of creating users, viewing or editing of specific report based on predefined criteria. For extreme cases while more serious action is needed such as deleting a user, user management module in such a case can modify or delete the role of a user via user management menu.

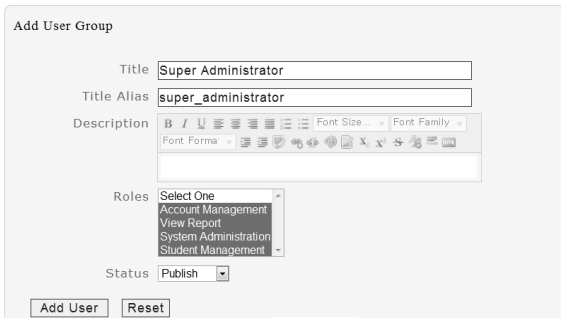

Fig 2. User Role

B. Customizable

Every campus has unique requirements, and operates differently. In order to achieve the dynamicity of the system. Campus-SIA has been implemented as to make its components customizable and configurable. For example, university may increase or decrease its campus, faculty or department; in such case the administrator of this system can easily customize the system to Campus-SIA thereby providing a highly customizable and flexible platform, where one can tailor everything from data entry screens to reports generation.

C. Information Tracking

Campus-SIA is well designed system not only to store the student information system but also to track the information stored in the database. Information, which could be changed, like address, guardian information is kept as history. The tracking of the faculty change and the career tracking after the graduation is also addressed while architecting the system.

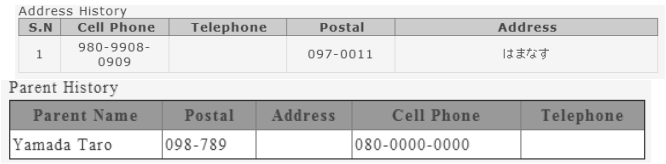

Fig 3. Tracking of Address and Parents of Student

D. Search

Well-equipped search functionality has extended the ability, not only in pages but also in reports to get the desired lists of students. Furthermore, the advance search feature makes it capable to query specific information by each campus, faculty, status, student year and other key words.

Fig 4. Normal Search

Fig 5. Advance Search

E. Dynamic Reporting System

We believe that the primary functionality of student management system should be featured with dynamic reporting. However, the prevailing reporting solutions are monolithic and the performance of reporting systems have been degraded due to their monolithic architecture at which all kinds of reports are generated from same components and are often displayed in static format. In contrast, our reporting system implemented in Campus-SIA is dynamic as the format of the report is changeable as per the configuration in the operational component. We agree that much of the campus administrative and business intelligence revolves around reporting, which receives considerable attention among university administration. In our study [5],[12] we found that there are very less practice to generate the dynamic format of reports and the prevailing reporting systems are very less adaptive to the dynamic features that is inevitable for efficient campus administration. In that sense, our reporting architecture which supports the format of html, pdf and excel can be applied in generating reports for campus administration and those formats are customizable through our operational modules. The layer based reporting architecture can further deal with the complexities of accounting and financial reporting, which is required by the university accountant to operate efficiently, including sophisticated financial reporting in their annual auditing process. We divided our reporting architecture in two distinct parts which are described in the following sections:

1) Operational Reports

We termed operational reports to those reports which can be configured by administrator or managers of the organization to run on day to day business process based on the the available data. In our case the organization indicates to the University administration. Such reports include information about the student academic and financial information. Our reports are generated so as to contain details that are essential for the day-to-day academic and financial analysis of the university. These kinds of decisions made on the basis of such reports are very detailed and immediate decisions and service can be delivered to the students as per the need. Similarly, we have implemented other reports for year-end analysis.

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2) Representative Reports

Representative reports are those intended for external usage. Such reports are well formatted and can be generated as per desired reporting format . These reports are submitted to the ministry and local government to depict the performance of the entire university. These reports could impact long-term and strategic decisions. Informational reporting should come from the data warehouse, whereas operational reporting come????????. Representative reports including academic report, financial report improve campus administration through data-driven decision-making. These reports are briefly discussed below.

a) Academic Reports

Student academic record is analyzed by generation of different kinds of reports like personal information report, current status information report, and parent information report. In addition to this, search features are available in all reports to analyze search result more easily on the basis of each faculty, student year and campus. An upto-date recent report is very useful to know the fact about total number of male and female students in each campus, no of male and female undertaking leave. Academic reports which are required for the official purpose, can be generated in printer friendly environment. It also allows user to export report in common Microsoft excel data format so that users can readily change its design.

その他学生情報
個人情報

S.N	Student Id	Kanji Name	Furigana Name	Gender	Birth Date	HighSchool	Joined Date	Faculty	Class Time	Status	Email	Cell Phone
2	10-01-001	Yamada Taro	ヤマダタロ	男	1993-12-23	Wakkanai Higher Secondary School	2010-04-01	情報メディア学科	昼		yamada@yam.co.jp	
3	10-01-002	Yamada Taro	ヤマダタロ	男	1993-12-23	Wakkanai Higher Secondary School	2010-04-01	情報メディア学科	昼		yamada@yam.co.jp	
4	10-01-003	Yamada Taro	ヤマダタロ	男	1993-12-23	Wakkanai Higher Secondary School	2010-04-01	情報メディア学科	昼		yamada@yam.co.jp	
5	10-01-004	Yamada Taro	ヤマダタロ	男	1993-12-23	Wakkanai Higher Secondary School	2010-04-01	情報メディア学科	昼		yamada@yam.co.jp	
6	10-01-005	Yamada Taro	ヤマダタロ	男	1993-12-23	Wakkanai Higher Secondary School	2010-04-01	情報メディア学科	昼		yamada@yam.co.jp	
7	10-01-006	Yamada Taro	ヤマダタロ	男	1993-12-23	Wakkanai Higher Secondary School	2010-04-01	情報メディア学科	昼		yamada@yam.co.jp	
8	10-01-007	Yamada Taro	ヤマダタロ	男	1993-12-23	Wakkanai Higher Secondary School	2010-04-01	情報メディア学科	昼		yamada@yam.co.jp	
9	10-01-008	Yamada Taro	ヤマダタロ	男	1993-12-23	Wakkanai Higher Secondary School	2010-04-01	情報メディア学科	昼		yamada@yam.co.jp	

Fig 6. Student Academic Information Report

b) Financial Reports

One of the most attractive features of Campus-SIA is the generation of the financial report required for the accountant to analyze the financial condition of the university and to send to its governing body. The financial report is further divided into two categories in accordance with the use of report naming: analyzing report and official report. Analyzing reports are used to analyze the current financial situation about the student and university itself. The advance search feature has added the feasibility to generate campus-wise report, faculty-wise report, student year-wise report which will obviously add the accuracy and value in analysis. In the representative report, the accuracy in the design of reports are highly considered and generated in print friendly condition. Furthermore, the architecture for the report is designed to make compatible with other data formats such as export the report in Excel that can be modified and further formatted easily.

	no. of student	入学金 Amount	授業料 Amount	教育充実費 Amount	実験充実費 Amount	no. of student	教職課程 Amount
稚内北星学園大学 1 年 昼	0	0	0	0	0	0	0
稚内北星学園大学 1 年 夜間主	0	0	0	0	0	0	0
稚内北星学園大学 2 年 昼	1	0	200,000	150,000	0	0	0
稚内北星学園大学 2 年 夜間主	0	0	0	0	0	0	0
稚内北星学園大学 3 年 昼	0	0	0	0	0	0	0
稚内北星学園大学 3 年 夜間主	0	0	0	0	0	0	0
稚内北星学園大学 4 年 昼	0	0	0	0	0	0	0
稚内北星学園大学 4 年 夜間主	0	0	0	0	0	0	0
東京サテライト校 3 年 昼	0	0	0	0	0	0	0
東京サテライト校 4 年 昼	0	0	0	0	0	0	0
	1	0	200,000	150,000	0	0	0

Fig 7. Financial Report

F. Unique ID System

The ID for each student is generated in the base of his admission year, campus, faculty and admission type, giving unique and informative 9 digits ID for each student. Such a unique ID system allows one to query student's information from the system

G. Multilingual Support

The multilingual support feature has made the Campus-SIA system capable of supporting any language with the simple addition of its language package. Campus-SIA utilizes XML technology in order to support multi language feature.

IV. Transparency of Workflow in Terms of Management

Campus-SIA provides accountability at all levels thus data entered in the system will be opened by the top level management. It makes all staff accountable towards the data and thus, the management can have a closer look on the activities of the campus. Campus-SIA has been built in such a way that it can automate redundant tasks and ensures that uncompleted tasks are followed up and their status are updated to all staff that have privileges to monitor, modify or update the tasks. The system reflects the steps required for the completion of each task and produces report of corresponding task that has been completed. We emphasizes in creation of report for each business process as it is one of the troublesome for campus staff who need to produce the report in timely manner and requires much effort. Unless documentation and report creation is performed properly, both systems and administrative processes will become a black boxes somewhere in the workflow. Campus-SIA is capable of generating reports automatically, which enables the transparency [4] – a vital feature for an efficient workflow.

V. The Fully Web Enabled Model

In the case of WAKHOK campus administration, there still are numbers of campuses at which, the job of an administrator is seen as monolithic: to perform a collection of tasks that are, with few exceptions, carried out alone and the status of tasks are obscured from their colleagues. In most colleges and universities, this kind of repetitive and monolithic approach can be labor-intensive and cost ineffective, thus needs to be transferred with web enabled application that is more transparent [1]. Individual administrative member can work with this web enabled Campus-SIA and deliver multiple works, each of which can be assisted and monitored by other colleagues. This type of web-based applications can be used largely as supplemental resources for administrative efficiency and productivity..

VI. Performance Enhancement of the Administration

The traditional administrative tools utilized in the administration for managing student records, including student financial records and other information system, has become bottle neck for the total performance of any college or university. We have witnessed such changes in campus working culture, especially due to the wide usage of Internet, have raised student expectations for the services provided by technology. However, there are still few colleges and

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universities who still utilize those traditional tools characterized by monolithic approach which cannot meet desired quality of services as expected by the students. As a result, those colleges and universities are vulnerable and may lose trust from their own students. This will obviously affect future student enrollment.. Information management system such as Campus-SIA can become an important management tool that builds trust among students through delivering services effectively and efficiently on a timely manner..

One of the goals of development of Campus-SIA was to maximize overall performance of campus administration. Before deciding the development of Campus-SIA, we benchmarked the current performance of the administration on the basis of the tools and the system they currently used. Our preliminary assessment suggested that the existing system inadequate and inefficient to provide necessary outputs and there is a need to develop a flexible, efficient and robust system to enhance productivity of administrative staffs. The key decision factor of this case study was to understand performance management from perspectives of different parameters and develop a framework that meets all the objectives of performance enhancement. In order to meet this goal, we developed Campus-SIA so as to enable the administration to understand all steps required in performance enhancement and examine shortcomings on each stage. The facility of providing common interface to each individual at which all members of the administration can work in the application simultaneously maximizes their performance and productivity.

VII. System Architecture

The appropriate software architecture is discussed, analyzed, reviewed and developed in order to meet all the objectives of Campus-SIA system. Fig 8 shows the Network Architecture consisting of Apache enabled Application server, data object enabled Database server and variants of Client. The system is fully web-based so that the variant of clients can browse the system running in the Application server using any of the available web browsers.

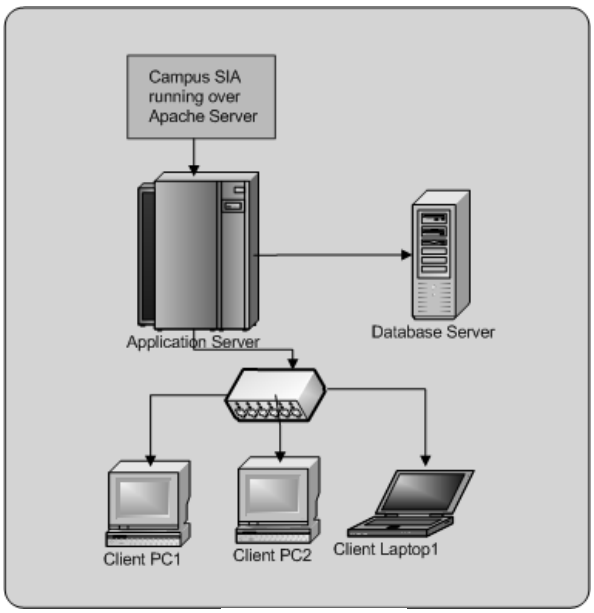

Fig 8. Network Architecture

Campus-SIA is developed in 3-layer architecture: User Interface Layer, Application Layer and Database Layer. User Interface Layer is the presentation layer for the clients from which user input is accepted from users. The accepted data will be posted to application logic layer. The different reports will be viewed by users from user interface layer. The user interface is implemented using HTML and PHP. The dynamicity on usability of the user interface is added using JQuery and AJAX Technology. The user interface is totally managed from the user role management which means the interface will be changed dynamically according to the role of the logged in user. For example, the user management interface is only displayed for the super administrator, student account management and scholarship management interface will only be displayed for Account Administrator and so on.

The business logic and web logic is implemented in Application Logic Layer. This layer takes input from user interface layer and stores information in the database layer according to applied business logic. The input data are logically separated according to the business logic which has divided whole Application Logic Layers into 3 major components. Various components are used to customize the business logic itself. The faculty and class time customization, user customization and fee customization is used to configure the parameter of business logic. Each management components are dedicated to their respective tasks and responsibility. Report Components are the output for the User Interface layer generating the report by joining the datasets from different table to make data analysis task more easy and effective.

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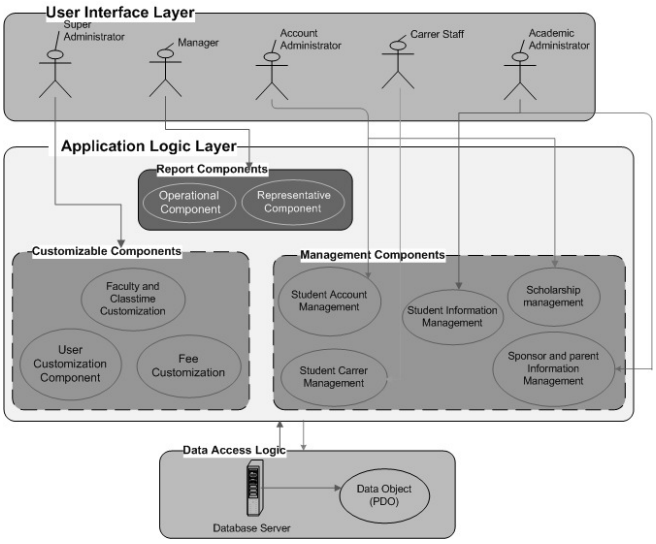

Fig 9. Campus-SIA Layer based architectural view

MYSQL database is chosen as database server considering its Usability, Portability and Localization features. The database abstraction layer of PHP Data Object (PDO) provides consistent API for our system regardless of the type of database server we connect which provides dynamicity in the use of database server also. The datasets are managed in the different table with respect to the data access logic.

The Use Case Diagram shown below depicts system flow of Campus-SIA.

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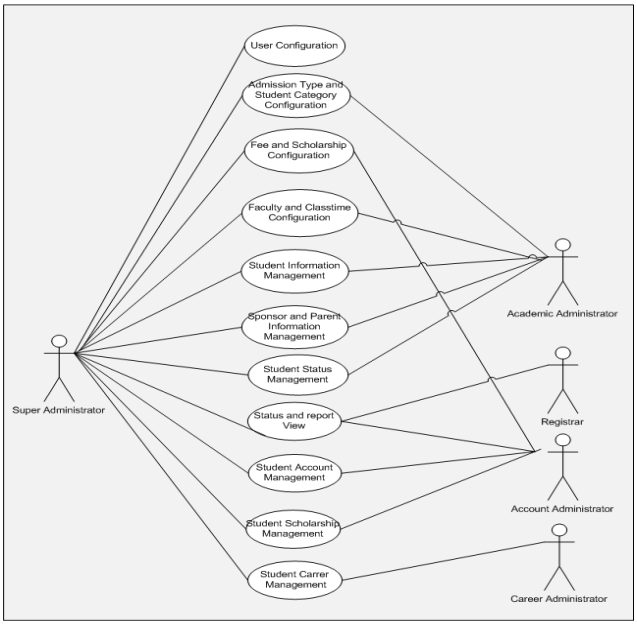

Fig 10. Campus-SIA Use Case Diagram

VIII. Related Works

Much research has identified component architecture as a key resource for Student Management System. Campus-SIA complements this work by introducing the configuration and customizable technique which is more users friendly and can be handled with relatively less effort. Campus-SIA is scalable due to its dynamic feature in its architecture. One can add, delete or update number of campuses with this system without modifying the application as it has been architected with easily customizable components. In academic front, we have observed number of campus management system and we found very similar kind of research done at Fiji National University. The management system developed in their research is called FNU-CIS [6] which has similar functionalities in terms of security, performance, and accessibility. In commercial front, we have done a case study of Campus-SQUARE[12], A2zcampus[13] implemented by NS-Solutions and CYBROSYS technologies respectively; however, we found that their research and solutions also did not indicate about the dynamic configuration of the modules such as fee structures and reporting architecture required for documentation in the campus administration. For example, the fee structure of the campus may change in the future academic years; however, due to their static nature of tuition fee structure; those systems are not adaptable for changing structure of the tuition fee. In contrast, Campus-SIA implemented in our research can support the changing structure of tuition fees and other financial modules as per the configuration, thereby provide easily customizable tools for each successive year in order to automate and minimize the administrative tasks.

IX. Conclusion

Our implementation illustrate that Campus-SIA presents many potentials to university administration management in terms of performance enhancement. Management issues are not new to those of us teaching and researching in the field of enabling campus administration into the web. Our research and the system we developed here suggested that Campus-SIA can be very effective tool to transfer monolithic administration management into very effective and service oriented by utilizing the feature of all-in-one web enabled interface. Campus-SIA serves specifically to the academic and administration staff to enter student information along with his/her financial data. This paper demostrated its major functionalities, and architecture whereas provides opportunity to overcome some of the limitation of monolithic management system. The architecture of Campus-SIA described the modular type of software architecture along with separating presentation logic, web logic, business logic and data logic as desired by the users. Future work would be carried on implementing further modules into the application and we will explore to standardize Campus-SIA so as to meet the management environment of any campus around the world.

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