



**UNIVERSITY OF NAIROBI
SCHOOL OF COMPUTING AND
INFORMATICS**

**University Examination
Information System**

By

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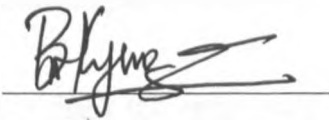
October 2011

Submitted in partial fulfillment of the requirements of the Master of Science in
Information Systems.

DECLARATION

I declare that this project report is my own original work and it has not been presented anywhere else for the award of any degree or diploma.

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Signed: 

Date: 17.11.2011

This project report has been submitted with my permission as the university supervisor.

Mr. Christopher A. Moturi

Signed: 

Date: 17 Nov 2011

ACKNOWLEDGEMENT

First and foremost, I would like to sincerely and deeply thank the Almighty God for the chance He has given me to pursue this course and in particular, this project work.

Special appreciation goes to my supervisor, Mr. Christopher Moturi, for his patience with me, and his guidance during the entire project duration. He also offered important reference points which helped me a great deal in carrying out this project. Thank you Mr. Moturi and may the Almighty God bless you.

I would also like to thank the entire staff of the School of Computing and Informatics (SCI), University of Nairobi (UON), for their support, understanding and professionalism. God bless you all.

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ABSTRACT

Jomo Kenyatta University of Agriculture and Technology (JKUAT), has a total student population of about 15,000 students spread across four faculties and eight constituent campuses spread across the country. Administration of all the university programs is centralized at the main campus, situated in Juja town. Currently the university undertakes its examination procedures using Microsoft Excel.

Due to lack of an efficient and effective system for processing and managing examinations, the entire process has been rather time consuming and error prone, particularly due to the many activities that require frequent human interventions. Inappropriate use of current technology has also been identified as a significant setback in ensuring timely and effective examination processing and results delivery.

The main objective of the project is to develop an Examination Information System which will ensure that the entire process of students' and lecturers' recruitment, registration of courses and units by students as well as capturing and consolidation of students' marks is made much more efficient.

The Unified Software Development Process (USDP) has been used as the main development methodology, due to its object oriented nature, besides being use case driven, iterative and incremental. The database part of the system has been implemented using MySQL as the back-end due to its openness. Both PHP and JavaScript have been used as the main programming tools due to their suitability for interactive web applications.

Various system tests have been carried out to ensure that all the user requirements are met. This mainly entails the systems' ability to identify authorized users, as well as target information recipients and relay appropriate information to them.

With the implementation of the new system, timeliness, accuracy and communication will be enhanced. This will ensure that examination processing at JKUAT is carried out using procedures that are in line with the expectations of its stakeholders.

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CHAPTER 1

INTRODUCTION

1.1 Background

One of the main functions of any institution of higher learning is assessment of students' in their understanding of concepts and skills acquired during their training period in the institution. The outcome of such assessments is realized via a series of activities that constitute the overall examination process. This process entails setting of examinations by the relevant lecturers, administration of such examinations by the appropriate course coordinators and subsequently processing and realizing of students results emanating from such a process. The entire assessment process can at times be such an enormous task that can take long periods of time to complete, and is prone to numerous errors, in addition to significant costs that may be involved. With the current advancement in technology, this process can be streamlined to a very large extent. The basis of this project is to look into ways and means in which examination information system can be used to significantly reduce the various drawbacks brought about by the current system of operation.

The case study is based on Jomo Kenyatta University of Agriculture and Technology (JKUAT), which has a total student population of about 15,000 students spread across four faculties. In addition to the main campus, there are other eight constituent campuses spread across the country as well as an additional campus in Arusha, Tanzania. These constituent campuses are collectively administered from the main campus.

In order for JKUAT to achieve its vision of being a world class institution of higher learning, it is imperative that appropriate technology is embraced. Advancement in ICT technologies, such as the decision support systems, distributed systems, mobile computing, and so on, have made enormous quantity of data and information processing within the Internet and other large-scale networks possible. This has presented numerous opportunities for the institution to carry out its day-to-day operations in an efficient manner that will ensure that it realizes its objectives much more effectively. The more information becomes available electronically the more the user is given greater diversity and choice. This however also means that the user must spend more time extracting and

sorting the relevant information from the increasing volumes of data. Institutions with affiliated campuses dispersed across wide geographical areas depend heavily on communication channels for information and data transfer. Availability and reliability of the communication network as well as up-to-date information is crucial for timely response and decision making. In the absence of this, the institution's operations, as well as its image can be seriously dented leading to significant losses. This problem can be compounded by the fact that the final data recipients are human users. Over-reliance on human operators is costly and time dependent, hence quality results may not be guaranteed due to the many human factors involved. Significant improvements on communication hardware, software, protocols and media have led to improved connectivity that has greatly increased performance.

Information collection, storage and processing at JKUAT, have over the years been bedeviled by various problems ranging from incorrect, incomplete and outdated information dissemination. Various technologies have emerged in an effort to address these problems, one of which has been application of a suitable Examination Information System, in carrying out the day-to-day operations. Effective course administration, examination processing and timely decision making are of utmost importance in a training institution. This is one of the main application areas of an examination information system that forms the overall basis of this project work.

The examination information system comes in as a support technology that focuses on operations and decisions that involve many people who include the board of examiners, chairmen of various departments, course coordinators as well as the academic registrar. An information system therefore recognizes that many decisions cut across several conventional lines of authority. It is however important to understand that:

It is not the technology itself that will enhance the decision making within an organization but rather the degree to which the support technology, decision strategies, and organizational power and politics work together (Marakas, 2003).

This means that the entire examination information system technology entails the use of accurate and timely information for ongoing coordination of activities and implementation of decisions by the various decision making organs of the institution. Availability of this correct information will enable the institution to reach the appropriate

stakeholders and provide quality services efficiently and at a much lower cost. As the institution seeks ways of increasing revenue at a minimal cost, the information system provides this much needed opportunity. As an example the system's function for confirmation of examination dates and results accessibility, offer opportunities for students who may be far away from the main campus to check all these details online, hence saving on administrative and travel costs. .

With the availability of the recently launched fiber optic cable, wider bandwidths are available on the Internet setting the stage for promising business endeavors. When this is coupled with the many flexible courses offered in most learning institutions, increased volumes and rates of data transfer are realized. However, accessing, sorting and processing large volumes of information require many skilled personnel working through out and sometimes making it quite costly. In addition, human users of information get overwhelmed with endless and probably meaningless streams of data. With time, these user ends up using trial and error information discovery methods. This approach is not only tedious and wasteful, but also counter productive. The examination information system will therefore be of great significance in trying to address these and many other issues that emanate from such voluminous amounts of data.

1.2 Problem Definition

The examination processing at JKUAT is a repetitively slow, tedious, insecure, costly and prone to errors due to the unprofessional way in which the exercise is carried out. As a result, the whole process has been generating many complaints from all the stakeholders, who include the students, administration as well as the parents and guardians. These irregularities have been experienced especially regarding preparation of consolidated marks lists, pass lists, supplementary/special lists as well as repeat performances.

The problems have been due to following factors among others:

- Tracking of students' status – it has been a daunting task to keep track of students' performances from the time they join the university up to the time at hand. This is because a student may repeat a unit, a semester or even a year, based on various reasons. These reasons may include failure to pass the required number of units, or

even an irregularity like cheating. A student may also request for an academic leave due grounds that range from medical, financial or even family issues like an untimely death in the family.

- Special/Supplementary – students have from time to time failed to appear and sit for special or supplementary examinations citing lack of prior knowledge of the examination dates.
- Erroneous communication - There have been cases where students have been asked to sit for supplementary exams when they had not failed, in the first place.
- Inaccurate consolidation of results - Students have erroneously continued from one stage of the course to another when they are either supposed to have repeated or even been discontinued.
- Long distance travels – students would travel long distances to come and check their results when they can do the same at the comfort of their home.
- Delayed decision making – Lack of accurate and up-to-date information has been a serious impediment to timely decision making by the relevant organs.

The above problems among others have therefore necessitated the implementation of an examination information system that streamlines examination processing so as to reduce the time taken to acquire, assemble, process and disperse results, enquiries and responses on examinations. This leads to cost savings, efficient examination processing and improved productivity.

1.3 Proposed Solution

In order to address the above problems, a solution is proposed that would use an examination information system that will make the entire assessment process much more efficient. The system will first and foremost ensure that only registered students are allowed to sit for examinations. In addition, the system ensures that all examination papers are received on time and their corresponding examination dates set appropriately. Students are able to check their examination dates online so that none will have any excuse as to why they could not sit for this or that examination. The communication mechanism between students and the administration is also enhanced such that any issues

arising thereof are communicated on a timely basis. For instance a student may want to request for a special examination due various reasons ranging from medical to various other reasons. The administration may as well wish to communicate to students on their scheduled dates for supplementary or special examinations.

Details of all transactions and communication sessions, as well as performance data is kept in the system and made available for purposes of decision support. In addition, students' current status regarding whether they are in session, on academic leave or even de-registered are well kept to make it easy for the coordinator to track down the students' past performance details and hasten decision making.

1.4 Objectives

The main objective of this project is the development and deployment of an examination information system that will automate the examination processing activities while at the same time being used by the university management to help in decision making.

The project aims at achieving, the following specific objectives:

1. Review and analyze examination information systems and their application and utilization in institutions of higher learning.
2. Implement an appropriate examination information system based on the above review and analysis.
3. Test and evaluate the system using suitable test cases.

1.5 Project Justification

The examination information system will be used by the JKUAT community to facilitate and support frequent communication and decision making, both internally and externally more efficiently, on timely manner and at reduced costs. The communication aspect will be facilitated by the use available communication tools namely the email and SMS, which are readily available. The information system will also support examination processing and the course administration processes, freeing personnel who include examination processing and course administration personnel, who will in turn engage themselves in other value adding activities.

The system will therefore be responsible for most of the examination processing and courses administrative activities thus reducing administrative cost, user response time and reduces the number of queries received from various stakeholders.

1.6 Project Scope

The scope of this project includes assessment of examination information system features, requirements analysis, design and implementation of an information system for examination processing and course administration. The main functions covered include students' registration and staff recruitment, course and units listing and registration; submission of draft examination and scheduling of the same, Submission of raw marks by lecturers and release of examination results to students.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

It is considered that the use of Information Systems in organization support for operations and decisions became an area of research of its own in the middle of the 1970s, before gaining in intensity during the 1980s. In the middle and late 1980s, executive information systems (EIS), Management Information Systems (MIS), and Transaction Information systems (TIS) evolved from the single user systems.

The definition and scope of these types of systems has been migrating over the years. In the 1970s EIS was described as "a computer based system to aid the top management level in decision making". Late 1970s the MIS movement started focusing on "interactive computer-based systems which help decision-makers utilize databases and models to solve ill-structured problems". In the 1980s Information Systems started to provide systems "using suitable and available technology to improve effectiveness of managerial and professional activities", and towards the end of 1980s a new challenge towards the design of intelligent workstations was faced (Sol, 1987).

The role of Information Systems in decision support has evolved from two main areas of research: The theoretical studies of organizational decision making done at the Carnegie Institute of Technology during the late 1950s and early 1960s, and the technical work on interactive computer systems, mainly carried out at the Massachusetts Institute of Technology in the 1960s (Keen, 1978).

Human, social and organizational factors are often cited as critical in determining whether or not a system successfully meets its objectives. This constitutes the environment within which the system operates. Ideally, the relevant environmental knowledge should be included in the system specifically so that it may be taken into account by the system developers. This means that all the user requirements, system requirements and the software requirements must be captured and implemented as comprehensively as possible.

The World Declaration on Higher Education for the Twenty-First Century: Vision and Action Conference sponsored by UNESCO in Paris between 5th and 9th October 1998 stated that higher education is presented with promising opportunities relating to technologies. However, these opportunities have been a challenge in using them to improving the information processes within the Higher Educational Institutions. Article 12 of the declaration enumerates the potential and challenges of technology that are posed to higher education. It also states that higher education should lead in drawing on the advantages and potential of new information and communication technologies, ensuring quality and maintaining high standards for education practices and outcomes in a spirit of openness, equity and international co-operation. This can be done through the adoption of a number of approaches among them creating new learning environments, ranging from distance education facilities to complete virtual higher education institutions and systems, capable of bridging distances and developing high-quality systems of education, and taking the new possibilities created by the use of ICT into account.

2.2 Emergence of E-Learning Systems in Kenya

E-Learning started being embraced in Kenya by November 2006, by the University of Nairobi (UoN). In the University website's homepage, a link was introduced to an "E-Learning Platform". Clicking the link would take the user to a page entitled "On-Going Projects in the E-Learning Section of MIS" (Kariuki, 2006).

Some of the Uniform Resource Locators (URLs) provided on the website were also difficult to access from outside of the university, as they were only accessible within the university's intranet. The amount of time taken to access a website was also relatively long due to slow internet speeds and low bandwidths. All the other public universities did not have any e-learning platform except Kenyatta University (KU) which seemed to benefit to a small extent from its association with the African Virtual University (AVU). This collaboration program was delivered through an e-learning platform. This platform however lacked a clear strategy hence providing minimal information.

Some of the private universities like USIU and AUSI had e-learning platforms that were not fully developed as most of the e-learning links in their websites were only accessible within their respective intranets. This basically suggested that their focus was mainly on the students within the campus.

With the introduction of the fiber optic cable and other emerging technologies, higher internet speeds and larger data bandwidths are being realized. This has led most public and private universities adopting e-learning platforms that can now be effectively used to deliver courses from remote locations. Majority of these e-learning systems have also incorporated an element of examination processing in the system, whereby students' marks can be processed and posted on the website so that each student can be able to view their marks online and from remote locations.

Some of the areas that have significantly been missing from these websites however are such as the ability to track students' status especially those who repeat classes, go on academic leaves or are suspended from the university for one reason or another; sending of reminders to students who need to sit for special or supplementary examinations; sending reminders to lecturers reminding them of due dates for submission of draft examinations among others.

For almost all systems, there are many possible designs which may be developed. These cover a range of solutions with different combinations of hardware, software and human operations. High quality designs should have characteristics that lead to quality products – ease of understanding, ease of implementation, ease of testing, ease of modification, and correct translation from the requirements specifications. Modifiability is particularly important since changes to requirements or changes need for fault corrects sometimes results in design change. The solution chosen for development should therefore be the most appropriate technical solution which meets the requirements.

Types of information that a typical Information System can process and present are:

- inventories of courses, units and students status in a learning institution.

- inventories of information assets (including legacy and relational data sources, cubes, data warehouses, and data marts),
- comparative sales figures between one period and the next,
- projected revenue figures based on product sales assumptions.

The proposed project uses the first item that is, gathering and presenting inventories of courses, units and students status in Jomo Kenyatta University of Agriculture and Technology (JKUAT). It combines this item with the assessment component, such that once students have registered for courses and been trained, they can be examined and their results captured and processed using the system. In addition, the system generates appropriate reports that provide the management with suitable and timely information that serves as a basis for quick decision making.

2.3 Examination Information System Components

There are five fundamental components found in the examination information system namely:

1. The data: This forms the database and consists of a repository of all the data and parameters that are provided by the users and which are manipulated by the system to assist decision makers with timely and up-to-date information. The data captured in this system includes details of courses, units, students, lecturers, examinations and students' results details among others.
2. The hardware: This forms the physical components used to effect the storage, processing and dissemination of all the required data to produce meaning information that can be useful for decision making. The hardware used includes workstations, communication devices such as routers and switches, servers and peripheral devices such as printers and scanners.
3. The software: This provides the interactivity mechanism between the system and the users, as well as the capacity to carrying out transactions with the system. The software used here include the browsers, MySQL, PHP, Macromedia Dream weaver and the web servers.
4. Users: To a large extent the users themselves are also considered as important components of the system. They include the system administrator, students, lecturers, coordinators and the registrar.

5. Standards and procedures: These are the rules and regulations governing the development and the use of this resource. Some of the rules applied are that a student can only view their own details course, units, examination time table and results.

The results obtained are a wide range of benefits accrued from the examination system which include but not limited to the following:

- Improvement of efficiency in the day-to-day examination processing activities
- Increase of organizational management and control
- Speeding up of problem solving in an organization
- Generates new evidence in support of a decision
- Hastening of the process of decision making through suitable data presentation structures.

CHAPTER 3

ANALYSIS AND DESIGN

3.1 Introduction

Examination processing is one of the core functions of the university in its endeavor to provide quality training, as stated in its core values and philosophy. The examination processing function of JKUAT includes the following activities:

- (i) identification allocation and scheduling of lecturers for various units.
- (ii) submission of draft examination by the relevant lecturers.
- (iii) scheduling of ordinary, special and supplementary examination dates.
- (iv) submission of students results by the lecturers.
- (v) recording of students' scores per subject.
- (vi) consolidation of centers' semester units score.
- (vii) generation of pass list.
- (viii) generation of students status reports
- (ix) posting of results summaries by the coordinator to the students.
- (x) communication to the students to check their results via email and SMS.
- (xi) responding to lecturers and students enquiries.

However, due to the numerous challenges currently being encountered in examination processing among them: ineffectiveness in tracing students records, diversity of centers and courses; strict and overlapping schedules; poor or delayed correspondence and audit of the same; staff overloads; poor or unreliable communication and poor record keeping. This forms the primary reason why the proposed examination information system would to a large extent eradicate the above stated problems, or at least bring them to a minimum.

2 Analysis

This section provides a description of the current examination processing procedures taking place at JKUAT. It also looks at the various limitations of such procedures and comes up with suitable proposed solutions to such limitations.

3.2.1 Course Administration

This refers to a set of activities carried out in an effort to provide effective training by JKUAT. The training involves not only identifying and addressing quality challenges but management aspects as well. These include, but not limited to establishment and management of various curricula; working with trainers, external institutions and administrators. It also entails handling of both internal and external communications to and from students and training arms of the institution.

This project focuses on specific aspects of course administration which include; course and unit listing and registration ;students and staff enrolment; course unit scheduling and allocation; examination setting, administration and control as well as posting of result to students and administrators.

3.2.2 Students' Enrolment

In effort to enroll potential students several methods may be applied which includes but not limited to:

- (i) Marketing, Advertising, Publication, Promotional Gifts and Material
- (ii) Coordination with External Partners
- (iii) Coordination with Internal Partners (Students, Alumni, Faculty and Staff)
- (iv) Events Management (Fairs, Conferences, Open Days)
- (v) Global Strategy of Recruitment Activities

The admission phase involves registration of successful applicant, attaching them to faculties of choice and enrolling them for various course units offered at various centers. This phase admit number of challenges which includes; delayed admission; diversity of units, prerequisite; attrition to other course; student flexible schedule; lack of or

3.2.3 Course Listing

The course listing allows students and lecturers to search for and get details about available courses for each semester. New courses or/and units may be added, discontinued or changed after the initial listing, for a particular semester. Additional information about new courses is available from the departments offering them. Proper and accurate course listing plays an integral part in supporting students, lecturers and administrators.

The course listing provides a guideline to students on available options. Upon selection and registering for units the information aids decision making on matters of allocation, scheduling and staffing. A number of challenges are encountered ranging from outdated courses, lack of interest; staffing problems; routine selection of units among others.

3.2.4 Lecturers' Registration

Attracting, selecting and maintaining the right lecturers is critical to the success of any institution in terms of content delivery, institutional image, student support and overall course administration. Every institution faces many challenges in these area, right from selection, retention and management. These problems are compounded by staff dynamisms, locality as well as other inherent human factors.

3.2.5 Units Allocation and Scheduling

The units' allocation function involves identification of the various units on offer, the number of student enrolled in each center and available lecturers after which unit are scheduled for learning and evaluation. This function is usually complicated due to the number of factors which include: units on offer; failure rate; the progression principle; course content duplication; cross link between departments; market demand as well as fall out of students after registration.

Just like most public universities and other private institutions of higher learning in Kenya, JKUAT has some of its students enrolled in a number of other campuses or affiliated centers, which are sparsely located in a number of towns across the country, and in some cases out of the country. These campuses and center activities are managed by the university registrar. Their curriculum as well as financial transactions in these centers are therefore centralized at the main campus, since that is where the top decision making body is based.

It is a well understood fact that there is stiff competition posed by other learning institutions for the same prospective students, despite the fact that some institutions receive subsidy from the government. For an institution to survive and guarantee return on investment it has to be innovative in terms of courses offered as well as promotion and administration of the same. New learning demands have been created by exploding information, accelerated competition and technology which is continually shortening learning time and shrinking space between learners and trainers, hence training functions need not be localized.

In the proposed system, students apply for courses offered at various campuses through the academic registrar. All applications are processed and successful applicants are informed through post or from various information desks. The successful applicants then enroll for courses at center of their choice where they study, are evaluated and receive performance result. A registered student enrolls for units on offer depending on course requirements and individual needs. Units' registration information is needed for administration of the unit such as allocation of lecturers and scheduling of the classes. Timely availability of such information is very crucial for the successful operation of any institution. A registered student may transfer from one center to another and transfer credit as they relocate to a new center. The academic registrar decides on qualifications of the lecturers for all the centers in order to guarantee quality. The registrar receives a list of applicants and creates a pool of lecturers from which the center coordinator can use to allocate course units. The center coordinators allocate units to lecturers and inform them of the same so as to prepare for the lessons. The lecturer prepares learning and evaluation materials for all courses offered in all the constituent campuses.

Lecturers are usually classified as either full time or part time lecturer. The number of lecturers enrolled in each center depends on the number of courses offered as well as the student population. Duties of the lecturer in the centers are as summarized below:

- Teaches courses assigned and registered for in the centers
- Sets drafts examinations for units allocated and submits the same to the coordinator.
- Administers examinations, marks examination scripts, records and submits raw marks to the centers' course coordinators.

The center's course coordinator is charged with the following responsibilities:

- Assists students in their registration process by recording all application details
- Receives course information from the academic registrar.
- Posts course schedules and details to students and lecturers.
- Conducts course needs assessments for training resource allocations.
- Schedules classes.
- Monitors student progress.
- Posts units progress to the academic registrar.
- Allocates units to lecturers.
- Evaluates lecturer's performance.
- Receives examination schedules, organizes for examination invigilations and posts examination time tables to both students and lecturers.
- Monitors lecturers' progress in marking assignments and examinations.
- Receives marks from individual lecturers and consolidates them.
- Remits consolidated marks to the registrar.
- Receives approved examination results from the registrar and posts them to students.
- Addresses all lecturers' and students' issues relating to the course.
- Handles all students' queries in liaison with the academic registrar.

The center coordinators form the main link between the constituent campuses and the main campus as well as both continuing and prospective students. This enormous role of the coordinators requires frequent and constant exchange of information between the centers and the main campus.

The academic registrar is central in management of all courses both in the main campus and at the centers. The following list summarizes responsibilities of registrar.

- Posts advertisements about upcoming courses and those offered in the centers.
- Posts details of courses on offer and their schedules
- Registers new and continuing students every semester.
- Liaises with the centers to establish training needs.
- Monitors students per center enrollment.
- Receives students per unit enrollment from each center for examination preparation.
- Schedules unit examinations for each center
- Monitors examination setting progress.
- Schedules all examinations.
- Receives examination results from the centers
- Consolidates results from the centers
- Analyzes students' performance from all centers per course, moderates results, produces pass lists and posts results accordingly.
- Addresses all centers and student issues.

Prospective students apply for courses offered directly to registrar or through the coordinator. Upon admission, students enroll for units of their choice depending on their needs and course requirements. Enrolled students sit for examinations for the units they have enrolled for. The students also check on their performance every semester before proceeding with the course.

The figure below represents the class diagram that provides a summary of the activities that take place during the enrolment and examination processing exercise.

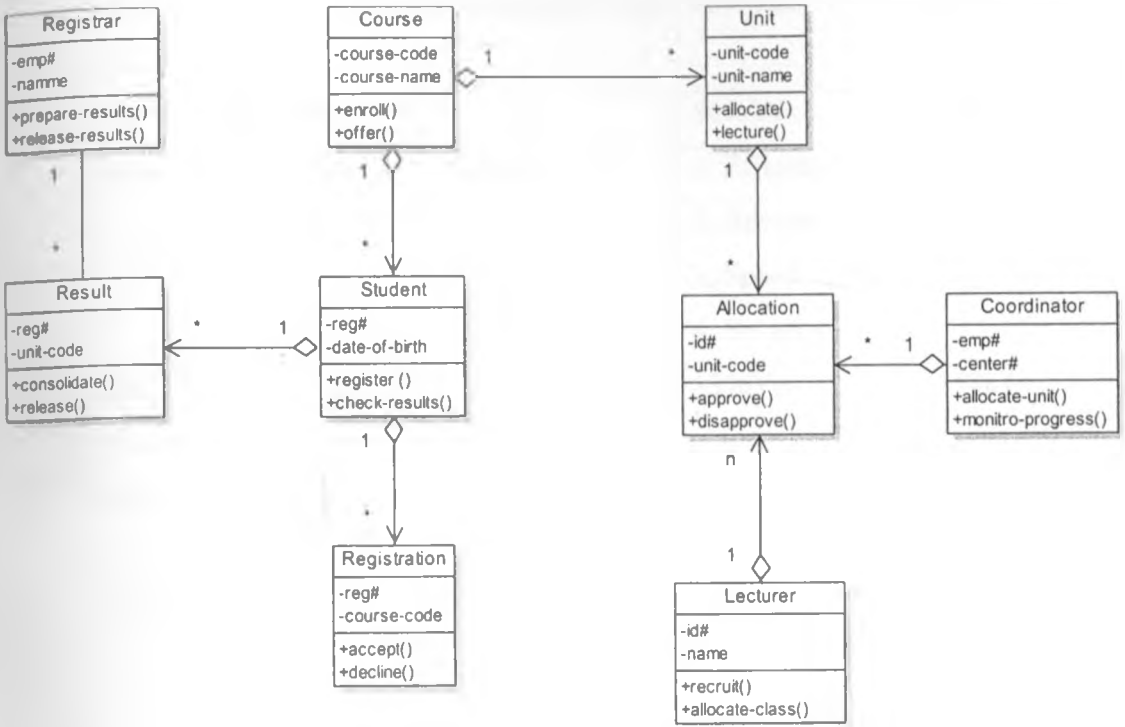


Figure 3.1: Enrolment and Examination Processing Class Diagram

It is important however, to note that the role of the coordinators and the registrar is enormous and would require initiating all information retrievals explicitly and monitoring all responses from the information system. The problem is compounded further by unreliable communication channels and especially regarding various students' progression and their results as well. The proposed system therefore comes in to attempt to solve these and other related problem.

The table below gives a summary of the results obtained from the interviews and observations that were carried out during the requirements capturing period: [see Appendix B for sample questionnaire].

No.	Requirements area	Responses	
1.	Examination processing methods currently being used are inefficient.	20% Yes	80% No
2.	Registration methods currently being used are inefficient.	80% Yes	20% No
3.	Preference for a new system	80% Yes	20% No
4.	Requirements in order of preference	1. Efficiency 2. Accuracy 3. Speed 4. Security	
5.	Need for the system to assist in tracking down students' status	85% Yes	15% No
6.	Need for the system to support in decision making	70% Yes	30% No
7.	Willingness to convert to the new system	75% Yes	25% No

Interviewees included students, lecturers, coordinators and the academic registrar. Based on the above responses among others, a model was proposed that would attempt to meet the above user requirements.

3.2.6 Expected Outcomes

In line with the above stated objectives of this system, given below is a description of the expected outcomes of the envisaged examination information system:

- A timely and reliable examination processing exercise. This will be realized by the fact that lecturers can enter examination results remotely, which are in turn consolidated automatically by the system.
- Students will be able to register their course of choice online.

- Students will be able to enquire online about courses, units and even their examination results.
- The information system will send emails to students immediately the results are approved and released by the board of examiners. The system will also keep a record of the sent emails so that no student will later come forward and claim that they never received communication, and especially if they are required to sit for special or supplementary examinations.
- The system will maintain the status of all the students in terms of whether the student is in session, on academic leave or even deregistered. This will facilitate quick decision making which discussing the students performance.

With the realization of the above outcomes, it would now be possible to produce timely and accurate results in addition to ensuring efficiency of data storage and retrieval. In addition the above outcomes will facilitate effective and efficient generation of relevant pass lists, as well as the corresponding lists of special and supplementary examinations and any other pending issues.

3.3 Design

The examination information system comprises of many interrelated interacting entities which require a model to aid in its comprehension, while at the same time meeting various user needs and supporting decision making.

The model is based on the understanding that decision making at JKUAT takes place in three levels as follows:

LEVEL	DECISION	SYSTEM SUPPORT
Operational (by the Coordinator)	Whether to recommend splitting/merging a class or not.	Enrolment details, class allocation reports
	Whether to allocate a class to a certain lecturer or not.	Email & sms alerts sent, results summaries
	How to prepare the exam timetable	Exam submission details of the lecturers
Tactical (by the Registrar)	Whether to close enrolments or not.	Enrolment details.
	Whether to recommend hiring of part-time lecturers or not.	Details of class allocations to lecturers.
	To know the status of each student.	Student's status details.
Strategic (by the Senate (Board))	Whether to deregister a student or not.	Email & sms alerts sent, results summaries
	Whether a disciplinary action needs to be taken or not.	Exam submission details, email & sms alerts sent.
	Whether to terminate/re-brand a course or not.	Enrolment details, exam performance reports.
	Whether a unit needs to be re-taught/re-taken or not	Exam results' summary reports
	Whether to re-admit a student or not.	Student performance details, email & sms alerts sent.

3.3.1 System Design

Due to the nature of the requirements and the need for a dynamic and flexible system, the object oriented analysis and design approach, and more specifically the unified software development process has been proposed. The main reason for choosing this methodology is its iterative and incremental approach to systems development. It is also use case driven, architecture centric and also risk focused, among many other features

The proposed examination information system will enable users to perform their various academic and administrative duties efficiently, effectively and at minimal cost in a competitive, dynamic and distributed environment. The system will provide users with an interface to capture and access examination results, details of courses, prospective and continuing students, lecturer, and administrator as well as other course administration information. The system should be open and accessible in a distributed environment.

It will provide users with an interface to interact with while at the same time supporting various types of decisions by the management. The system also holds data in a persistent database which serves as input and output reference point for the users. It provides communication channels to the users to enable them access and convey information to the intended recipients as scheduled. The system should provide an interface to use in the execution intended functions. When invoked, the system should execute functionalities and generate appropriate outputs that way offloading users of routine and tedious work. It will also submit results of its operations by updating database and or generating summaries. These summaries are in turn availed to the intended recipients using appropriate communication media. System users should be able to obtain summaries either by logging into the system or through their mobile phone and or their email accounts.

3.3.2 The Unified Software Development Process (USDP)

USDP is an industry standard software development process which is generic software engineering process for the UML. This means that USDP can be customized for your a specific project. Towards this end, the approach consists of

- In-house standards
- Document templates

- Tools
- Databases
- Lifecycle modifications

The USDP possesses the following features:

- Use-case and risk driven
- Architecture centric
- Iterative and incremental

Rational Unified Process (RUP) is an instantiation of USDP.

Iterations

Iterations are the key concepts used in the USDP. Each iteration is like a mini-project that includes:

- Planning
- Analysis and design
- Integration and test
- An internal or external release
- The result of an iteration is an increment

The final product release is arrived at through a sequence of iterations. These iterations contain workflows and are organized into phases. The main phases are:

(a) Inception

This phase includes the following:

- Establishment of the business models
- Risk and quality analysis
- Feasibility and scope identification
- Stakeholder analysis and acceptance
- Establishment of the funding of the project
- Requirements analysis

(b) Elaboration

The phase includes:

- Establishment of the requirements specifications
- Development of the basic architecture of the system
- The main development of the analysis and design models
- Some initial testing of the analysis and design models.
- Development of an agreeable plan for the construction stage
- Final identification of risks.

(c) **Construction**

The construction phase includes:

- Implementation and testing of the system
- The beginning of the deployment of the system by releasing a beta release
- Configuration management

(d) **Transition**

This phase includes:

- The process of introducing the system to the users and carrying out further configuration management.

3.3.3 Design Strategies

Two common design strategies that can be applied for the development of the system are:

1. Programming a customized examination information system:
 - either a general purpose language like C++ or a fourth-generation language like Delphi or Visual Basic can be used. This allows for development of special interfaces between the system and other applications.
2. Employing a generator:
 - these range from spreadsheets such as Excel, perhaps with some add-ins, or a more sophisticated generator such as MicroStrategy's System Architect.

Several other approaches can also be applied to the process of examination information systems development. These are as follows:

System Development Life Cycle: Employs phases that begin with "Problem definition" then "Feasibility Analysis" and finish with "Implementation" and "Maintenance". The

primary advantage of SDLC is the structure and discipline it brings. It is often used today, especially in cases where there is a contractual relationship between the system developer and the end users. The major complaint about SDLC however, is its rigidity since requirements in an examination system can change rapidly.

For unstructured problems, an object oriented development strategy is usually employed. There are seven basic activities in this process (not all may be performed in every project).

1. Problem diagnosis – formal identification of the problem context.
2. Identification of objectives and resources – specific objectives must be described and available resources identified.
3. System analysis – three categories of requirements (functional, interface, and coordination) are established.

The remaining steps are:

4. System design – the determination of components, structure, and platform.
5. System construction – an iterative prototyping approach, with small but constant refinement employed.
6. System implementation – where testing, evaluation, and deployment occurs.
7. Incremental adaptation – this final stage is a continual refinement of the activities of the earlier six stages

3.3.4 SDLC versus the Object Oriented (O-O) Development Process

- SDLC evolved out of developers' experience with computer-based information systems. The sequential and structured nature of the process is one of its primary strengths. In practice however, a more iterative, bottom-up design approach might work better.
- For O-O development, as opposed to traditional SDLC development, problems tend to be less structured and a more evolutionary design approach is needed.

The unified software development approach allows for the examination system to be changed and redesigned at various intervals. Once the system is designed, it will need to be tested and revised for the desired outcome.

The figure below illustrates the expected interactions between the various users of the system.

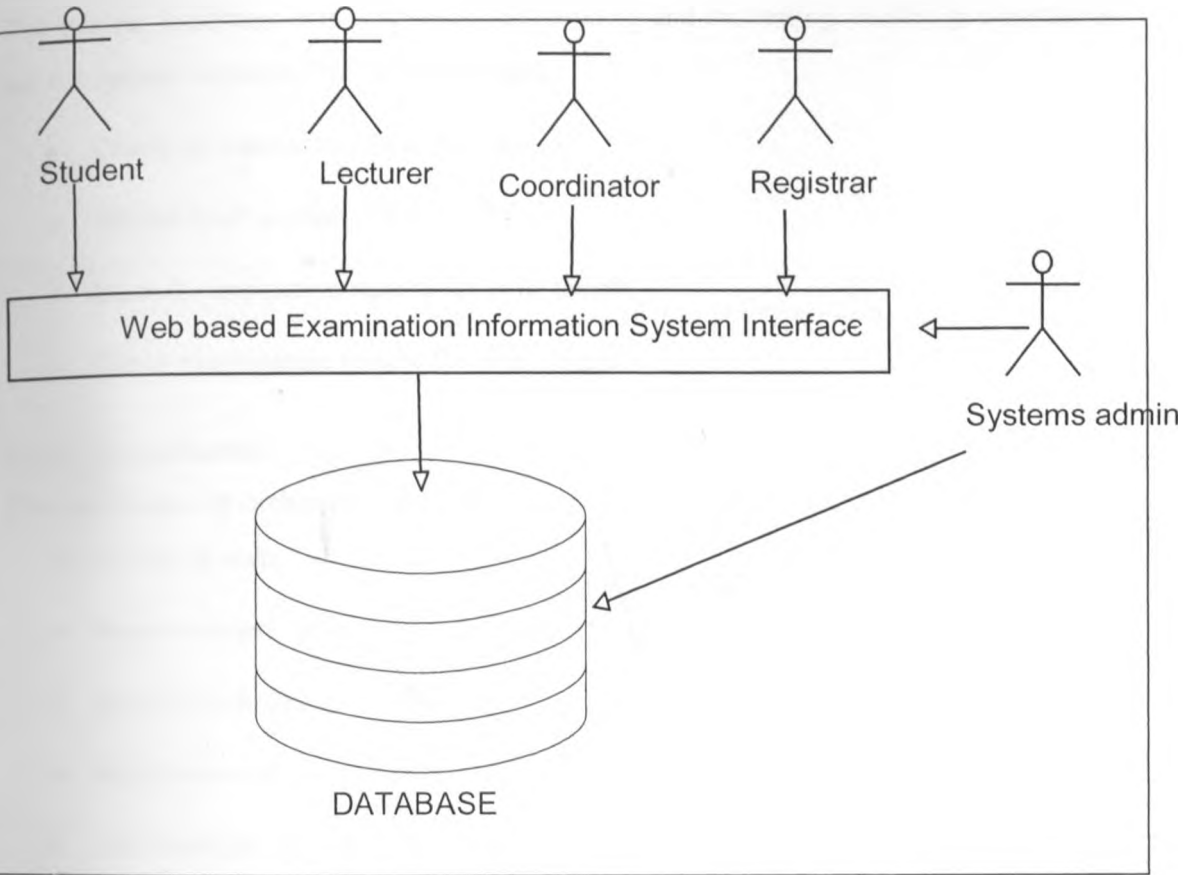


Figure 3.2 Interaction in Web Based System

3.4 System Users

The system is expected to have many users each with a distinct role to play as specified below.

3.4.1 Student

Every student is expected to perform the following task using the system:

- Check course registration requirement details
- Provide all required details during registration.
- Register for unit on or before due date
- Check course and examination timings

- Check examination results.

3.4.2 Lecturer

The lecturer facilitates unit(s) allocated by teaching and evaluating. He/she is expected to use the system to perform the following task:

- Check on units schedule and allocation
- Submit draft examination
- Record examination results for units taught.
- Check examination results for units taught.

3.4.3 Coordinator

The coordinator is in charge of the center operations and would use the system to perform the following tasks

- Record centers' employee details
- Records unit allocation to lecturers
- Monitor course enrollments
- Monitor draft examination submissions.
- Monitor result submissions.

3.4.4 Registrar

Registrar is in charge of operation for all the centers. He/she is assisted by the coordinator. The registrar will use the system to carry out the following.

- Register units offered in each center.
- Register students for courses in the centers
- Monitor student registrations
- Monitor unit allocations to lecturers
- Monitor course progress
- Monitor lecturer performance

- Monitor draft examination submissions
- Moderate examination results
- Post examination results to students
- Any other administrative role.

3.4.5 Systems Administrator

The systems admin is the super user in charge of the overall system. He/she is expected to ensure availability, reliability and integrity of the system. The administrator would be expected to do the following.

- Define user roles in the systems
- Grant and or revoke user rights on the system
- Configure and fine tune the system.
- Trouble shooting, backup and recovery
- Enhance overall system performance.
-

The Unified Modeling Language (UML) is used to model the system due of its traditional object oriented nature. Figure 3.3 below models the system's use case diagram for examination registration and result processing

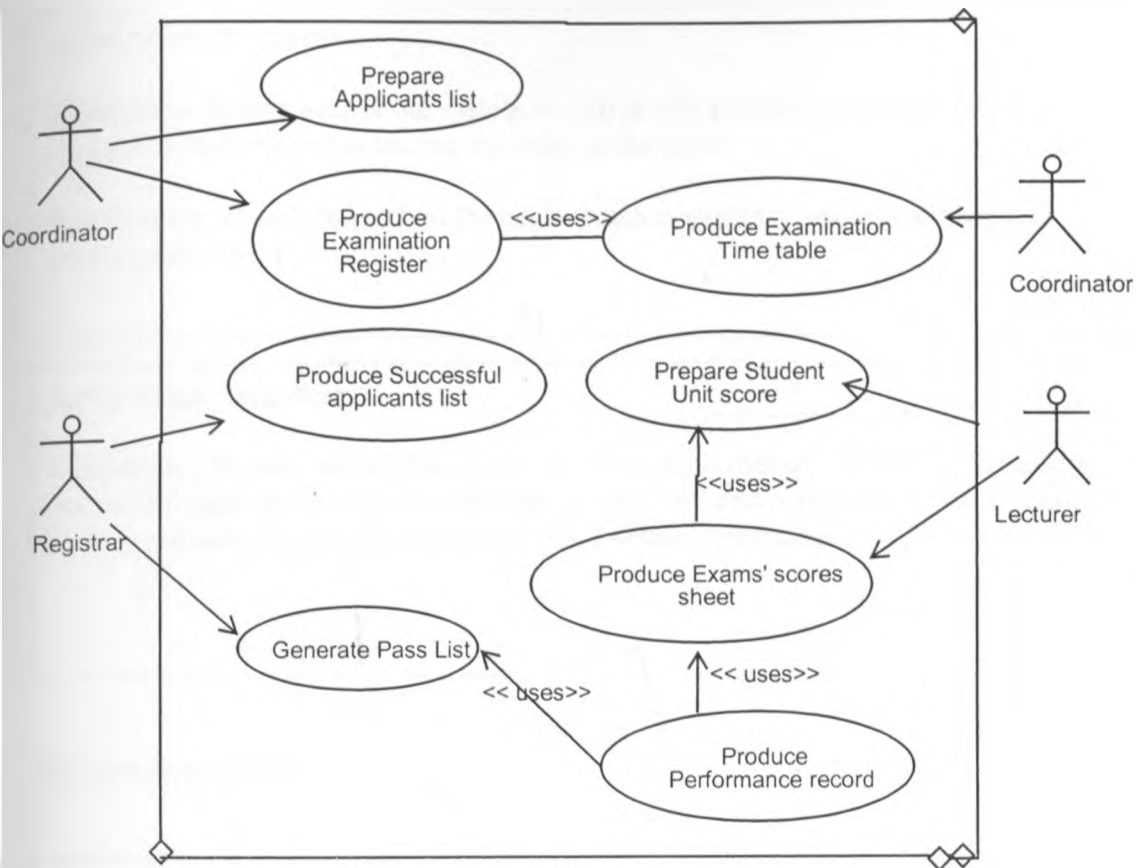


Figure 3.3 Examination Registration and Result Processing Use Case Diagram

Actor descriptions:

Actor name: Course coordinator

Definition : Human user of the system in charge of the center. Receives applications, prepares list of units enrolled, gathers student marks and submits to registrar.

Receives and communicates information on examinations e.g exams offered, time table, etc.

Actor name: Lecturer

Definition: Human user of the system in charge of preparing outlines, delivery content to students and assessing students on the same.

Receives list of units to teach in the center teaches students, sets and administers exams, posts marks.

Actor name: Registrar

Definition : Human user of the system ,oversees activities of all centers. Registers successful applicants, maintains student nominal roll and performance list. Generates list of graduates from performance records. Prepare certificates.

Use case descriptions:

Use case name: Prepare Applicants List

Actors : Course coordinator

Description:

Applicants submit correctly filled application form. List of applicants prepared and stored for reference.

Use case name: Produce Successful Applications List

Actors : Registrar, Course coordinator

Description:

Applicants details processed and list of successful applicant sorted per center. List submitted to appropriate.

Use case name: Produce Examination register

Actors : Course coordinator, Lecturer

Description:

Lecturer submits exams, coordinator prepares timetable. The both administer exams.

Use case name: Produce Examination timetable

Actors : Coordinator

Description:

Examination schedule prepared and submitted posted.

Use case name: Produce Student subject score

Actors : Lecturer

Description:

Lecturer enters students' score for each unit in a common mark sheet. Preliminary examination scores' sheet prepared and submitted to examiner.

Use case name: Produce Student performance record

Actors : Coordinator

Description:

Coordinator consolidates marks

Use case name: Prepare Pass List

Actors : Registrar

Description:

Receive Performance list and prepare pass list, grandaunt list, progress report and certificates for posting.

3.5 Generalized Globally Integrated I.S.

Figure 3.4 below shows a generalized globally integrated examination information system with decision support capabilities.

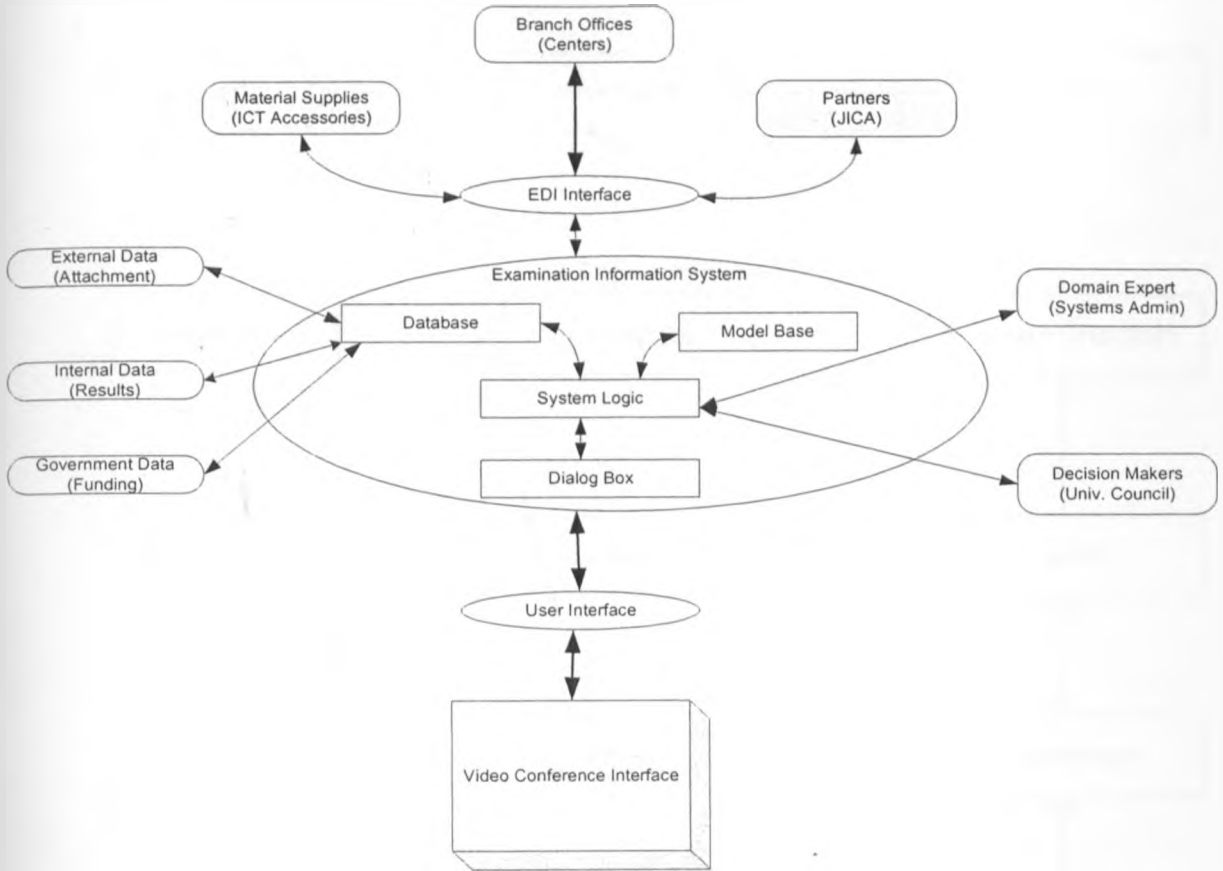


Figure 3.4 Globally Integrated Examination Information System

Data Repository

In order to implement a persistent data repository a relational data base was created using MySQL 3.7.1. The database contained all the tables as designed and others for control and sequencing.

3.6 Database Design

In order to realize the examination information system's objective, data is stored in a MySQL data base management system which is an open source database system and has the capacity to store very large amounts of data.

The database system is developed based on the Entity Relationship Model shown in figure 3.5 below:

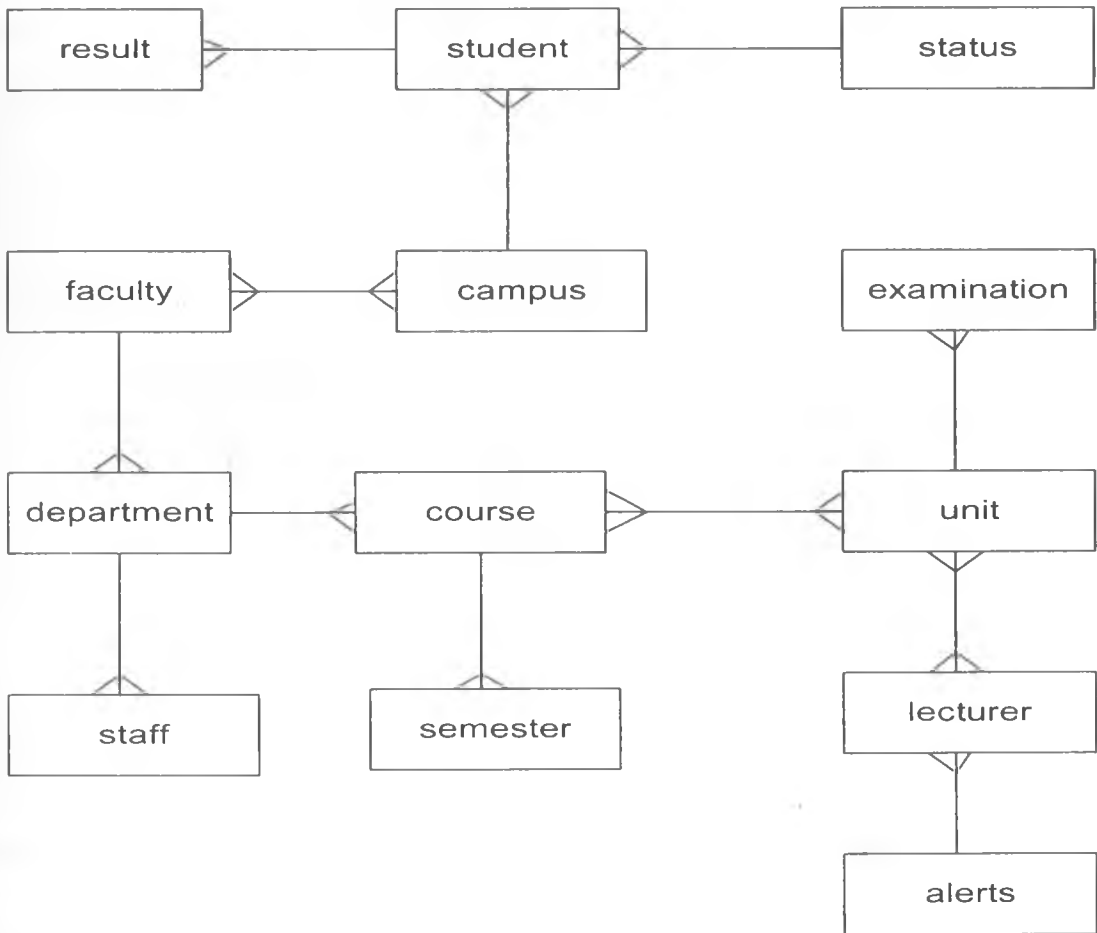


Figure 3.5 Entity Relationship Model

The Class diagram shown in figure 3.6 below describes the classes that are required to realize the systems' data base objective. The various classes identified maps onto the database tables which are implemented using a relational DBMS, namely MySQL.

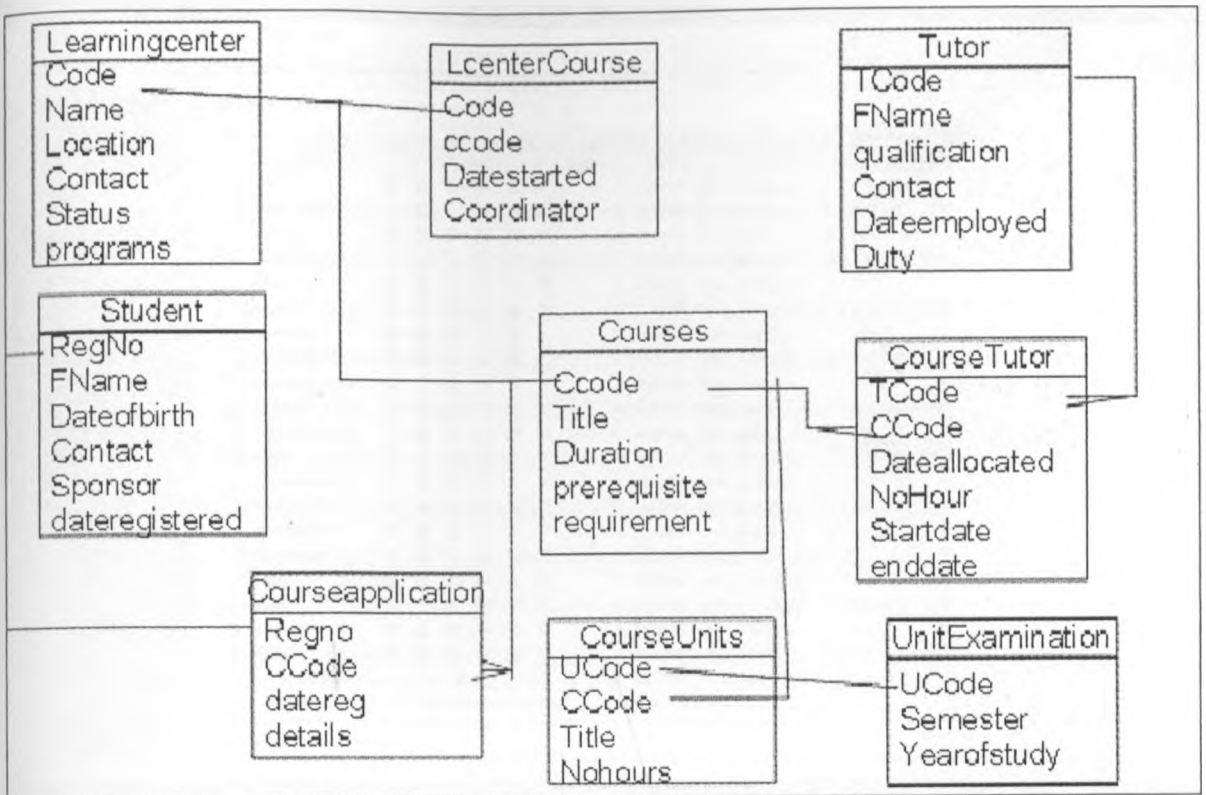


Figure 3.6 Database Design Classes

The basic database design is derived from the Entity Relationship Model depicted as figure 3.4 above. From the proposed data base design it's anticipated that a comprehensive user interface would be needed to facilitate data capture and retrieval.

The main physical database design is given below as demonstrated using the Xampp database interface:

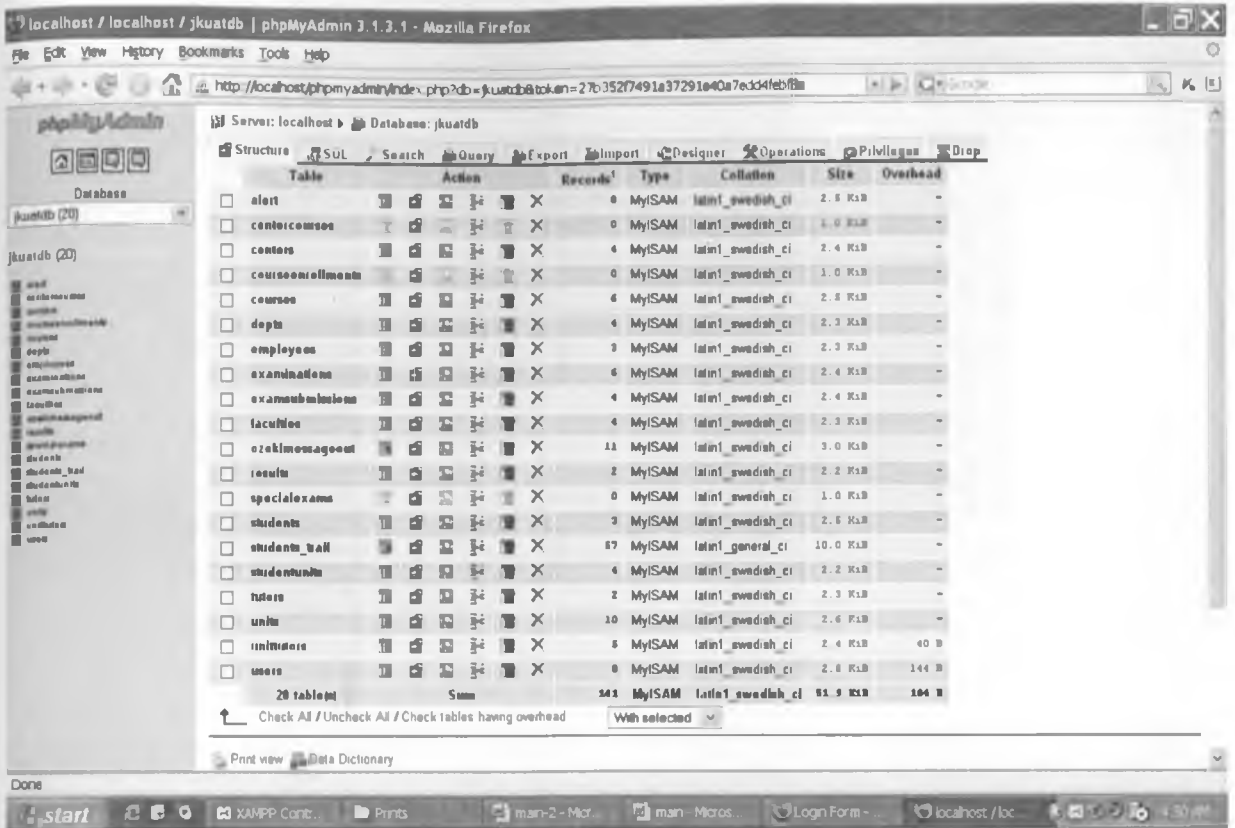


Figure 3.7 Physical Database Design

Below are samples of the table designs used in the development of the database:

(b) Faculty

localhost / localhost / jkuatdb / faculties | phpMyAdmin 3.1.3.1 - Mozilla Firefox

http://localhost/phpmyadmin/index.php?db=jkuatdb&token=27b352f7491a37291e40a7edd4febfa

Server: localhost Database: jkuatdb Table: faculties

Field	Type	Collation	Attributes	Null	Default	Extra	Actions
<input type="checkbox"/> id	int(11)			No	None	auto_increment	
<input type="checkbox"/> code	varchar(32)	latin1_swedish_ci		No	None		
<input type="checkbox"/> name	varchar(100)	latin1_swedish_ci		No	None		
<input type="checkbox"/> description	text	latin1_swedish_ci		No	None		
<input type="checkbox"/> centerid	varchar(32)	latin1_swedish_ci		No	None		
<input type="checkbox"/> employeaid	int(11)			No	None		
<input type="checkbox"/> createdby	int(11)			No	None		
<input type="checkbox"/> createdon	datetime			No	None		
<input type="checkbox"/> lasteditby	int(11)			No	None		
<input type="checkbox"/> lastediton	datetime			No	None		

Check All / Uncheck All With selected

Print view Relation view Propose table structure

Add 1 field(s) At End of Table At Beginning of Table After id Go

* Details

Open new phpMyAdmin window

(a) Campus

localhost / localhost / jkuatdb / centers | phpMyAdmin 3.1.3.1 - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://localhost/phpmyadmin/index.php?db=jkuatdb&token=27b352f7491a37291e40a7edd4feb8a

phpMyAdmin

Server: localhost Database: jkuatdb Table: centers

Browse Structure SQL Search Insert Export Import Operations Empty Drop

Field	Type	Collation	Attributes	Null	Default	Extra	Action						
<input type="checkbox"/> id	int(11)			No	None	auto_increment			<input type="checkbox"/>				
<input type="checkbox"/> code	varchar(32)	latin1_swedish_ci		No	None				<input type="checkbox"/>				
<input type="checkbox"/> name	varchar(108)	latin1_swedish_ci		No	None				<input type="checkbox"/>				
<input type="checkbox"/> location	varchar(108)	latin1_swedish_ci		No	None				<input type="checkbox"/>				
<input type="checkbox"/> contact	text	latin1_swedish_ci		No	None				<input type="checkbox"/>				
<input type="checkbox"/> coordinator	int(11)			No	None				<input type="checkbox"/>				
<input type="checkbox"/> centerstatus	varchar(32)	latin1_swedish_ci		No	None				<input type="checkbox"/>				
<input type="checkbox"/> email	varchar(32)	latin1_swedish_ci		No	None				<input type="checkbox"/>				
<input type="checkbox"/> description	text	latin1_swedish_ci		No	None				<input type="checkbox"/>				
<input type="checkbox"/> createdby	int(11)			No	None				<input type="checkbox"/>				
<input type="checkbox"/> createdon	datetime			No	None				<input type="checkbox"/>				
<input type="checkbox"/> lasteditedby	int(11)			No	None				<input type="checkbox"/>				
<input type="checkbox"/> lasteditedon	datetime			No	None				<input type="checkbox"/>				

Check All / Uncheck All With selected | | | | | |

Print view Relation view Propose table structure

Add 1 field(s) At End of Table At Beginning of Table After id Go

+ Details

Open new phpMyAdmin window

CHAPTER 4

IMPLEMENTATION AND TESTING

4.1 Introduction

This chapter focuses on the various implementation aspects of the designed examination information system. It looks at aspects of interface implementation as well as the quality features required, in an effort to realize the user requirements. Aspects of testing are also considered, which touch on unit testing, integration testing, system testing as well as user acceptance testing.

4.2 Implementation Criteria

The following criteria were considered important, particularly in ensuring that the examination information system was comprehensively implemented.

1. Data management functions – these included generation of suitable queries, for instance to know the number of students who have passed or failed in a particular unit.
2. Model management functions – appropriate PHP functions have been used to implement the various UML models designed.
3. User interface capabilities – suitable forms were used to ensure convenience and friendliness for the user.
4. Compatibility and degree of connectivity – the fact that the system is web-based ensures that there is variety of browsers that can assist one to access the system anywhere, provided he/she has access to the internet.
5. Available hardware platforms – the tools used such as PHP, MySQL, Xampp and Ozeki are open source tools designed to be used on virtually any platform.
6. Cost – since the tools are free and available, the cost of implementation was kept at minimum.
7. Quality and availability of vendor support – the tools used are readily available and widely used in the market. As such, they have been tried and tested thus guaranteeing quality.

4.3 User Interface Issues

The main characteristics of the system's user interface stem from the unique characteristics of typical end users:

- They play an organizational role based on something other than computing skills.
- They have latitude in exercising judgment.
- Their decisions have impact.
- They spend more time on tasks that do not need a computer to do.
- The unique nature of the decisions they make means their personal preferences must be accommodated.

4.3.1 Factors Related to the Quality of the User Interface

The following factors were considered in relation to the quality of the user interface:

- Learning curve – how fast will the user learn?
- Operational recall – how long will it take the user to recall how to use the System?
- Task-related time – how long will a typical task take?
- System versatility – will it support a variety of end user tasks?
- Error-trapping and support – what type of errors will users make?
- Degree of system adaptability – will it adjust to individual use?
- Management of cognitive overload – to what extent will the system reduce the need to remember things while using it?
- Degree of personal engagement – to what extent will the system be enjoyable to use?
- Degree of guidance and structure – to what extent will the interface guide the user?

4.3.2 Prescribed Sequence for Interface Development

The following are 12-steps prescribed by Marakas were used to develop the end user interface:

1. Determining the exact set of possible end users.

2. Determining the exact nature of use of the system for each identified end user.
3. Determining the sequence of steps or events each user will employ to accomplish their task(s).
4. Creating an iteration and incremental process for each task identified in step 3 and reviewing it with the end user for accuracy and completeness.
5. Ascertaining which of the steps in each process will require direct interaction between the user and the system.
6. Determining the exact nature of the information requirements for each of the interactions identified in step 5.
7. Selecting an appropriate set of dialog approaches (menus, command prompts, windows etc.).
8. Create a process of the flow of all possible dialogs, and reviewing them with the end user for accuracy and completeness.
9. Designing the interface screens to accommodate all requirements as determined in the previous steps.
10. Testing it, analyzing it, changing it, testing it, changing it
11. Updating all decision diagrams as conditions change.
12. Creating a bulletproof ('idiotproof') dialog for the system because the user may do something totally unexpected at some point.

4.4 System Evaluation

In most cases, measures of success usually remain less than clear. For instance, how do the designer and user know success when they see it? Although no generalizable set of standards exist, a number of ways were used to measure success, each with its own criteria.

4.4.1 Criteria for a Successful Examination System

The server hosting the web site and the database would contain a lot of useful data about prospective students, registered students, lecturers, examinations, performance, student progress etc. This data is stored and manipulated from a MySQL database system. The application logic part of the system ensures that all the system functionalities are adequately and effectively implemented. This is

achieved by using PHP and JavaScript. Various types of reports based on the data can be generated to support decision making.

4.4.2 Measuring System Success

One framework contains four measurement categories:

1. System performance – efficiency, response time, data entry, output format, hardware, usage, and user interface.
2. Task performance – decision-making time, measured by time spent in the decision process. Also, user perceptions of trust, confidence, and satisfaction.
3. Business opportunities – costs of development and operation maintenance. Benefits associated with increased income, reduced costs and changes in productivity. Value through better service, competitive advantage, and training.
4. Evolutionary aspects – degree of flexibility, ability to change, and overall functionality of the system.

4.4.3 Alternative Implementation Strategies

Besides the above described implementation criteria and strategies, below are other strategies that can also be used in implementing the examination information system.

1. Divide the project into manageable pieces, use prototypes, an 'evolutionary approach, and develop a series of tools.
2. Keep the solutions simple, hide complexity, and avoid change.
3. Develop a satisfactory support base, obtain user participation and commitment, and obtain management support.
4. Meet user needs and institutionalize the system, provide training and assistance, insist on mandatory use, permit voluntary use, rely on diffusion and exposure, and tailor systems to users' capabilities.

4.4.4 Importance of Integration

- Integrating the system into the organization means the new application is merged in a seamless fashion. This contributes to user perception that it is easy to use and useful.
- Two general categories of integration are functional (various system functions are integrated and linked to those existing systems) and physical (involves the bundling of hardware, software and data communication characteristics associated with the new system into existing physical systems).

The system therefore requires various user interactions via capturing of user data and relaying information to users. To input data comprehensive and interactive web pages have been developed using Macromedia Dream weaver, PHP and JavaScript. To provide a suitable repository of the web pages, apache web server was used. The various users of the examination information system can access the system using any web browser. The system requires frequent and time dependent information exchange to and from the user. Information into and from the system is conveyed to and from the user through various means, as stated below:

In order to enhance effective communication, both email addresses and mobile phone numbers are used. To support email mode of communication a mail server component is required. This system uses the mercury mail server found in the Xampp software package. This package is downloadable for free, from the internet. Uses of email enhance system reliability by ensuring receipts get information.

To support the SMS mode of communication, the OZEKI message server is installed. The system is connected in such a way that information recipient on mobile network can receive and respond to correspondences instantly. Figure 4.1 below show how a mobile phone is connected to the application.

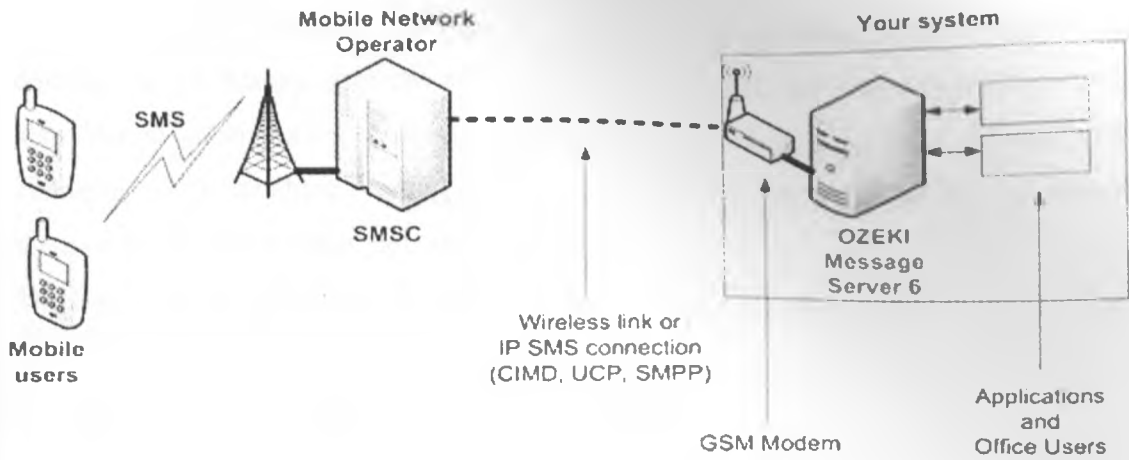


Figure 4.1 Mobile Phone to GSM Connection (adapted from OZEKI informatics)

The OZEKI message server 6.0 provides appropriate API to enhance system functionality. By use of mobile phone communication, reliability and flexibility are enhanced.

4.4.5 Systems Deployment

In order to appropriately deploy the system, XAMPP software package was used. This is application development and deployment tools consisting of phpMyAdmin for MySQL administration, Webalizer, php switch for development, mercury mail server and fileZilaFTP for file upload. To connect MySQL database engine with the rest of application MySQLODBC3.5.1 was used. The OZEKI message server was installed and configured in the server and PC connected to cell Phone modem for sending of text messages. Application files were hosted in the server and agents' application commissioned by running batch scripts.

4.5 Testing

In order to demonstrate deploy the system it is imperative to ensure that all the system components are working according to specifications and that all functional and non-functional requirements are conformed as much as possible. To realize this objective, there was need to carry out thorough tests on the system.

To execute the system for testing, web server is set up using apache, which is a components of Xampp software tool. In addition, MySQL and mercury services were also started from Xampps' control panel. The OZEKI text message gateway was connected to the database running on MySQL database management system, and also to the mobile service provider and connection tested.

The following were the main objectives aimed at while testing the system:

- Test whether the system is running
- Test interoperability of various software components used
- Testing ability of the system to identify information recipients and relay appropriate information to them.
- Testing the ability of the system to meet the required academic and administrative needs.
- Testing ability of the system to offload routine information processing from human user.

4.5.1 Registering Students

This process starts by a prospective student submitting a duly filled application form to center coordinator or to the registrar. This application form can be downloaded from JKUAT's main web site. The coordinator logs into the system and accesses the online request form and keys in the student's details. Figure 4.2 below shows the form.

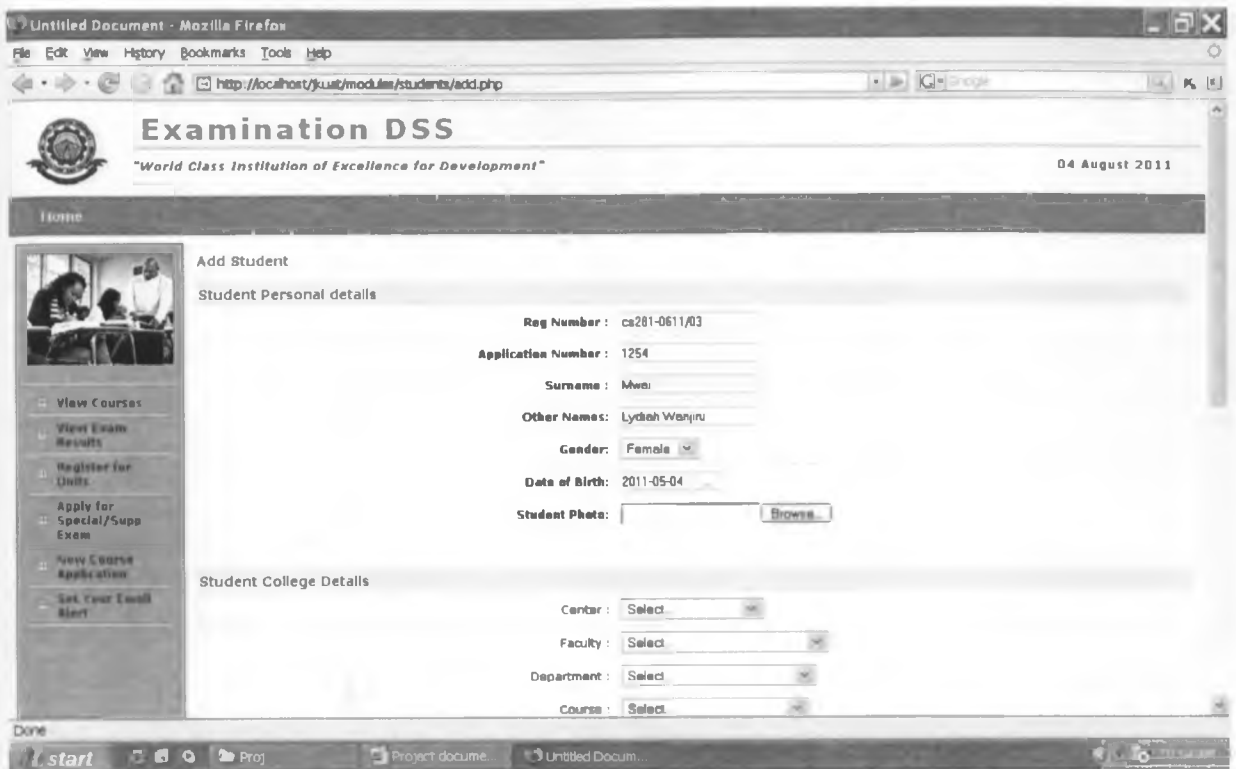


Figure 4.2 Course Application Form

The registrar on the other hand logs into the system to check the list of applicants. These applications are then downloaded and discussed in an admissions board meeting which may approve or reject an application, based on the admission criteria. The approval process by the admissions board is not within the scope of this system. If approved the applicant is assigned registration number. An email and a text message is sent to the successful applicant by the coordinator. The system keeps records of sent messages in the database.

Figure 4.3 below shows the interface used by the coordinator to send the information:

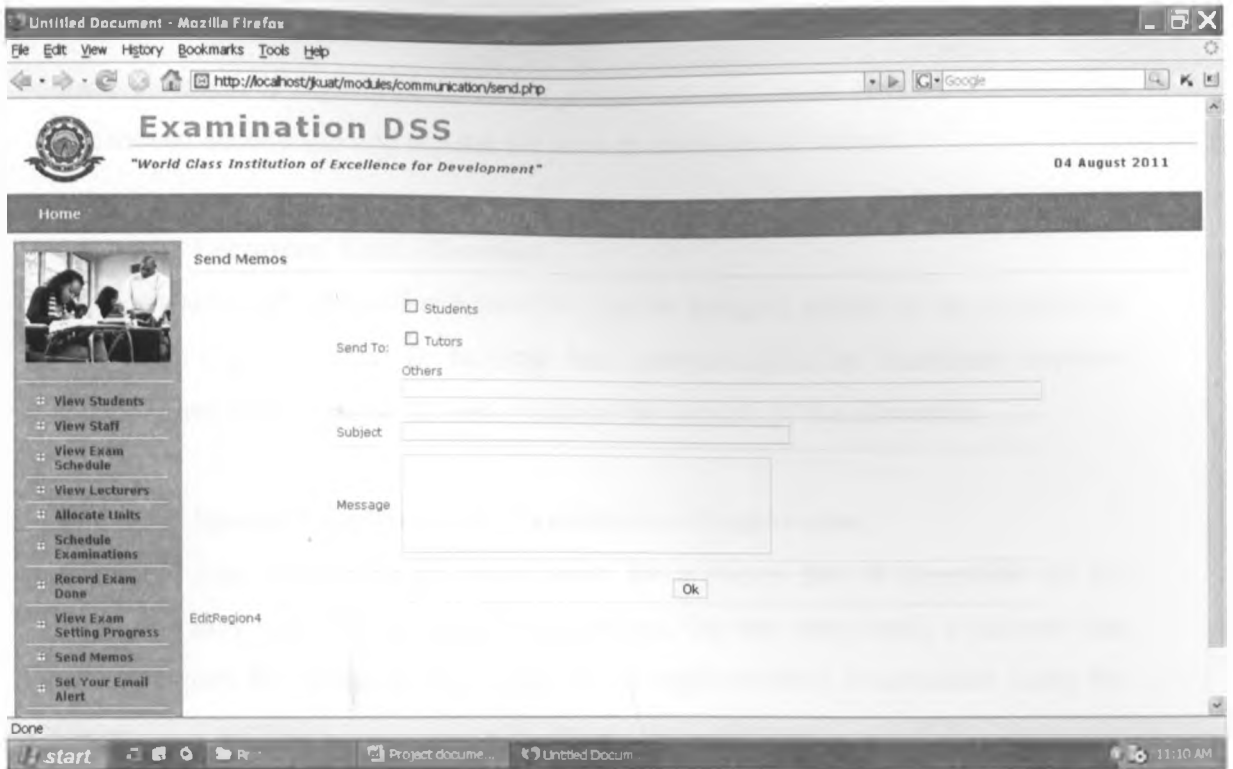


Figure 4.3 Interface for Sending of Messages.

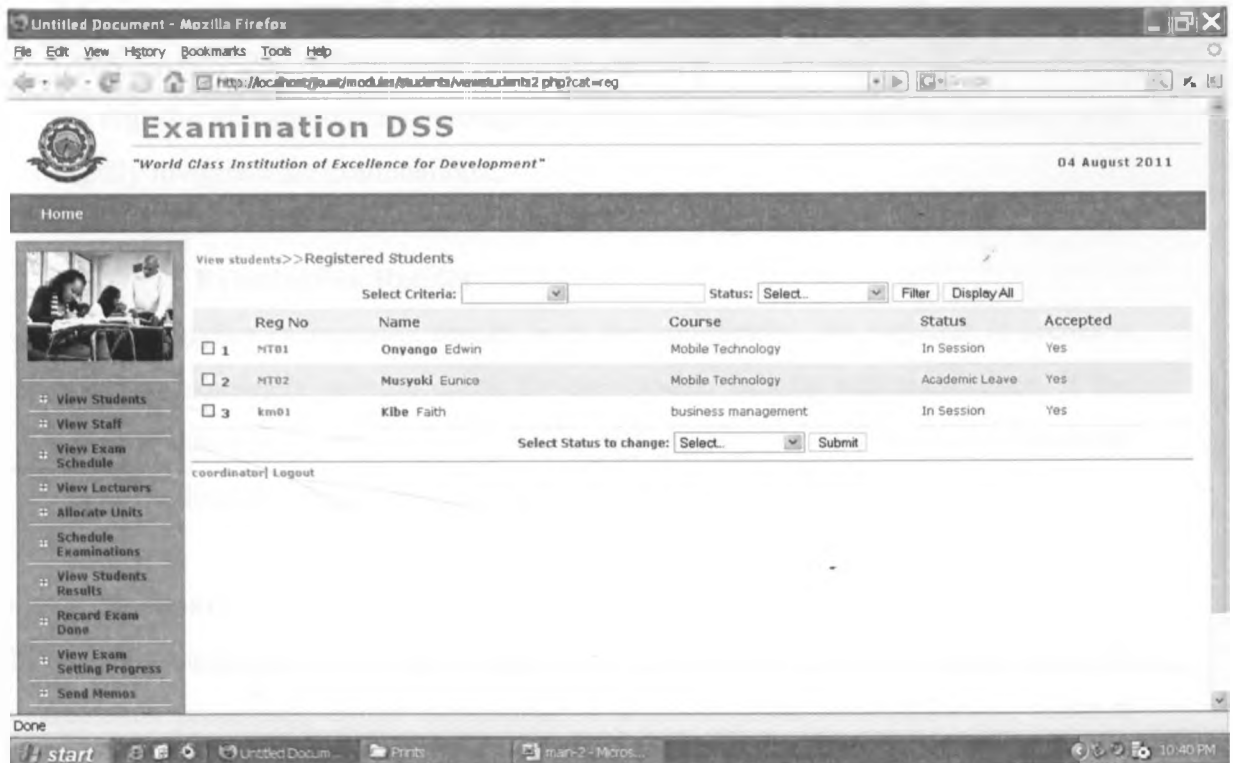


Figure 4.4 Newly Registered Students.

4.5.2 Units Selection

Once a student is registered, he/she is assigned a user name and a password. The student can hence login and register for units in their area of interest.

4.5.3 Lecturers' Unit Allocation

Lecturers are also registered and therefore can be assigned unit(s) by the coordinator to teach in a given center. To facilitate fast communication for immediate response and planning a text message is sent to inform the lecturer of the allocation.

4.5.4 Special/Supplementary Examinations Registration

A student who fails to do an examination for a reason that is acceptable by the institution may apply for a special examination. On the other hand, a student who fails to satisfy the examiner may apply for a supplementary examination using the system.

4.5.5 Scheduling of Examinations

Examinations are scheduled and following consultation between the coordinator and the registrar and appropriate messages sent to both the students and the lecturers who usually invigilate the examinations.

4.5.6 Examination Results

Upon receiving examination results from the coordinator, the registrar convenes a board of examiners meeting check for correctness, validity and consistence. If the board is satisfied, it approves the results and the registrar is mandated release the results to the student, lecturers and any other stakeholders.

4.6 Summary

In summary therefore, it is clearly demonstrated that the system could be quite useful for examination processing, course administration and convenient communication, while at the same time offloading routine and tedious tasks of information handling and processing from the human user. Majority of the users were generally satisfied with the prospects of having the new system which could subsequently be improved with time.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter evaluates the system implementation against the earlier stated project objectives. It also highlights the various challenges faced, lessons learned and provides appropriate recommendation.

5.2 Evaluation of Objectives

This section discusses the extent to which the project objectives were achieved as detailed below.

1. Reviewing and analyzing examination information systems and their application and utilization in institutions of higher learning.

This objective was realized as anticipated, as it was established that examination information systems present many opportunities in such institutions by helping them meet their objectives.

2. Implementing an appropriate examination information system based on the above model.

This was successfully designed and developed with various functionalities intended to carry out varied activities in examination processing and course administration. The implemented tasks ranges from identifying information recipients, processing information and communicating findings to various recipients. The role of the system is simply supportive in ensuring that the whole examination process is smoothly carried out.

3. Test and evaluating the system using suitable test cases

This objective was realized as the implemented system is able to perform the intended tasks serving as proof that an examination Information system can effectively support examination processing as well as course administration functions. The system was found to achieve most of the functionality proposed in the analysis as described below:

Based on the realization of the above objectives as stated, the following functionalities were satisfactorily achieved:

- The system uses a web based interface to provide users with facilities to capture user as well as client details for submission to database for processing, as well as facilitating effective communication mechanisms such as emails and sms. In addition, it can support examination processing, course administration, communication and several other functions, while at the same time offloading some of the tedious tasks from the user. The system also generates and posts reminders to the concerned parties appropriately.
- Other aspects realized by the system include: Security: Users of the system are only allowed access what is relevant to perform their tasks. This restriction ensures that data integrity and validity is maintained; Availability: The system is hosted on a server and every user with access permission can access it any where any time; Reliability: Though the use of alternative communication methods, information delivery is guaranteed as failure of one method will affect the other and Scalability: As the system is distributed, it is possible to increase the number of users or even components with minimal service interruptions.

5.3 Challenges

A substantial amount of time and effort was spent in a bid to realize the objectives. Additional time was spent evaluating the objectives and defining of the system boundaries.

Identification and evaluation of suitable tools for implementation was also a challenge. It emerged that development tools were either not available, contained bugs, platform dependent or not compatible with other tools. Much time was spent on learning new development tools which frequently changed. Another problem experienced was lack of a clear development methodology hence the need to blend them.

Carrying out suitable tests of the system was a challenge as this would require a reliable communication and software tools which at times will depend on a particular platform or specific operating system versions. All in all it was a good experience to finally be able to realize the results as anticipated.

5.4 Lessons Learned

One of the main lessons learnt here is how useful an examination information system is to an institution of higher learning. It also became clear that application areas of an examination information system are quite diverse and the system can keep on being expanded to accommodate many other new areas of examination processing and management. There is also quite a variety of tools in the market that can constantly be used to improve the system in due course. Thus it is a good development idea to ensure that the system retains an open interface, for future integration with new emerging technologies.

5.5 Conclusion

In conclusion, this project work focused on modeling and deployment of an information system to support examination processing functions in JKUAT. This also serves as a way of improving human productivity by offloading routine and tedious tasks from the users. It is clear from this research that an examination information system can revolutionize the way most functions are carried out in many organizations hence making work much easier. The continued growth and use of the internet and the World Wide Web have prompted many researchers to look for new ways of doing business using information systems.

5.6 Recommendations

The following recommendations are suggested in line the experience gained while carrying out the project:

a) Change of existing communication practices.

It can be of great importance if institutions can establish effective and regular communication mechanisms between the management and the students, regarding examination results, student's status and so on, via emails and sms's.

b) Integration of systems

There are other types of systems in institutions that manage different aspects of education and administration. This leads to redundancy, more costs and unnecessary overlaps. It would therefore be necessary to integrate the systems for easy of management, control and maintenance.

c) Supporting tool cases

It would be prudent to research on the available and convenient software tool cases before embarking on their use, since a wrong option can lead to regrettable inconveniences.

The system can further be developed to support other administrative functions in distributed enterprises, and not only in institutions of higher learning. Intelligence can also be incorporated into this system so as to offer possible decisions in areas that are difficult to make decisions in.

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APPENDICES

Appendix A: The User Manual

In order to run the system successfully, the following sets of software need to be installed:

- (a) Xampp – This sets the local host server and consists of several tools such as – Apache, MySQL, PHP and Mercury.
- (b) Macromedia Dreamweaver – for designing the user interfaces.
- (c) Ozeki - an sms message server.

There are five main types of users namely:

- (a) Administrator
- (b) Registrar
- (c) Coordinator
- (d) Lecturer
- (e) Student

The administrator is a super user of the system. He/she is in charge of the overall management of the system.

NB: The default password is initially set to 'a', for all the users. Once a user logs in, he/she can change the password appropriately.

The table below provides usernames, passwords and the privileges given to each user, by the administrator:

User	Username	Password	Responsibilities
Administrator	admin	a	Define user roles in the systems Grant and or revoke user rights on the system Configure and fine tune the system. Trouble shooting, backup and recovery Enhance overall system performance

Registrar	registrar	a	Register students Monitor students' and lecturers' performance
Coordinator	coordinator	a	Record lecturers' details Records unit allocations to lecturers Monitor course enrollments Monitor draft examination submissions. Monitor students performance
Lecturer	First name	a	Check on units schedule and allocation Submit draft examination Record examination results for units taught.
Student	First name	a	Check course registration requirement details Provide all required details during registration. Register for unit on or before due date Check course and examination timings

The user can interact with the system directly by logging into the designed web pages. The system provides varying user levels. A login form shown in the figure below is displayed once the user runs the system.

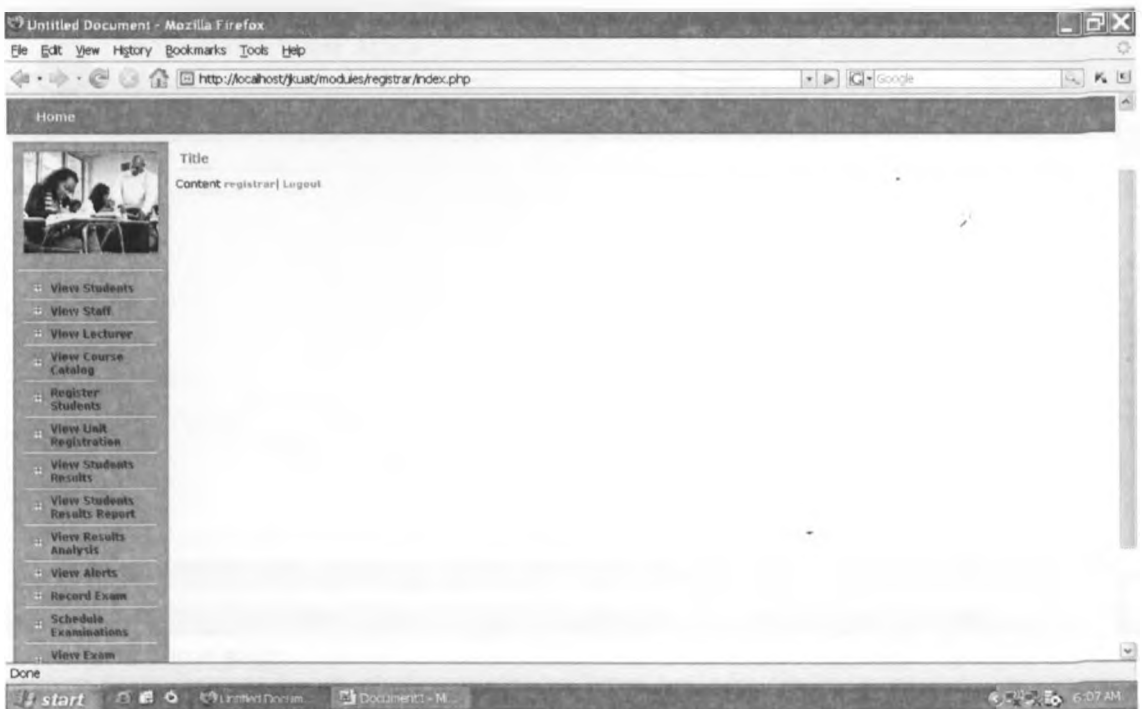


Login Form

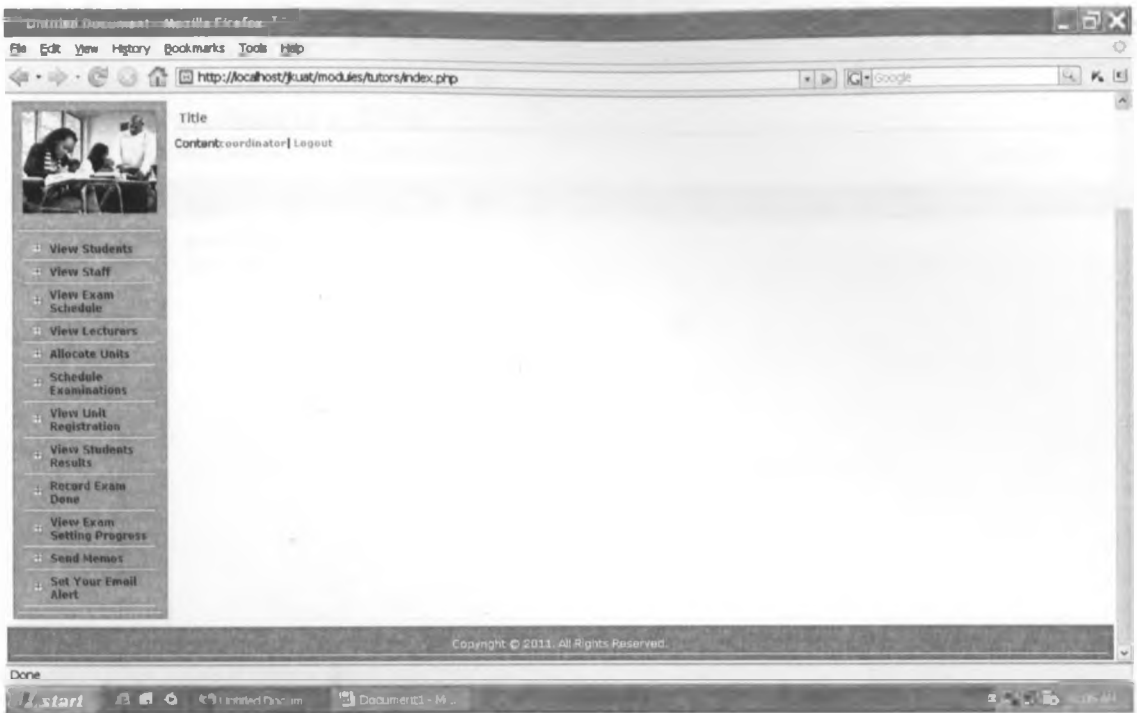
As there are various types of users supported by the system, the appropriate user type is selected by clicking one of the radio buttons provided, that corresponds to a specific user. After successful login, the user can navigate through the system by selecting suitable choices of actions from the user menu, as shown in the example home pages given below:



System Administrator's home page



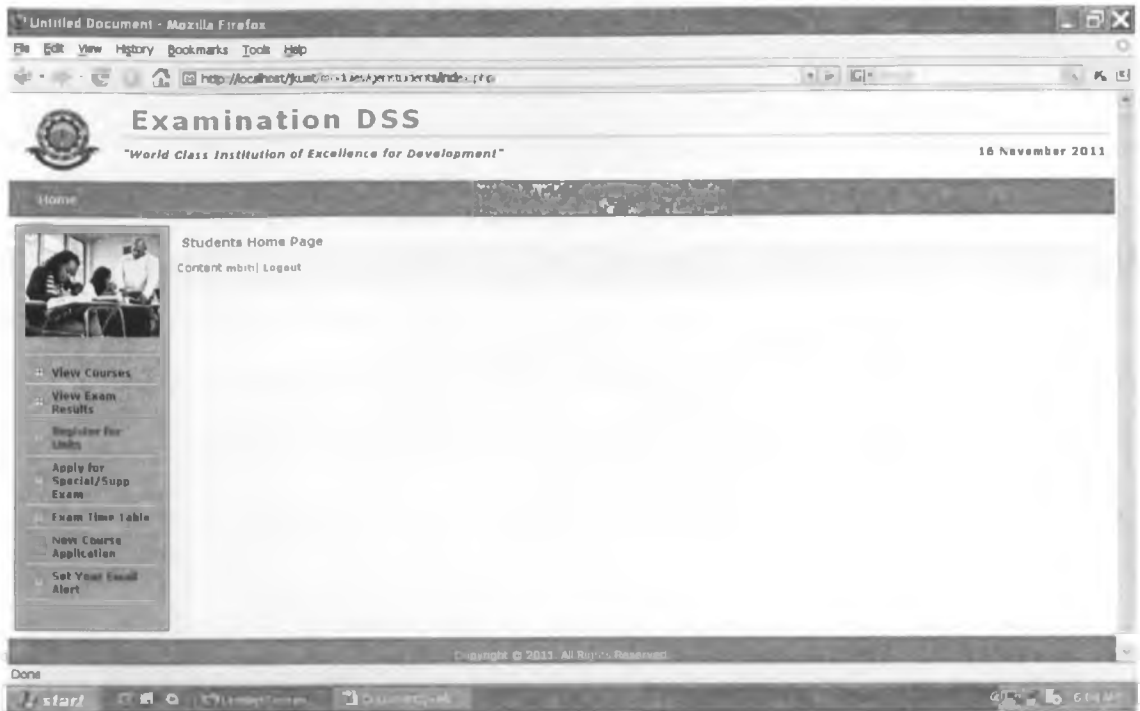
The registrar's home page



The Coordinator's home page



Lecturer's home page



Student's home page

In addition, the system generates a number of reports for various users. Samples of such reports are as follows:

(a) List of registered student

View students>>Registered Students

Select Criteria: Status: Filter Display All

Reg No	Name	Course	Status	Accepted	
<input type="checkbox"/> 1	HT01 Onyango Edwin	Mobile Technology	In Session	Yes	Edit
<input type="checkbox"/> 2	HT02 Musyoki Eunice	Mobile Technology	Academic Leave	Yes	Edit
<input type="checkbox"/> 3	km01 Kibe Faith	business management	In Session	Yes	Edit

Select Status to change: Submit

registrar Logout

(b) Students' Trails

View students>>Declined students

Select Criteria: Status: Filter Display All

Reg No	Name	Course	Status	Action	Record Date
1	BBIT-007-0079/2008 Kyenge Boniface	Bachelor of Commerce		update	2011-07-27 15:33:41
2	BBIT-007-0079/2008 Kyenge Boniface	Bachelor of Commerce		update	2011-07-28 11:06:27
3	BBIT-007-0079/2008 Kyenge Boniface	Bachelor of Commerce		update	2011-07-27 15:34:05
4	cs201-0612/03 Mugo J. Gatharu	Bachelor of Commerce	In Session	update	2011-07-11 19:14:17
5	cs201-0612/03 Mugo J. Gatharu	Bachelor of Commerce		update	2011-06-20 20:38:36
6	cs201-0612/03 Mugo J. Gatharu	Bachelor of Commerce	Academic Leave	update	2011-06-20 17:23:49
7	cs201-0612/03 Mugo J. Gatharu	Bachelor of Commerce	Academic Leave	update	2011-06-20 14:51:25
8	cs201-0612/03 Mugo J. Gatharu	Bachelor of Commerce	In Session	update	2011-06-20 14:48:38
9	cs201-0612/03 Mugo J. Gatharu	Bachelor of Commerce	In Session	update	2011-07-28 11:35:33
10	cs201-0611/03 Mwai Lydiah Wanjiru	BSc Computer Science	In Session	update	2011-07-20 19:10:06
11	cs201-0611/03 Mwai Lydiah Wanjiru	BSc Computer Science	In Session	update	2011-07-20 19:09:06

(c) Alerts (emails sent to users)

Home

Alert Module

#	Sent To	Subject	Communication	Time
1		Email	Pass list	2011-08-04 18:27:48
2		Email	Pass list	2011-08-04 18:27:48
3	bmasila5@gmail.com	Email	Pass list	2011-08-04 18:27:48
4		Email	Pass list	2011-08-04 18:28:33
5		Email	Pass list	2011-08-04 18:28:33
6	bmasila5@gmail.com	Email	Pass list	2011-08-04 18:28:34
7		Email	Late Exam Submissions	2011-08-04 18:42:05
8	bmasila@gmail.com	Email	Late Exam Submissions	2011-08-04 18:42:05

Appendix B: Sample Questionnaire

Questionnaire

This questionnaire is aimed at carrying out research to establish whether the current examination processing system suitable or not. It also attempts to establish the various user requirements that can be incorporated into a new system.

Please answer the following questions as comprehensively as possible, and to the best of your knowledge. Answer by ticking the appropriate checkboxes as provided.

Name:..... Sign:.....

1. What is your level of experience in the use of computers?

High Medium Low

2. Are the current examination processing procedures manual or computerized?

Manual Computerized

3. What is your level of involvement in examination processing?

High Medium Low

4. Are you satisfied with the current examination processing procedures being used?

Yes No

5. Do you think there is need to improve the existing examination processing procedures? Yes No

Specify:

.....
.....
.....

6. Tick the areas below that you think require improvement or need to be addressed:

Efficiency Security Speed Decision Support

Other.....

7. What kind of an examination processing system would you prefer?

Stand alone Intranet Online

Other (specify).....

.....

8. Are you involved in any decision making level? Yes No

If Yes please specify whether operational, tactical or strategic:

.....

9. Does the current system support you in any way to make decisions?

Yes No

10. Which among the following areas would you prefer to be included in the system?

Student status at any time Performance Registration

Class allocations

11. What other features would you like the system to have? Specify..

1.

2.

3.....

4.

5.....

Appendix C: Sample Code

//Generates a list of new applicants to the registrar and sends message to students

```
<?php
session_start();
require_once("config.php");
require_once("connection.php");
require_once("lib.php");
?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
<meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
<title>Students list</title>
</head>
<body>
<?php
$res=retrieveNewlyAppliedStudentsByCenter();
$stud="";
$st="";
$j=0;
while($row=mysql_fetch_object($res))
{
    $students="";$i=0;
        $rs=retrieveCenterNewlyAppliedStudents($row->centerid);
        while($rw=mysql_fetch_object($rs))
        {
            $i++;$j++;
            $students.=$i.". ".$rw->fname."&nbsp;".$rw->onames."<br>";
            $st.="<li>".$rw->fname."&nbsp;".$rw->onames."</li>";
            mysql_query("update students set checked='Yes' where id='$rw->id'");
        }
    if($i>0)
        { $center=retrieveCenter($row->centerid);
```

```

        $cood = retrieveCenterCoordinator($center->id);
        $email=$cood->email;//$center->name."@jkuat.ac.ke";
        $headers="MIME-Version: 1.0\r\n";
        $headers.="Content-type: text/html; charset=iso-8859-1\r\n";
        ini_set("SMTP","10.2.28.5");
        ini_set("sendmail_from","bmasila5@gmail.com");
        if(mail($email,'Newly Applied Students to '.$center->
        name,$students,$headers))
        {
            recordAlert($center->id, $email,"Email","Newly applied
            students","center","");
            echo"Email Sent to ".$email;
        }
    }
}
//sending an overall list of all applied students to registrar
if($j>0)
{
    $stud = "<ol>".$st."</ol>";
    $email="bmasila5@gmail.com";//$center->name."@jkuat.ac.ke";
    $headers="MIME-Version: 1.0\r\n";
    $headers.="Content-type: text/html; charset=iso-8859-1\r\n";
    ini_set("SMTP","10.2.28.5");
    ini_set("sendmail_from","bmasila5@gmail.com");
    if(mail($email,'Overall Newly Applied Students sent to
    Registrar',$stud,$headers))
    {
        recordAlert(0, $email,"Email","Newly registered students","registrar","");
        echo"Email Sent to ".$email;
    }
}
$res=retrieveNewlyRegisteredStudentsByCenter();
$stud="";

```



```

$st="";
$ج=0;
while($row=mysql_fetch_object($res))
{
    $students="";$i=0;
        $rs=retrieveCenterNewlyRegisteredStudents($row->centerid);
        while($rw=mysql_fetch_object($rs))
        {
            $i++;$ج++;
                $course=retrieveCourse($rw->courseid);
                $students.=$i.". ".$rw->fname."&nbsp;".$rw->onames."&nbsp;".$rw->
                regno."&nbsp;".$course->code."&nbsp;".$course->name."<br>";
                $st.=<li>".$rw->fname."&nbsp;".$rw->onames."&nbsp;".$rw->
                regno."&nbsp;<strong>".$course->code.</strong>&nbsp;".$course->
                name.</li>";
                mysql_query("update students set checked='Yes' where id='$rw->id'");
                //mysql_query("update students set acceptstatus='Yes' where id='$id'");
        }
        //Sending list of newly registered students to every center
        if($i>0)
        {
            $center=retrieveCenter($row->centerid);
                $cood = retrieveCenterCoordinator($center->id);
                $email=$cood->email;//$center->name."&@jkuat.ac.ke";
                $headers="MIME-Version: 1.0\r\n";
                $headers.="Content-type: text/html; charset=iso-8859-1\r\n";
                ini_set("SMTP","10.2.28.5");
                ini_set("sendmail_from","bmasila5@gmail.com");
                if(mail($email,'Newly Registered Students to '.$center->
                name,$students,$headers))
                {
                    recordAlert($center->id, $email,"Email","Newly registered
                    students","center","");
                    echo"Email Sent to ".$email;
                }
        }
    }
}

```

```

}
}
//sending an overall list of all registered students to registrar
if($j>0)
{$stud = "<ol>".$st."</ol>";
$email="bmasila5@gmail.com";//$center->name."@jkuat.ac.ke";
$headers="MIME-Version: 1.0\r\n";
    $headers.="Content-type: text/html; charset=iso-8859-1\r\n";
    ini_set("SMTP","10.2.28.5");
    ini_set("sendmail_from","bmasila5@gmail.com");
    if(mail($email,'Overall Newly Registered Students sent to
Registrar',$stud,$headers))
    {
        recordAlert(0, $email,"Email","Newly registered students","registrar","");
        echo"Email Sent to ".$email;
    }
}
//mysql_query("update students set checked='Yes' where id='$row->id'");
?>
</body>
</html>

```