Declaration

The thesis is my original work and has not been submitted previously for a degree at this or any other university/institute.

To the best of my knowledge it does not contain any material published or written by another person, except as acknowledged in the text.

Student Name: M.S Hettiarachchi

Registration Number: 2014/MIT/022

Index Number: 14550222

_____

Signature: Date:

This is to certify that this thesis is based on the work of

Mr. /Ms.

Under my supervision. The thesis has been prepared according to the format stipulated and is of acceptable standard.

Certified by:

Supervisor Name:

_____

Signature: Date:

Abstract

This project is focused on creating a web based Examination Management System. This is an automated examination details management system for Examination Branch of University of Kelaniya. The manual method was found to be tedious, especially when carried out for a large number of postgraduate students from different postgraduate programs, this makes the entire process time-consuming and error prone. There will be a separate system module which is carried out by the Faculty of Graduate Studies, University of Kelaniya. Examination Management System will be another separate system module for Examination Branch in University of Kelaniya which was proposed and developed. As per the client request both modules will share the same student data and system will only consider on postgraduate students. Solution which was implemented will be much more helpful to both students and the university staff to make their examination process efficient. Implemented solution facilitates important functions such as examination results sheets, exam timetables, admission forms, exam registration details etc. for admin users. Students has facility to fill exam applications online, generate the admission form, view examination timetable and view the results through the system. All the records are maintaining within a single database and all documentation has automated through implemented solution.

Table of Content

List of Figures

List of Tables

Chapter 1: Introduction

1.1 Motivation

Motivation of this system is due to the necessity of an automated web based Examination Management System to Examination Department at the University of Kelaniya which is designed and developed to optimum utilization of the resources offered by the University.

1.2 Problem

Current process of the examination branch is when the higher authorities decides the examination time period The Faculty of Graduate Studies starts issuing paper based exam application for students and coordinators where departments stars preparing exam timetable for each unit of the course. After the completion of above process the Faculty of Graduate Studies hands over those forms to relevant sub faculties or to departments to arrange examination admission forms. Then admissions would be prepared and issued by relevant departments. Clerical staff from departments, manually fill individual students' admission details post them to students using snail mail. Additionally they also prepare attendance sheets, mark sheets manually by using MS Word or Excel.

Different faculties and departments use different formats of above mention documents. In some occasions respective department prepares them or otherwise branch for examinations prepare those documents. When it comes to results everything has to be re-entered manually in branch for examinations since, there is no common format for every department results issuing process is also carried out manually by publishing results on notice board or uploading it in to web site as PDF or Word format. Students are continuously querying from Examination Branch as well as Faculty of Graduate Studies to get exam dates and to confirm their results. So it creates an extra effort to both Examination Branch and Faculty of Graduate Studies throughout the whole examination process Students could not see their results privately. Current process is violating the privacy of students and it's not ethical. Current process involves lot of paper based work, man power and it is very time consuming. Solution to overcome above problems of the current process is to automate the manual process.

1.3   Solution

Technology always build bridges that could take us where we never reached before. It has all ways improved the pattern of our working structure, adding value by making day to day work more reliable, effective and efficient.

Best solution for overcome mentioned concerns is a web based examination management system. It will bridge the gap between program coordinators, students, examination branch and FGS. All the manual paper work done by the staff of examination branch will be automated.
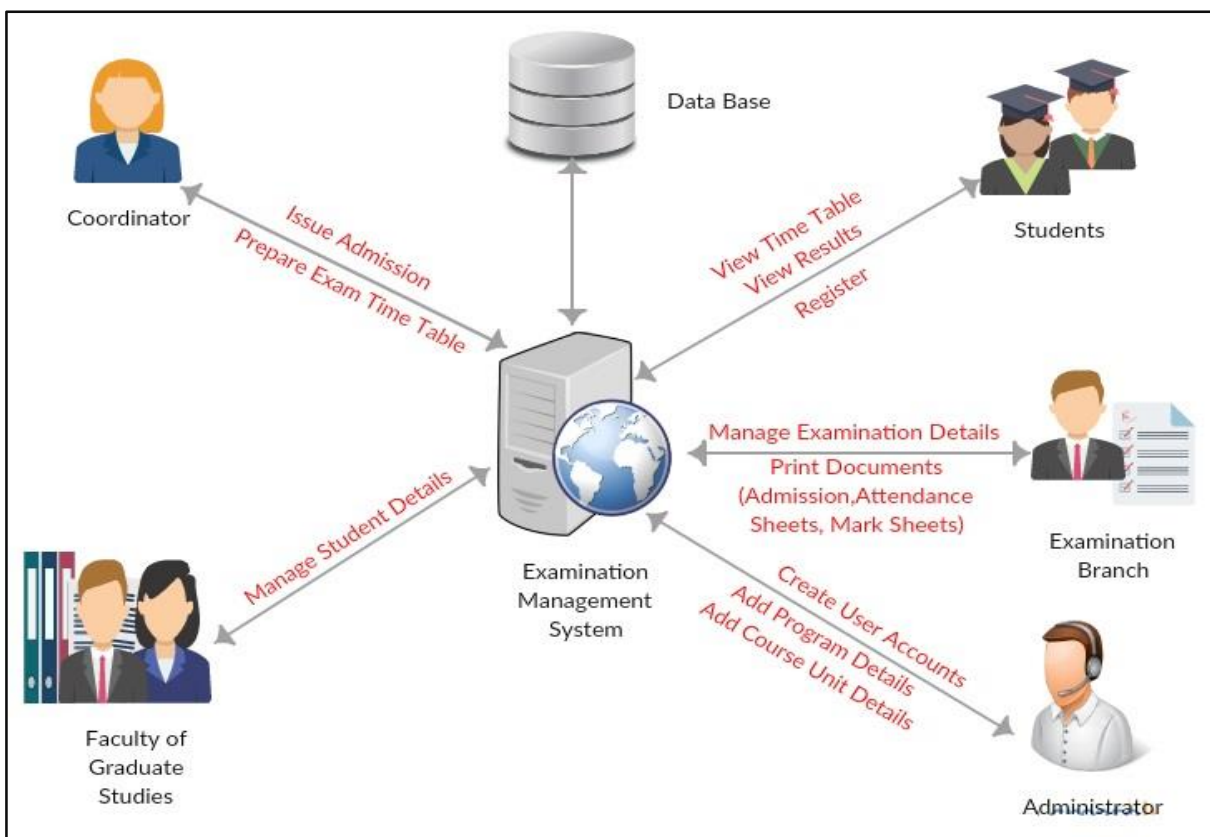
System Architecture Diagram

Figure 1 System Architecture Diagram

Examination Management System comprise of several components. Followings describe each of the steps indicated in the diagram.

Student: First, student have to register (Sign Up) through the Examination Management System and every registered student have their own profiles. It will help student for view exam timetable,

view results and download admission form. Student have to register to a postgraduate program under the FGS and their details will maintain by the FGS.

Faculty of Graduate Studies (FGS): FGS is the place where student details are maintained. And they will be responsible for calling applications for new postgraduate programs. Students are registered under the FGS. User accounts will be created for FGS staff too.

Examination Branch: Examination branch is the main user of this system. Examination details are maintained by the examination branch. Print admission, attendance sheets, mark sheets, moderating sheets, semester vies result sheets as per student request, transcript are the functions which are carried by the examination branch.

Coordinator: Will prepare the exam timetable. Coordinator will store the timetable in an interactive way and can view the examination timetable in order with their respective departments and programs.

Administrator: Will be responsible for create user accounts and all backend process such as add new program, add new course details, etc.

1.4   Aims & Objectives

1.4.1 Aims of the Project

Aim of this project is to develop a web based Examination Management System to optimize the work carried by the Examination Department at University of Kelaniya.

1.4.2 Objectives of the Project

Objective of this system is to provide a "***Web Base Examination Management System***" to automate the activities carried around the examination process by the examination branch of the university, with more secured, accurate and efficiency way. The system will provide a reliable, user friendly, efficient and accurate system for users. Examination Management System will bridge the gap between users.

And it will help to

- Reduce or eliminate the repetition of work.
- Improve efficiency.
- Decrease the work load.
- Error free information.
- Accurate remuneration details.

1.5   Scope of the Project

Scope of this project is very broad in terms of manual process.

Few of them are: -

- User Logins for different user roles. (Dean-FGS, SAR-FGS, DR-Examination Branch, Lecturer, Coordinator, Clerk, Student)
- Maintain examination results. (Program wise, Academic year/batch wise)
- Maintain examination details. (Timetable, Attendance, etc...)
- Student Profile.

  Student will be able to log in to their profile and
  - Select which papers that they are going to sit for the exam. (optional subjects)
  - View exam timetable.
  - View results.
  - Download admission form.
- Reporting Function.
  - Program wise graduated list.
- Print Functions.
  - Examination admission form.
  - Attendance sheets.
  - Mark sheets for 1st and 2nd examiner.
  - Moderating sheet.

1.6 Structure of Dissertation

This dissertation contains following chapters.

Chapter 2: Describe the details about existing similar systems in globally. The purpose of this chapter is to show that where my own project fits in the field.

Chapter 3: Describes the development and system analysis and design of the system, where it describes with research methods, data collection and data analysis method which has being used.

Chapter 4: Describes the implementation of the examination management system. Implementation details of each module. It state about, software, hardware, algorithms, pseudo codes, code segments which are used in examination management system.

Chapter 5: Describes about the testing and evaluation of the system. Techniques which are used to evaluate the system are describe in this chapter.

Chapter 6: Describes conclusion and further work of the research. Problem encountered and lesson learned while developing this system and a critical evaluation of the system will be discussed in this chapter. Moreover, it shows how this system can be improved and which sectors can be improved.

Chapter 2: Background

2.1   Introduction

Examination is a basic requirement of any institute at any level. Lot of tasks are involved in organizing an examination such as registration information of students, the list of students in each subject, the examination schedule (i.e., date and time) etc. These tasks usually involve a large amount of data from many sources.

All Processers in today's world is being automated, so it will be easy and effective if examination process and examination related functions is being automated. Examination Management System automates the activities carried around the examination processes by the Examination Branch of Kelaniya University. This system is highly interactive and user friendly. This system will be used by the Examination Branch as well as Faculty of Graduate Studies University of Kelaniya and the system will cover the examination process of postgraduate students.

2.2   Related Literature

The literature survey is done to find the current status of the problem which has been identified. The main intention is to gather information from previously carried out work to study their methodologies and features.

Before start developing the system I have gathered information about similar features in the education field and some of the existing systems and web base systems in the literature survey. Some of their features are listed below.

2.2.1 Existing Systems Globally

Creatrix Campus- Examination Management System [1]

End-to-end automated examination management system for schools, colleges and universities provides ultra-systematic processes at every stage with complete confidentiality and significant cost reduction.
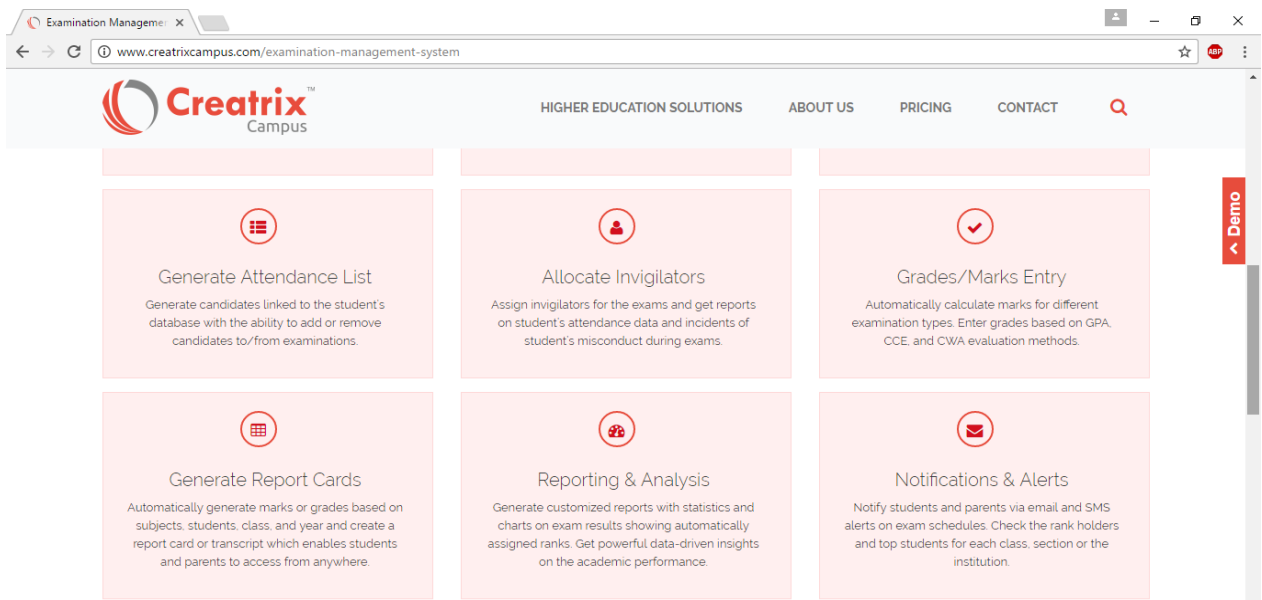
Figure 2 Creatrix Campus- Examination Management System

VirtualX Pro [2]

VirtualX Pro is a fully automated exam management system which can significantly help your organization to improve the efficiency when conducting online examinations.

Some features of the VirtualX Pro

- Role based access and security for users.
- Generate Reports and Results.
- Schedule exams to individual or group, notify examinee.

VirtualX Pro is an easy yet powerful web based online exam management software that caterers all online examination management requirements.
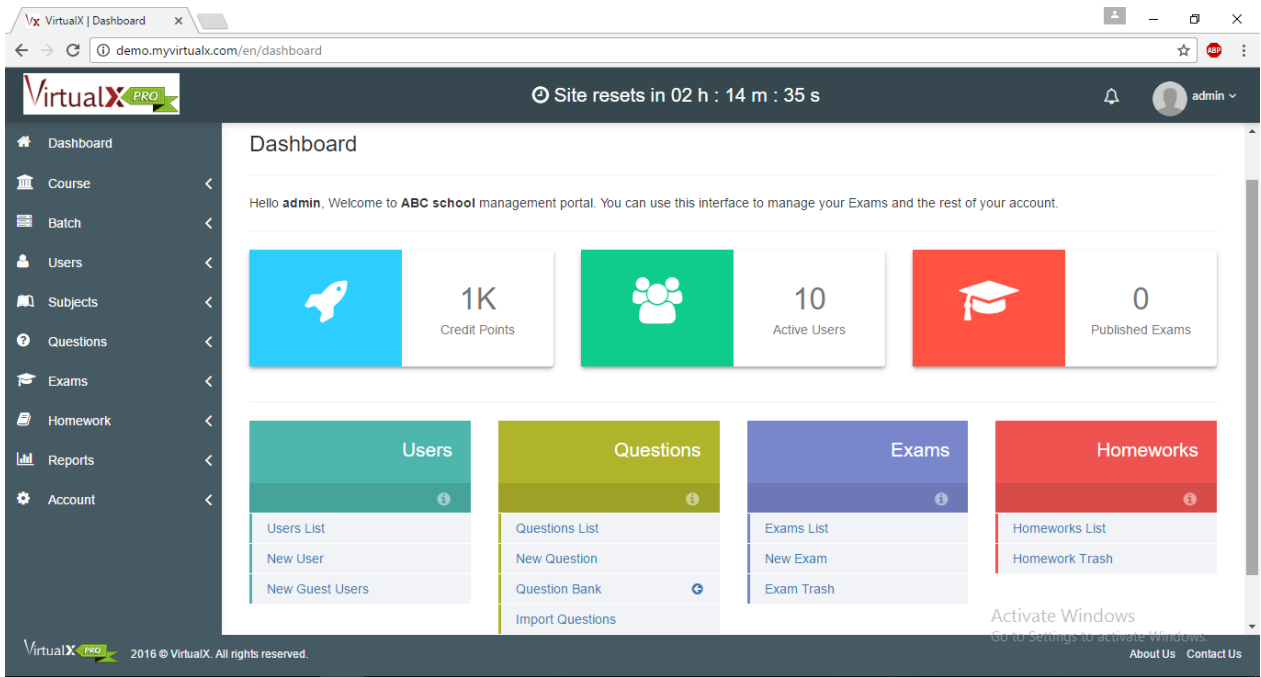
Figure 3 VirtualX Pro

Softfixer [3]

Exam solution designed to create tests for educational institutes, schools, colleges, and education acadmies.
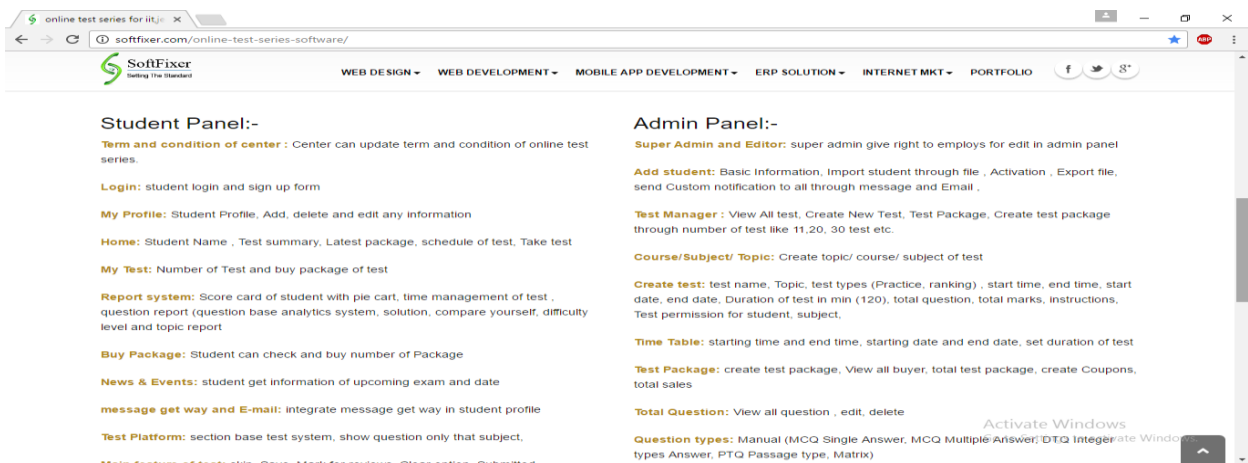

Figure 4 Softfixer

<u>mySkoolApp</u> [4]

Online exam and result management modules make teacher and admin staff easier and productive. Manage examination flow, publish results and report card online.
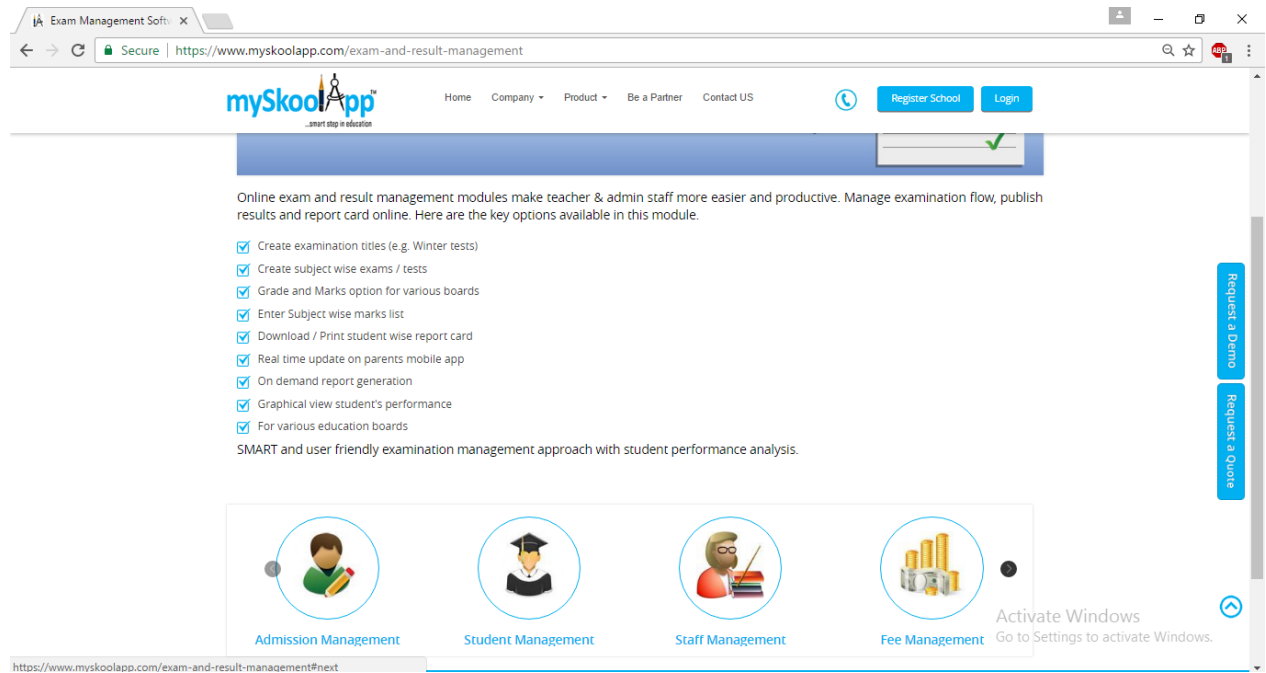

Figure 5 myskooolApp - Examination and result Management Module

Above mentioned systems are few of the top rated systems under the education management stream. Most of the systems are focused on online test preparations and exam conduction. There are few reputed systems in the world that has only focus on, online applications and mark storing process.

As per the client requirement, developing system has focused on results publications, exams preparation documents and notifications. This will make the examination process fast and efficient.

Chapter 3: Analysis & Design

3.1 System Development

3.1.1 System Development Life Cycle (SDLC)

The Systems Development Life Cycle (SDLC) is a conceptual model used in project management that describes the stages involved in an information system development project, from an initial feasibility study through maintenance of the completed application.

It contains five stages

- Planning
- Requirement gathering and Analysis
- Design
- Implementation
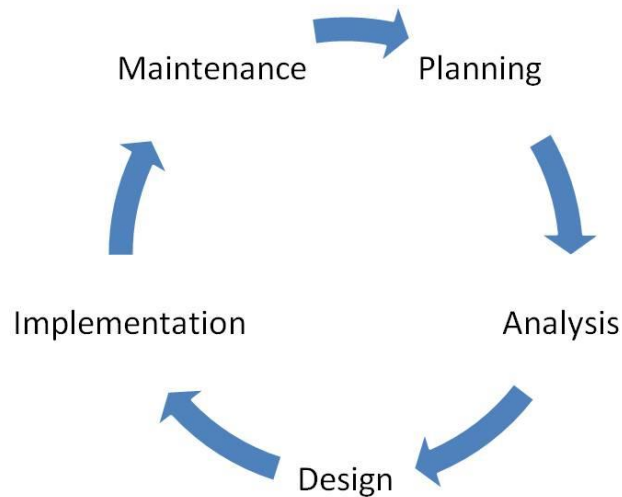- Testing and Maintenance

Figure 6 System Development Life Cycle

<u>Planning</u>

The Planning is the first step of SDLC and this phase is the most crucial step in creating a successful system, during this phase decide exactly what you want to do and the problems you're trying to solve, by:

- Defining the problems, the objectives and the resources such as personnel and costs.
- Studying the ability of proposing alternative solutions after meeting with clients, consultants and employees.
- Studying how to make your product better

<u>Requirement Gathering and Analysis</u>

Requirement gathering and analysis is the next phase of SDLC. The main task occurs in this phase is the gathering information related to project. If the collection information is wrong the whole project might be in a risky status.

Information was gathered by holding several meetings with the client (Deputy Registrar-Examination Branch) and the advisor (Dean- Faculty of Computing and Technology), interviews with postgraduate program coordinators and observations of the manual process which is carried by the Examination Branch and the Faculty of Graduate Studies. It was much helpful to find lot of rich information related to this project.

After gathering all requirements, it should have analysed problems and designed it in a graphical way to get a good idea about the system. It is very important to understand the problem. In this way we can understand the system needs. And also eliminate the errors, ensure requirements are completed. The analysis should cover all the aspects. Then how they will interact with the system, their main necessities that have to be covered from the system have to be analysed. All the present hardware, software, people and data should be considered during the time of analysis.

- Functional requirements.
- Non Functional requirements.
- Verifications.
- Constraints and Limitations.

Design

High Level Design: -

This will deliver a system and relationship between student, program coordinator, Examination Branch and FGS. Internal interfaces, external interfaces (System inputs and outputs). The outcome will be structure charts or software architecture.

Low Level Design: -

Throughout the design phase test plans and procedures for quality assurance should be developed. It is necessary to obtain an approval on design and project plans. In parallel to design the database, understanding of the requirements of user inputs and outputs is necessary. According to the interfaces that has been developed database should design with all the data structures and queries. Then again the database structure also has to submit for reviews to find out whether the tables and there inter connections are correct and also to find out whether the tables contains all relevant and important data fields. Sample data will also be prepared to test the database and queries.

Implementation

Implementation is one of the major phases of a project. In the final phase of each project the integrity of the solution is verified by allowing the client or user to test the system; this way the project will be approved with the confidence of receiving a solution that complies with each of requirements and that corresponds to the approved solution during the design phase. As the design implementation is done, it is all about coding and connecting the databases. Effort of this phase is very high comparing to the Requirement gathering, requirement specification and Designing.

After the coding is done it has to be tested before combining all the interfaces. This is also known as unit testing. It is very important to correct the errors separately rather than checking in the testing phase.

<u>Testing</u>

Software applications need intensive testing, as the applications will always function as a multi-user system within the whole network system.

- Testing will be done by several stages.
- Unit Testing – will be done in implementation stage (Test each module)
- Black box testing- (By entering some values check input and output whether it is correct or not.
- White box testing- (Go through the code and check whether it is correct or not)
- Integration Testing - step by step building the system while testing.
- System testing- check whole part.
- Alpha testing – (Client use dummy data and test while we inspecting).
- Beta Testing – (Client use actual data and test)
- Stress Testing – (Last time system test by us)
- Accepting testing – (Client test when he/she use the application)

3.2   Development Methodology

A methodology is a formalized approach to implementing the SDLC (System Development Life Cycle). This section defines the methodology or the procedures that was followed in order to meet the main goal and also to accomplish all the objectives.

Though are many different system development methodologies, I have decided to use the "System Prototype Methodology" for this project.

Prototype methodology performs the analysis, design and implementation phases concurrently, and all three phases are performed repeatedly in a cycle until the system is completed.

The key advantage of using this prototype methodology is that it very quickly provides a system for the users to interact with, even if it is not ready for widespread organizational use at first and help to more quickly refine real requirements and also the user can interact with the prototype to better understand what it can and cannot do.
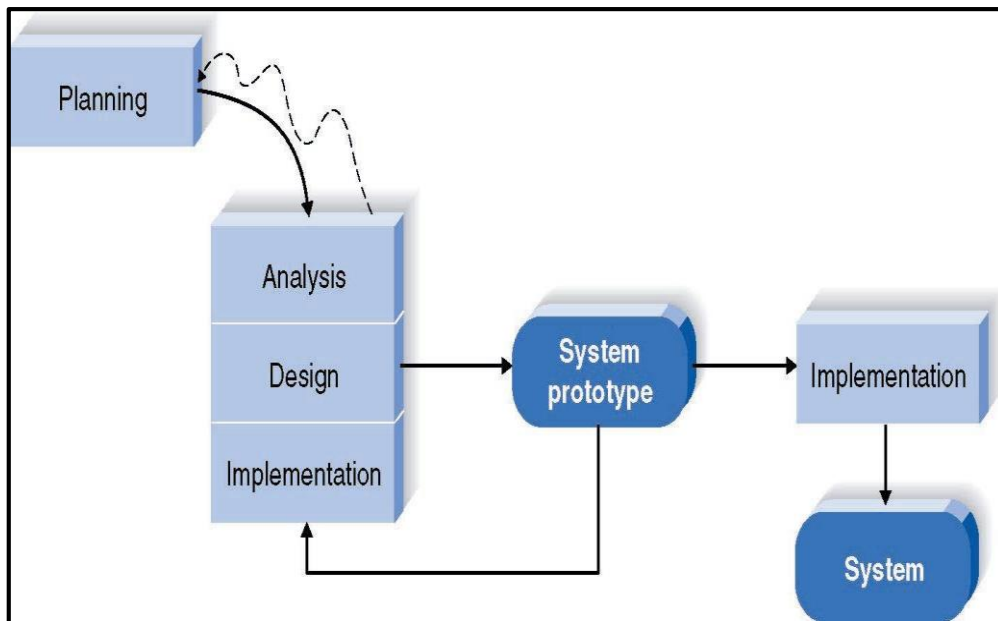
Figure 7 Methodology
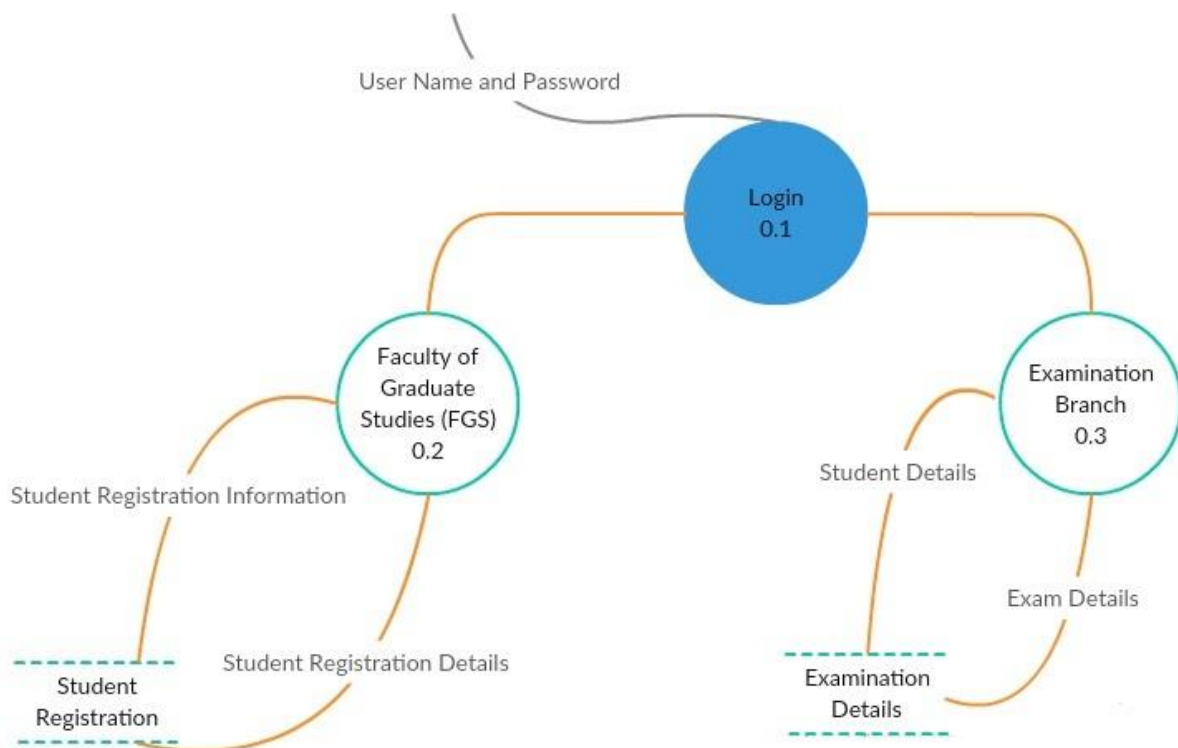
3.3 Design and Development

Context Diagram

Figure 8 Context Diagram

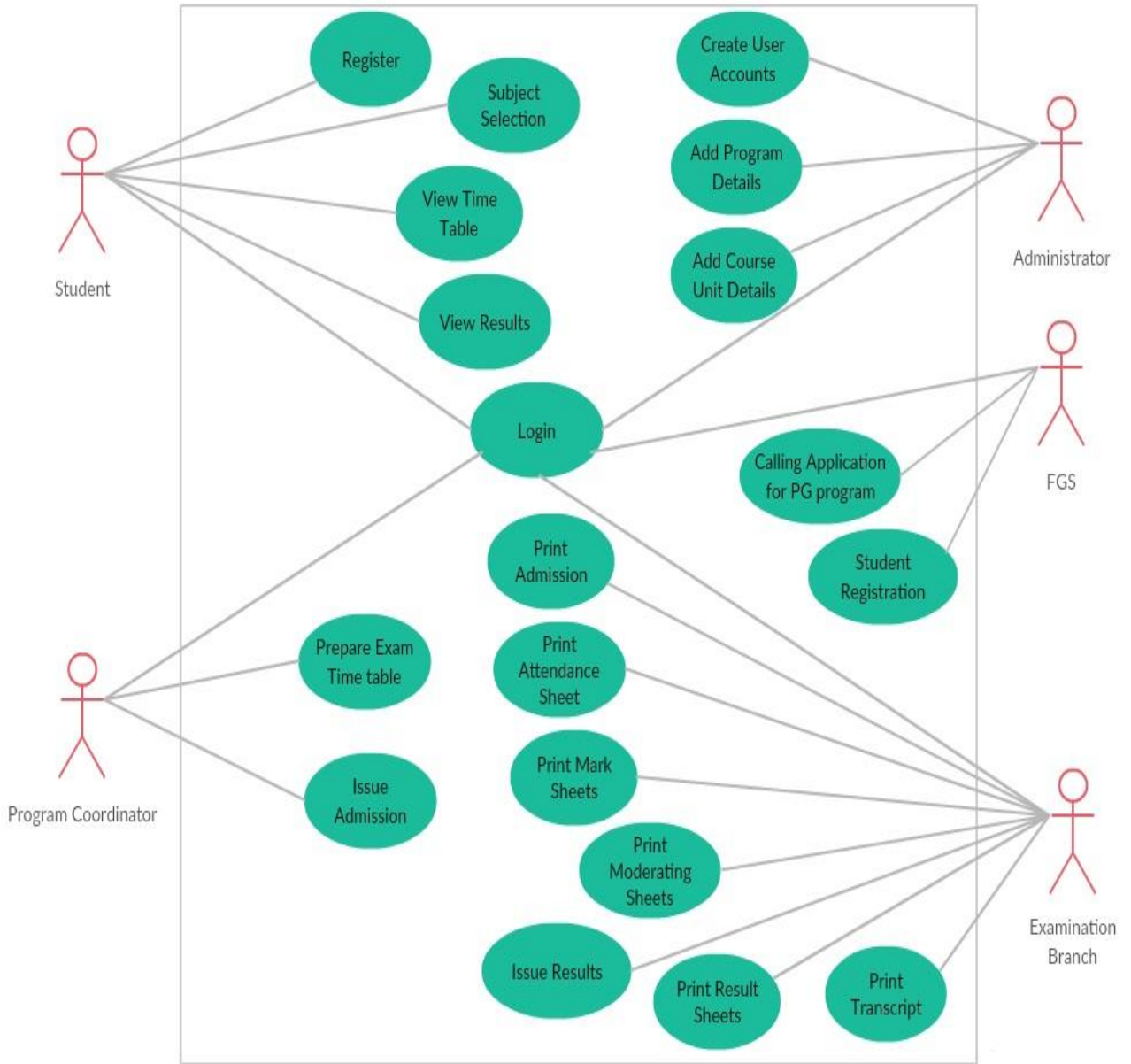**Examination Management System**

Figure 9 Use case Diagram

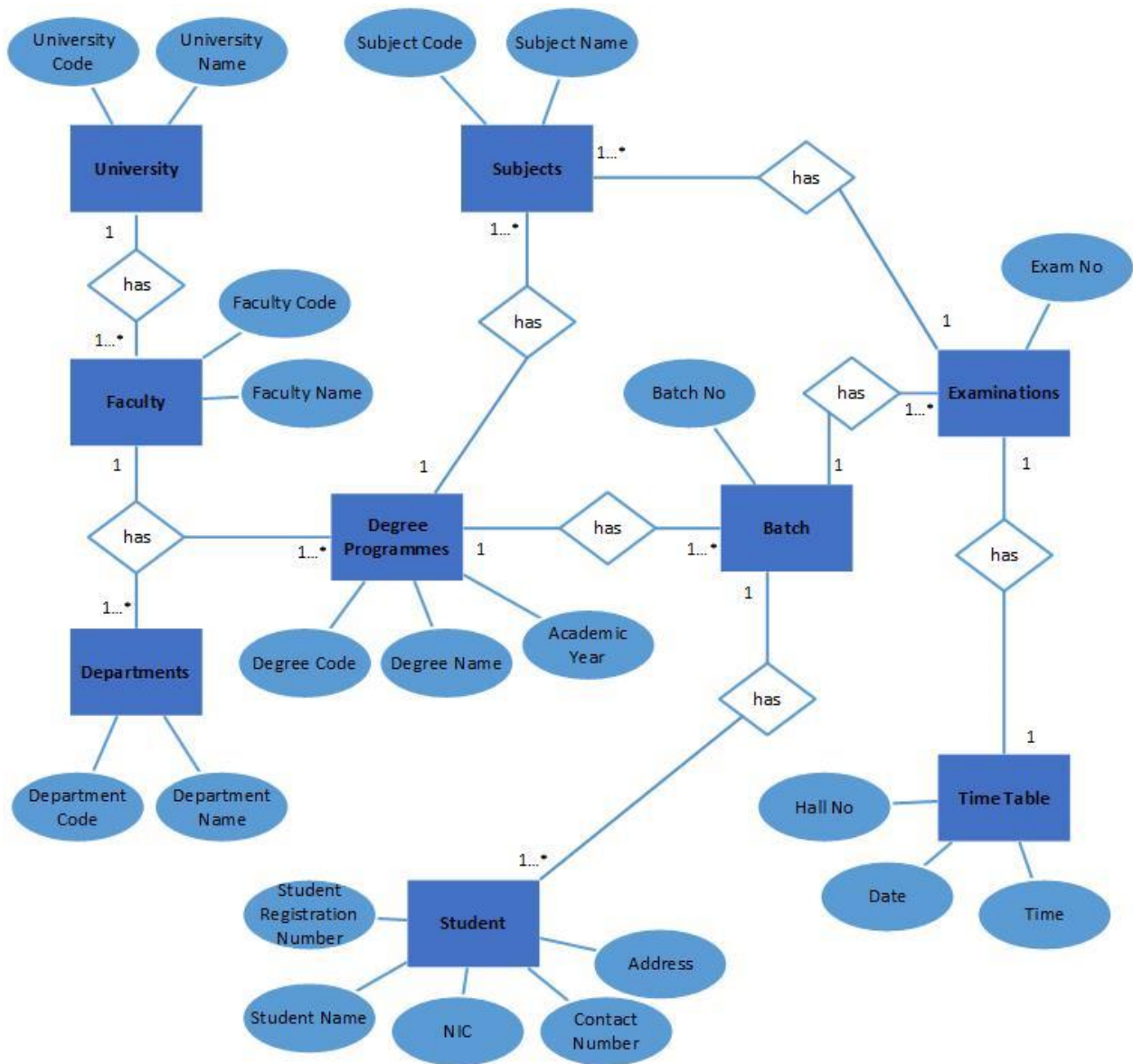Entity Relationship Diagram

Figure 10 Entity Relationship Diagram

Chapter 4: Implementation

This chapter include the aspects such as selection of implementation technology (languages, platforms frameworks, platforms etc.) Further, it describes reviews of technologies and justification of using them in this project.

4.1   Software Environment

Free Open source software products and technologies are used for implement examination management system.

- Programming Language – JavaScript, PHP
- Server - Apache
- Database Management System – MYSQL
- Designing Tools – Rational Rose and MS Visio

Below sections gives the small description about the technologies used to implements the system and reasons to select those technologies.

PHP

PHP stands for Hypertext Pre-processor. PHP can be interspersed within Hypertext Mark-up Language (HTML) that makes developing dynamic websites more reachable.

It uses a server side, cross-platform technology. Server-side actually refers to the fact that everything PHP does occurs on the server instead of the client's site. PHP runs on any operating system such as Windows, UNIX or Macintosh. Further, PHP is better, faster and easier to learn than the alternatives when developing dynamic websites. As required by the user the system has to be set up on a server. Since it was open source, PHP was selected to develop this web-based system at University of Kelaniya.

JavaScript

JavaScript resides inside HTML documents, and can provide levels of interactivity to web pages that are not achievable with simple HTML. Java Script is an OOP scripting language.

Notepad++

Notepad++ is a text editor and source code editor for use with Microsoft Windows. Unlike Microsoft Notepad, the built-in Windows text editor, it supports tabbed editing, which allows working with multiple open files in a single window. Notepad++ is distributed as free software.

Database Technology

MySQL is a database management system (DBMS) for relational databases. MySQL was selected to develop the database for this web-based system because, like PHP, MySQL offers excellent performance, portability and reliability, with moderate learning curve at little to no cost because MySQL is the world's most popular open source database. Further, PHP always gives good support for MySQL.

Unified Modelling Language (UML)

Because of the following benefits, UML was selected to graphically represent the proposed system.

- Usually, it offers regulations for software development.
- Reduce cost for diagram development.
- Lesser time for development.

4.2   Hardware Environment

- Network – University network (wired and wireless) or Strong Network connection at home.
- Client Computers – From Windows 95 up to Windows 10.
- 1GB of Ram and 500GB hard disk.
- Intel 3.0 GHz Processor.
- System use hardware devises to connect sub systems together.
- For install system to the user computer has to have an USB port or CD ROM.
- To connect devices together use routers, network cables, and other devices.

4.3   User Interfaces

Figure 11 Main Login Form

Figure 12 Administrator Menu

Figure 13 Add New University

Figure 14 Add New Faculty

Figure 15 Add New Department

You are Logged In As : Administrator | logout

New Degree Programme

University	: University of Kelaniya
	◉ Offering Faculty ○ Offering Department
Faculty	: Faculty of Science
Type	: MSc
Degree Code	:
Degree Title	:
Academic Year	:
Duration	:
Medium	: English
Degree Eligible Criteria	:

- ☐ Bachelor's degree(General or Special) from a recognized university with relevant subject
- ☐ Bachelor's degree(General or Special)from a recognized university with relevant subject and one year experience(staff category)in a recognized library
- ☐ Bachelor's degree(Special with class)from a recognized university with relevant subject
- ☐ Parachina Panditha
- ☐ BSc or MBBS
- ☐ Bachelor's Degree(Special)in Commerce / Management / Science /Engineering or Economics
- ☐ Bachelor's Degree with at least one year managerial / executive / teaching experience in recognized institute
- ☐ Bachelor's Degree(Special)in any field
- ☐ Bachelor's Degree (General) with at least one year of working experience
- ☐ Bachelor's Degree in Business / Management /Commerce from a recognized university
- ☐ Bachelor's Degree other than the above from recognized university with at least one year post qualifying experience in managerial capacity
- ☐ Passed finalist from a recognized professional institution accepted by the university , with at least one year experience in executive capacity
- ☐ Senior managers and entrepreneurs who have an exceptional and outstanding track record (The university will define special eligibility criteria case by case)
- ☐ University Degree in any Stream (Local or Foreign)
- ☐ Higher Diploma/ Advanced Diploma (Related to Stream of Business Management along with working experience)
- ☐ Professional Qualification (Marketing /HR/ Finance and other related along with working experience)
- ☐ Any Bachelor's Degree from a recognized University
- ☐ BSc Degree in Biological, Agricultural or Environmental Sciences
- ☐ MBBS degree or a degree in Dental or Veterinary Sciences
- ☐ Medical degree in Ayurvedic or Unani traditions
- ☐ Any Bachelor's Degree from a recognized University with working experience
- ☐ Related Postgraduate Diploma/Postgraduate Certificate
- ☐ B.Sc. (Special) degree in Botany/ Plant Sciences/ Applied Science/ Food Science/ Molecular Biology and Plant Biotechnology/ Molecular Biology/ Plant Biotechnology/ Zoology/ Microbiology/ Chemistry (with biological science subjects)
- ☐ B. Sc. (Agric.)/ B.Sc. (Agriculture Technology and Management)
- ☐ B.Sc. (General) degree with Botany/ Plant Sciences/ Applied Sciences/ Food Science/ Molecular Biology and Plant Biotechnology/ Molecular Biology/ Biotechnology/ Zoology/ Microbiology/ Food Science as a subject
- ☐ B.Sc. (Special) degree in Chemistry
- ☐ B.Sc. (General or Special) degree with Chemistry as a Subject
- ☐ B. Sc. Degree in Chemical Engineering or Environmental Science or Agriculture
- ☐ Four year Bachelors Degree in Commerce/Management/Science/Engineering or Economics
- ☐ Bachelors Degree with at least one year Managerial/Executive/Teaching experience in a recognized instituttion
- ☐ Professional qualification with relevant experince, approved by the University of Kelaniya
- ☐ Two year Master degree/ MPhil degree and a minimum of five years related caliber managerial experience.
- ☐ Bachelor's degree (General/Special) from a recognized University with one (01) year professional experience (Staff category) in a recognized library
- ☐ Bachelor's degree (General/Special) from a reconginzed University with Higher Diploma Certificate in Library and Information Science from the University of Kelaniya or a pass in the Final Examination of Sri Lanka Library Association
- ☐ Any other academic professional qualification accepted by the senate of the University of Kelaniya
- ☐ Any academic professional qualification accepted by the senate of the University of Kelaniya

[Save] [View Degree Programme] [Reset Values] [Back to Administrator Menu] [logout]

Figure 16 Add New Degree Program

23

Figure 17 Add New Course Unit

Figure 18 Create New User Account

Figure 19 Examination Branch Menu

Figure 20 Generate Admission Form

Figure 21 Generate Time Table

Figure 22 Enter Examination Results

FACULTY OF SOCIAL SCIENCES - UNIVERSITY OF KELANIYA

MA/MSSC Examination 2016

Examination Admission Card

Name with Initials : A.G.D. Srinath Bandara
Student Number : FGS/MA/ARCH/13/026

Date/Time	Paper Code/Exam Hall	Signature of Applicant	Signature of Supervisor
10/10/2016 13.30-16.30	ARCH 53015/M 01 K1 201		
10/17/2016 13.30-16.30	ARCH 53025/M 02 K1 201		
10/24/2016 13.30-16.30	ARCH 53035/M 03 K1 201		
10/31/2016 13.30-16.30	ARCH 53045/M 04 K1 201		
11/7/2016 13.30-16.30	ARCH 53055/M 05 K1 201		

Certification of Signature

Signature of Applicant..   National identity Card Number...
I Certify that the above named applicant signed before me today.

Signature of the Attester...   Date...
Name, Designation and Address of Attester...
....

Instructions for the certification of signature

The signature of the applicant should be certified by A Professor/head of the Department /Senior Lecturer/Lecturer/Senior Assistant Registrar/Assistant Registrar/ Assistant Registrar of the University of Kelaniya or a Principal of a Government School /Grama Niladari of the GN Division/Justice of Peace/ Commissioned officer of the Armed Forces/incumbent or the High Priest of a Temple/a Priest of a Temple/a Priest of any other Religious Place or a Clergy of important Position or a Permanent Staff officer drawing Rs. 79,080.00 or above annual consolidated salary in Public Sector or Local Government sector.

After Sitting for the final question paper, this admission card should be handed over to the Supervisor of the examination hall in order to be submitted to the Faculty Social Sciences.

It is compulsory for every candidate to carry on this admission card along with the University identity card, and present it to the supervisor of the examination hall

Assistant Registrar/ Faculty of Social Sciences
on behalf of the Registrar/ Examination

Return: Mrs. D.P. Tharangani Assistant Registrar Faculty of Social Sciences University of Kelaniya	To: A.G.D. Srinath Bandara Police, I.O.T. Wing, Sri Lanka Police College, Kaluthara

Print

Figure 23 Print Version of Admission Form

Figure 24 Document Printing Form

FACULTY OF SOCIAL SCIENCES - UNIVERSITY OF KELANIYA

MA/MSSC Examination 2016

Attendence Sheet

Paper : ARCH 53025/M 02
Examination Hall : K1 201
Examination Date : 11/7/2016--13.30-16.30

Student Number	Signature
FGS/MA/ARCH/11/002	
FGS/MA/ARCH/13/002	
FGS/MA/ARCH/13/026	
FGS/MC/ARCH/13/002	
FGS/MA/ARCH/13/001	
FGS/MA/ARCH/13/003	
FGS/MA/ARCH/13/004	
FGS/MA/ARCH/13/005	
FGS/MA/ARCH/13/006	
FGS/MA/ARCH/13/007	
FGS/MA/ARCH/13/008	
FGS/MA/ARCH/13/009	
FGS/MA/ARCH/13/010	
FGS/MA/ARCH/13/012	
FGS/MA/ARCH/13/013	
FGS/MA/ARCH/13/014	
FGS/MA/ARCH/13/016	
FGS/MA/ARCH/13/019	
FGS/MA/ARCH/13/019	
FGS/MA/ARCH/13/020	
FGS/MA/ARCH/13/021	
FGS/MA/ARCH/13/022	
FGS/MA/ARCH/13/023	
FGS/MA/ARCH/13/025	
FGS/MA/ARCH/13/027	
FGS/MA/ARCH/13/028	

Print

Figure 25 Print Version of Attendance Sheet

FACULTY OF SOCIAL SCIENCES - UNIVERSITY OF KELANIYA
MA/MSSC Examination 2016
Mark Sheet

The Supervisor should complete the relevant parts of sheet and enclose with answer scripts. Students who were not present for the examination, Absent against their Student No. in the mark sheet.

Paper : ARCH 53025/M 02
Examination Hall : K1 201
Examination Date : 11/7/2016--13.30-16.30

Name of Supervisor :

Signature of Supervisor :

Student Number	Grade	Total	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
		(100)										
FGS/MA /ARCH/11/002												
FGS/MA /ARCH/13/002												
FGS/MA /ARCH/13/026												
FGS/MC /ARCH/13/002												
FGS/MA /ARCH/13/001												
FGS/MA /ARCH/13/003												
FGS/MA /ARCH/13/004												
FGS/MA /ARCH/13/005												
FGS/MA /ARCH/13/006												
FGS/MA /ARCH/13/007												
FGS/MA /ARCH/13/008												
FGS/MA /ARCH/13/009												
FGS/MA /ARCH/13/010												
FGS/MA /ARCH/13/012												
FGS/MA /ARCH/13/013												
FGS/MA /ARCH/13/014												
FGS/MA /ARCH/13/016												
FGS/MA /ARCH/13/019												
FGS/MA /ARCH/13/019												
FGS/MA /ARCH/13/020												
FGS/MA /ARCH/13/021												
FGS/MA /ARCH/13/022												
FGS/MA /ARCH/13/023												
FGS/MA /ARCH/13/025												
FGS/MA /ARCH/13/027												
FGS/MA /ARCH/13/028												

Print

Figure 26 Print Version of Mark Sheet

Figure 27 Student Subject Selection Form

Figure 28 Student Profile

Chapter 5: User Evaluation & Testing

Testing is important due to maintaining the reliability and the robustness of an application. This chapter will describe the evaluation of the system with sample test cases. Further, it will discuss whether the system meets objectives defined earlier. In addition, it will discuss about performance and robustness of the system.

5.1   Evaluation Strategy

A proper system evaluation strategy formulated for the purpose of evaluation process. In that sense, the answers for the following questions evaluated through a suitable mechanism. [6]

- Can this system save time and optimize resources?
- Can the users of the system, use it effectively and easily?
- Is this system meets its goal and objectives?

This Examination Management System was evaluated using number of evaluation techniques such as interviews, observation and questionnaires

5.1.1 Interviews

Several interviews were conducted with the client (Deputy Registrar-Examination Branch) and the advisor (Dean- Faculty of Computing and Technology), interviews with postgraduate program coordinators. There are more than four face-to-face interviews conducted with clerical staff and some of the lecturers. During the interview their feedback about the system were noted down. Interviews were done before and after developing some modules of the system.

5.1.2 Observation

Observed the manual process which is carried by the Examination Branch and the Faculty of Graduate Studies before stared developing the system and system observed through sample input data for each interface, their anticipated outputs and their definite output results in the evaluation phase of the examination management system. Several browser capabilities such as Google Chrome, Firefox was also successfully tested. If the system takes a huge loading time, users may not be satisfying about it. Therefore, loading time for all the interfaces has to be considered. Until it is hosted on a server of the campus. Finally, their feedback evaluation could be gathered by a questionnaire.

5.1.3 Questionnaire

Examination Management System was further evaluated through a questionnaire by supplying that to clerical staff of examination department, some of the lecturers and some programme coordinators. From that, their satisfaction level of the system could be discovered.

5.2 Software Testing

Software testing involves executing an implementation of the software with test data and examining the outputs of the software and its operational behaviour to check that it is performing as required. Testing is a dynamic technique of validation and verification because it works with an executable representation of the system.

Validation is set of activities that ensure that the software that has been built is the one that user needs which matches with their requirements.

Verification is set of activities that ensure that software correctly implements the specified functions. Following testing methods were adopted during the testing process.

- Unit Testing
- Integration Testing
- Validation Testing
- System Testing
- Acceptance Testing

5.3 Test Functions

Test Case: Student Login				
Pre-condition: Student Should be a registers postgraduate student				
Test Case ID	Sequence No	Test Description	Input Value	Expected Output
1	1.1	Student enter User Name Password	FGS/MA/ECON/2016/001. 123456789V.	
	1.2	Click Login button		Login Successfully and Student Profile page loaded.
Actual Output				

Table 1 Student Login

Test Case: Staff Login				
Pre-condition: User Should be in Examination Management System home page				
Test Case ID	Sequence No	Test Description	Input Value	Expected Output
2	2.1	User enter User Name Password (if Examination Deputy Registrar)	DRexam. 123.	
	2.2	Click Login button		Login Successfully and Examination department page loaded.
Actual Output				

Table 2 Staff Login

Test Case: Create Exam Time Table				
Pre-condition: User Should be in logged into Examination Management System				
Test Case ID	Sequence No	Test Description	Input Value	Expected Output
3	3.1	User enter User Name Password (if Examination Deputy Registrar)	DRexam. 123.	
	3.2	Click Login button		Login Successfully and Examination department page loaded.
	3.3	Click Create Time Table button		Create Time Table interface loaded successfully
	3.4	Select Values Faculty Academic Year Start date End date Programme	Faculty of Social Science 2017 2017.01.01 2017.02.01 MA Economics	
	3.4	Select Values		

		Paper Date	ECON 53015/M01 2017.01.19	
		Enter Values Start Time End Time Hall no	 9.00 am 11.00 am K214	
		Click Add button to add more papers And repeat the process for each number of papers		
		Click Save button		Time table created successfully

Actual Output

Table 3 Create Time Table

Test Case: Enter Examination results				
Pre-condition: User Should be in logged into Examination Management System				
Test Case ID	Sequence No	Test Description	Input Value	Expected Output
4	4.1	User enter User Name Password (if Examination Deputy Registrar)	DRexam. 123.	
	4.2	Click Login button		Login Successfully and Examination department page loaded.
	4.3	Click Enter Exam Results button		Examination results interface loaded successfully
	4.4	Type Student No and click search button	FGS/MA/ECON/2016/001	Display student name and registered degree programme

| | 4.5 | Click Add marks button and enter Subject Grade/ Marks | ECON 53015/M01 B | |
| | 4.6 | Click add marks button to repeat the process and Click save button | | Examination results saved successfully |

Actual Output
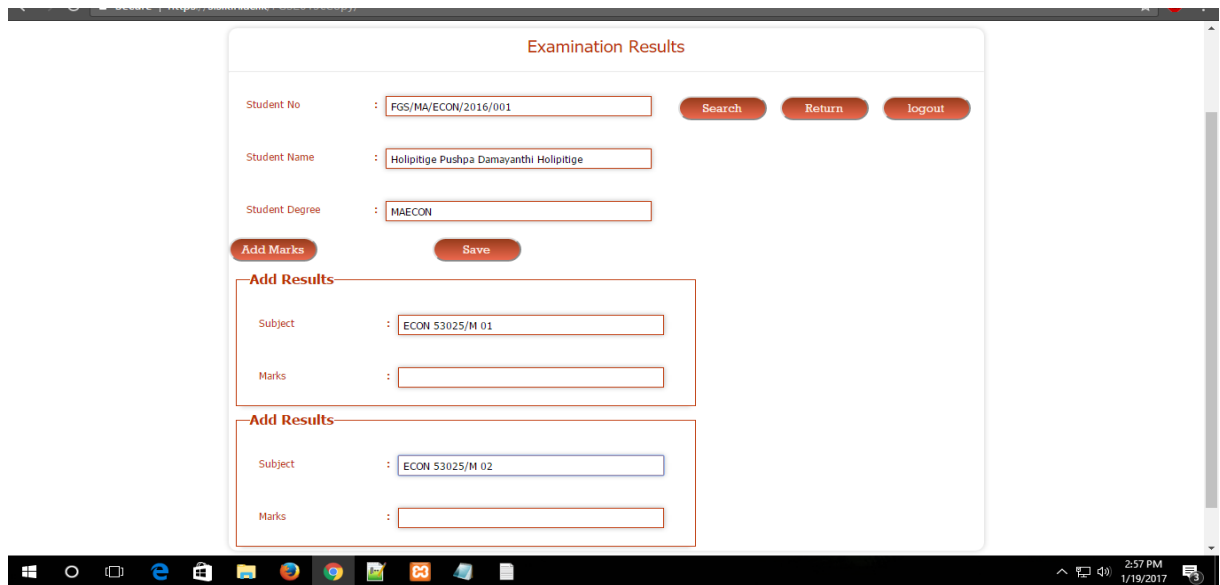
Table 4 Enter Examination results

Chapter 6: Conclusion and Future Works

Examination Management System is an automated web based examination details management system for Examination Branch of University of Kelaniya. The system is mainly focused on the problems occurred in the manual method which was found to be tedious, especially when carried out for a large number of postgraduate students from different postgraduate programs, this makes the entire process time-consuming and error prone. Solution which has implemented will be much more helpful to both students and the university staff to make their examination process efficient.

The prototype methodology was used to implement this system. The key advantage of using this prototype methodology was that it very quickly provided a system for the users to interact with, even if it is not ready for widespread organizational use at first and help to more quickly refine real requirements. The main functionalities of this automated system are containing create examination time table, enter examination results, provide an easy way to get all needed documents printed.

The idea of automation suggested because of the vast advantages it could bring users up such as students, programme coordinators and clerical staff of examination department are now able to process information much more quickly and precise than the manual system which is added more value to the academic field with the huge efficiency which they are gaining with the system**.**

6.1   Problem Encountered and Lesson Learned

This system is designed to meet general requirements of the examination process which is carried out by the Examination Department, University of Kelaniya. While developing the system some problems occurred that can't eliminate in project scoop. Some problems of the Examination Management System are as follows.

Framework

Framework which were used to develop this system is an in house build framework by Dr. Gamini Wijayarathna, Dean, Faculty of Computing and Technology who is my advisor. This framework is based on PHP and JavaScript which is different version of a client server architecture. I studied this framework after a training given by my advisor and started developing the system. Main problem in this frame work which I have encountered is that we cannot plug third party libraries to

the system such as calendar, date picker, time picker, email/sms gateways and etc. So if someone want to add calendar we have to write our own library functions.

Changes in Requirements

Initial requirement gathering was done before the project proposal and when before and started developing the system, had several requirement gathering meetings with client and advisor. Problem occurred at the initial stage of the development because of user's lack of IT skills and knowledge. Because of that users cannot give system wise proper initial requirements. When some phases are completed there were review meetings with the client and they were cable of giving requirements that would change 65% of development and sometimes they change initial requirements after completing some phases. This became a huge problem for the future developments of the system.

Sharing the common details with Faculty of Graduate Studies system

Faculty of Graduate Studies have a separate system to maintain student registration process. Since the examination management system is designed to manage examination details of postgraduate students only, had to find a way to get all registered student details for the examination management system. Faculty of Graduate Studies staff is prohibited to maintain and access examination results. When it comes to share common data, faced a huge problem by bridging the gap between examination staff and FGS staff access levels and share common details.

Limited Knowledge of Information Technology

Too often, the effects of technology on the organization are not given enough thought prior to the introduction of a new system. In government sector there are people who are new to technology. Their lack of knowledge is affecting while developing and introducing a new automated method to replace their manual work. Had to find a way to improve their IT related skills and give a proper training of the system.

Maintain Common Process

Maintain a common examination process, results entering process, common document formats were the next problem arise. Different faculties, departments used different examination process,

document formats. Had to find a way to merge them all and get a common procedure for the examination management system.

There were some lessons learned while developing this system.

<u>Project Management</u>

Multitasking, proper planning, managing time and deadlines, staff training was learned during the development of the project.

<u>Start small, then extend</u>

Whether creating a new system, or adding a feature to an existing system, it should start by making a very simple version. Then extend the solution step by step, until it does what it is required to.

<u>Change one thing at a time</u>

When develop the system, and some tests fail, or a function stops working, it's much easier to find the problem if only changed one thing.

6.2   Critical Evaluation of the System

Examination Management System was evaluated using following evaluation techniques.

- Interviews
- Observation
- Questionnaires (Appendix B)

These evaluation methods were used before developing, in middle of development and after developing the system.

In Examination Management System, system users can be divided in to two parts.

- High Level Users
- Low Level Users

These user levels are defined based on their user roles. Such as Dean, Deputy registrar, Senior Assistant Registrar, System Administrator and Clerical staff.

High Level Users	Low Level Users
Dean – Faculty of Graduate Studies	Clerical Staff – Examination Department, Faculty of Graduate Studies
Deputy Registrar – Examination Department	CAA – Examination Department, Faculty of Graduate Studies
Senior Assistant Registrar – Faculty of Graduate Studies	Trainee Staff – Examination Department, Faculty of Graduate Studies
System Administrator – Examination Management System	

Table 5 User Level

System evaluation was carried out to measure the overall satisfaction of above mention users about the new automated method.

High level users were highly satisfied with the developed system, since they are the users who were in need of a solution to the manual method. Dean, Deputy Registrar were the client of this examination management system. They were highly satisfied with the outcomes of the developed system.

When it comes to the low level users at the beginning of the system development they were not happy to change their manual work procedure. Their opinion was that it would be an extra work when it comes to the automated process. Some of the clerical staff's IT skills were not up to date and they requested a training on not only for the system but also for some basic IT related training in order to use the system. Computer application assistants were happy to use the system since they were from technical background. And they were satisfied with the automated method that would make their work much easy and error free.

When it comes to the overall satisfaction most of the user were highly satisfied with the developed system and adequate trainings, user manuals were requested. Automation of this examination process reduces the time, human involvement and errors that could occur while making use of the manual method.

The system was successfully developed, tested, and found to be working as expected. It is capable of storing and retrieving records with high speed and accuracy, and presenting useful information to its users. Its qualities are the reduction in the cost, reduction in the time spent to maintain student's grades in large excel sheets, books and the elimination of duplication of resources in terms of manpower and infrastructure. The system is flexible and runs in a web browser. It also minimizes data redundancy and is user-friendly.

6.3   Future Works

Examination Management System will be more efficient and reliable with some enhancements in the future. Printing the transcript and semester wise result sheets were included in the road map of the project scope. Initially these were in the system, but some changes in the requirement made by the client removed them from the scope will be developed in the future. Apart from that project will focused to print the convocation book. And further enhancement will maintain examination details of undergraduate students too.

Even though provided solution is ideal for a middle scaled university as Kelaniya, larger universities cannot get the best out of it due to complexity of their process. Therefore, objective is to enhance the project scope which will fit for larger universities. Using these enhancements and client requested customizations, the goal is to develop more efficient and more reliable system in future.

References

[1] "Creatrix Campus Examination Managemen" Available:http://www.creatrixcampus.com/examination-management-system

[2] "VirtualX Pro" Available: https://myvirtualx.com/en

[3] "Softfixer" Available: http://softfixer.com/online-test-series-software/

[4] "muSkoolApp" Available:https://www.myskoolapp.com/exam-and-result-management

[5] Cole A. J., The Preparation of Examination Time Tables Using a Small Store Computer, The Computer Journal, 7: 2, pp. 117–121, 1964. Google Scholar

[6] Patton, M. Q. (2002). Qualitative Research and Evaluation Methods (3rd ed.). Thousand Oaks, CA: Sage.

[7] Rea, L. M. & Parker, R.A. (2005). Designing and Conducting Survey Research: A Comprehensive Guide. San Francisco: Jossey-Bass.

[8] Lu Chang, Xu Guang Ming, Application Research of Web Examination System Based on College, 2012 International Conference on Future Electrical Power and Energy Systems, Published by Elsevier Ltd.

[9] Ji Wen , Shunren Xia , A web-based examination system based on PHP plus MySQL , Annual International Conference of the IEEE Engineering in Medicine and Biology Society.

Appendix A

User Feedback Results
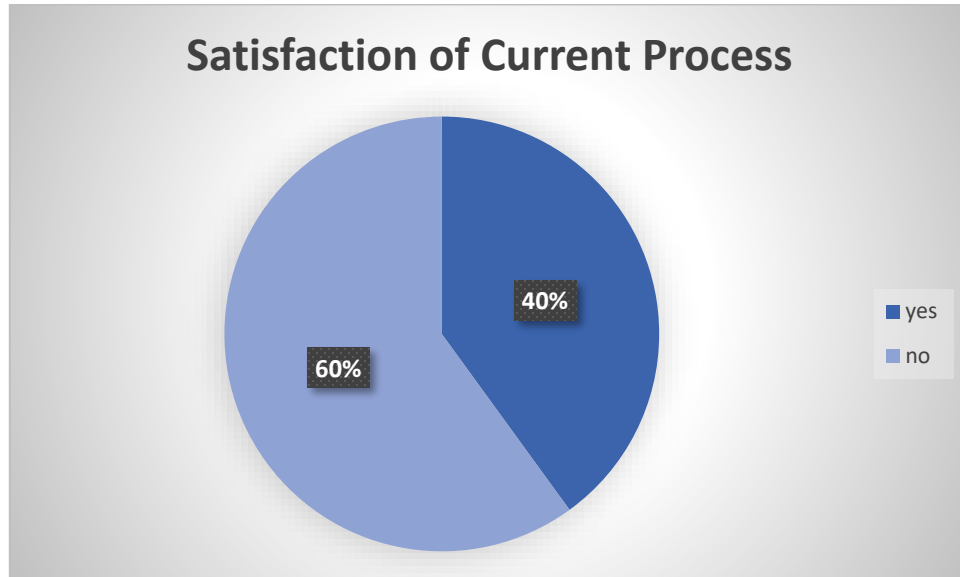
Figure 29 User Feedback One
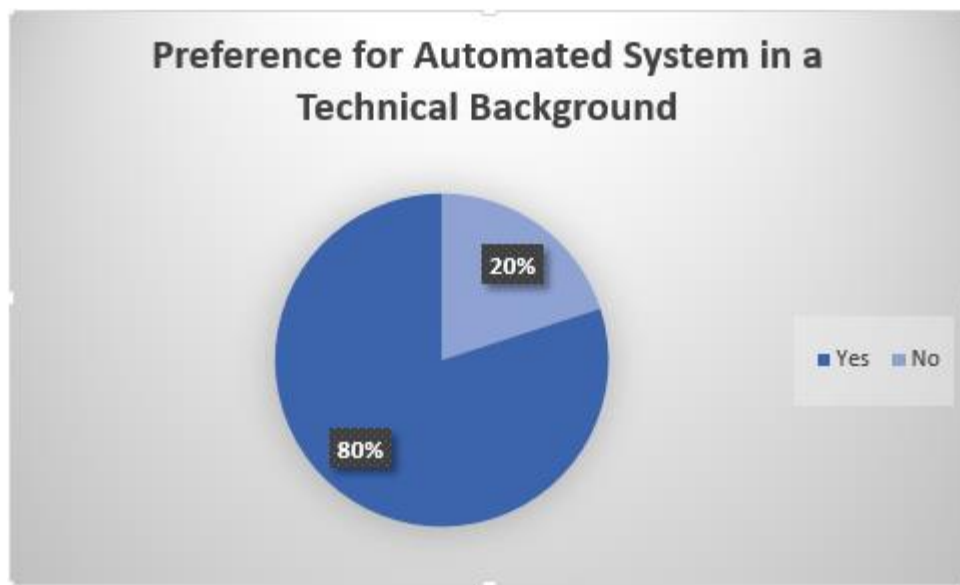
Figure 30 User Feedback Two
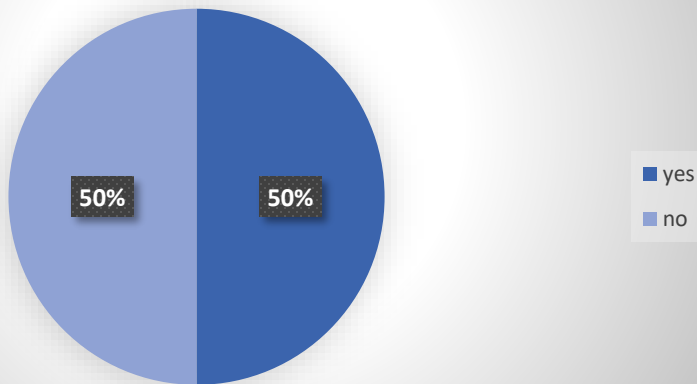
Figure 31 User Feedback Three

Appendix B

Evaluation of the Examination Management System

1. Strongly agree
2. Fairly agree
3. Agree
4. Disagree
5. Strongly disagree

		1	2	3	4	5	N/A
1	This system is simple and easy to use						
2	Interfaces of the system are good and attractive						
3	It is easy to get information from this system						
4	It is easy to recover and correct from the system mistakes						
5	System gives error messages which clearly tells me how to fix problem						
6	I'm satisfying with the feature of effective use of time						
7	System functionalities are user friendly						
8	I am satisfying with the functionalities of this system						

9	Better than the manual working process						
10	Overall I am satisfied with this system						
11	Any other suggestions						

Table 6 Evaluation Questioner

Appendix C
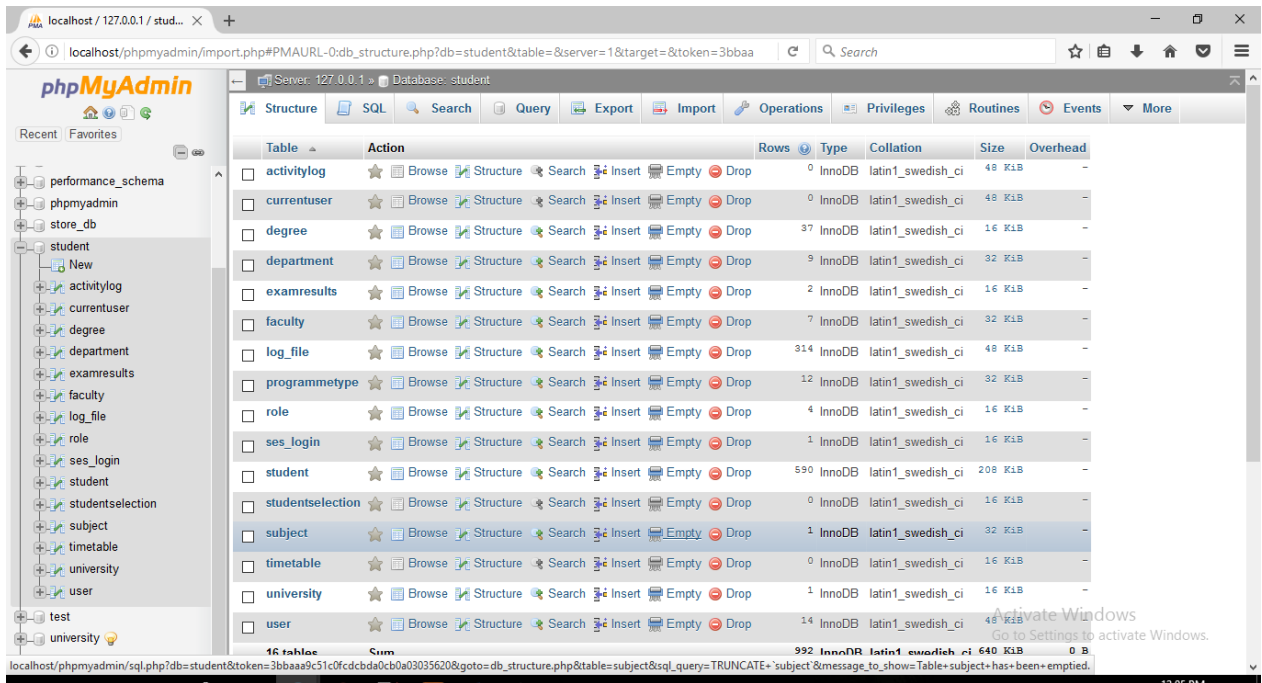
Figure 32 Database Structure
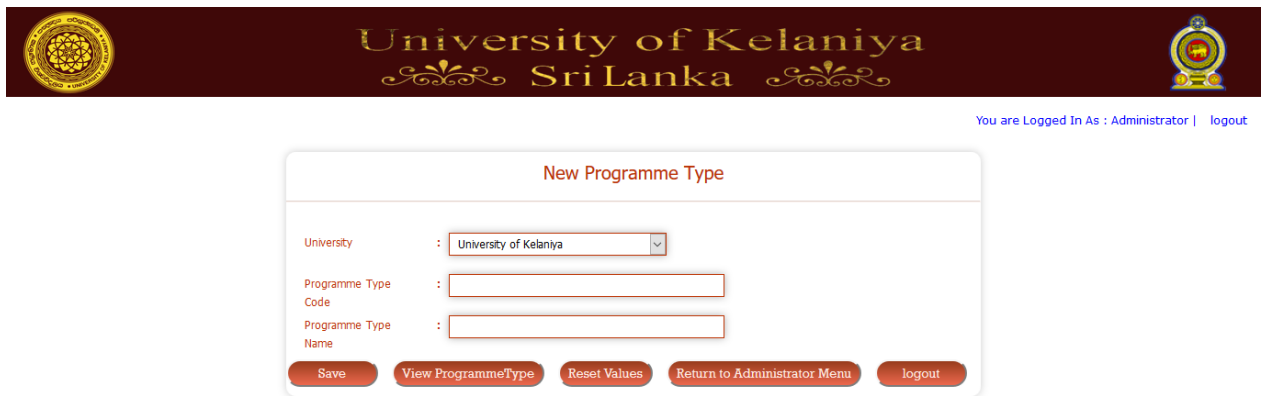
Figure 33 New Programme Type

Figure 34 Enter Results

Figure 35 View Examination Results

Figure 36 Report One

Figure 37 Report Two

Figure 38 Report Three