



**Strathmore**  
UNIVERSITY

Strathmore University  
**SU+ @ Strathmore**  
University Library

---

**Electronic Theses and Dissertations**

---

2017

# Information dissemination framework for Technical Training Institutions in Kenya

**Patrick Alianda**  
*Faculty of Information Technology (FIT)*  
*Strathmore University*

Follow this and additional works at <https://su-plus.strathmore.edu/handle/11071/5689>

## Recommended Citation

Alianda, P. (2017). *Information dissemination framework for Technical Training Institutions in Kenya*

(Thesis). Strathmore University. Retrieved from <http://su-plus.strathmore.edu/handle/11071/5689>



Information Dissemination Framework for Technical Training Institutions in

Kenya

By

Alianda Patrick (085012)

A research dissertation submitted in partial fulfillment of the requirements for the

Degree of Masters of

Science in Mobile Telecommunications and Innovation at Strathmore University

Faculty of Information Technology

Strathmore University

Nairobi, Kenya

June, 2017

## **DECLARATION**

I certify that this research document is my original work and any part of it that is not my own has been duly referenced. I further certify that no material has previously been submitted and approved for the award of a degree by this or any other University. No part of this dissertation may be reproduced without the permission of the Author and Strathmore University.

Alianda Patrick

Signature.....

Date: .....

## **APPROVAL**

This dissertation was reviewed and approved by:

Dr. Vitalis Ozianyi (PhD),

Lecturer, Faculty of Information Technology,

Strathmore University

Signature.....

Date: .....

## **DEDICATION**

I dedicate this work to the Almighty God who gave me the favour and opportunity to do this Masters, @iLabAfrica for the opportunity, support and training they offered for the attainment of this Masters.

## **ACKNOWLEDGEMENTS**

First of all I would like to thank God the Almighty for having given me the opportunity, strength and breakthrough to see this work come to completion.

Secondly I thank my parents, Henry Wabwire Khalende and Ludwin Khalende, my brothers Joseph Khalende, Adrian Khalende and Sister Catherine Khalende and Daniel Mureithi for their support and encouragement during the time I was doing this Masters.

Thirdly special thanks go to my Project Supervisor Dr.Vitalis Ozianyi and Dr. Sevilla for their guidance and support to see that I finish this project.

## **ABSTRACT**

Mobile Technology is increasingly being utilised as a tool for information dissemination and collection. Information is an important tool used in the realisation of any objective or goal set by individuals. Effectiveness of any information dissemination system is measured in terms of accessibility, timeliness as well as relevance of the information provided. Accessing Academic Information in Technical Training Institutions has been marked with numerous challenges. Key of these include under funding of these institutions and technological advancements that the Institutions have failed to embrace over a long period of time.

This research provides a detailed study of the information needs of students in Technical Training Institutions in Kenya, the techniques currently used to disseminate information, how a mobile application for information dissemination can be designed, developed and tested and if the mobile application solves the challenges that are faced when using the current information dissemination techniques. Online Questionnaire were used to gather user requirements. Data analysis was done using Google analysis tools that led to the development of the Web, SMS and Mobile application to be used to disseminate information. The final prototype was an Android application that was synchronised with a backend that was very friendly and easy to use.

Agile Software Methodology was used in the research. The Methodology has a series of steps that make the user much more involved in the development process. The final prototype was tested to check if functional and nonfunctional requirements were met. Testing was conducted by both the developer and potential users of the application. Last but not least the Mobile application was published on Google Play Store, SMS application hosted on both Africa is Talking Gateway with a customised name of Masai TTI and masaitti.com as the domain name. Finally a responsive Website hosted on masaitti.com to facilitate students, lecturers and support staff to be able to access timely, less costly, efficiently disseminated information.

**Keywords:** Dissemination, Information Dissemination, Technical Education, Access Information.

## Table of Contents

DECLARATION .....	i
DEDICATION .....	ii
ACKNOWLEDGEMENTS .....	iii
ABSTRACT.....	iv
LIST OF TABLES .....	ix
LIST OF FIGURES .....	x
ABBREVIATIONS .....	xiii
CHAPTER ONE: INTRODUCTION .....	1
1.1 Background of the Study.....	1
1.2 Problem Statement .....	2
1.3 Research Objectives.....	3
1.4 Research Questions .....	3
1.5 Scope of the Study .....	3
1.6 Significance of the Research.....	4
CHAPTER TWO: LITERATURE REVIEW.....	5
2.1 Introduction.....	5
2.2 The Need For Information in an Institution .....	5
2.3 Challenges Facing College Students.....	6
2.3.1 Access to Academic Records .....	6
2.3.2 Urgent Notifications.....	7
2.3.3 Schedule of Kitchen Services .....	8
2.3.4 Slow Adoption of Emerging Technology .....	8
2.3.5 Inadequate Funding.....	8
2.3.6 Inadequate Training Facilities.....	9
2.4 Existing Methods of Information Dissemination.....	9
2.4.1 Noticeboards .....	10
2.4.2 Heads of Departments .....	10
2.4.3 Friday Parade .....	11
2.5 Information Dissemination Technologies .....	11
2.5.1 Podcasts.....	11
2.5.2 V CAST .....	12
2.5.3 Custom Applications.....	12
2.5.4 Traditional Web .....	13
2.5.5 Wiki.....	13

2.5.6	Short Message Service .....	14
2.6	Technical Education Outside Kenya.....	14
2.6.1	College of the Sequoias.....	14
2.6.2	Ohio Technical College .....	14
2.6.3	Karnataka German Technical Training Institute.....	15
2.7	Related Mobile Applications and Limitations .....	15
2.7.1	Kakatiya University Results Application.....	15
2.7.2	MIT Mobile Application.....	16
2.7.3	Harvard Mobile Application .....	16
2.8	Gaps and Limitations .....	16
2.9	Conclusions.....	17
CHAPTER THREE: RESEARCH METHODOLOGY.....		18
3.1	Introduction.....	18
3.2	Agile Development Methodology.....	18
3.2.1	Requirement Analysis Phase.....	19
3.2.3	Prototype Building Phase.....	21
3.2.4	Prototype Testing .....	22
3.2.5	Validation.....	23
3.3	Conclusions.....	23
CHAPTER FOUR: SYSTEM DESIGN AND ARCHITECTURE.....		24
4.1	Introduction.....	24
4.2	System Analysis.....	24
4.3	Online Questionnaire Response .....	24
4.4	Proposed Features for Information Dissemination Framework.....	30
4.5	System Requirements.....	31
4.5.1	Functional Requirements .....	31
4.5.2	Non Functional Requirements .....	32
4.6	Proposed System Architecture .....	32
4.7	System Design .....	33
4.7.1	Use Case Diagram.....	34
4.7.2	Activity Diagram.....	43
4.7.3	Class Diagram.....	44
4.7.4	Collaboration Diagram.....	45
4.7.5	Component Diagram .....	46

4.7.6	Deployment Diagram.....	47
4.7.7	Entity Relationship Diagram.....	48
4.7.8	Database Schema .....	49
4.7.9	Mobile Application Wireframes .....	51
4.7.10	Web Application Wireframes .....	55
4.8	Conclusions.....	58
CHAPTER FIVE: SYSTEM IMPLEMENTATION AND TESTING .....		59
5.1	Introduction.....	59
5.2	Mobile Application Implementation.....	59
5.2.1	Mobile Application Components .....	59
5.2.2	Web Application Components .....	67
5.2.3	SMS Application.....	72
5.3	Testing.....	73
5.3.1	Test Schedule .....	73
5.3.2	Developer Testing .....	74
5.4	User Testing.....	80
5.4.1	User Interface Aesthetics .....	80
5.4.2	User Interface Friendliness .....	81
5.4.3	Functionality .....	82
5.4.4	Acceptability .....	82
5.4.5	Validation.....	83
5.5	Conclusions.....	86
CHAPTER SIX: DISCUSSIONS .....		87
6.1	Introduction.....	87
6.2	Literature Review in Relation to the Research Topic .....	87
6.2.1	Review of Research Questions in Relation to the Mobile Application.....	88
6.2.2	Advantages of the Application.....	90
6.2.3	Disadvantages of the Application .....	90
CHAPTER SEVEN: CONCLUSIONS, RECOMMENDATIONS AND FUTURE WORK.....		91
7.1	Conclusions.....	91
7.2	Recommendations.....	92
7.3	Suggestions for Future Work .....	92
REFERENCES.....		94
APPENDICES.....		97
Appendix A: Student Questionnaire: .....		97

Appendix B: User Testing Questionnaire .....102  
Appendix C: Information Dissemination Framework Validation Questionnaire .....104  
Appendix D: Related Mobile Applications.....105  
Appendix E: Mobile Application Wireframes .....107  
Appendix F: Web Application Wireframes .....108  
Appendix G: Mobile Application Implementation .....109  
Appendix H: Web Application Implementation .....111  
Appendix I: SMS ID .....112  
Appendix J: TURNITIN .....113

## LIST OF TABLES

TABLE 4.1: CREATE ACCOUNT USE CASE DESCRIPTION.....	36
TABLE 4.2: LOGIN USE CASEDESCRIPTION.....	37
TABLE 4.3: CHECK RESULT USE CASEDESCRIPTION.....	38
TABLE 4.4: KITCHEN SERVICES USE CASEANALYSIS.....	39
TABLE 4.5 FEES USE CASEDESCRIPTION.....	40
TABLE 4.6: NOTIFICATIONS USE CASEDESCRIPTION.....	41
TABLE 4.7: ADMINISTRATOR MANAGE SECURITY USE CASE SCENARIO .....	42
TABLE 4.8: USERTABLE.....	49
TABLE 4.9: STUDENTTABLE.....	49
TABLE 4.10: COURSETABLE.....	50
TABLE 4.11: SUBJECT TABLE.....	50
TABLE 4.12: GRADETABLE.....	50
TABLE 4.13: FEE TABLE.....	50
TABLE 4.14: MENU TABLE.....	51
TABLE 4.15: DOWNLOADSTABLE.....	51
TABLE 5.1: TEST SCHEDULE.....	73
TABLE 5.2: TEST PLAN FOR INSTALLATION TESTING .....	74
TABLE 5.3: TEST PLAN FOR SUCURITY TESTING.....	75
TABLE 5.4: TEST PLAN FOR FUNCTIONALTESTING.....	76
TABLE 5.5: TEST PLAN FOR COMPATIBILITY TESTING .....	77
TABLE 5.6: TEST PLAN FOR INTEGRATION TESTING .....	78
TABLE 5.7: TEST PLAN FOR STRESS TESTING .....	79

## LIST OF FIGURES

FIGURE 2.1: INFORMATION DISSEMINATION METHODS .....	10
FIGURE 3.1: AGILE SOFTWARE DEVELOPMENT METHODOLOGY .....	18
FIGURE 4.1: TIMELY INFORMATION IN TECHNICAL INSTITUTIONS .....	25
FIGURE 4.2: TYPE OF INFORMATION .....	25
FIGURE 4.3 FREQUENCY OF THE INFORMATION.....	26
FIGURE 4.4: SATISFACTION LEVEL.....	26
FIGURE 4.5: TOOLS USED TO DISSEMINATE INFORMATION .....	27
FIGURE 4.6: EFFECTIVE MEDIUM .....	28
FIGURE 4.7: SMARTPHONE OWNERSHIP .....	28
FIGURE 4.8: SMARTPHONE OPERATING SYSTEM.....	29
FIGURE 4.9: USE OF SMARTPHONES .....	30
FIGURE 4.10 CONCEPTUAL MODEL.....	33
FIGURE 4.11: SYSTEM ARCHITECTURE OF THE PROPOSED SYSTEM .....	33
FIGURE 4.12: USE CASE DIAGRAM OF THE PROPOSED SYSTEM .....	35
FIGURE 4.13: ACTIVITY DIAGRAM OF THE PROPOSED SYSTEM.....	43
FIGURE 4.14: CLASS DIAGRAM OF THE PROPOSED SYSTEM.....	44
FIGURE 4.15: COLLABORATION DIAGRAM FOR INFORMATION DISSEMINATION FRAMEWORK .....	45
FIGURE 4.16: COMPONENT DIAGRAM FOR INFORMATION DISSEMINATION FRAMEWORK .....	46
FIGURE 4.17: DEPLOYMENT DIAGRAM FOR INFORMATION DISSEMINATION FRAMEWORK .....	47
FIGURE 4.18: ENTITY RELATIONSHIP DIAGRAM .....	48
FIGURE 4.19: LOGIN.....	52
FIGURE 4.20: DASHBOARD .....	53
FIGURE 4.21: RESULTS.....	54
FIGURE 4.22: FEE.....	54
FIGURE 4.23: MENU .....	55
FIGURE 4.24: DOWNLOADS.....	55
FIGURE 4.25: REGISTRAR.....	56
FIGURE 4.26: RESULTS.....	57

FIGURE 4.27: FEE.....	57
FIGURE 4.28: SEND SMS .....	58
FIGURE 5.1: DASHBOARD.....	60
FIGURE 5.2: STUDENT MODULE.....	61
FIGURE 5.3: RESULTS.....	61
FIGURE 5.4: DOWNLOADS .....	62
FIGURE 5.5: FEE PAYMENT .....	63
FIGURE 5.6: KITCHEN MODULE.....	64
FIGURE 5.7: UPLOAD FOOD ITEM.....	64
FIGURE 5.8: VIEW MENU.....	64
FIGURE 5.9: PAY FOOD ITEM.....	64
FIGURE 5.10: CONFIRM PAYMENT.....	65
FIGURE 5.11: STAFF MODULE.....	65
FIGURE 5.12: STAFF DOWNLOADS .....	66
FIGURE 5.13: MTECHNICAL.....	66
FIGURE 5.14: LIST OF COURSES .....	67
FIGURE 5.15: RESULTS.....	68
FIGURE 5.16: UPLOADS.....	69
FIGURE 5.17: DOWNLOADS .....	69
FIGURE 5.18 FEE PAYMENT .....	70
FIGURE 5.19 VIEW ACADEMIC TRANSCRIPT .....	70
FIGURE 5.20: PRINT ACADEMIC TRANSCRIPT .....	71
FIGURE 5.21: SELECT CATEGORY .....	72
FIGURE 5.22: SEND SMS .....	72
FIGURE 5.23 UI AESTHETIC FEEDBACK .....	81
FIGURE 5.24 USER FRIENDLINESS FEEDBACK .....	81
FIGURE 5.25 TEST RESULTS ON FUNCTIONALITY OF THE MOBILE APPLICATION .....	82
FIGURE 5.26 ACCEPTABILITY FEEDBACK.....	83
FIGURE 5.27 CATEGORY OF RESPONDENTS.....	83
FIGURE 5.28 RESPONDENTS' PARTICIPATION IN USER REQUIREMENTS SURVEY .....	84

FIGURE 5.29 CHECK WHETHER THE MOBILE APPLICATION SOLVES THE CHALLENGES .....	84
FIGURE 5.30 USER SATISFACTION ON THE FUNCTIONALITIES OF THE MOBILE APPLICATION .....	85
FIGURE 6.31 RECOMMENDATION ON ADOPTION OF THE MOBILE APPLICATION.....	85

## **ABBREVIATIONS**

B & C	-	Building and Construction.
BUS	-	Business.
F & B	-	Food and Beverage.
GoK	-	Government of Kenya.
HOD	-	Head of Department.
ICT	-	Information Communication Technology.
IT	-	Institutes of Technology.
KIE	-	Kenya Institute of Education.
MECH	-	Mechanical.
MoHEST	-	Ministry of Higher Education Science and Technology.
MTTI	-	Masai Technical Training Institution.
SMS	-	Short Message Service.
STI	-	Science, Technology and Innovation.
TTI	-	Technical Training Institution.
TIVET	-	Technical, Industrial, Vocational and Entrepreneurship Training.
TIVETA	-	Technical, Industrial, Vocational and Entrepreneurship Training Authority.
TTI	-	Technical Training Institute.
TVET	-	Technical and Vocational Education Training.

## CHAPTER ONE: INTRODUCTION

### 1.1 Background of the Study

The embedment of technology into learning institutions has continued to give institutions better tools for academic delivery (Wroblewski, 2011). Technical education in Kenya covers a minimum of three academic years for Diploma students and two years for certificate students. The curriculum is divided into three modules and the final exams are administered by Kenya National Examination Council (KNEC). Before the final examination students normally sit for internal examinations as they prepare for Diploma or Certificate exams. Technical training institutions are fully funded by the Government of Kenya (G.O.K). These institutions are mostly neglected and allocated less funds to cater for important daily activities (Antony, Sang, Muthaa and Zacharia, 2016). According to Antony, Sang, Muthaa and Zacharia, (2016), they found out that these institutions suffer from negative perception from the general public and lack of enough funds from the Government of Kenya which hinders the growth of technical education in Kenya. With this in mind, technical institutions are unable to fully develop the human capacity, infrastructure and improve technologically (Antony, Sang, Muthaa and Zacharia, 2016).

Kaufman (2012) conducted a research and found that students in technical training institutions (TTI) search for information and such information include: academic results, timetable and important downloads, notification of important events, kitchen services, and fee balance. However, use of traditional methods for information dissemination in technical training institutions remains a problem. The traditional methods used in the current era of technological advancement makes information access a challenge to students and lecturers in technical training institutions in Kenya (Ayo, 2012). Kerubo (2011) went as far as to identify a gap that exists between the administration and students because of top down structure of management in technical institutions, where information is disseminated from the Principal through the noticeboards or Heads of Departments' who then communicate to respective class representatives hence a prolonged channel of communication that leads to distorted information. Render and Heizer (2004) agree that effectiveness of any communication channel should be direct to the recipients. The use of traditional methods of information dissemination is the biggest challenge in all technical training institutions in Kenya (Ayo, 2012).

The challenges lead to more serious effects to students such as; poor academic performance, leading a frustrated college life with unmanageable stress levels and finally high rates of drop out before

finishing their studies (Baloyi, 2006). These problems magnify to real life issues to the individual which also have a negative impact on the nation too. The students lose on their future career; an income potential and it ends up affecting their psychological state. Furthermore the nation eventually loses out on responsible individual and a work force strong enough to compete at nation and international level.

There is an urgent need to address this issue using different standard methods such as current emerging technological trends such as smartphones applications. The undoubtable fact that students are addicted to the use of smartphones, can be manipulated to suit their academic benefit by designing a smartphone applications that will address the problems faced in technical training institutions (Adjunct, 2012). The following category of information or records are required in technical training institutions; exam reports, fees statements, bursary, scholarship or loans leads, kitchen services and assignment notification. The lack of an effective way to obtain and track the required data leads to confusion, lack of motivation and poor output. The bridge to a successful solution of the above mentioned challenges is to provide a convenient and reliable information dissemination channel hence there is need for a fast and reliable system that will assist in the process of disseminating information in all technical institutions.

## **1.2 Problem Statement**

Ayo (2012) suggested that proper decision making by students is determined by the timeliness, effectiveness and a reliable source of information. On the contrary this is not the case with Technical Training Institutions in Kenya, lack of enough funds allocated to these institutions makes development and embracing new technologies a big challenge to all the Technical Institutions in Kenya.

Antony, Sang, Muthaa and Zacharia, (2016) noted that many institutions have no financial power to buy expensive management information systems to use in the daily operation and management of activities in respective institutions. They went further to acknowledge that the problem has led to slow development of both structural, human resource and technological advancements that these institutions experience. Because of this many Technical Institutions use traditional methods like noticeboards to disseminate educational information which hinders proper flow of timely information to students for proper decision making. As a result, this presents a pressing need to develop a less costly and efficient system that can be adopted by all Technical Institutions in Kenya to solve this problem.

### **1.3 Research Objectives**

- i. To identify the information needs of students in Technical Training Institutions,
- ii. To review the existing tools and methods that have been used to disseminate information in Technical Training Institutions,
- iii. To design develop and test a solution that addresses the failures of the current solutions for information dissemination in Technical Training Institutions,
- iv. To validate the developed solution.

### **1.4 Research Questions**

- i. What are the information needs of students in Technical Training Institutions?
- ii. What are the existing methods of disseminating information in Technical Training Institutions?
- iii. How will the proposed system be designed, developed and tested?
- iv. Does the mobile application solve the challenges faced using the current techniques for information dissemination?

### **1.5 Scope of the Study**

For purposes of creating an integrated mobile application framework, the research will be conducted in Masai Technical Training Institute. This is because all Government Technical Training Institutions have the same organisational structure and face the same challenges. With this in mind, by conducting the research based on a specific institution the solution will be easily applicable to other Technical Training Institutions in Kenya.

Additionally, the solution to be developed shall incorporate Android Platform, SMS and a Backend that will be a responsive web system. The use of Android operating system is because of the market share in Kenya as it runs, over 84 percent of the market during the second quarter of 2014, this is according to mobile statistic report study by Sara (2014). The use of Android smartphones will enable students to access the integrated system on the smartphones. Lastly in the proposed study the researcher will focus mainly on information disseminated to students with a slight focus on lecturers and support staff. The objective is not to build a complete Management Information System or a website, but a subset of the two.

## **1.6 Significance of the Research**

In order to reduce the current paper work, notices and traditional methods of disseminating information in Technical Institutions, there is need for a heterogeneous solution that will simplify the process of accessing academic results, notifications, services from the kitchen, timetable and a fee balance. The use of a mobile application will be fast, efficient, reliable and affordable to disseminate information. This is because of the high adoption of mobile phone technology and the easy accessibility of mobile phones in Kenya (Asif, 2011). Information dissemination in Technical Institutions is very important because it allows students to be able to make informed choices and even improve academically because of proper flow of information.

This study aims to build a mobile-based solution that takes advantage of the increase in use of mobile phones to quicken the task of disseminating information and accessing the same information in a timely, less costly and efficient way in Technical Institutions. In addition the research will be useful to all students' in Technical Training Institutions in Kenya because it will result into the development of a student centric focused prototype that will improve students' satisfaction with the services provided in Technical Institutions in Kenya (Asif, 2011).

## **CHAPTER TWO: LITERATURE REVIEW**

### **2.1 Introduction**

This chapter provides an overview of previous research on Information Dissemination in Technical Training Institutions in Kenya. The literature review includes an examination of the need for information to an organisation, challenges that college students' face, existing methods for information dissemination, Technical Education outside Kenya and finally review of related mobile application and limitations. From the literature gaps and limitations were noted down.

### **2.2 The Need For Information in an Institution**

Information is needed in any organisation as a source of answers to specific questions and it affects people lives, the need arise when a person recognises a gap in his/her state of knowledge and wishes to resolve that anomaly (Nicholas, 2000). In addition, Singh and Satija (2006) found that the concept need can be known through the various terms such as want (a state or fact of being without or having an insufficient, absence or deficiency of necessities), desire (an unsatisfied longing or craving), demand (to require, asking for what is due or asking for something, and requirement (a need, a thing needed, necessary condition).

Adams and Fiankor (2004) sees information need as the amount of positive information an individual or group of people need to have for their work, recreation and many other like satisfaction. This however implies that lack of information needed to accomplish tasks results in information need. Therefore, information need is a gap in person's knowledge, when experienced at the conscious level as a question hence giving rise to search for answers. Adams and Tackie (2007) acknowledges that work related information seeking is different from everyday information seeking. In their view, information influencers, such as accessibility, availability, and familiarity of source consumed determines the suitability of the information. Devadason and Lingam, (1997) suggested that information represents an ordered reality about the nature of the world people live in. It is a cognitive experience that represents gaps in the current knowledge of information users.

The need stage may begin when a person senses that it might be useful to know something that is currently ambiguous for him or her. In some models, the stage begins when a person formulates a statement of an information need. Alternatively, an explicit search statement sometimes is viewed as the starting point for studying information needs (Borgman, 2000).

Owalabi, Jimoh and Okpeh (2010) in their study of information seeking behaviour of polytechnic students discovered that 285 (59.4%) of their respondents needed information in relation to their academic level. This shows that students use information primarily for academic purposes and hence concluded that students at the polytechnic seek information for academic improvement. In a different study carried out by Fatima and Ahmad (2008), the findings showed that 30 (50%) of the respondents seeks information on career development and other reasons include seeking information for problem solving, keeping up-to-date and the need to write an article or research paper.

The study of Ajiboye and Tella (2007) conducted on university undergraduate's information-seeking behaviour showed that 12% of the respondents (students) required information for their personal development, while 11.25% claimed that they sought for information on health matters, and 64.1% sought information for their academic development, 9.3% seeks information to secure employment. Also, Bhatti (2010) using faculty members at the Islamia University of Bahawalpur, respondents indicated their purposes of seeking information, 88% sought information for teaching purpose (preparing class lectures), 68% for literature searches, 43% to borrow books or journal articles, 44% of faculty members consult the library for research and 43% for keeping their knowledge up to date, and 27% visit the library for reading newspapers and magazines (recreational purposes). This clearly showed that nearly all the respondents search for information in an academic institution and there is need for information at all times.

In summary, Safahieh (2007) ascertain that people need information for five broad functions which are the fact- finding function, which provides answers to specific question; the current awareness function, which keeps information up-to-date; the research function, which investigates a new field in-depth; the briefing function, which obtains a background understanding of an issue; and the stimulus function, which provides ideas to obtain stimulus.

## **2.3 Challenges Facing College Students**

Hallisy (2015) found that college students face many challenges in 21<sup>st</sup> Century. Below is a discussion of the challenges that TTI students face in Kenya.

### **2.3.1 Access to Academic Records**

Keeping track of academic records is a very important exercise in an academic institution (Hallisy, 2015). The current method of accessing academic records is through printing of exams at the end of the each term which normally takes a period of two weeks to print and then send the printed copy to

students using postal address of the respective student. Furthermore keeping track of academic records is a powerful way of managing academic life (Bomhold, 2013).

Academic information that is important to TTI students include: Examination results, which should be available on time after marking. Also the timetable, which enables students to be able to schedule events, in addition kitchen Services, which offers all the services from the kitchen department and finally notifications, for decision making and important downloads uploaded for use by the administration.

Safahieh (2007) found out that delay in dissemination of information is bad for decision making. Unfortunately information is normally disseminated very late to all the students in Technical Institutions. Many students do not have postal addresses which means they pick end of term reports in a new academic calendar after a break of four weeks, which is huge frustration to students' and parents. Bomhold (2013) found that this information is very important to students because it allows them to prepare in advance for any exam re-sits or it acts as a motivation to work harder by viewing ones grades on time.

### **2.3.2 Urgent Notifications**

Morrison (2014) highlighted the importance of urgent notification in decision making process. Additionally, he noted the importance of urgent notifications in an academic institution (Morrison, 2014). In case of announcements', urgent notices or warning, the current method of information dissemination only trickles down to few students' who were fortunate to be at the noticeboard at the time of display thus this makes information dissemination from the administrators to students' a challenge.

In Technical Institutions there is a lot of on wall notice boards placed at different locations where by people with their announcements type on a sheet of paper and place it on the notice boards for other people to read when passing through those notice boards. Thus there is a lot of accumulation of papers due to carelessness of people who place them and no one is responsible for removing the notices (Adkins and Grant, 2007). Moreover the announcement may not reach all students, as others may not be having the habit of passing through those notice boards or sometimes the person is not living within the college compound so it becomes difficult for them to see those announcements on time. For this reason communication using current manual method is a huge challenge to Technical Institutions in Kenya.

### **2.3.3 Schedule of Kitchen Services**

Vajda (2012) found out that a kitchen is a very important segment in a learning institution. Taylor and Francis (2012) suggested that the services provided in a kitchen should be easily accessible to all in the same boundary. The services offered from this section of Masai Technical Training Institution (MTTI) are not easily accessible to all the students before service time which in most cases is breakfast, lunchtime and supper time. This makes students to be an aware of what is on the menu and prices beforehand, also the students cannot be able to purchase whatever they want using their smartphones.

### **2.3.4 Slow Adoption of Emerging Technology**

Today's world is driven by technology for its communication, its economy and increasingly its day to day organisation (Mcfall, 2007). The rapid development of information technology has made available a plethora of new tools for higher education (Hanna, 2009). New technology offers learning and dissemination of information opportunities anywhere to anyone at any time (Karen, 2006).

Further the response of higher education (HE) institutions to this new technology is uncharacteristically rapid. The lack of investment in technology based learning and information dissemination tools in Technical Training Institutions may prove to be a significant barrier to their ability to compete in new or changing markets (Gail, 2009). Technologies like internet, Mobile applications and its associated technologies can increase the capacity of an educator and learner more quickly, easily and more scalable to help students make connections to content, context, and decision making skills resulting in more powerful learning experience (Gumport, 2012).

### **2.3.5 Inadequate Funding**

Over the past fifteen years Technical Institutions have become increasingly reliant on Government of Kenya (G.O.K) Grants (Nzimande, 2016). In a study done by Dr Blade (2016), he found out that College Vocational Training plan may fail because of lack of money. Funds allocated to technical institutions in Kenya is not enough to cater for the daily operations that the institutions incur which then affects the students (Nzimande, 2016).

The operational expenses for this institutions include; building infrastructure, maintaining the same infrastructure, support staff salaries and many more operational expenses that hinder the advancement in technology in this institutions. Because of the facilities that this institutions have and perception

from ordinary citizens this institutions struggle to attract students to pursue different courses (Nzimande, 2016). The ripple effect of lack of enough funds, the institutions purposively choose to focus only on basic facilities for survival purpose. Which simply means that the institutions are not in a position to buy very expensive management information systems for their daily operations (Nzimande, 2016).

### **2.3.6 Inadequate Training Facilities**

The Nzimande (2016) observed that training facilities were critical if education in Kenya was to meet the technological market skill needs and move the country to vision 2030. In a study carried out by Antony, Sang, Muthaa and Zacharia, (2016) about facilities and information dissemination in Technical Institutions, found that majority of the Heads of Departments (H.O.D) respondents (83.3%) indicated that training facilities were not adequate compared to only 16.7% of respondents who indicated that the physical facilities were adequate. This implies that the H.O.Ds felt that Technical Training Institutions (TTI) operated with inadequate training facilities.

TTI graduates' opinion was also sought in reference to the adequacy of the physical facilities. Majority of the graduate respondents (63.1%) indicated that the training facilities in T.T.Is were inadequate while 36.9% indicated that the facilities were adequate. This implies that majority of the T.T.I graduates felt that they were trained using inadequate training facilities. A hypothesis was postulated to determine the significance of difference in the mean of the opinions held by the H.O.Ds and graduates on the availability of training facilities in T.T.Is. The computed p-value (1.00) was greater than critical p-value (0.05) the null hypothesis was therefore accepted as true. There was no significant difference in the opinions of H.O.Ds' and the graduates. This data indicated that training equipment compromised the relevance of T.T.I in teaching skill based education for industries and business organisations (Antony, Sang, Muthaa and Zacharia, 2016).

## **2.4 Existing Methods of Information Dissemination**

The section below discusses the three methods that are currently used in Masai Technical Training Institute (MTTI) to disseminate information to students as shown in Figure 2.1 below. The existing methods that are indicated in the figure below assisted during requirement analysis and design of the solution.

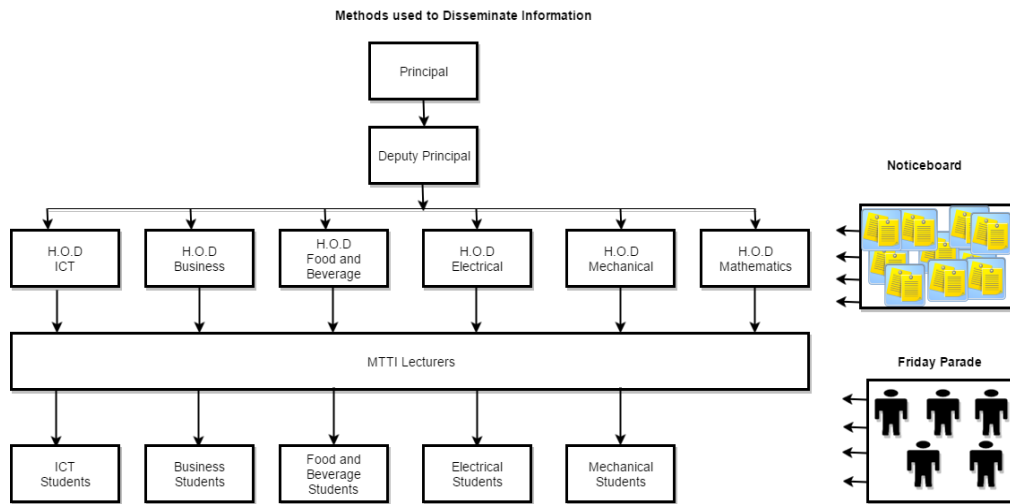


Figure 2.1: Information Dissemination Methods. (Source: Personal collection)

### 2.4.1 Noticeboards

In Masai Technical there is a lot of on wall notice boards placed on different location where by people with their announcements type on a sheet of paper and place on the notice boards for other people to read when passing through those notice boards. Thus there is a lot of accumulation of papers (Adkins & Grant, 2007). Dominik (2011) found that noticeboards are static structures, where a person is required to be personally available to read notices and hence this makes students to strain a lot. Students are required to constantly visit the noticeboard for latest information.

Adkins and Grant, (2007) noted three disadvantages of using noticeboards to disseminate information. First, cluttered noticeboards that causes confusion to students hence students may have difficult time to decipher the information or consume a lot of time on the noticeboard. Second, use of sharp objects like tacks or pins to hold up the information being posted. Such sharp objects can become a safety hazard for students. Loose pins that fall to the floor or scrape against students can cause injuries. Lastly the method is not very green (Adkins and Grant, 2007).

### 2.4.2 Heads of Departments

The second method for disseminating information is through the Head of Department (H.O.D). Heller (2008) defined a head of department as an appointed potholder who has responsibility for either an academic department or school. The head of department (H.O.D) disseminates information to students who are in a class. The institution has no proper structure of student leadership because of constant violence that is always experienced during election (Heller, 2008).

The top down approach of disseminating information presents numerous challenges to any organisation. Some of the challenges include: distortion of information, delay of information, slows the system, and also reduces the relationship between the H.O.D and the students (Heller, 2008).

### **2.4.3 Friday Parade**

The third method for disseminating information is through Friday parades. Heller (2008) found that parade in a college was not an effective tool to use to disseminate information. Many students do not attend parade sessions in a college which hinders proper flow of information (Heller, 2008). This method is effective in a military or a confined school setting like a boarding school which is not the case of MTTL.

## **2.5 Information Dissemination Technologies**

Today's mobile devices are able to disseminate information in many ways. Each of these dissemination technologies offers distinct advantages and disadvantages depending on the mode of operation. Currently, there are six widely adopted methods of information dissemination for the mobile user, the methods are Podcasts, V CASTs, Custom Mobile Applications, Traditional websites and wikipedias, finally use of Short Messages.

### **2.5.1 Podcasts**

A podcast is a non-streamed webcast (Watt, 2016). It consists of a series of digital media files that are released by episode and downloaded from the Internet. The method of delivery for content distributors is different than that of traditional downloads over the Internet. A list of the podcast files associated with a given series is usually kept on the distributor's server as a web feed. The client uses special software to access the web feed, check it for updates, and download any new files in the series. This process can be automated so that new episodes or files can be downloaded without user interaction .After acquisition, the podcast files are stored locally on the user's computer or mobile device ready for offline use. Podcasts, in many ways, are closer to traditional publishing models associated with books and magazines than other web content (Watt, 2016).

The major benefit of information dissemination via a podcast is its portability. Because the podcast is downloaded in its entirety before viewing, no active connection is needed when watching the podcast. A user is only limited by the storage space on the device. Connectivity issues are completely eliminated (Watt, 2016).

### **2.5.2 V CAST**

V CAST is a 3G Evolution-Data Optimised (EV-DO) network created by Verizon Wireless to deliver audio, video, and entertainment content to mobile devices (Jeffrey, 2006). V CAST provides downloads of music, streaming video clips, and games which can be saved to the phone or a removable memory card. However, they cannot be read by other phones or computers because they are protected by Digital Rights Management software (Jeffrey, 2006). Video playback and menu navigation in V CAST requires EV-DO coverage to function. Without coverage, video playback is blocked. Due to the streaming nature of this technology, information could be updated and distributed real-time to students on their mobile devices. This feature makes V CAST especially useful for dynamic information that will be constantly changing and evolving (Jeffrey, 2006).

The real benefit of the V CAST network is its ability to adapt to rapidly changing information content and disseminate this information in real time. However, without a connection to an EV-DO network, information cannot be disseminated or viewed. An active connection to a mobile network is not always possible most of the time due to factors such as geography and interference. During these times, V CAST technology will be unable to function to its fullest and will provide only limited value (Jeffrey, 2006).

### **2.5.3 Custom Applications**

Custom applications for mobile devices are third party developed software programs designed specifically for mobile usage. These applications can be downloaded to the mobile device and used immediately. They also allow for added control on how information is disseminated to mobile devices and what type of information is sent and received (Nelson 2014).

Custom mobile applications are already widely used in different environments. Preferences about when to receive information updates, what types of information to receive automatically, and connectivity settings can all be customised by the user allowing applications to be tailored to the environment they need to function in (McWherter, 2015).

Because many custom applications are targeted to a specific brand of hardware, they are often not cross-compatible. In cases where multiple types of mobile devices are being used, this issue must be considered when implementing custom applications (McWherter, 2015).

#### **2.5.4 Traditional Web**

The Internet, or traditional web, is still the most widely used source of informational content distribution today. Web information can be accessed by traditional computer systems and mobile devices via web browsers. With its widespread usage, virtually any type of information can be located and retrieved from the web (Rodger, 2011).

To help support traditional web to disseminate information to mobile devices, the Wireless Application Protocol (WAP) was created. By defining a communications protocol and an application environment, WAP was able to standardise information that is disseminated to mobile devices. Compatible with most major cellular signal types including GSM, CDMA, and 3G, the advantage of WAP is that it optimises traditional web information for viewing on devices with low amounts of bandwidth, memory, and display capabilities. With support from companies such as Microsoft, Oracle, IBM, and Intel, WAP standards are rapidly being adopted (Rodger, 2011).

#### **2.5.5 Wiki**

A wiki is a website that allows the creation and editing of interconnected web pages from a web browser using a customised markup language (Kay, 2010). Wikis are most often used in a collaborative environment with multiple sources able to contribute to the content of the site. Many wikis have user management capabilities providing different users with different levels of access (Kay, 2010).

Wikis are an excellent method for information dissemination and collection. Because of their collaborative nature, the variety and quantity of information available in a wiki is unmatched by any other type of information dissemination medium. This method of information dissemination would be very useful for academic institutions around the globe. Users can contribute and view information from any computer.

Because wikis are collaboratively managed and updated, new information can be instantly disseminated as it becomes available. Similar to traditional web technology, access to wiki pages require Internet connectivity. Therefore, the latest up-to-date information could not be viewed in areas where there was limited or no connectivity. Wikis offer a powerful information tool when connectivity is present (Kay, 2010).

### **2.5.6 Short Message Service**

SMS stands for Short Message Service (Adam, 2016). The service allows for short text messages to be sent from one cell phone to another cell phone or from the Web to another cell phone. It uses standardised communication protocols to allow fixed line or mobile phone devices to exchange short text messages (Patel, 2013).

Because SMS are cross platform, information can be instantly disseminated to different devices. SMS does not require internet connectivity to send messages, which makes the tool a very powerful tool for dissemination of information (Patel, 2013).

## **2.6 Technical Education Outside Kenya**

This section examines College students' from different learning institutions preferred communication methods.

### **2.6.1 College of the Sequoias**

College of the Sequoias is a public two-year community college in Visalia which is in Tulare County and California's San Joaquin Valley. The college is named for the Giant Sequoia trees native to the nearby Sierra Nevada mountain range.

In a study conducted at the College of the Sequoias (Student Voice Forum, 2009), it was determined that slightly over 60% of students prefer to communicate using SMS texting, almost 40% use the telephone, almost 30% use email, and about 10% prefer social networking, instant messaging or face to face methods. Of those who said that they do not use the college email system, 17% said they do not use email much for communication. The small proportion of students who named face to face as a preferred method is somewhat suspect, however, given that 58% stated that they would like to attend college social events where they can meet other students, meaning a face to face experience (Volker, 2009).

### **2.6.2 Ohio Technical College**

Ohio Technical College is a private automotive Technical College located in Cleveland, Ohio, United States. It offered its first classes in 1969 as Ohio Diesel Mechanics School. At the Ohio Technical College, students were asked how they would like the school to communicate with them about their accounts, academic schedules, etc. (Ohio Technical Office of Student Life, 2010). Mobile phone application was selected by 82% followed by the website (17.8%), with Twitter, SMS, Email, and

Facebook chosen by fewer than 10%. For general updates, 68.9% chose email and 33.7% chose the website, with the other modes of communication again being chosen by fewer than 10% of the students. Similar results were found in regard to events and activities except that Facebook increased to 14.3% (Volker, 2009).

### **2.6.3 Karnataka German Technical Training Institute**

Karnataka German Technical Training Institute was set up by the Government of India with technical support of German International Services (GIZ-IS). The primary mission of KGTTI was to provide broad-based multidisciplinary world class training programs in various technical fields, directed towards development of specialised skills in alignment with the industry requirements across the globe. ("Karnataka German Technical Training Institute"). The mode of communication with students is through brochures, website and a mobile application Karnataka, (2016) on Google Play to access all the relevant information (Volker, 2009).

## **2.7 Related Mobile Applications and Limitations**

A large number of information dissemination applications have been developed over the last years, in a number of different domains. Appendix D contains a list of Mobile Applications, how the applications function and the limitations of the applications. myStrath application from Strathmore University which allows its users or students' to view profile, financial details for the degree he has enrolled for (see Figure D-1, Appendix D). The application can be accessed on Google Play store with the name myStrath.

The student can also view the courses enrolled in, attendance to classes, timetable for his/her courses and any library overdue charges. The application also provides links to the university website and social media accounts. The application is tailored for Strathmore which has a well-designed responsive web system that has all the functionalities, this simply means it is expensive and out of reach for many Technical Training Institutions as indicated in section 2.3.6. In addition tailoring the same application to any other university will prove to be a challenge because all universities are autonomous which means they can tailor and have a slightly different model of operation.

### **2.7.1 Kakatiya University Results Application**

Kakatiya University Results application (2016) is an Indian university mobile application on Google Play that was built to disseminate results to students (see Figure D-2, Appendix D). The application

has only one module that deals with exams which will fail and will not capture the requirements of the user when implemented in TTI in Kenya (Kakatiya, 2016).

### **2.7.2 MIT Mobile Application**

MIT Mobile Web (2015) has a similar solution (see Figure D-3, Appendix D). This solution provides the services like News, Events, Shuttle track service, campus map, people directory, and mobile access to MIT course management system. This solution utilises mobile web technology to provide these services. The solution is provided for iPhone, this simply means that many students in Technical Training Institutions (TTI) in Kenya will not use the system because iPhone market share is only 2.14% (Lomas, 2015) and majority of students have Android Phones as discussed in section 5.1 (MIT ,2015).

### **2.7.3 Harvard Mobile Application**

Harvard Mobile application developed by Harvard University (2010) has a similar solution (see Figure D-4, Appendix D). This solution is based on web technology and provides services like news, events, course updates, map and a directory of people. This application does not have a module for Bulk SMS, and the dining module does not have the ability to update a new service.

The new framework for information dissemination would be a unique way of disseminating information in Technical Training Institutions (TTI) that would achieve efficiency and timeliness. The solution will focus on MTTI but could be scaled to other Government Technical Training Institutions (TTI) because all Technical Training Institutions share the same organisational structure. The solution will be affordable to Technical Institutions and it will be of great help to the administrative personnel, academic personnel, grantors or stakeholders, parents and students in disseminating information.

## **2.8 Gaps and Limitations**

Review of existing techniques for information dissemination has shown that the approaches that are currently used for disseminating information include use of noticeboard, Head of Department (H.O.D) and college parade. The noticeboard results into accumulation of papers (Adkins and Grant, 2007). Additionally noticeboards are static structures, where a person is required to be personally available to read notices and hence this courses a lot of strain on the students to be constantly visiting the noticeboard for the latest information (Dominik, 2011).

The head of department (H.O.D) receives information from relevant authorities and communicates the information to the students who are present in a class. When a student is absent then he / she cannot be able to receive information. Adkins and Grant (2007) found out that the longer the communication channel the higher risk of distorting the information. Friday parades have proved to be very difficult in a college setting. Most of the time many students do not attend parade sessions which hinders proper flow of information (Heller, 2008). The reviewed mobile application like mystrath (see Figure D-1, Appendix D) depend of a fully functional content management information system which many technical institutions do not have because of the cost.

The proposed Mobile Application shall bridge the gaps of the existing methods. This is because it is fast, affordable and easily accessible. The solution shall be applicable to all Government Technical Training Institutions in Kenya because of top down administrative structures that many Technical Institution in Kenya use.

## **2.9 Conclusions**

From the above analysis of dissemination techniques in this section the researcher shall use the following techniques to disseminate information in MTTI. A Short Message Service, a web application and a custom mobile application. The main reason is because of the available literature that supports the above techniques (Patel, 2013).

The current methods of disseminating information are slow, unreliable and time consuming. The proposal to come up with a mobile application for disseminating information is more justified given the unreliability of the existing methods. A mobile application for disseminating information combines benefits from other techniques which include affordability; efficiency; accessibility and security. Lastly it provides a heterogeneous solution that will incorporate SMS, Android and a Back-end.

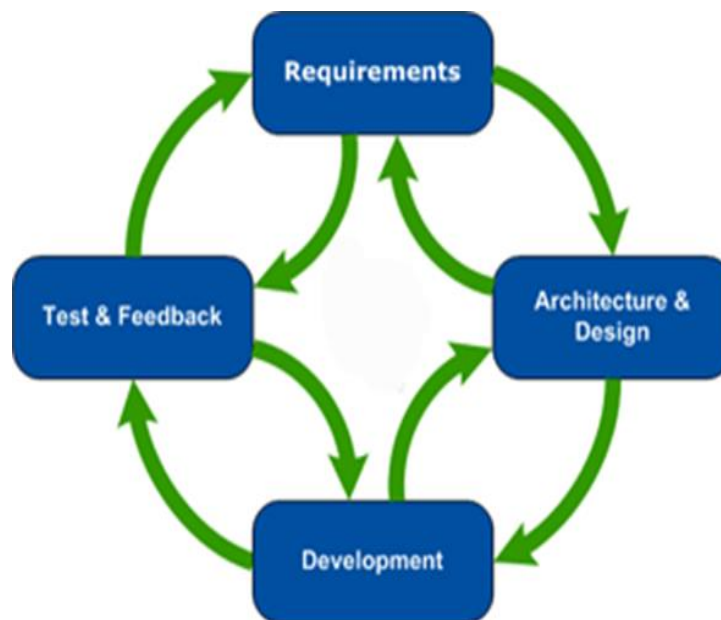
## CHAPTER THREE: RESEARCH METHODOLOGY

### 3.1 Introduction

This section is concerned with the methodology of the software in development process of the prototype. The section is made up of key areas namely; Requirement Analysis, Location of the study, Sampling strategies, Target population, Sample size, Design phase, building, testing and validation.

### 3.2 Agile Development Methodology

The development model chosen for this dissertation was based on Agile Software Methodology. Abrahamsson, (2004); Rahimian, (2007); Jeong, (2008); Scharff, (2010) and Thiago, (2011) all agree that Agile Methodologies adhere to the mobile software development process and assist developers in need of high quality development processes. In addition, Agile Model has a series of steps as represented in Figure 3.1 below that fit into today's dynamic world, where all phases (requirement analysis, design, development, quality assurance and deployment) are completed through incremental and iterative sprints (Prismetric, 2013). With this in mind a diagrammatic representation of the model is as shown below.



*Figure 3.1: Agile Software Development Methodology Adapted from Agile Methodology (2016)*

The section below provides a discussion of how the researcher implemented Agile Methodology in software development of the proposed solution.

### **3.2.1 Requirement Analysis Phase**

This is the first phase which involves analysing the requirements of the system or what the system is expected to do. Analysis helped to reveal important information like what environment was needed to develop and test the application and what exactly does the client want.

#### **Location of the Study**

The location of study for the research was Masai Technical Training Institution (MTTI) that is located 87 Kilometers from Nairobi Namanga route. MTTI was chosen because all Government Institutions share the same organisation structure as shown in Figure 2.1. In addition, the Government employs the lecturers which clearly shows harmony in all the Government institutions.

#### **Sampling Strategies**

In this study, stratified random sampling was used to come up with the sample population. In this technique the target population is divided into groups based on relevant characteristics, then participants selected from these groups. This is the appropriate sampling strategy because it ensures people from specific subgroups (in this case departments) are adequately represented within the sample space. Moreover, it ensures that all aspects of the research are adequately covered.

#### **Target Population**

The target population is the group of elements to which the researcher wants to make inference (Fricker, 2013). The target population was split into two groups, first group was before the application was developed to determine the right features and development environment of the application, then second group was after the development of the application to verify the application functions as required.

The first group was split into four categories; students, lecturers, heads of departments, and academic registrar. The institution was targeted because it was a reflection of the other institutions. The target population comprised of 20 students, 10 lecturers, 10 heads of departments and 10 employees from Ujuzi company that were used to test and validate the application. This was resulted to a target of 50 respondents in total. This formed a representative sample for the entire country and was used to give requirement specification of the system and appropriate feedback on the prototype.

## **Sample Size**

A total of 20 respondents were involved in this study. These respondents were selected using Stratified random sampling strategy. They included students, lectures, and heads of departments. This was the appropriate sample size because the respondents were directly involved in the dissemination of information.

## **Data Analysis and Functional Model**

Google Forms were used to collect and analyse data from pre-formulated questionnaires after which qualitative data was represented as graphs and charts to provide clear interpretation of the findings.

Object oriented analysis was employed to ensure all user requirements were modelled and analysed comprehensively. Objects were also developed and their relationship identified. Functionality of the system were modelled with the use of use case diagrams and use case descriptions. The flow of the system was be modelled using the system sequence diagram. For the database the entity relationship diagram with the tables, their attributes and their relationship were shown.

## **Data collection Procedure**

Information on dissemination of information was collected from respondents who included students, lecturers, academic registrar and heads of departments in Masai Technical. The information was collected through the use of online questionnaires and document review. These methods were chosen because of their high chance in providing accurate information, which would be helpful in understanding the scenario on the ground, as well as to provide information which would be useful in coming up with requirements of the application.

Online Questionnaires in appendix A was also administered to respondents who included academic registrars, students, lecturers and heads of departments in Masai Technical. This helped the researcher to identify the various challenges faced in dissemination of information and the current techniques that are used to disseminate information.

The researcher also reviewed both secondary and primary sources of information which included journals, books, academic articles and previously done research on dissemination of information, which helped to identify the current techniques used for disseminating information which are documented in the reviewed documents.

Questionnaire in Appendix B was also sent out to end users of the application to test for user satisfaction and finally, the questionnaire in Appendix C was sent to the end users of the application to validate if the developed mobile application solves the challenges of information dissemination.

### **3.2.2 Design Phase**

The third phase of Agile Methodology where, the design of the system was done after requirements had been analysed. Object oriented analysis and design (OOAD) paradigm was used in the analysis and design of the application. Roebuck, Kevin (2012) argued that the main reason for using OOAD was because the paradigm allows for iterative and incremental style of developing an application (Roebuck, Kevin 2012).

The following OOAD design tools were used during the design and development of the application. A use case diagram was used to depict the interaction among the elements of the system; a use case full description was used to describe steps the actors take to accomplish the goal of the use case; a class diagram was used to show the structure of the system by showing the system's classes, their attributes, operations (methods) and relationships among objects; a collaboration diagram was used to show the message flow between objects in an Object Oriented (OO) application; a component diagram was used to model physical aspects of a system; an activity diagram was used to show the flow of activities in the system; a deployment diagram was used to describe the hardware components where software components were deployed. The database was modeled using an Entity Relationship Diagram (ERD) which was used to show the conceptual model of the system which resulted in the modeling of the database schemas and modeling of the database by use of a hierarchical database schema for proper visualisation of the database.

Finally for design of the application interface wireframes were modeled both for the application and the database by use of the following collection of tools; [www.draw.io](http://www.draw.io), [moqups.com](http://moqups.com), Balsamiq, pencil and Microsoft Visio (Goma, 2014).

### **3.2.3 Prototype Building Phase**

This phase involved coming up with a Mobile, SMS and Web application. Both the mobile and web application were connected to a central database (Goma, 2014). The application development environments that were employed include:

i. **Mobile Application**

The application was compiled and tested using the Android Software Development Kit (SDK) Emulator and an Android device (Neil and Smith, 2015). Android was chosen as the client application because of the flexible SDK, availability of Android Development Tools (ADT) and availability of abundant support from online developer communities (Neil and Smith, 2015).

ii. **Web Application**

The web application was built using Bootstrap. Reasons for choosing Bootstrap, was because it is open source and also makes the site to be mobile friendly, it provides security and user management as part of the Content Management System (CMS), it offers good performance, easy to scale and customise and available online community support (Greg and Joel, 2015).

iii. **SMS Application**

The SMS application used the existing GSM sub systems like base station sub system, the network switching sub system and the operation support sub system to deliver messages (Martin, 2007). A web application was developed for bulk SMS to all the stakeholders.

iv. **Database**

MySQL database management system was used to store application data for both mobile and web application. The website was hosted on an online Apache Hypertext Transfer Protocol (HTTP) server. Reasons for choosing MySQL database include: it is open source and provides full compatibility with the Bootstrap framework (Tanuj, 2012).

### **3.2.4 Prototype Testing**

After building each module, testing was done, this was aimed at ensuring that the solution achieved its objectives or what it was meant to do Greg and Joel (2015). According to Greg and Joel (2015) validation is the process of checking that a software system meets specifications and that it fulfills its intended purpose. In the first place a test schedule was designed to guide through the testing process and finally a test plan was developed which described the test cases, expected outcome and the actual outcome from the system (Wolff and Zaïdi, 2011).

The following tests were performed: installation testing, which was carried out to determine if the application was installable; security testing, which was carried out to find out if the solution was secure; functional testing was performed to check if the application modules were all correctly functioning; compatibility testing was also carried out and the purpose was to find out if the application was compatible in different Android smartphones and finally, uninstallation testing was performed to check if the system files and components were all uninstalled from the smartphone (Sandler, Badgett and Myers, 2013).

### **3.2.5 Validation**

To validate if the developed mobile application solves the challenges faced using the current techniques for information dissemination, a total of 10 respondents were selected from the sample population of 20 respondents who participated in the survey for collecting user requirements and also participated in the usability testing of the mobile application. An Online questionnaire was designed (as shown in Appendix C) and sent to all the respondents to collect data from them.

Stratified random sampling was used to come up with the 10 respondents. It comprised of 2 lecturers in the institution, 6 students in Masai Technical, 2 employees from Ujuzi Software Company. The user's response is discussed in chapter 6.

### **3.3 Conclusions**

This chapter has described the methods and processes that were used to collect data and the methodologies that were used to answer the research questions. It also helped to decide on the logistics with regards to the population to collect data from and to check if the data collected was sufficient to make conclusions with regards to the current systems that exist, and whether a mobile application would be a solution to the challenges being faced.

## **CHAPTER FOUR: SYSTEM DESIGN AND ARCHITECTURE**

### **4.1 Introduction**

This chapter discusses requirement analysis and system design. The researcher discusses the results of the findings of the research carried. This involves the Analysis of the results obtained from the online questionnaires. The analysis was done using Google forms analysis tools. The responses from the users were represented using graphs and Charts in order to offer clear visualisations of the responses and to enhance deeper understanding of the results. The results obtained were used to answer some of the research questions in section 1.4. The responses were also used to come up with the system design for the application. The questionnaires are attached in Appendix A.

The sample size was 20 respondents from different departments. The number of respondents who participated in the survey was 20 while the number of respondents who completed the survey was 18 hence the response rate was 90.0%.

Response Rate=Number of respondents who completed the survey/The total sample size

*ResponseRate*=18/20\*100=90.0%

### **4.2 System Analysis**

Systems Analysis is concerned with research findings of the study. Results were used to answer research questions evident in section 1.4 of this dissertation. The overall results contributed to design of the application through integration of various functionalities.

### **4.3 Online Questionnaire Response**

#### **What are the Information Needs of Students in Technical Training Institutions?**

To get a proper view from respondents, the researcher's online questionnaire contained three questions that were related to research question one in section 1.4. The main aim of having different questions was to enable the researcher be able to understand information needs in TTIs' in a different perspective.

#### **Research Question One:**

**Q1: Timely Information in an Institution is good for a Student?**

This question was used to find out if the respondents shared the same concern as the researcher. 77.8 % of the respondents shared the same view as shown in Figure 4.1.

### Timely information in an Institution is good for a Student?

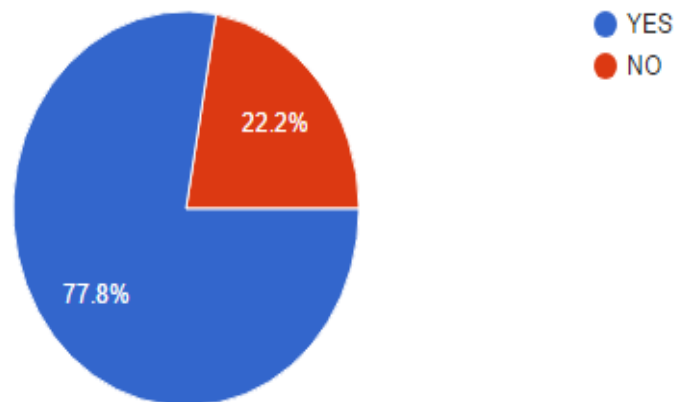


Figure 4.1: Timely information in Technical Institutions

### Q2: What Type of Information do you want to Access Frequently?

This question aimed at finding out the type of information that was the most frequently accessed. From Figure 4.2, 33.3% of the respondents selected academic results, followed closely by notifications. The chart was very useful during system development.

### What type of information do you want to access frequently?

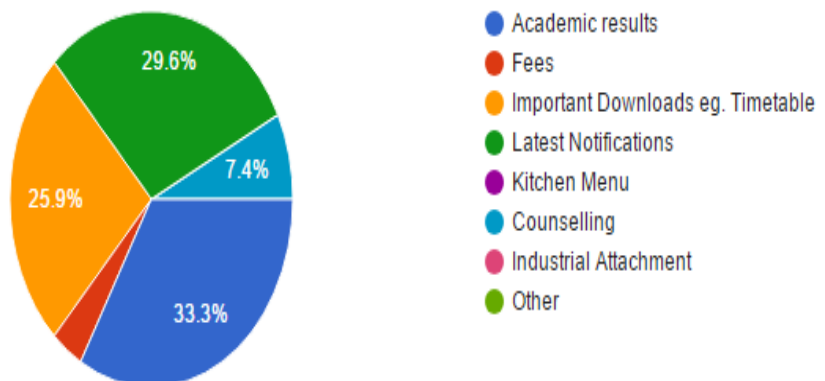
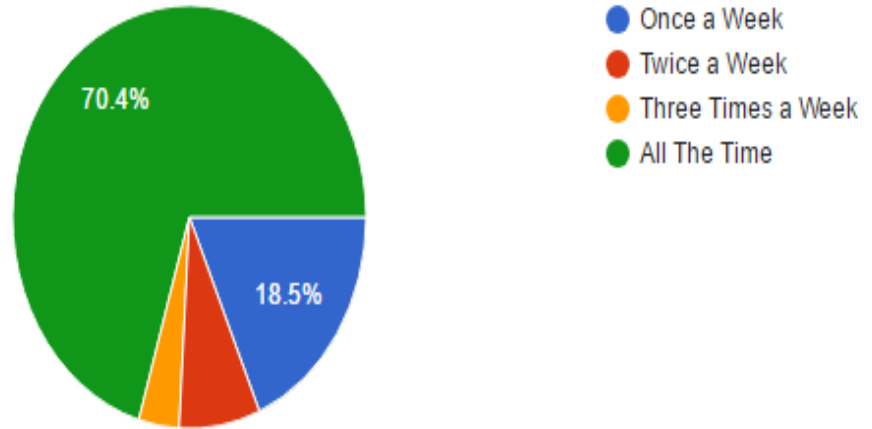


Figure 4.2: Type of Information

**Q3: How frequently do you need the Information?**

### How Frequently Do you Need The Information?

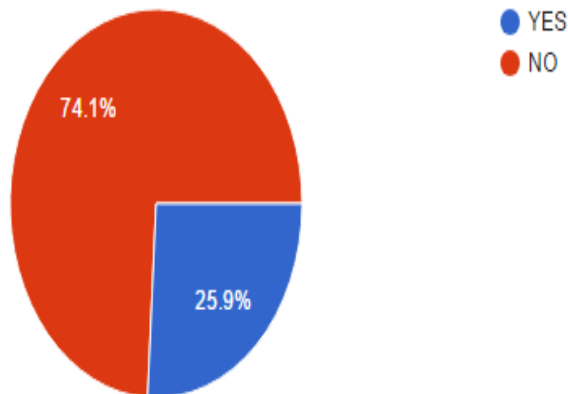


*Figure 4.3 Frequency of the Information*

Figure 4.3 clearly shows that information is needed all the time at 70.4% which simply means that Technical Institutions should adopt efficient and reliable tools to disseminate information.

**Q4: Are you satisfied with the Current Information Dissemination Methods in MTTI?**

### Are you Satisfied With The Current Information Dissemination Methods in MTTI?



*Figure 4.4: Satisfaction Level*

Figure 4.4 reveals the level of satisfaction from the students. From the above figure many of the respondents 74.1% said no, which means that TTIs' should try other techniques to dissemination information.

**Research Question Two:**

**What are the Existing Methods of Disseminating Information in Technical Training Institutions?**

The respondents were required to answer four questions that were all similar to the research questions in section 1.4 for proper analysis and interpretation.

**Q5: Select The Tools That You Frequently Use to Access Information in MTTI?**

Select The Tools That You Frequently Use To Access Information in MTTI?

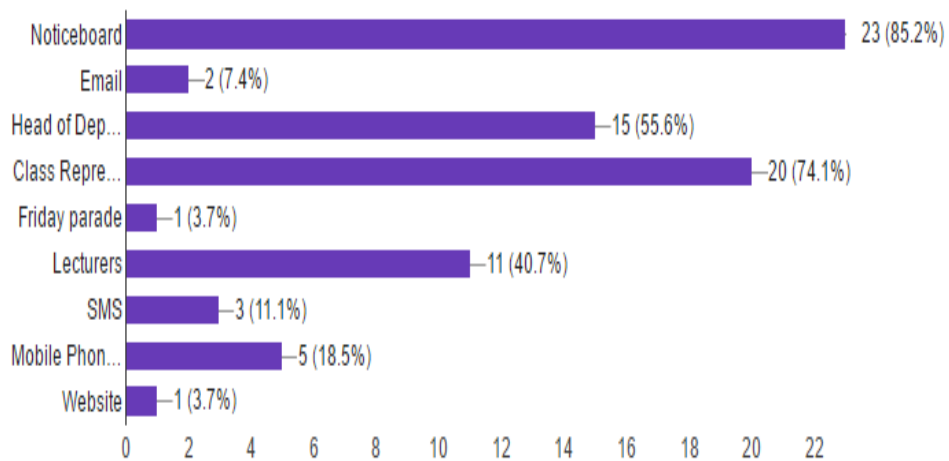
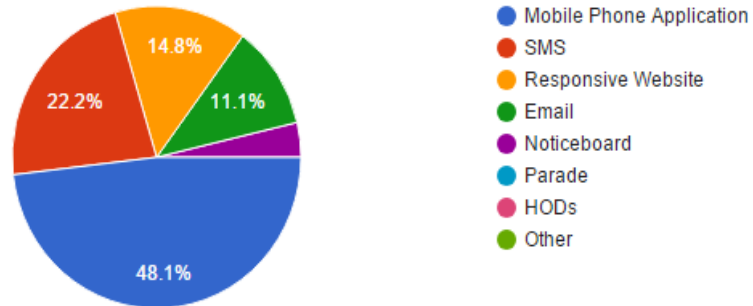


Figure 4.5: Tools used to disseminate information

Respondents were asked to indicate the tool that they frequently use to access information. Figure 4.5 shows the various tools that were used to access information. In summary noticeboard, head of department, class representative and lecturers were frequently selected by the respondents. But as indicated in Figure 4.4, 74% of respondents were not happy with the above information dissemination tools.

**Q6: Choose on Medium that will be the MOST Effective to Disseminate Information?**  
 Choose one medium that will be the MOST Effective To Disseminate Information in MTTI?



*Figure 4.6: Effective Medium*

Respondents were asked to select a medium that they would prefer to disseminate information. From Figure 4.6 it can be seen clearly that many of the respondents preferred Mobile phone application at 48, followed by SMS at 22, 14 responsive website and 11 email. It can be seen that the majority of respondents were more interested in the current technology to be used to disseminate information.

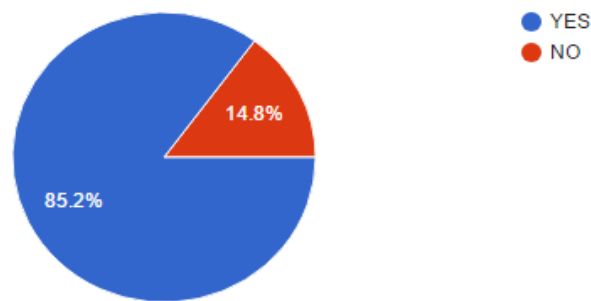
**Research Question Three:**

**Smartphone Ownership and Usage**

Part IV of the questionnaire was designed to investigate ownership of smartphones and usage in Technical Institutions. This would give the researcher a clear perspective of the tools to use during development phase.

**Q7: Do you own a Smartphone?**

Do you Own a Smartphone



*Figure 4.7: Smartphone Ownership*

Figure 4.7 shows that 85.2% of respondents own a smartphone as compared to 14.8% who own other models of mobile phones. Thus this gave the researcher surety of many students being able to access and use Mobile Application. The framework incorporated responsive website, SMS and Mobile Application.

**Q8: What Type of Operating System is your Smartphone?**

In the questionnaire, this question was designed to investigate the respondents' mobile phone operating system. Respondents were requested to select the operating system of the mobile phone that they use. The findings are summarised in Figure 4.8.

What Type of Operating System is your Smartphone?

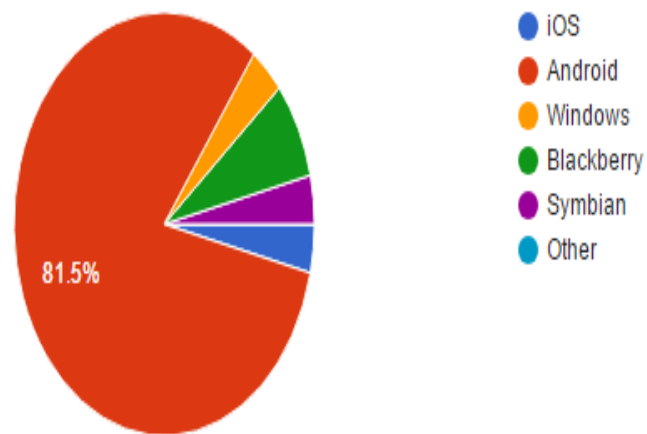
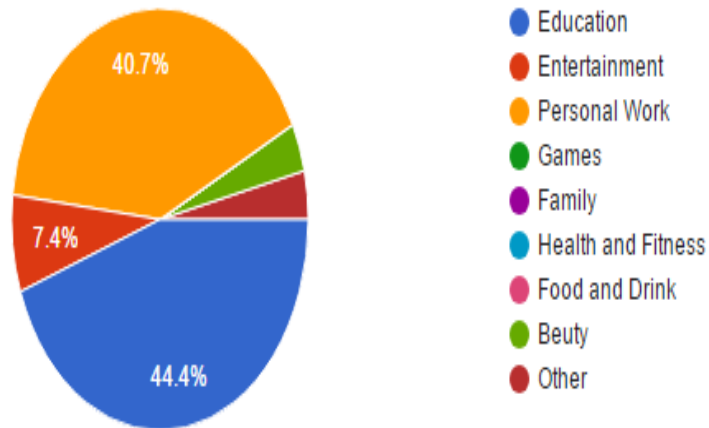


Figure 4.8: Smartphone Operating System

Figure 4.8 clearly shows the respondents' operating system of choice. According to the results 81.5% use Android smartphones, followed by blackberry mobile phones. It was established from the findings the dominant mobile phone operating system was Android in Masai Technical.

**Q9: What do you mostly use Smartphone Features for?**

## What Do You Mostly Use The Smartphone Features For?



*Figure 4.9: Use of Smartphones*

This question was designed to investigate the respondents' use of smartphone. The most frequently used features by the respondent. Respondents were requested to select the features that they use on mobile phones. 44.4% of the respondents selected education, 40.7% for personal work and 7.4% is entertainment as shown in Figure 4.9.

This result is not surprising, as in previous section, they had indicated that they own smartphones.

#### **4.4 Proposed Features for Information Dissemination Framework for Technical Training Institutions in Kenya.**

The respondents who believed that a mobile application would be suitable to be used in dissemination of information proposed features of the application. These features were used to come up with the system requirements and functionality. Below is a summary of the proposed features.

- The application should have user management and information should be accessed based on user levels and roles.
- The application should offer a single platform for dissemination of information.
- The application should have a module on the kitchen.
- The application should have a module on notifications and downloads.

## 4.5 System Requirements

This section outlines the Functional and Non- Functional requirements based on the user requirements collected alongside the initial study objectives.

### 4.5.1 Functional Requirements

Functional requirements define the capabilities and functions that the implemented application and its components must perform successfully.

i. *Create account*

All users must create an account, set username and password in order to access the system

ii. *Login*

All users must login into their accounts using their username and password for them to access the system.

iii. *View academic results*

All students should be able to view results, downloads and receive notifications.

iv. *Logout*

All users should be able to logout of their accounts.

v. *View reports*

Users of the institution should be able view academic reports.

vi. *Add users*

Administrators should be able to add new users into the system

vii. *Update users*

Administrators should be able to update the user's accounts

viii. *Delete users*

Administrators should be able to delete users.

#### 4.5.2 Non Functional Requirements

These requirements that do not affect the way the application works or its core business, the application can still work without it but, are part of the system. They include:

- i. Security – The system should allow access to only authorized users.
- ii. Usability – The system should have an interface that is easy to use.
- iii. Reliability and availability - The system should be reliable and always available to perform user tasks.
- iv. Scalability – it should be easy to add additional functionalities into the system.
- v. Performance – The system should have an acceptable response time while performing its functions.
- vi. Integrity – the system ensure that data stored is not altered or corrupted.
- vii. Search – a user should be able to search a particular university in the system.

#### 4.6 Proposed System Architecture

The architecture adopted for the development of the application was the Client Server Architecture. Client server architecture is a model that acts as distributed application that partitions tasks or workloads between the providers of a resource or service, called servers, and service requesters, called clients (Bharat, 2012). The client side consisted of Android Mobile Application which contained all the important modules in MTTI. Through internet connection the client interacts with the database that contains all the information.

Figure 4.10 is a general framework for information dissemination in Technical Training Institutions in Kenya. The framework shows salient features involved in the development of the system. It contains a mobile and wireless environment for students' and lecturers'. Which is supported by information communication technology (ICT) policies and guidelines. Basically, the purpose of ICT policies and guidelines is in place to ensure that users who use ICT services like wireless, messaging and so on in accordance with MTTI policies and values. The policies also intended to set out best practice for communicating, storing and retrieving of information. Protect the security of information held on systems and limit the opportunity for fraudulent use of technology. Figure 4.10 shows the proposed system architecture.

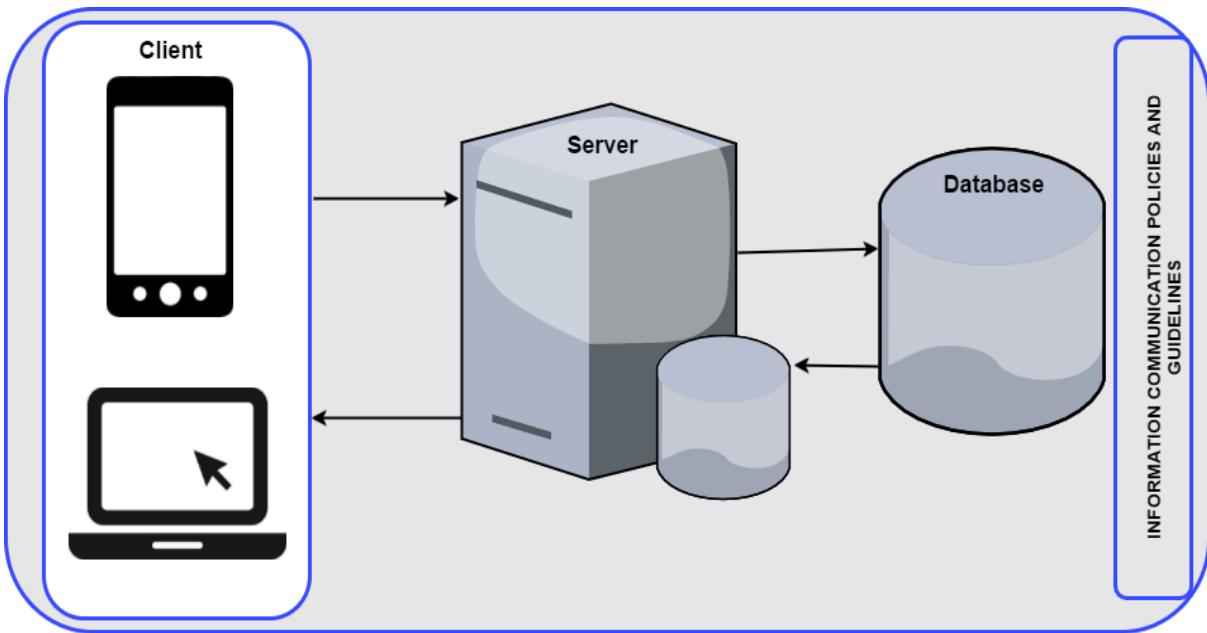


Figure 4.10 Conceptual Model

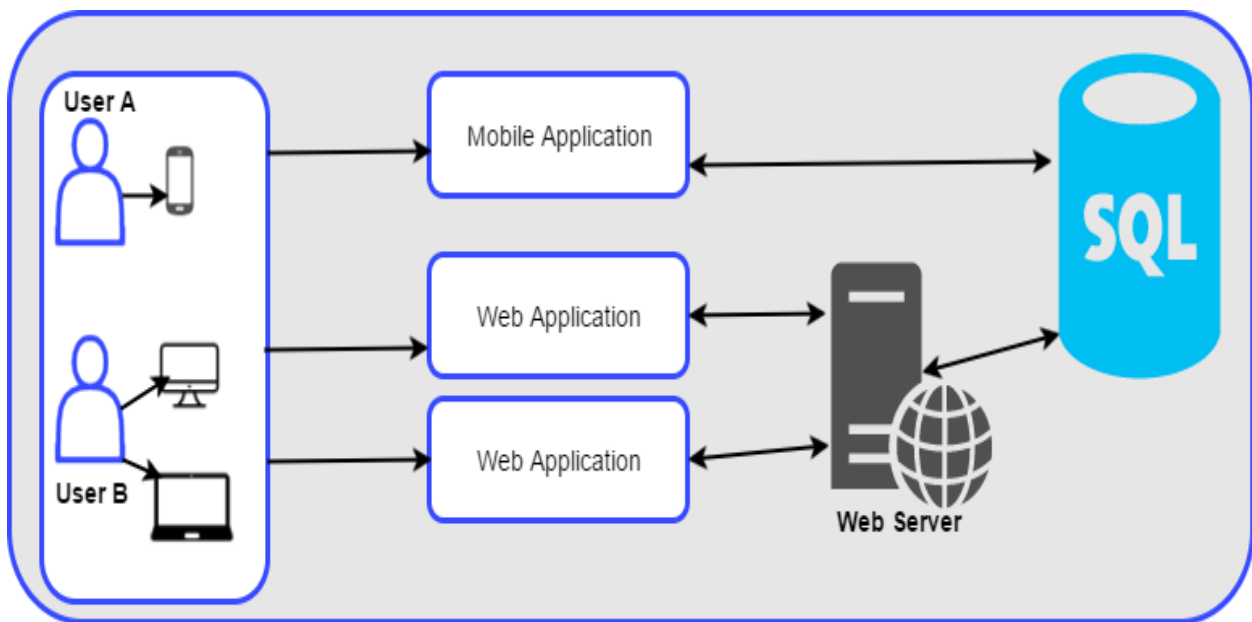


Figure 4.11: System Architecture of the Proposed System

#### 4.7 System Design

Hoffer, George and Valacich, (2015) defined system design as the process of defining the components, modules, interfaces, and data for a system to satisfy specified requirements. The developer designed the system using two types of UML diagrams. The structural diagrams that show the things being modeled or the conceptual view and behavioural diagrams to show how objects interact with each other to create a functioning system (Grady, 2014).

### 4.7.1 Use Case Diagram

Use Case diagram see Figure 4.12 is a behavioural diagram that shows the functionalities of a system in terms of actors and their goals as represented by use cases and any dependencies on those use cases. The following are a list of actors who interact with the system: (Hoffer, George and Valacich, 2015).

**System Administrator** - these include developers of the system who are also responsible for the management and maintenance of the system.

**Student** –these include all the students in MTTI who were supposed to interact with the system.

**Head Cook** – the representative of the kitchen staff that carries out daily update of all the services in the kitchen.

**Tutor** - they are involved in the implementation of the curriculum.

The following are the main processes in this application:

1. Create Account - Primary actors are the students who want to access academic information.
2. Check Results - Primary actors are the students who want to access results.
3. Check Fee status - Primary actors are the students who want to check fee balance.
4. Downloads - Primary actors are the students and support staff who access latest downloads.
5. Notifications - Primary actors are all actors in the system boundary who want to receive notifications.
6. Administrator - Primary actors are the System Administrators who manages the entire system.
7. Kitchen – All actors who want to access what is on the menu.

Figure 4.12 shows the use case diagram for the proposed application. Refer to section 1.5 for the scope of the system.

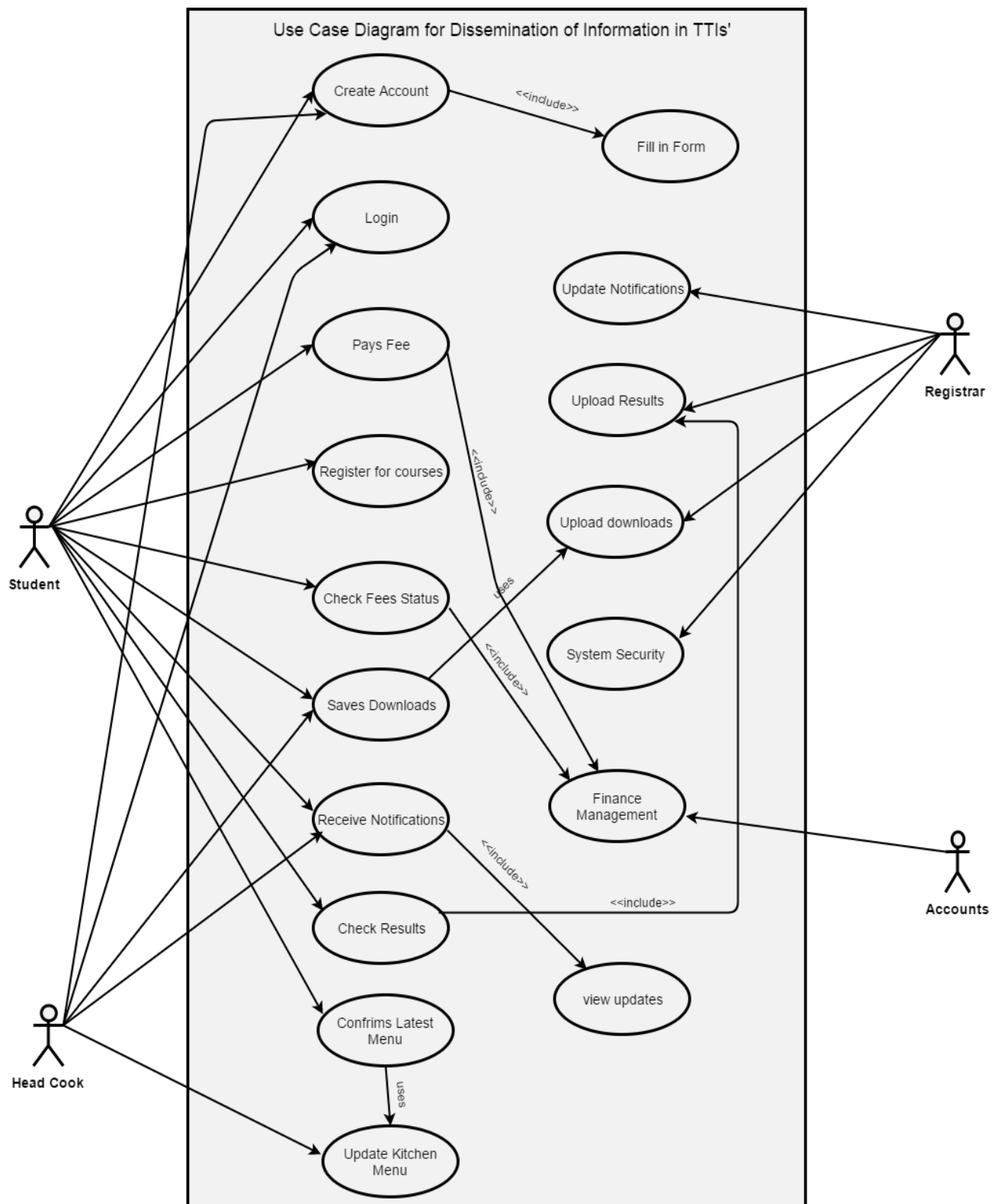


Figure 4.12: Use Case Diagram of the Proposed System

## Use Case Full Description

Use cases full description are textual requirements specification that captures and describes the step by step process a user goes through to complete a specific goal as shown in Table 4.1 to Table 4.7 (Marwedel, 2011). The following are the main processes as per the use case diagram in Figure 4.3:

Table 4.1: Create Account Use Case Description

<b>Use_Case Name:</b>	Create Account	
<b>Scenario:</b>	Web based, involving student.	
<b>Triggering Event:</b>	Student surfs the internet to register into the system.	
<b>Brief Description:</b>	When a student registers into the system, he/she is able now to receive information from the system.	
<b>Actors:</b>	Student and system.	
<b>Related_Use Case:</b>	Includes: Fees status.	
<b>Stakeholders:</b>	Principal: to provide financial assistance. Students: to be used to test the system. Lecturers: to be used to test the system. System design department: to design the system. Finance department: to receive payment.	
<b>Preconditions:</b>	A student has access to internet and he or she has the URL of the MTTI system or Google Play Application.	
<b>Post_conditions:</b>	At the end of the use case, the actor is registered and issued with a user name and password.	
<b>FlowOf Events:</b>	<b>Actor</b>	<b>System</b>
	<ol style="list-style-type: none"> <li>1. Student requests for registration.</li> <li>2. Student key in registration details.</li> <li>3. Student receives user name and password.</li> </ol>	<ol style="list-style-type: none"> <li>2.1 Approve registration.</li> <li>2.2 Createnew account.</li> <li>2.3 Provide registration Details.</li> </ol>
<b>Exception Conditions:</b>	2.1 if student does not provide correct registration information then: a) Student will not receive user_name and password.	

Table 4.2: Login Use Case Description

<b>Use_Case Name:</b>	Login / Logout	
<b>Scenario:</b>	Web based, involving student.	
<b>Triggering Event:</b>	Student surfs the internet to login / logout of the system.	
<b>Brief Description:</b>	When a student logs into the system, he/she is able now to receive information from the system.	
<b>Actors:</b>	Student and system.	
<b>Related_Use Case:</b>	Includes: Fees status.	
<b>Stakeholders:</b>	Principal: to provide financial assistance. Students: to be used to test the system. Lecturers: to be used to test the system. System design department: to design the system. Finance department: to receive payment.	
<b>Preconditions:</b>	A student has access to internet and he or she has the URL of the MTTI system or Google Play Application.	
<b>Post_conditions:</b>	At the end of the use case, the actor is logs into the system and accesses system services.	
<b>FlowOf Events:</b>	<b>Actor</b>	<b>System</b>
	<ol style="list-style-type: none"> <li>1. Student key in system credentials details.</li> <li>2. Student uses the system.</li> </ol>	<ol style="list-style-type: none"> <li>1.1 Approve details.</li> <li>1.2 Allows access.</li> <li>2.1 Provide use of all system resources.</li> </ol>
<b>Exception Conditions:</b>	<ol style="list-style-type: none"> <li>2.1 if student does not provide correct registration information then:             <ol style="list-style-type: none"> <li>b) Student will not receive user_name and password.</li> </ol> </li> </ol>	

Table 4.3 is a use case description that outlines a representation of how students in Masai Technical Training Institute check or confirm results.

Table 4.3: Check Result Use Case Description

<b>UseCase Name:</b>	Check Results	
<b>Scenario:</b>	Web based, involving student/ lecturer.	
<b>Triggering Event:</b>	Student/ Client surfs the internet for the website or Mobile Application on Google Play store.	
<b>Brief Description:</b>	When the student is already registered, he/she can view results.	
<b>Actors:</b>	Student and system.	
<b>Related_Use Case:</b>	Includes: Registration.	
<b>Stakeholders:</b>	Principal: to provide financial assistance. Students: to be used to test the system. Lecturers: to be used to test the system. System design department: to design the system. Finance department: to receive payment.	
<b>Preconditions:</b>	A student has access to internet and he or she has the URL of the MTTI system or Google Play Application.	
<b>Postconditions:</b>	At the end of the use case, the actor is allowed access to his/ her results.	
<b>FlowOf Events:</b>	<b>Actor</b>	<b>System</b>
	1. Student logs into the system.	2.1 Authenticate user.
	2. Student gain access to the system.	2.2 Grants access.
<b>Exception Conditions:</b>	2.1 If student does not provide correct registration information then:- a) The student will not be allowed access.	

Table 4.4 is a use case description that outlines a representation of how students and lecturers in Masai Technical Training Institute access kitchen services.

Table 4.4: Kitchen Services Use case Analysis

<b>Use_Case Name:</b>	Latest Menu	
<b>Scenario:</b>	Application based, involving student or lecturer.	
<b>Triggering Event:</b>	Student downloads the application to access services.	
<b>Brief Description:</b>	When a student downloads the application, he/she is able now to access information from the mobile application.	
<b>Actors:</b>	Student and mobile application.	
<b>Related_Use Case:</b>	Includes: Registration.	
<b>Stakeholders:</b>	Principal: to provide financial assistance. Students: to be used to test the system. Lecturers: to be used to test the system. System design department: to design the system. Finance department: to receive payment.	
<b>Preconditions:</b>	A student has to download the mobile application and he or she has the URL of the MTTI system or Google Play Application.	
<b>Postconditions:</b>	At the end of the use case, the actor accesses the services on the mobile application.	
<b>FlowOf Events:</b>	<b>Actor</b>	<b>System</b>
	1. Student downloads the mobile application.	2.1 Approve registration.
	2. Student key in registration details.	2.2 Access mobile application.
	3. Student has access to mobile application.	2.3 Provide menu details.
<b>Exception Conditions:</b>	2.1 if student does not provide correct registration information then: a) Student will not receive access kitchen services.	

Table 4.5 is a use case description that outlines a representation of how students in Masai Technical Training Institute access Fee balance.

Table 4.5 Fees Use Case Description

<b>Use_Case Name:</b>	Fees	
<b>Scenario:</b>	Web based and Mobile Application, involving student.	
<b>Triggering Event:</b>	Student surfs the internet or downloads the mobile application.	
<b>Brief Description:</b>	When a student registers into the system, he/she is able now to receive information from the system.	
<b>Actors:</b>	Student and registration.	
<b>Related_Use Case:</b>	Includes: Fees status.	
<b>Stakeholders:</b>	Principal: to provide financial assistance. Students: to be used to test the system. Lecturers: to be used to test the system. System design department: to design the system. Finance department: to receive payment.	
<b>Preconditions:</b>	A student has access to internet and he or she has the URL of the MTTI system or Google Play Application.	
<b>Postconditions:</b>	At the end of the use case, the actor is registered and can access system components.	
<b>Flow_Of Events:</b>	<b>Actor</b>	<b>System</b>
	<ol style="list-style-type: none"> <li>1. Student requests for registration.</li> <li>2. Student key in registration details to access services.</li> <li>3. Access all services.</li> </ol>	<ol style="list-style-type: none"> <li>2.1 Approve registration.</li> <li>2.2 Access all services.</li> <li>2.3 Provide Details.</li> </ol>
<b>Exception Conditions:</b>	2.1 if student does not provide correct registration information then: <ol style="list-style-type: none"> <li>a) Student will not be registered.</li> </ol>	

Table 4.6 is a use case description that outlines a representation of how students and lecturers in Masai Technical Training Institute access notifications.

Table 4.6: Notifications Use Case Description

<b>Use_Case Name:</b>	Notifications	
<b>Scenario:</b>	Web based and Mobile Application, involving student.	
<b>Triggering Event:</b>	Student surfs the internet or downloads the mobile application.	
<b>Brief Description:</b>	When a student registers into the system, he/she is able now to receive information from the system.	
<b>Actors:</b>	Student and registration.	
<b>Related_Use Case:</b>	Includes: Fees status.	
<b>Stakeholders:</b>	Principal: to provide financial assistance. Students: to be used to test the system. Lecturers: to be used to test the system. System design department: to design the system. Finance department: to receive payment.	
<b>Preconditions:</b>	A student has access to internet and he or she has the URL of the MTTI system or Google Play Application.	
<b>Post_conditions:</b>	At the end of the use case, the actor is registered and can access system components.	
<b>FlowOf Events:</b>	<b>Actor</b>	<b>System</b>
	<ol style="list-style-type: none"> <li>1. Student requests for registration.</li> <li>2. Student key in registration details to access services.</li> <li>3. Receives notifications.</li> </ol>	<ol style="list-style-type: none"> <li>2.1 Approve registration.</li> <li>2.2 Send notifications.</li> <li>2.3 Provide Details.</li> </ol>
<b>Exception Conditions:</b>	2.1 if student does not provide correct registration information then: <ol style="list-style-type: none"> <li>a) Student will not receive notifications.</li> </ol>	

Table 4.7 is a use case description that outlines a representation of how the administrator manages security.

Table 4.7: Administrator Manage security use case scenario

<b>Use_Case Name:</b>	Manage security.	
<b>Scenario:</b>	Administrator manage security from back end.	
<b>Brief Description:</b>	The Admin is the overall manager of the system.	
<b>Primary Actor:</b>	Administrator.	
<b>Related_Use Case:</b>	Includes: Manage security, user credentials, monitor activities.	
<b>Stakeholders:</b>	Student, Lecturer, Principal, Deputy Principal, Parents.	
<b>Preconditions:</b>	Admin is identified, authenticated and manage users.	
<b>Postconditions:</b>	At the end of the use case, the actor will oversee use of system	
<b>Flow_Of Events:</b>	<b>Actor</b>	<b>System</b>
	<ol style="list-style-type: none"> <li>1. Confirm if user exists in the system.</li> <li>2. Update password.</li> </ol>	<ol style="list-style-type: none"> <li>1.1 Verify user.</li> <li>1.2 Updates password.</li> </ol>
<b>Exception Conditions:</b>	1.1 If user not registered, contact Admin no.	

### 4.7.2 Activity Diagram

Activity diagram was used to show the flow from one activity to another activity the emphasis was on the student module (Hoffer, George and Valacich 2015). As shown in Figure 4.13.

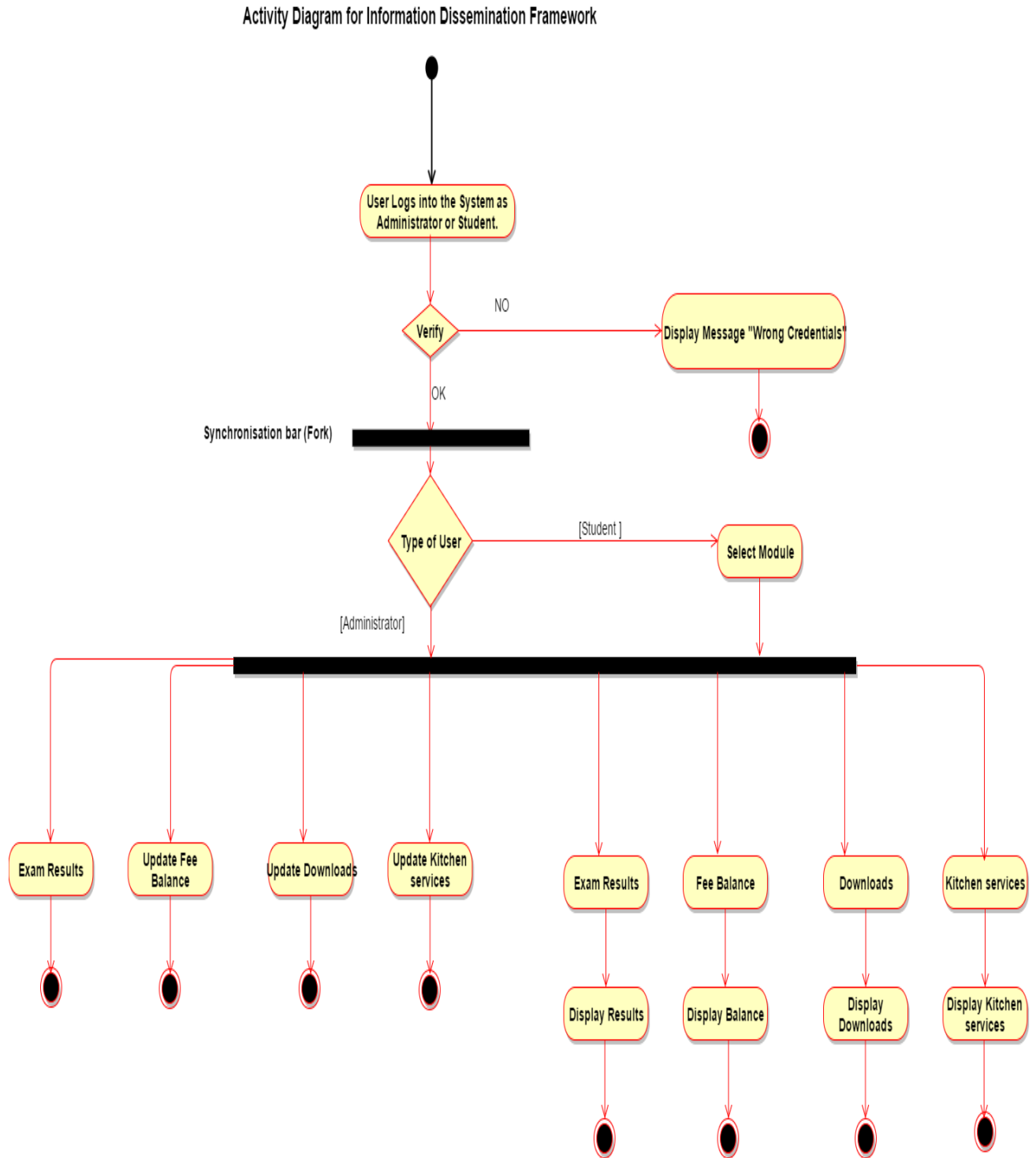


Figure 4.13: Activity Diagram of the Proposed System

### 4.7.3 Class Diagram

A class diagram was used, it aimed at showing structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects (Eriksson, 2011). Figure 4.14 shows a class diagram for the proposed system.

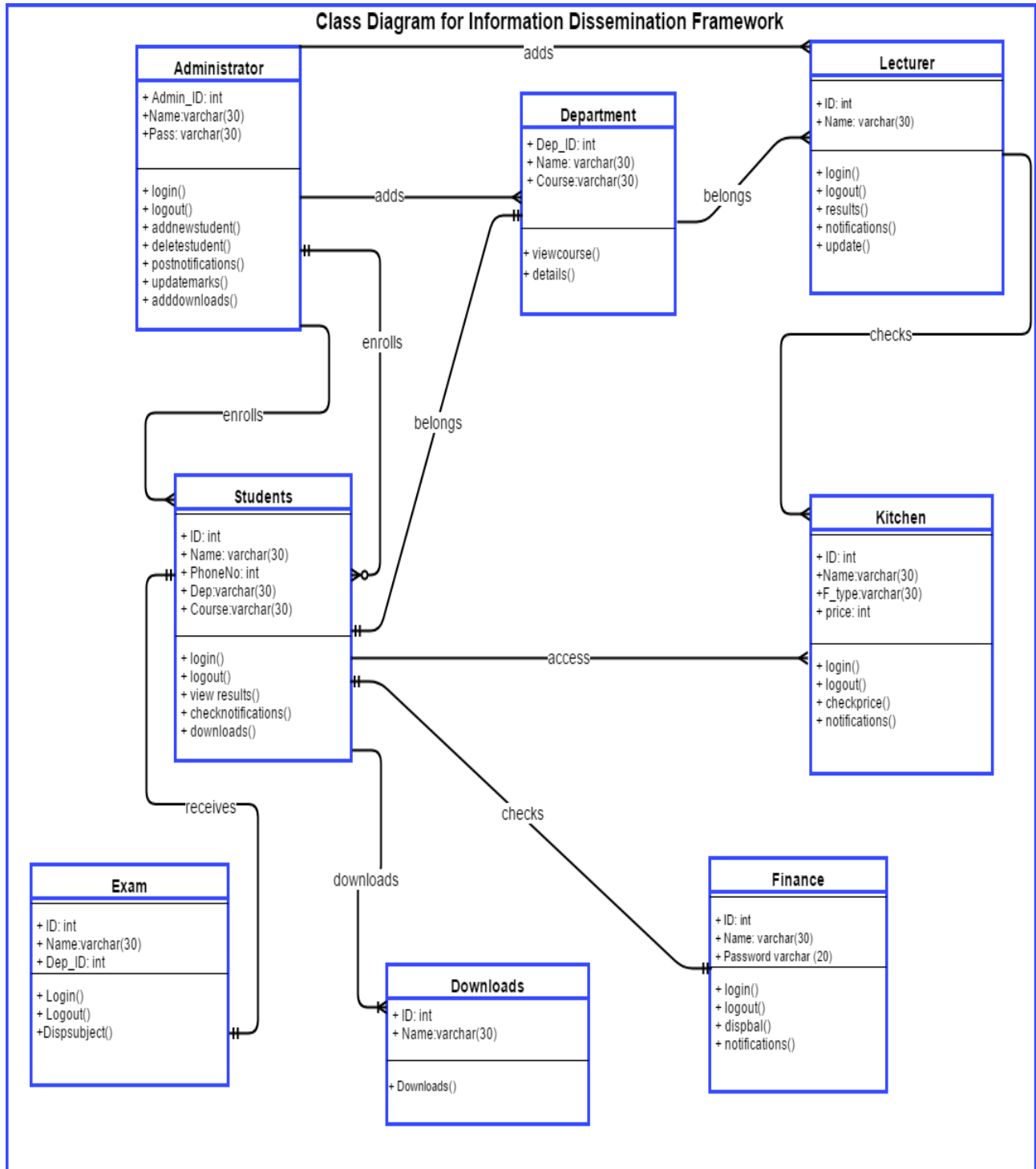


Figure 4.14: Class Diagram of the Proposed System

#### 4.7.4 Collaboration Diagram

A collaboration diagrams aims at showing the communications that happen between objects, by defining messages that flow between each other, it is the diagrams that shows process interaction and messaging as presented in Figure 4.15 similar to sequence diagram but the focus was on messages passed between objects (Hoffer, George and Valacich 2015).

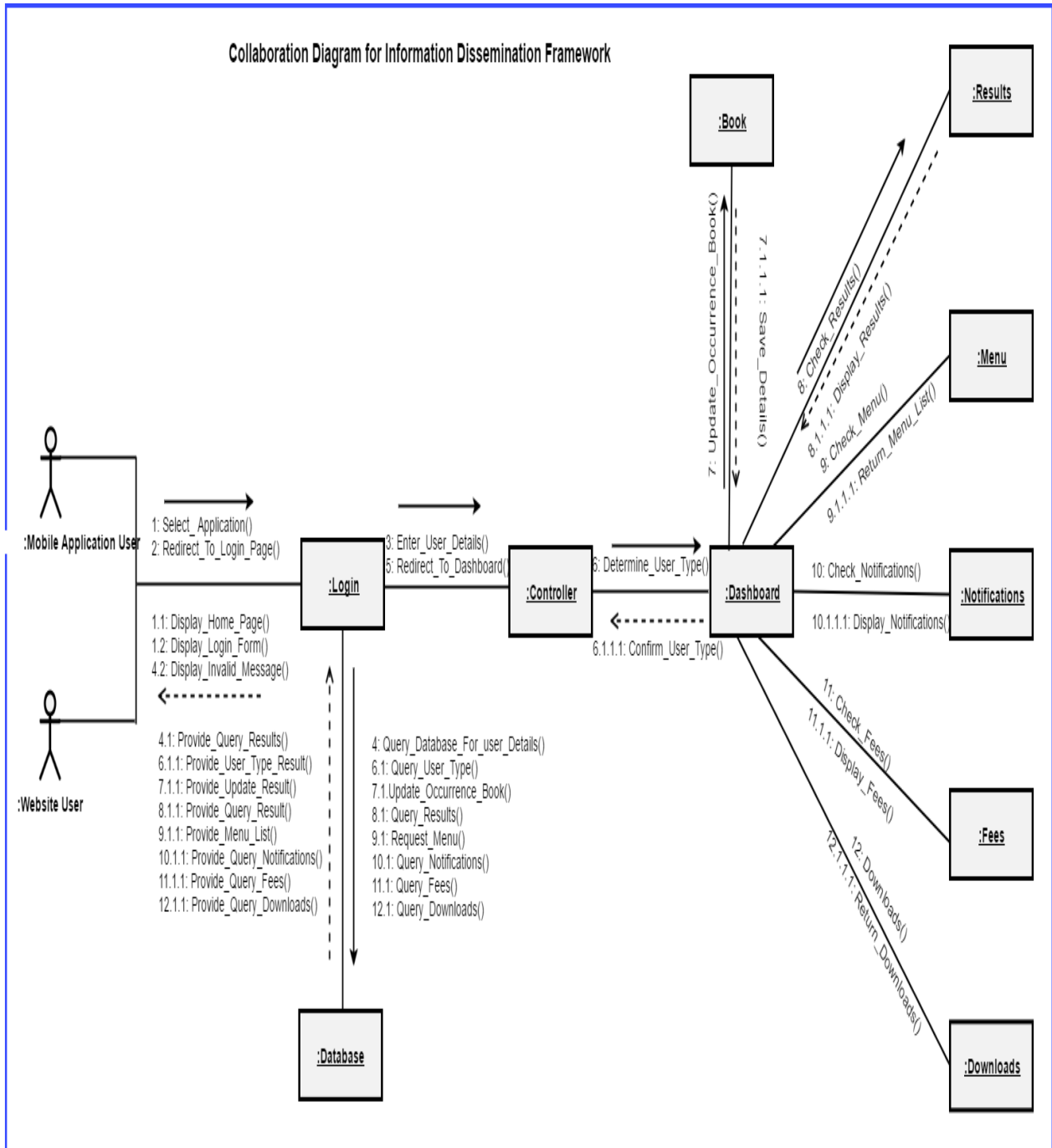


Figure 4.15: Collaboration Diagram for Information Dissemination Framework for TTI's in Kenya use case

#### 4.7.5 Component Diagram

Component diagrams are used to model physical aspects of a system. The physical aspects are the elements like executables, libraries, files and documents. It does not describe the functionality of the system but it describes the components used to make those functionalities (Hoffer, George and Valacich 2015). Figure 4.16 represents the component diagram for the proposed solution.

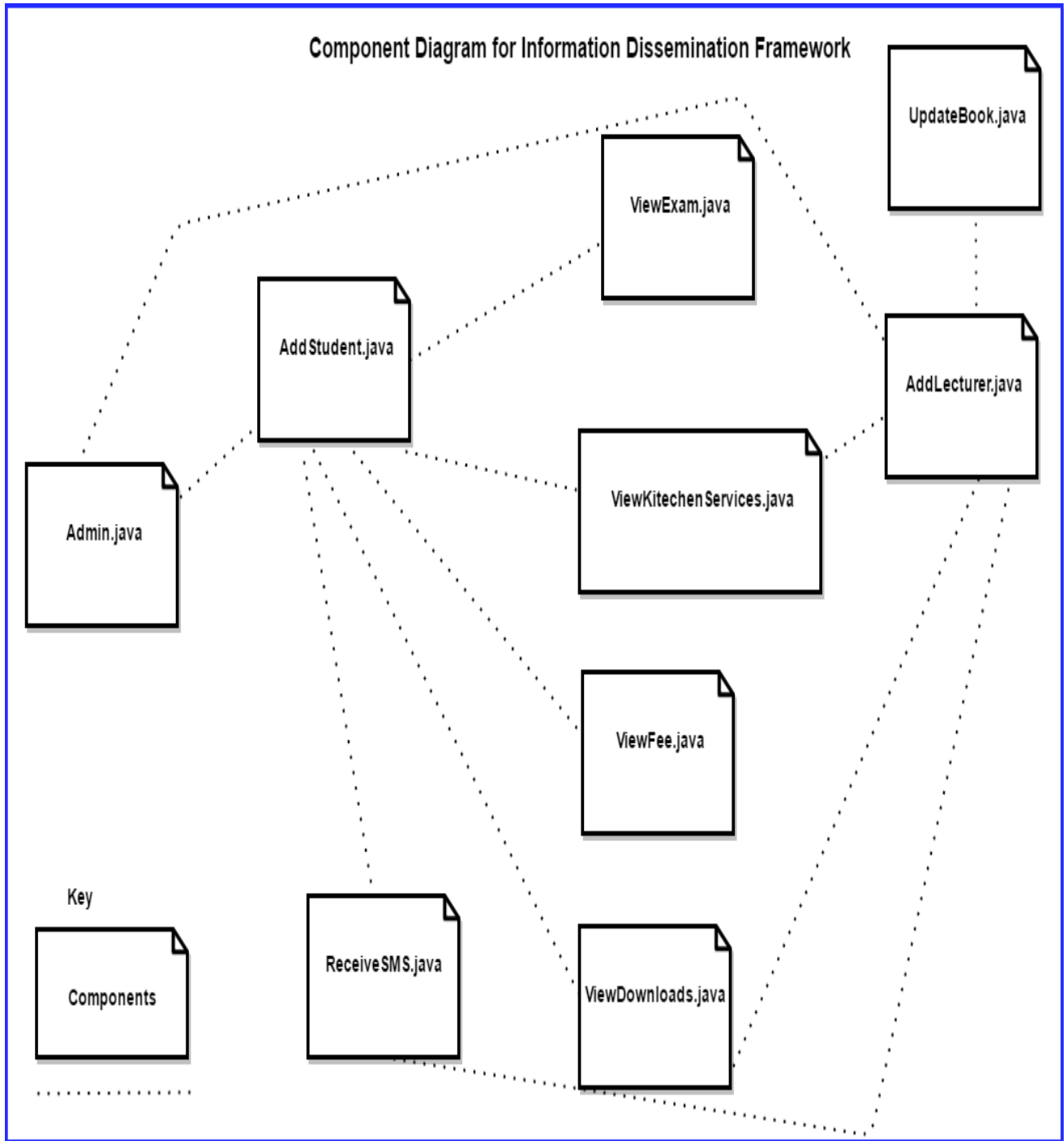


Figure 4.16: Component Diagram for Information Dissemination Framework

#### 4.7.6 Deployment Diagram

Deployment diagrams was used to describe the hardware components where software components were deployed (Hoffer, George and Valacich 2015). Figure 4.17 represents the deployment diagram for the proposed system.

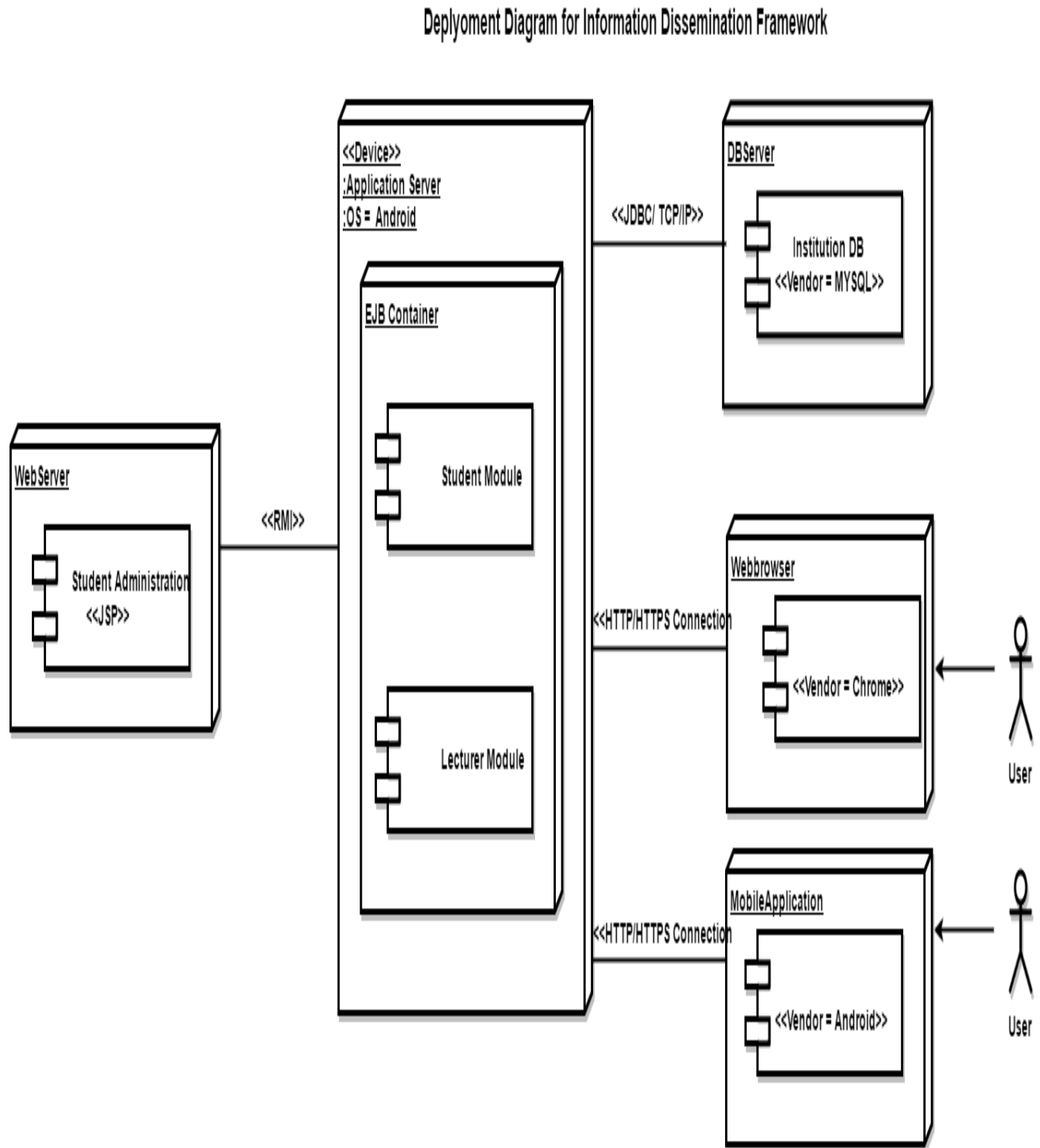


Figure 4.17: Deployment Diagram for Information Dissemination Framework

### 4.7.7 Entity Relationship Diagram

Figure 4.18 shows a representation of detailed data model of the database. An Entity Relationship Diagram (ERD) was used to design the conceptual view of the database (Teorey 2011).

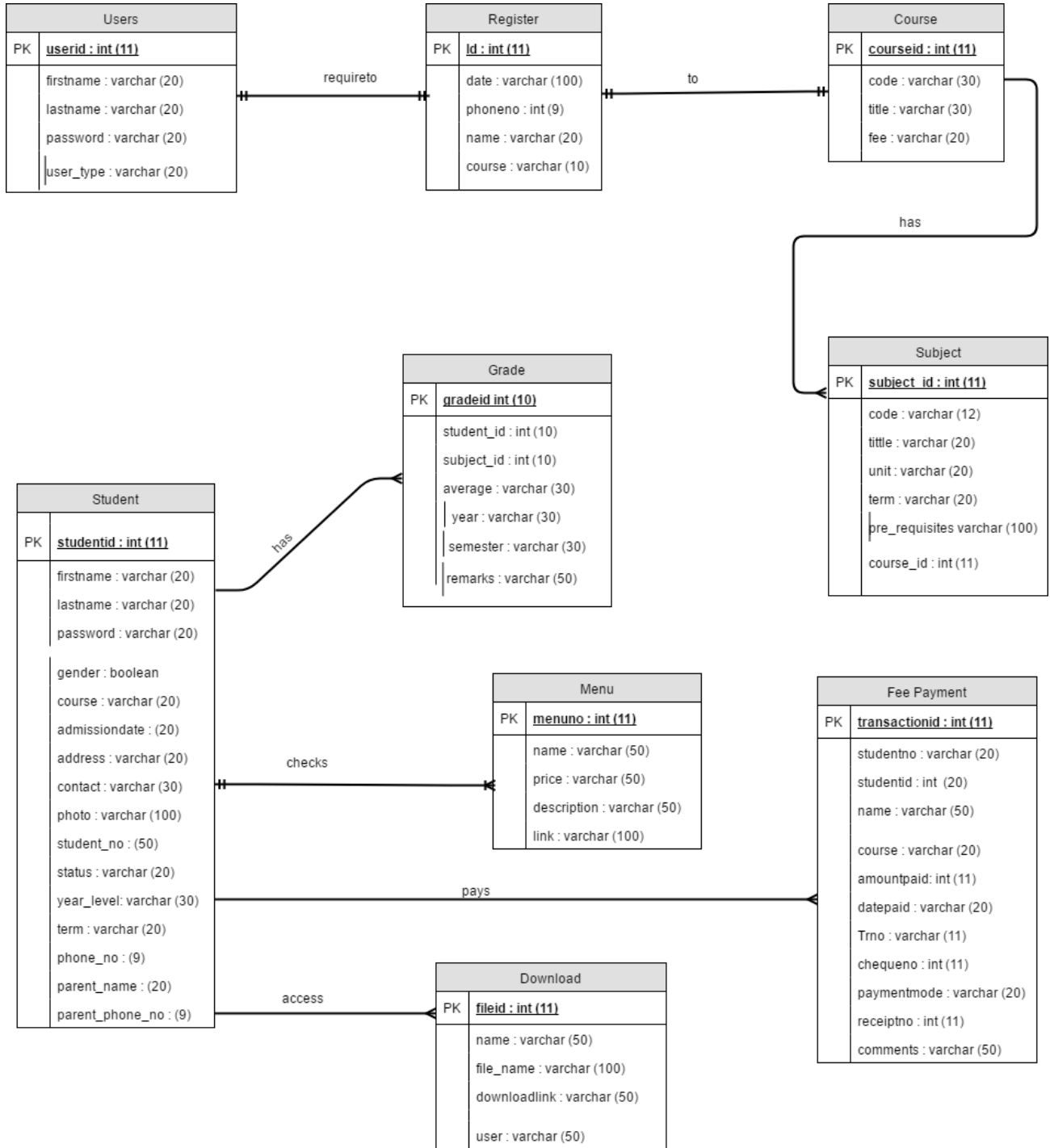


Figure 4.18: Entity Relationship Diagram

### 4.7.8 Database Schema

A database schema was used to represent the logical view of the entire database as shown in Table 4.8 to 4.15, it defines how the data was organised and how the relations among them were associated. It formulated all the constraints that were applied on the data (Hoffer, George and Valacich, 2015).

Table 4.8: **Users Table**

Column Name	Data type	Index
User_id	int	Primary Key
username	varchar (20)	
password	varchar (20)	
first_name	varchar (20)	
last_name	varchar (20)	
User_type	Varchar (20)	

Table 4.9: **Student Table**

Column Name	Data type	Index
Student_id	int	Primary Key
first_name	varchar (20)	
last_name	varchar (20)	
password	varchar (20)	
gender	varchar (20)	
course	varchar (20)	
address	varchar (20)	
contact	varchar (30)	
photo	varchar (100)	
student_no	varchar (100)	
status	varchar (50)	
year	varchar (20)	
level	varchar (20)	
term	varchar (20)	
student_status	varchar (20)	
fee_balance	varchar (10)	
downloads	varchar (50)	

Table 4.10: **Course Table**

Column Name	Data type	Index
Course_id	int (30)	Primary Key
course_code	varchar (30)	
title	varchar (20)	

Table 4.11: **Subject Table**

Column Name	Data type	Index
Subject_id	int (12)	Primary Key
code	varchar (20)	
title	varchar (20)	
unit	varchar (20)	
year	varchar (20)	
term	varchar (50)	
prerequisite	varchar (100)	

Table 4.12: **Table Grade**

Column Name	Data type	Index
Student_id	int (11)	Primary Key
Subject_id	int (50)	
General_avg	varchar (50)	
year	varchar (50)	
term	varchar (50)	
remarks	varchar (100)	

Table 4.13: **Table Fee Payment**

Column Name	Data type	Index
Student_id	int (11)	Primary Key
Subject_id	int (50)	
name	varchar (50)	

course	varchar (20)	
amountpaid	varchar (10)	
datepaid	varchar (20)	
Trno	int (11)	
chequeno	int(11)	
paymentmode	varchar (20)	
receiptno	int (11)	
Comments	varchar (50)	

Table 4.14: **Table Menu**

Column Name	Data type	Index
Student_id	menuno (11)	Primary Key
name	varchar (50)	
price	varchar (50)	
description	varchar (20)	
link	varchar (100)	

Table 4.15: **Table Downloads**

Column Name	Data type	Index
fileid	int (11)	Primary Key
filename	varchar (100)	
downloadlink	varchar (50)	
user	varchar (50)	

#### 4.7.9 Mobile Application Wireframes

A wireframe offers a page schematic or screen blueprint that represents the skeletal framework of applications. (Faranello, 2012). This section deals with the flow of screen presentations when the user interacts with the application.

When the application is first runs a splash screen appears followed by the login page. On successful login, the dashboard screen displays all the modules in the system. The sections below represents the

Mobile Application wireframes, Web Application and SMS Application wireframes, some wireframes are attached in Appendix E, Appendix F and Appendix G.

### **Launch Application**

To view this module (see Figure E-1, Appendix E) that shows a wireframe of a mobile phone that has an icon of the proposed solution. The student or lecturer taps on the icon to launch the application.

### **Splash Screen - wireframe**

The splash screen appears for three seconds, where all the system components are loaded and configured ready for use (see Figure E-2, Appendix E).

### **Login Module- wireframe**

The login module shall be used to authenticate users before using the system see Figure 4.19.

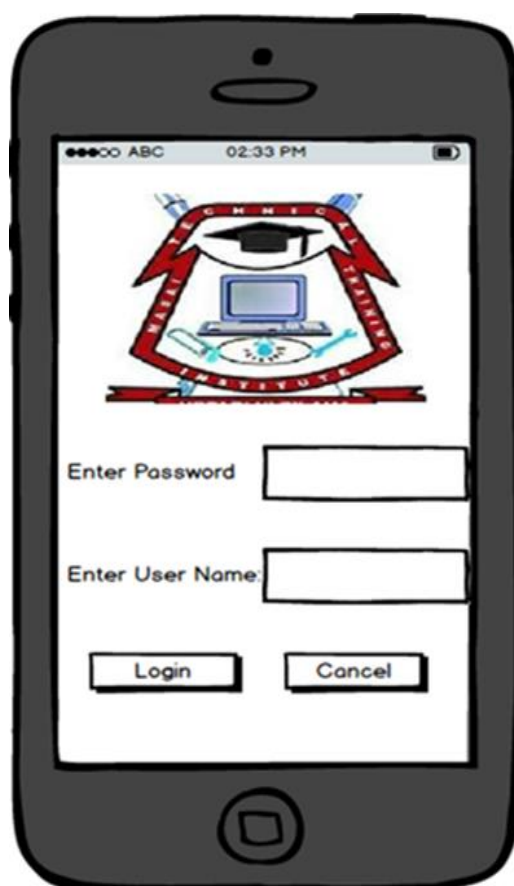
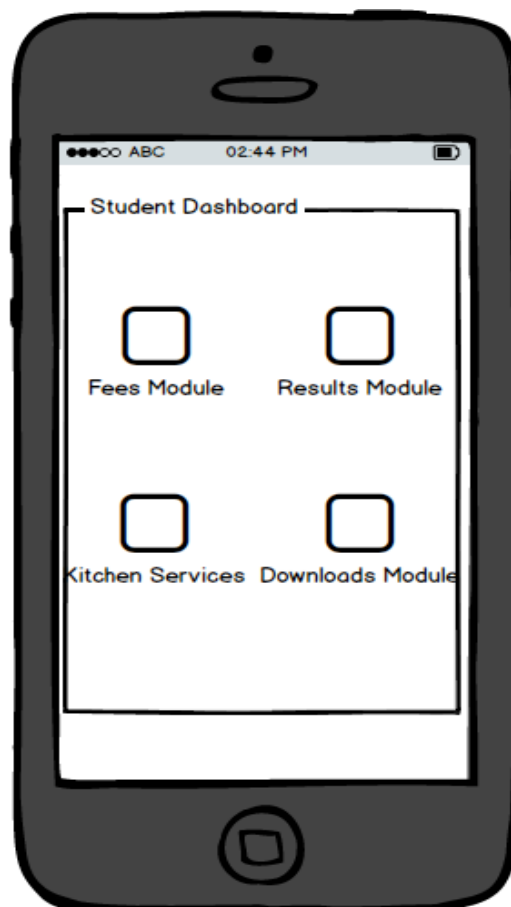


Figure 4.19: Login

### Dashboard Module- wireframe

A dashboard is a user interface in which multiple activities reside (Faranello, 2012). The wireframe that represents the dashboard is as shown in Figure 4.20. On the dashboard the user shall be able to access all the modules in the system.



*Figure 4.20: Login*

### Results Module- wireframe

Figure 4.21 shows a representation of the wireframe that was used to design Results Module. This module shall allow student to be able to access results through use of mobile phones.

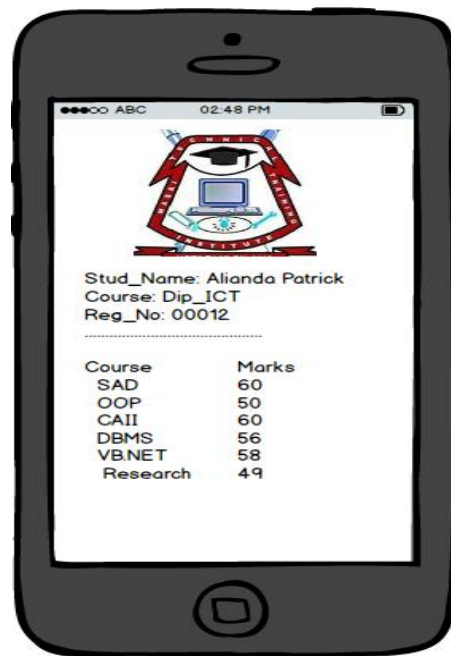


Figure 4.21: Results

### Fees Module- wireframe

This module shall allow students to be able to view fee statement. The wireframe is as shown in Figure 4.22.

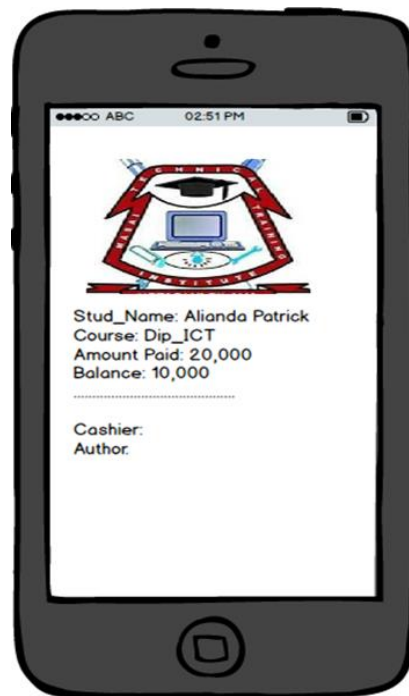


Figure 4.22: Fee

## Kitchen Module- wireframe

Services offered from this module shall be seen and accessed from this module after uploading the services by the system administrator. The wireframe is as shown in figure in Figure 4.23 and Figure 4.24.

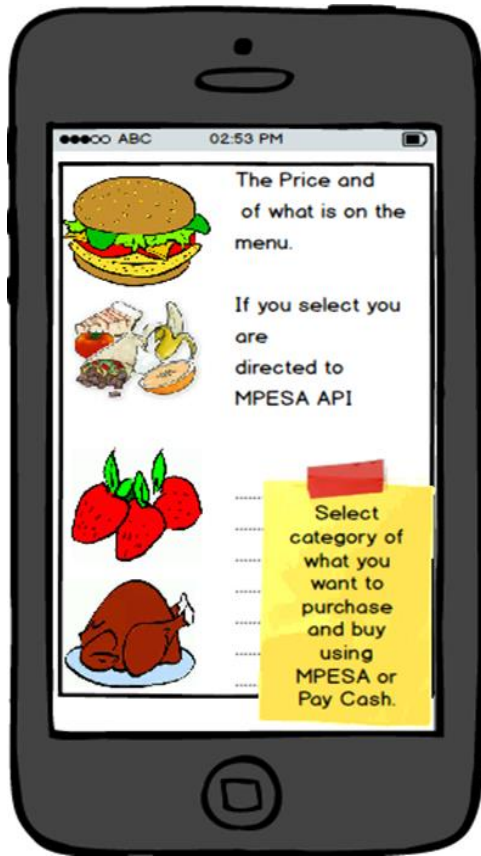


Figure 4.23: Menu

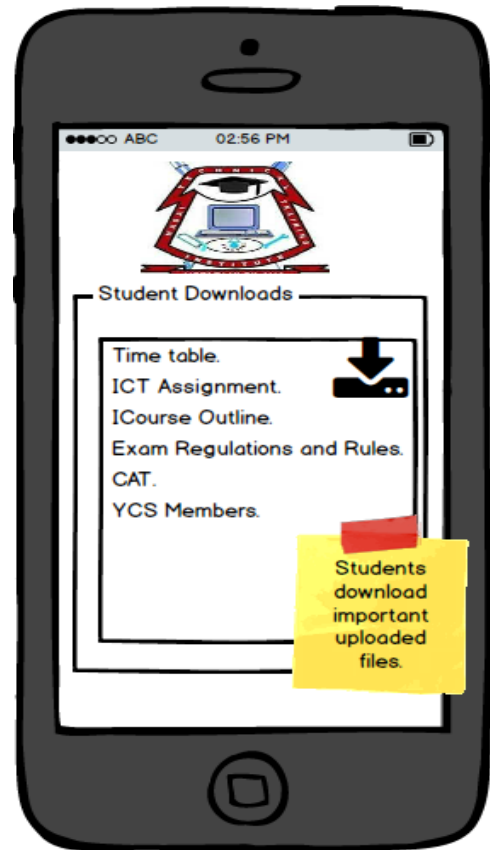


Figure 4.24: Downloads

### 4.7.10 Web Application Wireframes

The Web Application shall be used by students to access information from the system also the administrator shall use it when managing all components of the system. The section below represents Web Application wireframes, some wireframes are attached in Appendix F.

## Login Module- wireframe

The login module shall be used to authenticate users before using the system. Students are supposed to login before using the system (see Figure F-1, Appendix F).

## Registrar Module- wireframe

As shown in Figure 4.25, this module shall be used to manage the entire system. Uploads, exam results, notifications all shall be accomplished using this module.

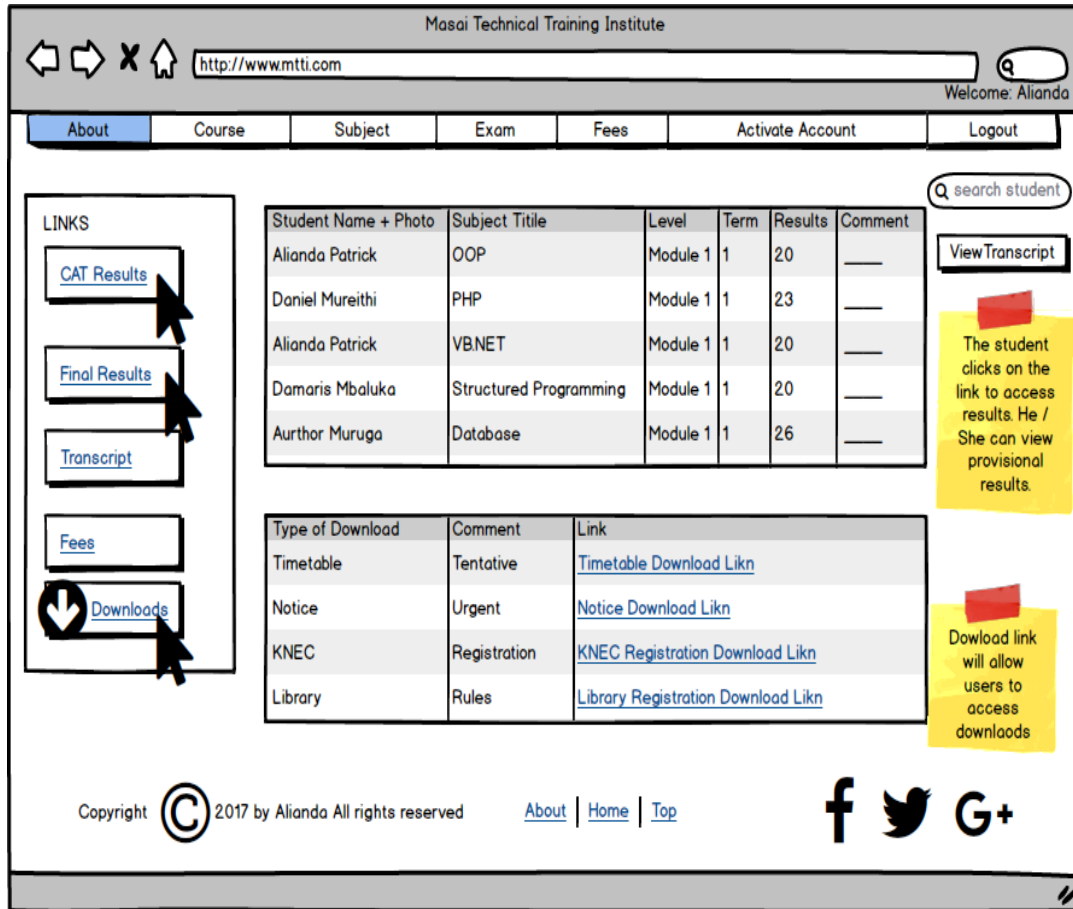


Figure 4.25: Registrar

## Results Module- wireframe

This module shall allow students to be able to access results through the website after the student has logged into the system see Figure 4.26.

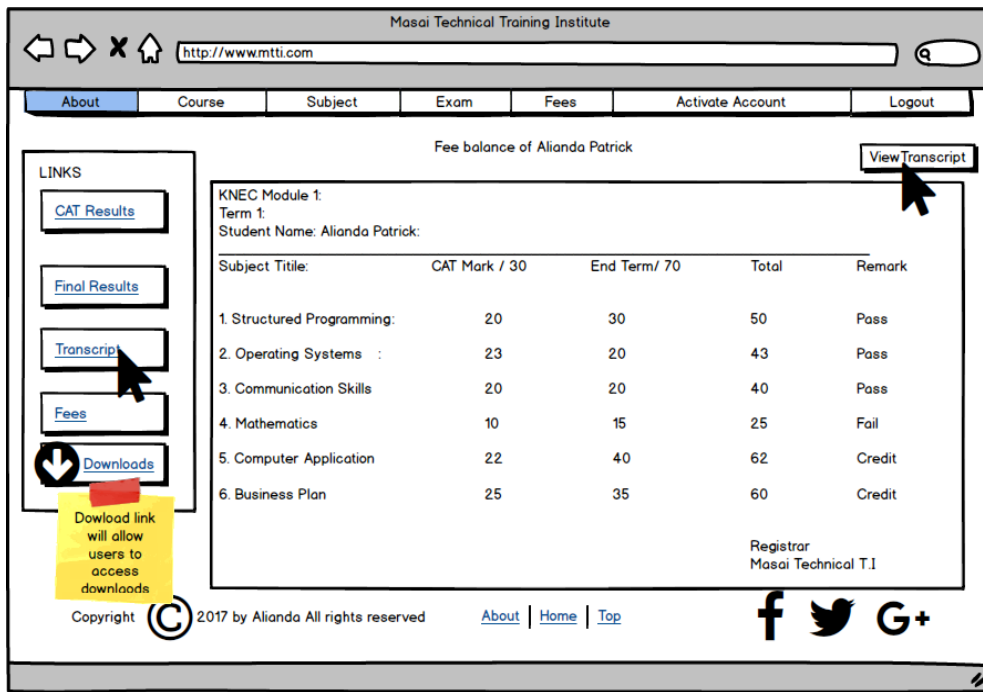


Figure 4.26: Results

### Fee Module- wireframe

This module shall assist students to be able to view fee statement. The wireframe is represented in Figure 4.27.

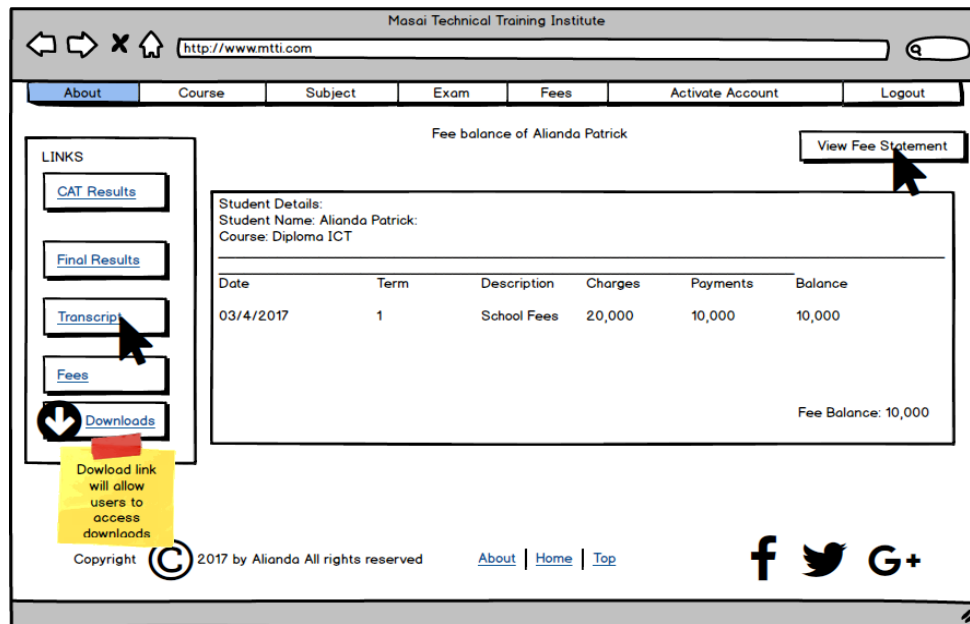


Figure 4.27: Fee

## SMS Application wireframes

This module is used by the administrator to send bulky SMS to all the registered students in the system as shown in Figures 4.28.

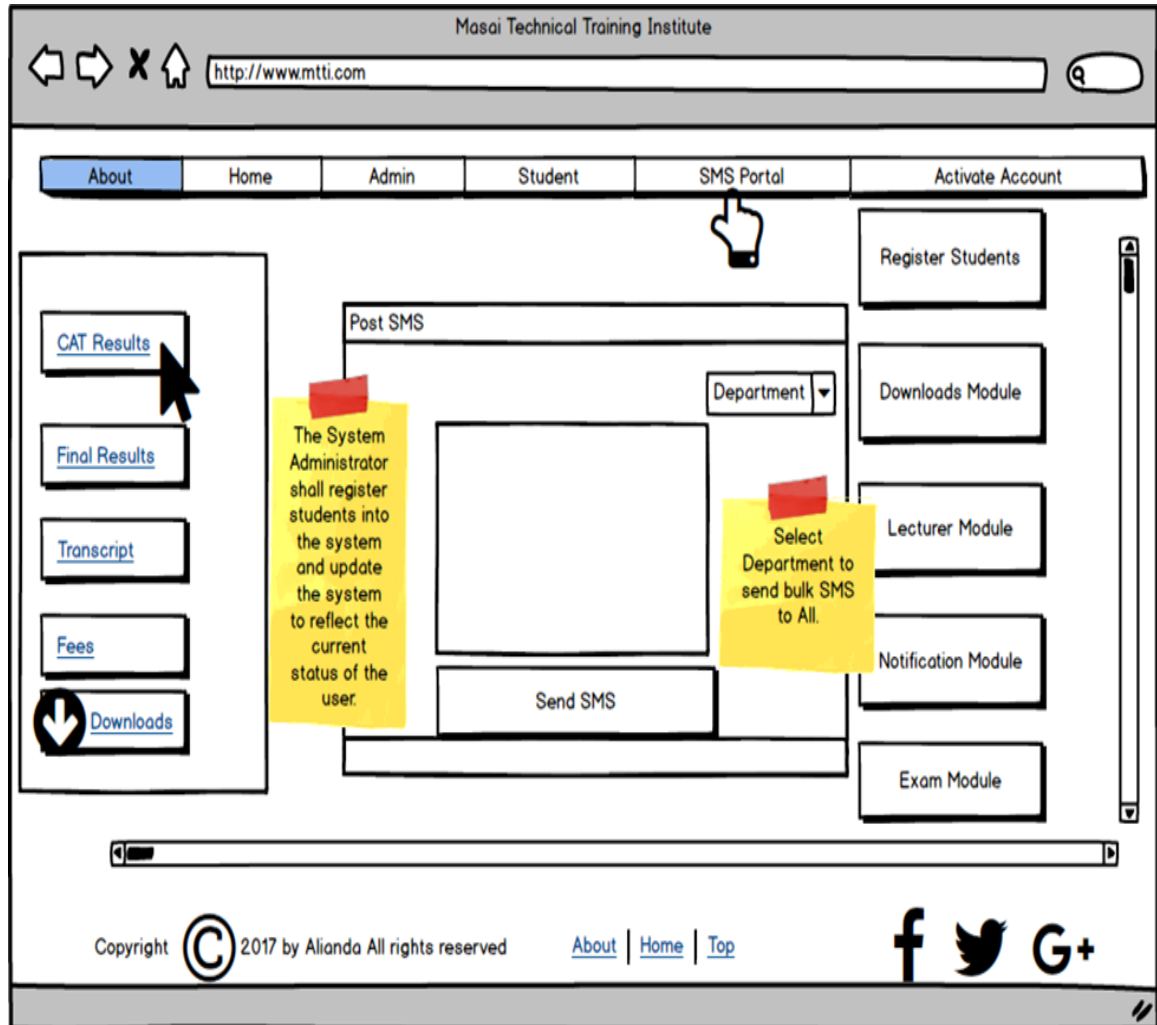


Figure 4.28: Send SMS Module

## 4.8 Conclusions

System design and architecture helped in understanding system requirements and the flow of the system. The system was divided in three layers of development, layer one logic design which was represented by the following diagrams; use case diagram, activity diagram, class diagram, collaboration diagram component diagram, and a deployment diagram. Layer two application design, the following tools were used; Balsamiq, Mockup flow, wireframe.cc, pencil and Mockplus. Finally the design of the database in which an ERD was used that allowed the extraction of a database schema and a hierarchical database schema.

## CHAPTER FIVE: SYSTEM IMPLEMENTATION AND TESTING

### 5.1 Introduction

This chapter explains the building process of the prototype, implementation and testing of the proposed application. In addition the major functionalities of the applications were implemented and tests carried on them. The system functional requirements were incorporated in the prototype functionalities and the system design adhered to the wireframes presented in the system design with some additional functionalities on the final system. The prototype building comprised of the front – end and backend systems that are all shown in this chapter and Appendix G and H.

### 5.2 Mobile Application Implementation

The Operating System for the mobile application implementation was Android. The source code was written in Java, utilising the knowledge acquired in Android classes. The application was compiled and tested using the Android Software Development Kit (SDK) Emulator and an Android device. The mobile application implementation is represented in Appendix G.

The application is optimised for Android Version 4.4.2 compatible with Android devices on minimum version 2.0 and maximum Version 4.4.4. JSON was used as the Web Service that provides the interface between the Android application and the database. Reasons for choosing Android as the client application include: flexible SDK, availability of Android Development Tools (ADT) and availability of abundant support from online developer communities (Boyer and Mew, 2016).

#### 5.2.1 Mobile Application Components

##### Launch Icon

The application was designed for Masai Technical Training Institution. The gist of the application was to disseminate information to students in Masai Technical. Once you install the application on your phone from play store, you can launch the application by tapping the icon as shown in Figure G-1, Appendix G.

##### Splash Screen

The splash screen appears for three seconds, during that time all the system components are loaded and configured ready for use (see Figure G-2, Appendix G).

## Dashboard

A dashboard is a user interface in which multiple activities reside (Faranello, 2012). Figure 5.1 shows the implementation of the proposed solution. The dashboard shall have four modules: student module, staff module, Kitchen and courses.



*Figure 5.1: Dashboard*

## Login

The login module shall be used to authenticate users before accessing the system from the dashboard (see Figure G-3, Appendix G).

## List of Services

The list of services will act as the interface to all the services offered in MTTI. The services that shall be displayed on the mobile phone include: results, Fee balance, kitchen services and downloads see Figure 5.2.

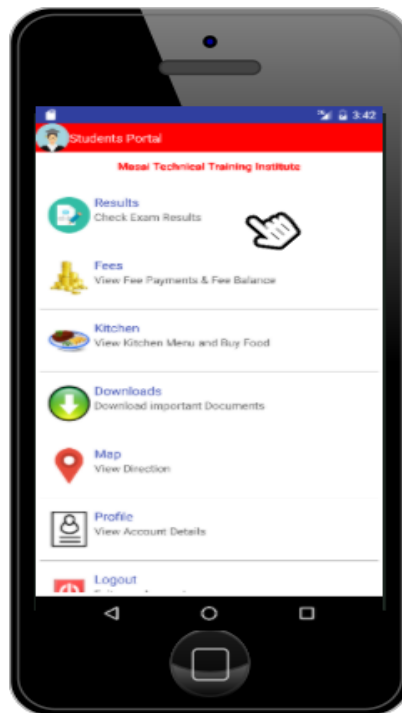


Figure 5.2: Dashboard

## Results

The results module shall display results to the student on the mobile phone as per his or her admission number see Figure 5.3.

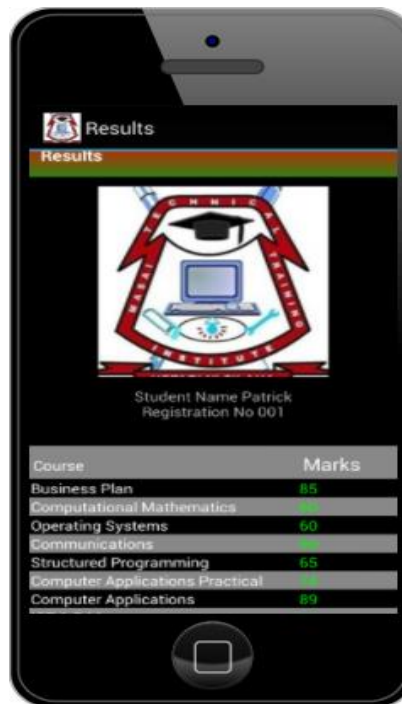
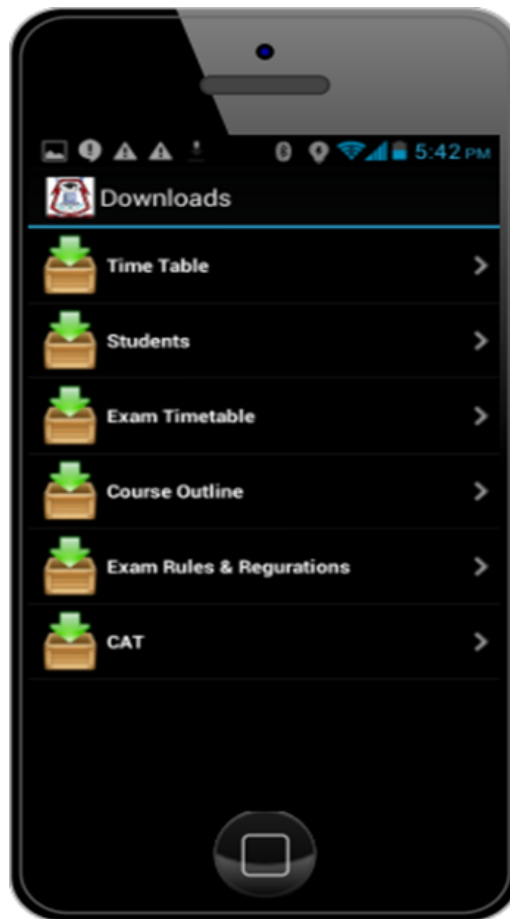


Figure 5.3: Results

## Downloads

The download module shall be used to access important downloads by use of the mobile phone. This downloads shall be uploaded by the system administrator see Figure 5.4.



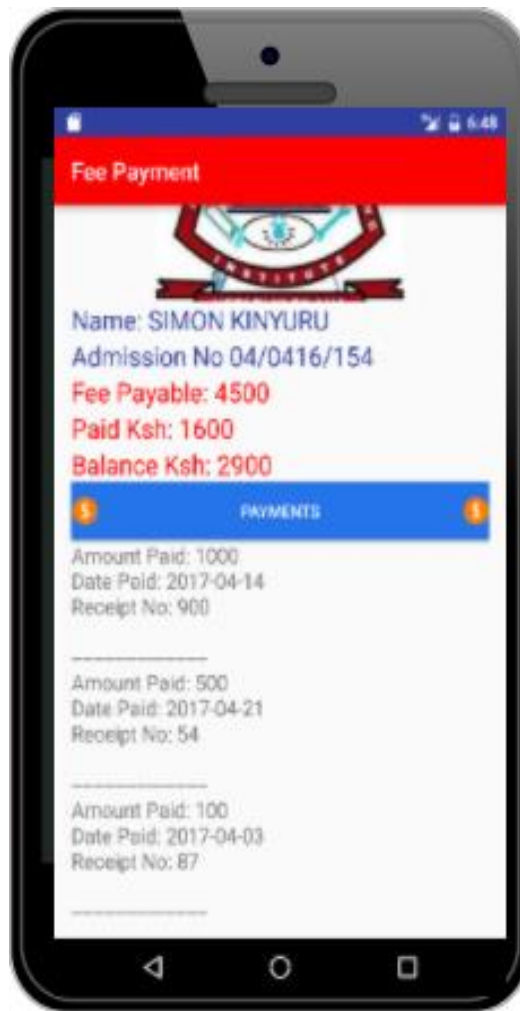
*Figure 5.4: Downloads*

## Departments

This module shall be used to show the departments in which the students belong for the purpose of calculating fee balance. This is because each course has different fee (see Figure G-4, Appendix G).

## Fee Payment

Fee Payment module shall display Fee balance to the student on the mobile phone as per his or her admission number see Figure 5.5 for clear representation.



*Figure 5.5: Fee Payment*

### **Kitchen Services**

This module shall be used to access services offered from the kitchen department. The administrator shall upload images of food items and prices for students to view and even buy see Figure 6.6 to Figure 5.11. Figure 5.11 which represents the staff module has four modules, but according to the scope of this solution in chapter one section 1.5 the main focus was on information disseminated to students.

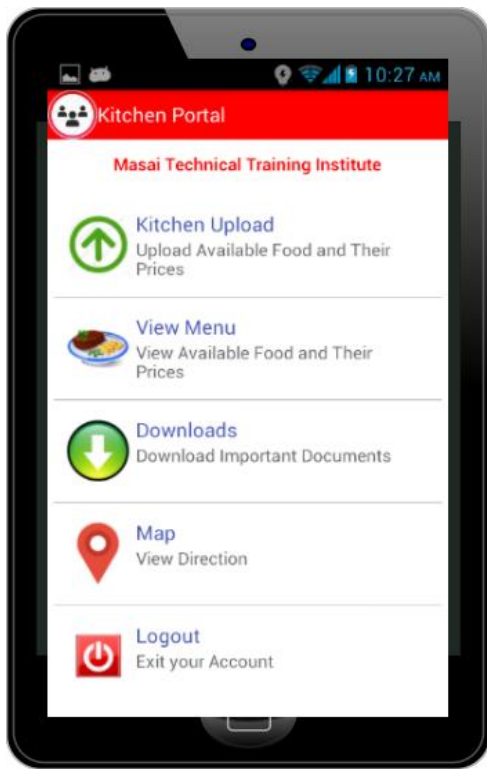


Figure 5.6: Kitchen Module

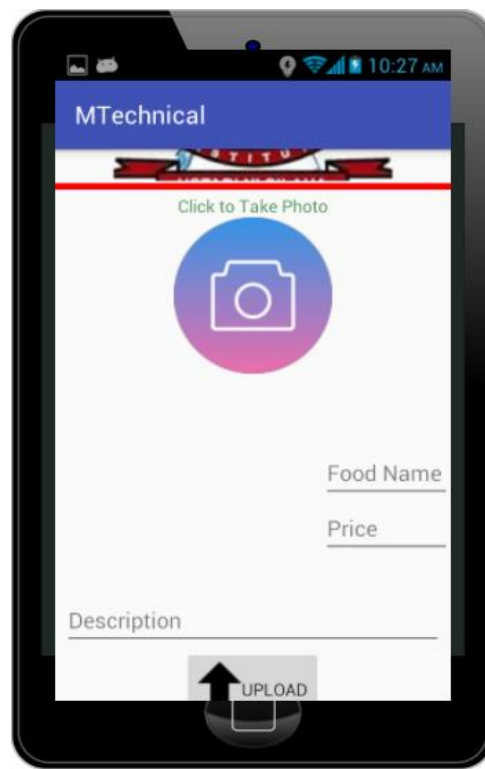


Figure 5.7: Upload Food Item

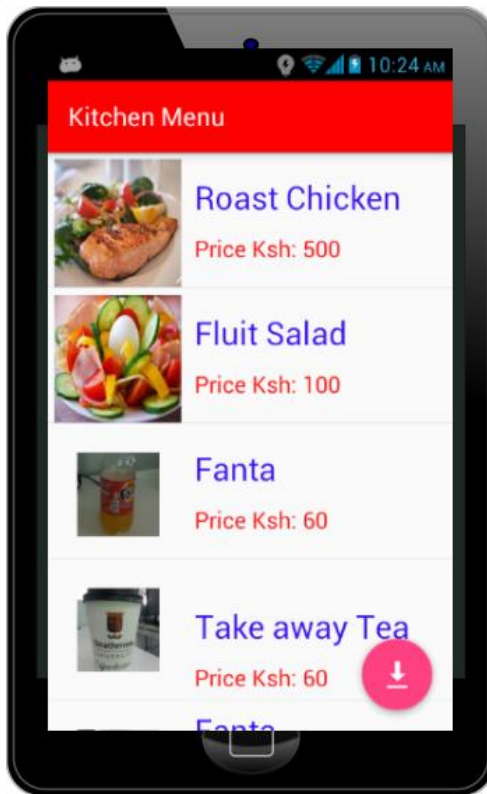


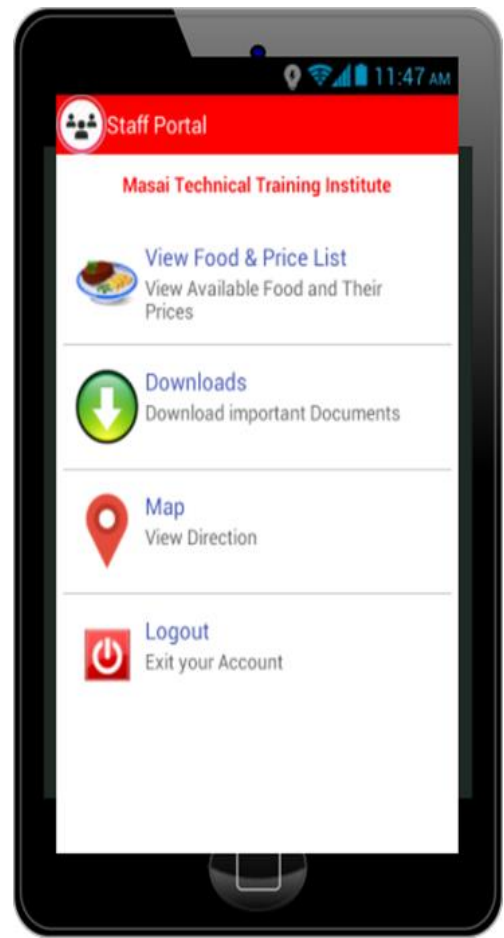
Figure 5.8: View Menu



Figure 5.9: Pay Food Item



*Figure 5.10: Confirm Payment*



*Figure 5.11: Staff Module*

### **View Food Items**

This module shall allow the staff to access view menu uploaded by the kitchen department. The interface is the same as shown on Figure 5.8.

### **Staff Downloads**

The download module shall be used to access important downloads by use of the mobile phone. This downloads shall be uploaded by the system administrator but very different from what the students download see Figure 5.12.

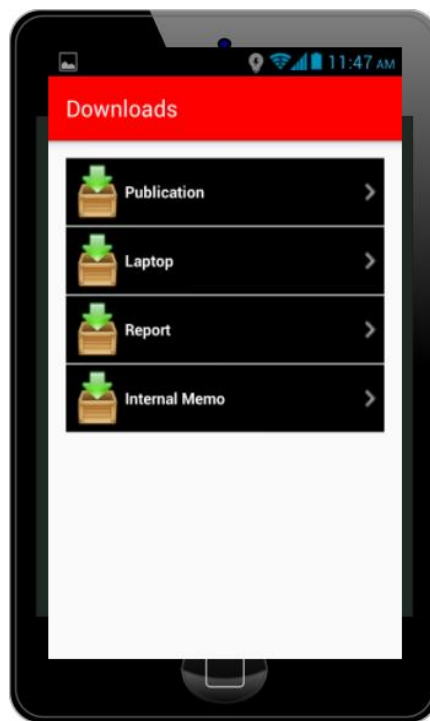


Figure 5.12: Staff Downloads

## Google Play Store

The client side system is a mobile application implemented in the Android platform. This mobile application can be found on the Android Play Store, titled “*MTechnical*”. The search result of this application is as shown in Figure 5.13.

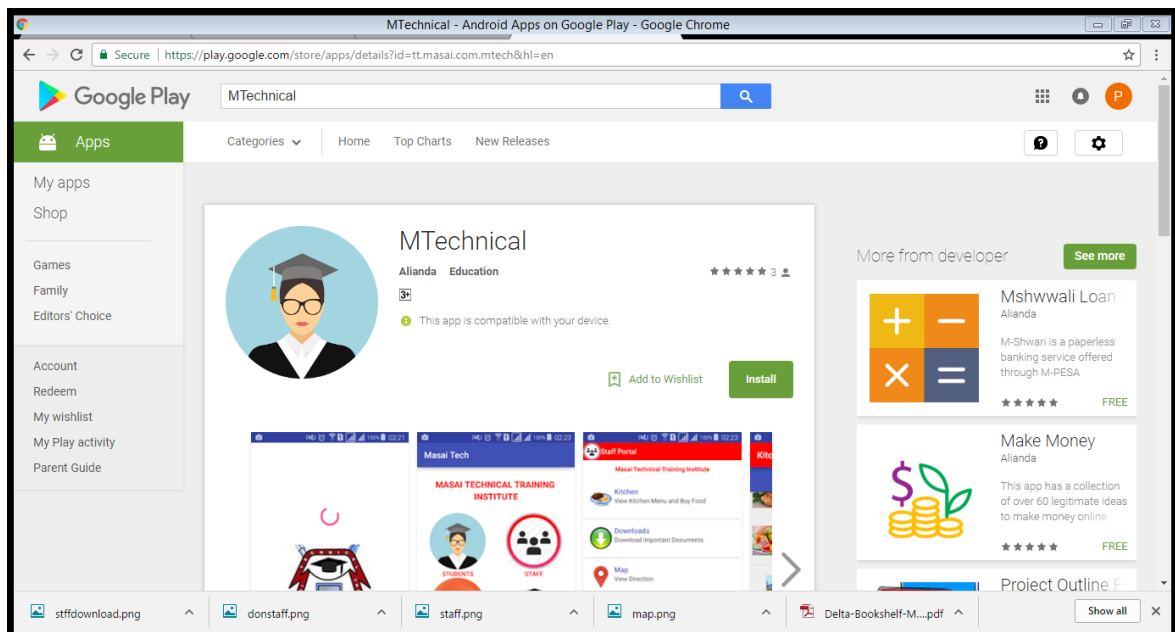


Figure 5.13: MTechnical

## 5.2.2 Web Application Components

The web based application was developed using Bootstrap because Bootstrap is the most popular HTML, CSS, and JS framework for developing responsive websites, it is an Open Source platform and supports all major web servers and databases (Moreto, 2016). This section and Appendix H contains illustrations of the web application components.

### Login

The login module shall be used to authenticate users before using the system (see Figure H-1, Appendix H).

### List of users

List of users as shown in Figure H-2, Appendix H, shows all the members logged into the system for the purpose of maintaining security.

### List of Courses

The list of courses as represented in Figure 5.14. This module shall be used to display all the courses offered in the institution as per the department selected.

Code	Subject	Marks	Remarks		
MECH-101	MATHEMATICS	15	Fail		
MECH-102	CERAMIC TECHNOLOGY	22	Fail		
MECH-103	ELECTRONIC ENGINEERING	23	Fail		
MECH-104	AUTOMOTIVE ENGINEERING	15	Fail		
MECH-105	COMPUTER STUDIES	23	Fail		
MECH-106	APPLIED STATISTICS	13	Fail		
MECH-107	HIGHWAY ENGINEERING	12	Fail		
MECH-108	COMMUNICATION SKILLS	23	Fail		

Figure 5.14: List of Courses

## Results

The results module shall display results to the student on the website as per his or her admission number see Figure 5.15.

Student_No	Name	Course	Action	Transcript
04/0415/002	Charles Mureithi	Computer Applications	<a href="#">CAT Result</a> <a href="#">Final Exam</a> <a href="#">Fee</a> <a href="#">View Transcript</a>	<a href="#">View Transcript</a>
04/0415/003	Sophie Gichuki	Computer Applications	<a href="#">CAT Result</a> <a href="#">Final Exam</a> <a href="#">Fee</a> <a href="#">View Transcript</a>	<a href="#">View Transcript</a>
04/0415/004	Reuben Maina	Computer Applications	<a href="#">CAT Result</a> <a href="#">Final Exam</a> <a href="#">Fee</a> <a href="#">View Transcript</a>	<a href="#">View Transcript</a>
04/0415/005	Jacinta Kirigo	Computer Applications	<a href="#">CAT Result</a> <a href="#">Final Exam</a> <a href="#">Fee</a> <a href="#">View Transcript</a>	<a href="#">View Transcript</a>
04/0415/006	Zipporah Karagu	Computer Applications	<a href="#">CAT Result</a> <a href="#">Final Exam</a> <a href="#">Fee</a> <a href="#">View Transcript</a>	<a href="#">View Transcript</a>
04/0415/010	Beth M	Computer Applications	<a href="#">CAT Result</a> <a href="#">Final Exam</a> <a href="#">Fee</a> <a href="#">View Transcript</a>	<a href="#">View Transcript</a>
04/0415/011	Hellen N	Computer Applications	<a href="#">CAT Result</a> <a href="#">Final Exam</a> <a href="#">Fee</a> <a href="#">View Transcript</a>	<a href="#">View Transcript</a>
04/0415/012	Leonard M	Computer Applications	<a href="#">CAT Result</a> <a href="#">Final Exam</a> <a href="#">Fee</a> <a href="#">View Transcript</a>	<a href="#">View Transcript</a>
04/0415/013	Beatrice Nyambura	Computer Applications	<a href="#">CAT Result</a> <a href="#">Final Exam</a> <a href="#">Fee</a> <a href="#">View Transcript</a>	<a href="#">View Transcript</a>
04/0415/014	John Njoroge	Computer Applications	<a href="#">CAT Result</a> <a href="#">Final Exam</a> <a href="#">Fee</a> <a href="#">View Transcript</a>	<a href="#">View Transcript</a>

Figure 5.15: Results

## Uploads

This module shall be used by the Administrator to upload attachment that shall be downloaded by the students see Figure 5.16.

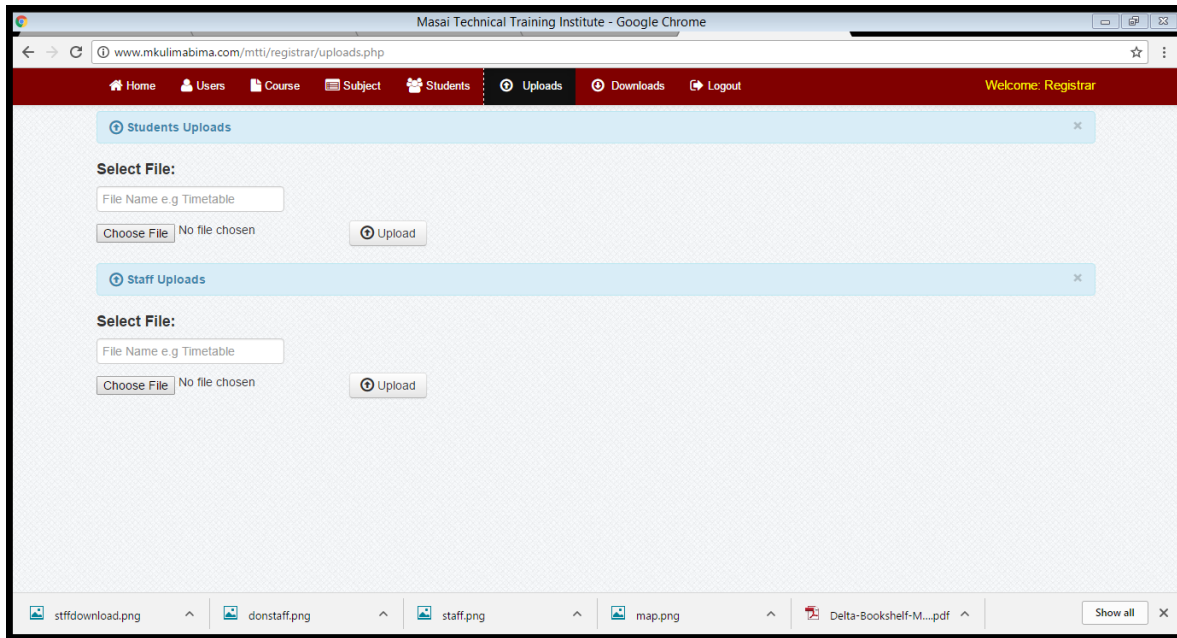


Figure 5.16: Uploads

## Downloads

This module shall be used by students to download attachments by use of the website see Figure 6.17.

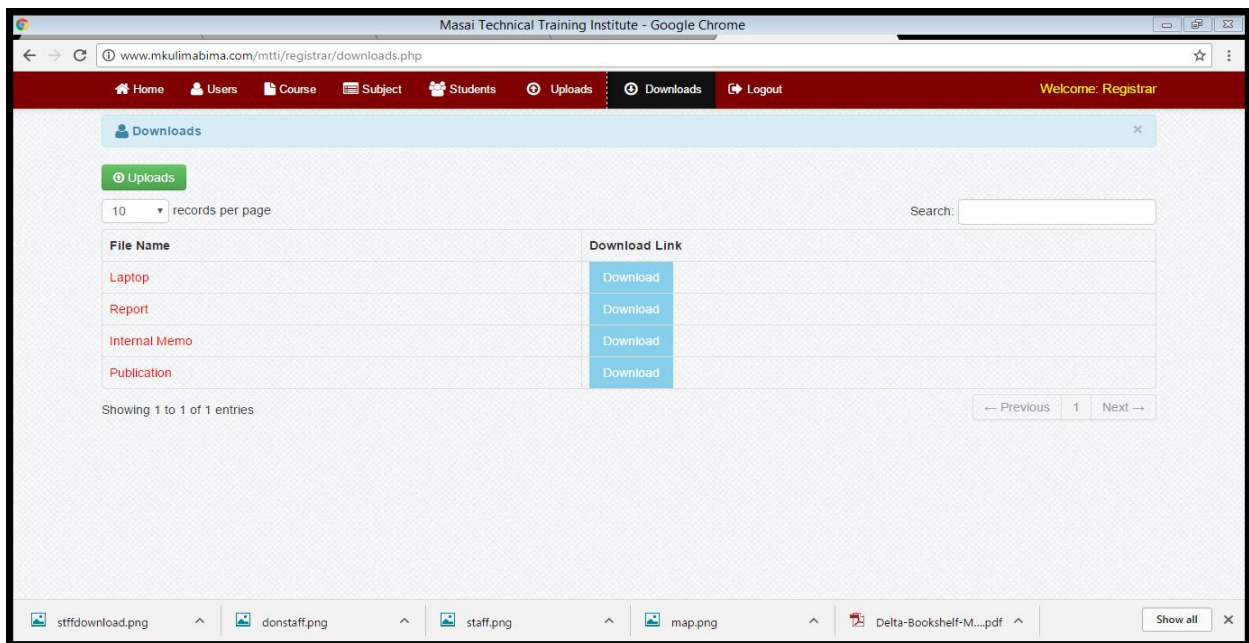


Figure 5.17: Downloads

## Fee Payment

Fee Payment module shall display Fee balance to the student on the website as per his or her admission number Figure 5.18.

STUDENT NUMBER: mc45    STUDENT NAME: john paul    COURSE: Mechanical

### FEE PAYMENTS

**Fee Payable Ksh 50000**

+ Record Fee Payment    10 records per page    Search:     Print Statement

Tr ID	Date Paid	Amount Paid	Reference No.	Cheque No	Payment Mode	Receipt No	Comments	Action
19	2017-04-26	10000	678	N/A	Bank Deposit	7		

**Balance 40000**

Showing 1 to 1 of 1 entries    ← Previous 1 Next →

**Total Amount Paid Ksh 10000**

Figure 5.18 Fee Payment

## Academic Transcript

Students shall access Academic Transcript using the Website or Mobile Application see Figure 5.19.

Masai Technical Training Institute - Google Chrome

www.mkulimabima.com/mti/registrar/transcript.php?id=318

Home Users Courses Subjects Students Uploads Downloads Logout    Welcome: Registrar

**Masai Technical Training Institute**  
Committed to Providing Flexible Quality Business and Engineering Courses

ADMISSION NUMBER: 5003    STUDENT NAME: Peter Deng    COURSE: MECHANICAL ENGINEERING    MODULE: Module 1

### Masai Technical Training Institute Academic Transcript

Print Transcript    10 records per page    Search:

Code	Subject	Marks	Remarks
MECH-101	MATHEMATICS	30	Fail
MECH-102	CERAMIC TECHNOLOGY	55	Pass
MECH-103	ELECTRONIC ENGINEERING	45	Pass
MECH-104	AUTOMOTIVE ENGINEERING	49	Pass

stffdownload.png    donstaff.png    staff.png    map.png    Delta-Bookshelf-M....pdf    Show all

Figure 5.19 View Academic Transcript

## Print Transcript

Students shall print a Provisional Transcript from the website see Figure 5.20.

The screenshot shows a Google Chrome browser window with the URL [www.mkulimabima.com/mtti/registrar/transcript.php?id=318](http://www.mkulimabima.com/mtti/registrar/transcript.php?id=318). A print dialog is open on the left side of the browser window. The print settings are as follows:

- Print: Total: 1 sheet of paper. Buttons: Print, Cancel.
- Destination: HP Deskjet 2050 J510 se... Change...
- Pages: All (selected). Input field: e.g. 1-5, 8, 11-13.
- Copies: 1.
- Layout: Portrait.
- Color: Color.
- More settings: + More settings.
- Print using system dialog... (Ctrl+Shift+P).

The main content of the page is an academic transcript for Masai Technical Training Institute. The transcript includes the following information:

ADMISSION NUMBER: 5003  
STUDENT NAME: PETER DENG  
COURSE: MECHANICAL ENGINEERING  
MODULE: MODULE 1

**Masai Technical Training Institute**  
**Academic Transcript**

Code	Subject	Marks	Remarks
MECH-101	MATHEMATICS	30	FAIL
MECH-102	CERAMIC TECHNOLOGY	55	PASS
MECH-103	ELECTRONIC ENGINEERING	45	PASS
MECH-104	AUTOMOTIVE ENGINEERING	49	PASS
MECH-105	COMPUTER STUDIES	46	PASS
MECH-106	APPLIED STATISTICS	58	PASS
MECH-107	HIGHWAY ENGINEERING	42	PASS
MECH-108	COMMUNICATION SKILLS	63	PASS

Masai TTI  
P.O. Box 125  
Kajiado

stffdownload.png ^ donstaff.png ^ staff.png ^ map.png ^ Delta-Bookshelf-M...pdf ^ Show all X

Figure 5.20: Print Academic Transcript

### 5.2.3 SMS Application

The Administrator shall add or delete students, Lecturers and Support staff. As shown in Figure M-1 and M-2 in Appendix M. The administrators shall select a department and send Bulk SMS.

Admission No	First Name	Last Name	Phone Number	Department	Action
3790	KEZIAH	NJAMBI	0712858237	Business	
3983	NANCY	MWANGI	0702505064	Business	
4047	George	Muigai	0719880154	Mechanical	
4071	MOSES	KARANJA	0708749346	Building & Construction	
4090	JOHN	RIMI	0723883209	Building & Construction	
4105	DENNIS	LANGAT	0713742122	Building & Construction	
4121	Virginia	Njoki	0717321626	Catering	
4156	NICHOLAS	OLOIPTIP	0714275517	Business	

Figure 5.21: Select Category

Send SMS to Students

[← Back](#)

Please Type your Message and Select Department

Department:

Message:

100 characters remaining

Figure 5.22: Send SMS

### 5.3 Testing

This section describes the tests performed on both the mobile and web application. The applications was tested against functional and non-functional requirements. During testing the mobile and web applications were handled as one system because none of them work in isolation. A Test Schedule was designed to be able to act as a guide and Test Cases were designed to illustrate the testing process (Wesley, 2015).

#### 5.3.1 Test Schedule

Greg and Joel, (2015) defined a test schedule as a document that provides a summary of the schedule or event, specifying key test milestones, and/or provide a link to the detailed schedule (Greg and Joel, 2015). Table 6.1 shows the test schedule used during testing process.

Table 5.1: Test Schedule

<b>Test Phase / Milestones</b>	<b>Start Date/Time End Date/Time.</b>	<b>Notes</b>	<b>Deliverables / Roles</b>
Test Plan Creation	1 Day 20 <sup>th</sup> March 2017: 20 <sup>th</sup> March 2017.	At this Milestone, the high level planning should be completed. Some of the deliverables were: Test schedule and Test cases.	High-level test planning activities, which include preliminary development of Test schedule.
Installation Testing	1 Hour 21 <sup>st</sup> March 2017: 21 <sup>st</sup> March 2017.	At this milestone the prototype was to be downloaded and installed.	Installed application by participants and Test team.
Security Testing	2 Hours 21 <sup>st</sup> March 2017: 21 <sup>st</sup> March 2017.	At this milestone brute force was to be used to test the prototype.	Failed login and wrong credential information done by participants and Test team.
Functional Testing	2 Hours 21 <sup>st</sup> March 2017: 21 <sup>st</sup> March 2017.	At this milestone different modules were to be tested independently.	Functioning modules.

Compatibility Testing	2 Hours 21 <sup>st</sup> March 2017: 21 <sup>st</sup> March 2017.	At this milestone the application was to be installed in different Android phone versions.	Installed application.
Un installation Testing	30 Minutes 21 <sup>st</sup> March 2017: 21 <sup>st</sup> March 2017.	At this mile stone the application was to be uninstalled.	Uninstalled application.

### 5.3.2 Developer Testing

#### Installation Testing

As represented in Table 6.2 installation testing was performed. It was performed to verify that the application was downloadable, installable and uninstallable.

Table 5.2: Test Plan for Installation Testing

TEST CASE			
<b>Test Case #:1</b>		<b>Test Case 1:</b> Install and Uninstall	
<b>System:</b> MTTI		<b>Subsystem:</b> Install	
<b>Designed by:</b> Alianda		<b>Designed Date:</b> 1/4/2017	
<b>Executed by:</b>		<b>Execution Date:</b>	
<b>Short Description</b>			
During the JAD session, the participants were requested to download the application from Play store and install in their mobile phones.			
List of participants Attached in Appendix B.			
<b>Preconditions</b>			
<ol style="list-style-type: none"> <li>1. The user has an Android phone.</li> <li>2. The user has internet connectivity.</li> </ol>			
Test Plan			
Step No:	Description of Step / Test Data	Result Expected	Obtained Result

1.	- Access the application from Google Play store and install in your phone.	- Installed application.	- SUCCESS.
2.	- Uninstall the application.	- Uninstallation Successful.	
<b>Post condition</b>			
1. The application was installed successfully and it was visible on play store.			
<b>Defects Obtained</b>			
<b>Defects</b>	None.		
Remedies to be carried out: Not Applicable.			

### Security Testing

Security testing was performed as shown in Table 6.3. It was performed to verify if the software was secure (Sandler, Badgett and Myers, 2013).

Table 5.3: Test Plan for Security Testing

TEST CASE			
<b>Test Case #:</b> 2		<b>Test Case 1:</b> Participants to login with wrong credentials.	
<b>System:</b> MTTI		<b>Subsystem:</b> Password	
<b>Designed by:</b> Alianda		<b>Designed Date:</b> 1/4/2017	
<b>Executed by:</b>		<b>Execution Date:</b>	
<b>Short Description</b>			
During the JAD session, the participants were requested to use wrong username and password to access the system. The technique used was brute force attack.			
List of participants Attached in Appendix B.			
<b>Precondition</b>			
1. The user has no valid password and user name.			
2. The system displays the authentication interface.			
Step No:	Description of Step/ Test Data	Result Expected	Obtained Result
1.	- Access the application.	- Wrong Credentials.	- SUCCESS.

2.	- Type wrong username and password.	- No access to the system.	
<b>Post condition</b>			
1. The system was not accessible without correct user credentials.			
<b>Defects Obtained</b>			
<b>Defect</b>	None.		
Remedies to be carried out: Not Applicable.			

### Functional Testing

This was used to find out if all modules were all working as per the functional requirements of the user (Sandler, Badgett and Myers, 2013). Table 6.4 shows how functional testing was performed.

Table 5.4: Test Plan for Functional Testing

<b>TEST CASE</b>			
<b>Test Case #:</b> 3	<b>Test Case 1:</b> Access Academic results		
<b>System:</b> MTTI	<b>Subsystem:</b> Navigability		
<b>Designed by:</b> Alianda	<b>Designed Date:</b> 1/4/2017		
<b>Executed by:</b>	<b>Execution Date:</b>		
<b>Short Description</b>			
During the JAD session, the participants were requested to access use all the modules.			
List of participants Attached in Appendix B.			
<b>Precondition</b>			
1. The user has an installed application.			
2. The user has access to the website.			
3. Internet is available.			
4. All modules are available for use.			
<b>Step No:</b>	<b>Description of Step/ Test Data</b>	<b>Result Expected</b>	<b>Obtained Result</b>

1.	<ul style="list-style-type: none"> <li>- Login to the application.</li> <li>- Select any module in the system.</li> <li>- Note any difficulty.</li> </ul>	<ul style="list-style-type: none"> <li>- Participants to use all the modules results.</li> </ul>	<ul style="list-style-type: none"> <li>- SUCCESS.</li> </ul>
<b>Post condition</b>			
1. The user was able to navigate through the system without any challenges and assistance all the modules were working correctly.			
<b>Defects Obtained</b>			
<b>Defect</b>	<b>None.</b>		
Remedies to be carried out: Not Applicable.			

### Compatibility Testing

Compatibility test was done (see Table 5.5) to ensure that the mobile and web application was compatible capable of running on different hardware, operating systems, applications or network environments.

Table 5.5: Test Plan for Compatibility Testing

TEST CASE			
<b>Test Case #:</b> 4		<b>Test Case 1:</b> Different platforms	
<b>System:</b> MTTI		<b>Subsystem:</b> Platforms	
<b>Designed by:</b> Alianda		<b>Designed Date:</b> 1/4/2017	
<b>Executed by:</b>		<b>Execution Date:</b>	
<b>Short Description</b>			
During the JAD session, the participants were requested to download and install the application in Android versions and the back end was accessed from different browsers.			
<b>Precondition</b>			
1. The user has internet.			
2. The user has different Android versions and web browsers.			
Step No:	Description of Step	Result Expected	Obtained Result
1.	<ul style="list-style-type: none"> <li>- Install the application in the following platforms: <ul style="list-style-type: none"> <li>▪ Android 10 (2.3.3)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- Installation of the application.</li> </ul>	<ul style="list-style-type: none"> <li>- SUCCESS</li> </ul>

	<ul style="list-style-type: none"> <li>▪ Android 11 (3.0)</li> <li>▪ Android 12 (3.1)</li> <li>▪ Android 13 (3.2)</li> <li>▪ Android 14 (3.3)</li> </ul> <p>- Access the application on commonly used browsers.</p> <ul style="list-style-type: none"> <li>▪ Internet Explorer</li> <li>▪ Mozilla</li> <li>▪ Chrome</li> </ul>		
<p><b>Post condition</b></p> <p>1. The application was able to be used on different smartphones platforms.</p>			
<b>Defect</b>	None.		
Remedies to be carried out: Not Applicable.			

### Integration Testing

There are three primary sub systems in the proposed prototype: the Android sub system, database sub system and SMS sub system. All the three modules were tested as shown in Table 5.6.

Table 5.6: Test Plan for Integration Testing

TEST CASE			
<b>Test Case #:</b> 5	<b>Test Case Name:</b> SMS, Android and Web Application use.		
<b>System:</b> MTTI	<b>Subsystem:</b> System testing		
<b>Designed by:</b> Alianda	<b>Designed Date:</b> 1/4/2017		
<b>Executed by:</b>	<b>Execution Date:</b>		
<b>Short Description</b>			
During the JAD session, the participants were requested to find out if the system was able to disseminate or receive information from all the three modules.			
List of participants Attached in Appendix B.			
<b>Precondition</b>			
<ol style="list-style-type: none"> <li>1. The user has internet connectivity.</li> <li>2. The user has an Android phone.</li> </ol>			
<b>Step No:</b>	<b>Description of Step / Test Data</b>	<b>Result Expected</b>	<b>Obtained Result</b>

1.	The user accesses downloads	GUI layout navigability.	- SUCCESS.
2.	The user receives notifications from both the phone and web.	Notifications dispatched	
<b>Post condition</b>			
1. The Web, Android and SMS modules were integrated.			
<b>Defect</b>	None.		
Remedies to be carried out: Not Applicable.			

### Stress Testing

Stress testing (sometimes called torture testing) was performed as shown in Table 5.7 to determine the stability of a given system or entity. It involved testing beyond normal operational capacity, often to a breaking point, in order to observe the results (Nielsen and Weise, 2012).

Table 5.7: Test Plan for Stress Testing

TEST CASE			
<b>Test Case #:</b> 6	<b>Test Case Name:</b> All Participants to access results at once		
<b>System:</b> MTTI	<b>Subsystem:</b> Results		
<b>Designed by:</b> Alianda	<b>Designed Date:</b> 1/4/2017		
<b>Executed by:</b>	<b>Execution Date:</b>		
<b>Short Description</b>			
During the JAD session, the participants were requested to access academic results all of them at once.			
List of participants Attached in Appendix B.			
<b>Precondition</b>			
1. The user has internet connectivity.			
2. The user has an Android phone.			
Step No:	Description of Step / Test Data	Result Expected	Obtained Result
1.	- All participants access results at once.	- Display results. - The system should work in a normal way.	- SUCCESS.

<b>Post condition</b>	
1. The results were displayed without any delay.	
<b>Defect</b>	None.
Remedies to be carried out: Not Applicable.	

**5.4 User Testing**

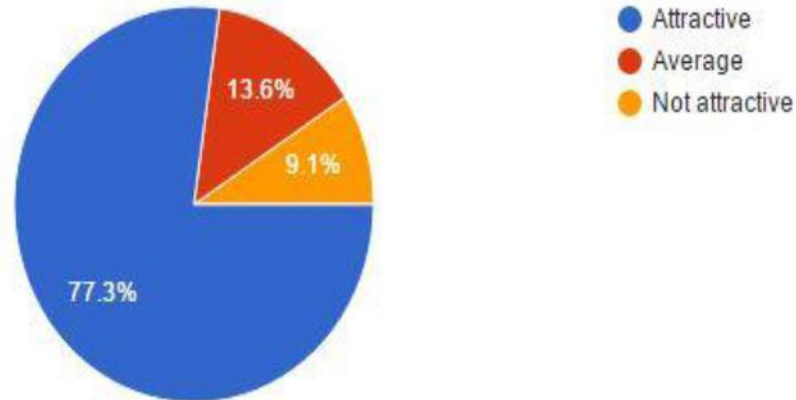
The end users of the application (target populations who are also) were directly involved in usability testing. A total of 18 respondents carried out the user testing and provided appropriate feedback which was used to refine the prototype until a satisfactory application was developed. 18 respondents participated in the user testing because they were the only ones who were available in the institution while user testing was being carried out. User testing was done to achieve the following objectives:

- User friendliness
- Functionality
- Aesthetics
- Acceptance

Appendix F provides the user-testing questionnaire. Charts were used to represent user responses.

**5.4.1 User Interface Aesthetics**

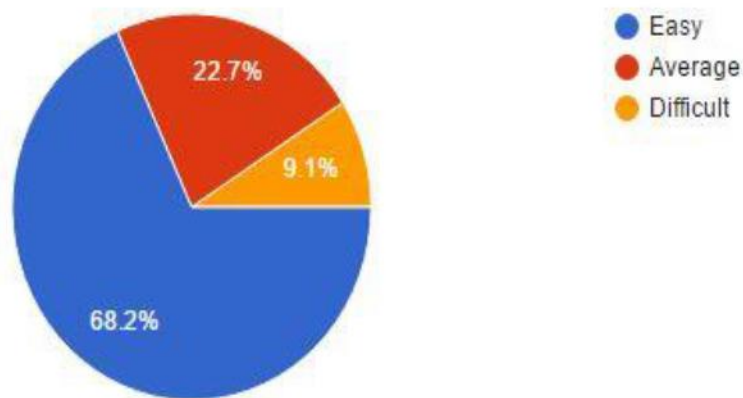
The application appearance including the look and feel was tested by the end users. 77.3% of the respondents indicated that the application was attractive, 13.6% indicated that the application was fairly attractive while the remaining 9.1% of the respondents indicated that the application was not attractive at all. A summary of the results is shown in Figure 5.24



*Figure 5.23 UI Aesthetic Feedback*

#### **5.4.2 User Interface Friendliness**

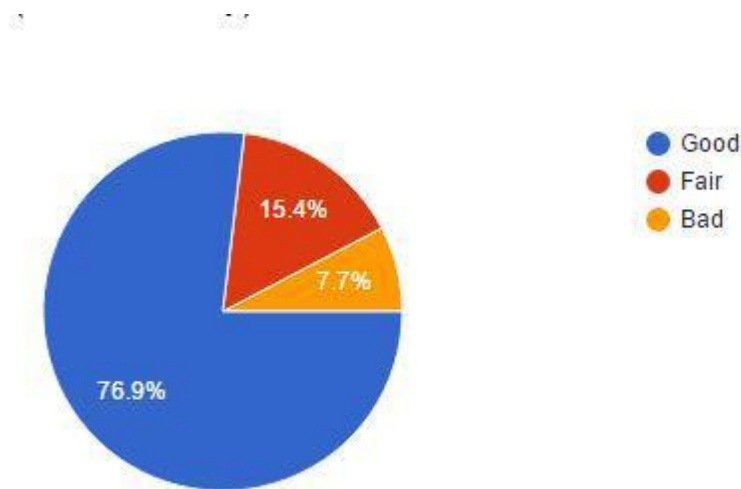
The ease of learning and using the application was tested by students' users. 68.2% of the students' indicated that the application was easy to learn and use, they 96 managed to use the application without prior training. 22.7% indicated that the application was average meaning it was neither hard nor easy to learn or use, they needed the intervention of a trainer in some cases to confirm that what they were doing was right. The remaining 9.1% indicated that the application was difficult to use. Figure 5.24 shows a summary of the results.



*Figure 5.24 User Friendliness Feedback*

### 5.4.3 Functionality

The end users of the application tested the system functionality against the user specifications. 76% of them indicated that the application's functionality was good meaning that the developer achieved most of the user functionality and requirements specification, 15.4 % indicated that the application's functionality was fair meaning that some of the user specifications were not entirely meet, and the remaining 7.7% indicated that the application functionality did not meet the intended purpose of the application. This result was used to refine the prototype until an acceptable application was developed. A summary of the results is shown in Figure 5.25.



*Figure 5.25 Test Results on Functionality of the Mobile Application*

### 5.4.4 Acceptability

To measure if the application was great success user acceptance was tested. 78.6% of the students' readily accepted the application for use in dissemination of information, 14.3% were undecided while the remaining 7.1% rejected the application. Since majority of the users readily accepted the application this test was a great success. Figure 5.26 provides a summary of these results.

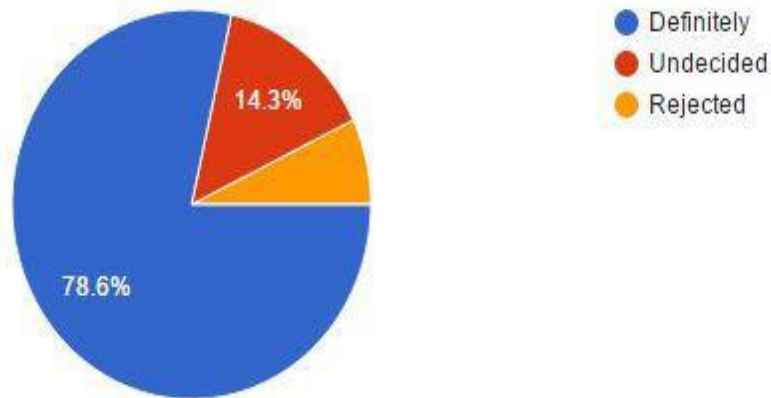


Figure 5.26 Acceptability Feedback

#### 5.4.5 Validation

Validation was done in order to ascertain whether the implementation addressed the challenges that were raised as far as information dissemination is concerned in Technical Institutions. An online questionnaire (In Appendix G) was designed and sent to end users to test the applicability of the developed mobile application for information dissemination in TTIs'. 33.3% of the respondents were students in Masai Technical Training who will be the core users of the application, 16.7% were lecturers in Masai Technical, and 16.7% were Academic registrar staff members are in charge of the system and finally 16.7% were heads of departments in Masai Technical. This is shown in Figure 5.27

Which category best describes you?

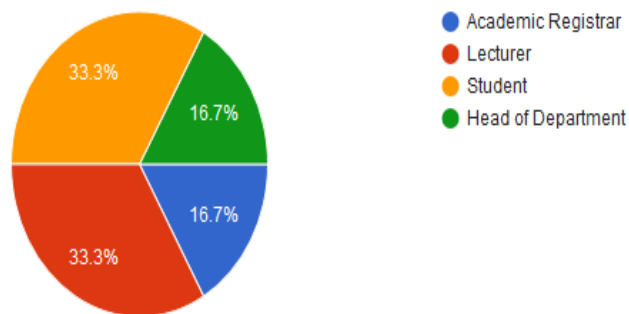


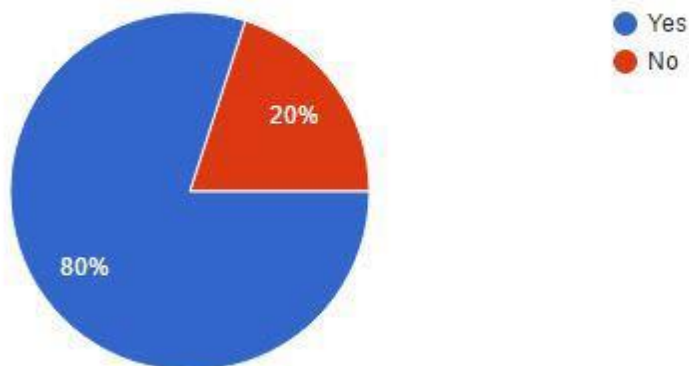
Figure 5.27category of respondents

All the respondents who participated in the validation testing also participated in survey to collect user requirements and the usability test of the mobile application as shown in Figure 5.27. The respondents were asked to state whether they participated in the above mentioned survey and tests.

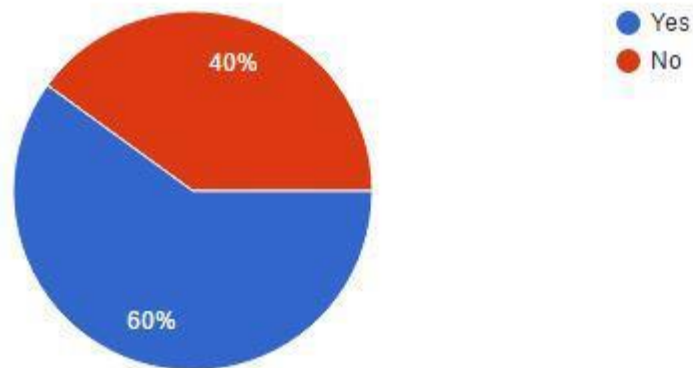


*Figure 5.28 Respondents' Participation in User Requirements Survey and Usability Testing*

The respondents were asked to indicate if the functionalities provided by the mobile application fully solves the problems posed by the current system. 80% of the respondents indicated that the functionalities provided by the mobile application fully solves the problems that are currently posed by the current systems for information dissemination while the other 20% stated that it partially solves the challenges. This is shown in Figure 5.28.

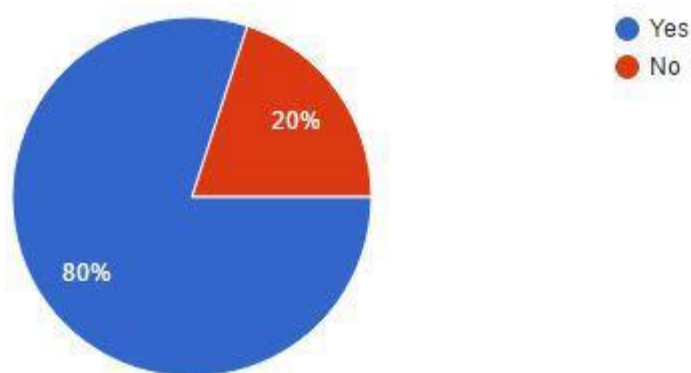


*Figure 5.29 Respondents Take on Whether the Mobile Application Solves the Challenges Faced in Dissemination of Information*



*Figure 5.30 User Satisfaction on the Functionalities of the Mobile Application*

Finally, the respondents were asked if they would recommend the mobile application to be adopted by all Technical Institutions in Kenya as an application solution to current challenges encountered in dissemination of information in Technical Institutions, and 80% of them indicated their confidence in the applicability of the mobile application in dissemination of information and recommended that the application should be adopted by all Technical Institutions in Kenya as a solution to solve the current problems faced by the students in Technical Institutions in Kenya.



*Figure 5.31 Respondents Recommendation on Adoption of the Mobile Application for Information Dissemination in Technical Training Institutions in Kenya*

## **5.5 Conclusions**

The system requirements formulated in the requirements gathering and analysis stage provided fundamental information that was used in system implementation. The system design provided details of how the system was implemented. The research objectives and questions were also put into consideration to ensure that the system was implemented to achieve user requirements provided by potential users. The overall development and implementation was done in adherence to the proposed objectives.

## **CHAPTER SIX: DISCUSSIONS**

### **6.1 Introduction**

The purpose of the research was to identify the information needs of students in Technical Training Institutions in Kenya, to review the existing tools and methods that have been used to disseminate information in Technical Training Institutions, to design, develop and test a solution that addresses the failures of the current solutions for information dissemination in Technical Training Institutions and to Validate the developed solution. This was in order to identify and develop a suitable solution that shall be adopted to address the current challenges facing Technical Institutions in Kenya. The research findings helped identify the appropriate technique that was adopted which was a Mobile, SMS and a Web application.

### **6.2 Literature Review in Relation to the Research Topic**

A review of the literature indicated that the techniques used to disseminate information in Technical Institutions include Noticeboard, Class Representatives, Heads of Departments and Friday Parade which were found to be very ineffective, time consuming and expensive. The following methods of disseminating information using mobile phones were reviewed. A podcast and a VCAST which are mainly used in entertainment Watt (2016) and cannot be used to disseminate academic information; Custom applications, website and SMS dissemination techniques were also reviewed and found to be the most appropriate tools to use to disseminate information.

The literature also covered Technical Training Institutions outside Kenya where students were asked on how they would like the school to communicate with them about their fee balance and academic results. The College of the Sequoias, where it was discovered that slightly over 60% of students preferred to communicate using SMS texting, almost 40% used the telephone, almost 30% used email, and about 10% preferred social networking. In Ohio Technical College, Mobile phone application were selected by 82% followed by the website at 17.8% and finally in Karnataka German Technical Training Institute brochures, website and a mobile application Karnataka were selected as the tools for information dissemination.

Related mobile applications were also reviewed and limitations noted down by the researcher. The researcher downloaded the following mobile applications with a view of finding out the applications were able to solve the challenges of information dissemination in Technical Training Institutions: myStrath (see Figure D-1, Appendix D), Kakatiya University (see Figure D-2, Appendix D), MIT

Mobile (see Figure D-3, Appendix D), Harvard University mobile (see Figure D-4, Appendix D). These university applications were downloaded from Google Play store. In general the applications were found to be using existing management information systems or websites as the back end. Many Technical Institutions in Kenya lack financial capacity to buy expensive management information systems as discussed in section 2.3.6.

From the literature the mobile application was the most appropriate technology for disseminating information since it was highlighted as being fast and very efficient form of disseminating information to students in Technical Institutions. Use of a mobile application was because of the features inbuilt and the availability of smartphones. The reviewed literature enabled the researcher to develop a heterogeneous solution which included SMS, Website and an Android Application for information dissemination for Technical Institutions in Kenya. The success of the system in Masai Technical Training Institution (MTTI) was to allow for smooth adaptation of the system to all TTI's in Kenya.

### **6.2.1 Review of Research Questions in Relation to the Mobile Application**

This section looks at how the research questions were met in this study in relation to Information Dissemination Framework for Technical Institutions in Kenya. This study identifies existing methods of information dissemination and their short comings and provides a framework for disseminating information to Technical Training Institutions (TTI) in Kenya. The research questions acted as a guideline in development process.

#### **Research Question 1**

When asked to state the information needs of students in Technical Training Institutions. This research question was achieved through the following use of an online questionnaire. The first research question was sub divided into four. The participants were asked about timely Information in an Institution and 77.8% responded by acknowledging that it was very important to get information on time and only 22.2% thought otherwise. The second participants were asked to state the type of information that they accessed frequently and 33.3% responded by selecting academic results, 7.4% counseling, 29.6% Latest notifications, 25.9% important downloads. The participants again were asked to state how frequently they accessed information, 70.4% of the respondents were in agreement that they needed information all the time. Lastly the participants were asked to state if they were happy with the current information dissemination techniques, 74.1% of the participants responded were not satisfied by the current techniques of disseminating information.

## **Research Question 2**

The second research question was about the existing tools and methods that have been used to disseminate information in Technical Training Institutions. This information was useful as it enabled the researcher to gain an understanding of the techniques used and identify the strengths and weaknesses of each technique hence choosing the best technique to be adopted. This research question was achieved by the review of literature based on the current techniques for information dissemination used globally. The best technology available was the use of use of a mobile application and responsive website.

## **Research Question 3**

The third research question was about finding out how the proposed system shall be designed, developed and tested. This research question was answered through us of OOAD techniques. For the design of the proposed application the following UML tools were used: Use case diagram, Activity Diagram, Class diagram, collaboration diagram, component diagram and a deployment diagram. The database was designed using the following tools an Entity relationship diagram, which resulted in the design of the database schema. The mobile application was developed for the Android platform while the web application and SMS application were developed using the Bootstrap. The following tests were carried out; installation testing, where the user was supposed to download and install the application; integration testing, where different modules were tested, security testing, where the user was told to login with wrong credentials; functional testing, where each module was tested independently; compatibility testing where the mobile application was tested against different Android versions and the web application was tested against different web browsers and finally usability testing where the aesthetics, user friendliness, application functionality and user acceptance were tested.

## **Research Question 4**

Validation was done in order to ascertain whether the implementation addressed the challenges that were raised as far as information dissemination is concerned in Technical Institutions. An online questionnaire was designed and sent to end users to test the applicability of the developed mobile application for information dissemination in TTIs'. 33.3% of the respondents were students in Masai Technical Training who will be the core users of the application, 16.7% were lecturers in Masai

Technical, and 16.7% were Academic registrar staff members are in charge of the system and finally 16.7% were heads of departments in Masai Technical.

The respondents were asked to indicate if the functionalities provided by the mobile application fully solves the problems posed by the current system. 80% of the respondents indicated that the functionalities provided by the mobile application fully solves the problems that are currently posed by the current systems for information dissemination while the other 20% stated that it partially solves the challenges.

Finally, the respondents were asked if they would recommend the mobile application to be adopted by all Technical Institutions in Kenya as an application solution to current challenges encountered in dissemination of information in Technical Institutions, and 80% of them indicated their confidence in the applicability of the mobile application in dissemination of information and recommended that the application should be adopted by all Technical Institutions in Kenya as a solution to solve the current problems faced by the students in Technical Institutions in Kenya.

### **6.2.2 Advantages of the Application**

The application was then compared with the current system and it provided the following benefits:

- i Users did not have to physically walk and check all the noticeboards in the institution.
- ii Very easy to access all services at one location.
- iii Efficient, less costly and timely information dissemination tool.
- iv Simple navigability of the solution.

### **6.2.3 Disadvantages of the Application**

- i The mobile application can only be used by Android operating system Smartphone holders.
- ii Both the mobile and web application needs Internet connection for them to work.

## **CHAPTER SEVEN: CONCLUSIONS, RECOMMENDATIONS AND FUTURE WORK**

### **7.1 Conclusions**

In conclusion, Information about techniques and methods used for disseminating information was reviewed using online questionnaires, the outcome pointed out that there were major problems in disseminating information in Masai Technical Training Institute (MTTI). The result was the development of an Information Dissemination Framework using a Mobile, SMS and a Web Application. The key features of the application include: Academic Information Dissemination, Notifications, Downloads and Kitchen services. The application was aimed at: fast and easy retrieval of information, elimination of costs, reduced time to access information and efficient dissemination of information.

The framework was modeled using the following UML diagrams, Use case, an Activity Diagram, Class Diagram, Collaboration Diagram, Component Diagram, and a Deployment Diagram. All these enabled the researcher to have a clear view of how and what the system was supposed to do. The use of the above diagrams also allowed the researcher to have a clear picture of how the wireframes and the logic of the system were to be modeled.

Testing was done and the following tests were performed, Usability test, Compatibility test, Security test, Integration testing, Stress testing and Functional testing. The objective of testing was to make sure that the prototype was conforming to the functional and nonfunctional requirements.

Finally user requirement analysis was done. The objective of the analysis was to make sure that the proposed solution was as per the user requirements. Also user Feedback was to prove that the researcher understood the challenges that the users face and he was able to solve by developing the solution.

The findings from this study led the researcher to develop a solution that incorporated three technologies a mobile application was published on Google Play Store, SMS application hosted on both Africa is Talking API with a customised name of Masai TTI and masaitti.com as the domain name. Finally a responsive Website hosted on masaitti.com to facilitate students, lecturers and support staff to be able to access timely, less costly and efficiently disseminated information.

## **7.2 Recommendations**

To be able to use the proposed framework, the institution needs to develop the same application using Windows phone frame work to cater for students who have windows operating system. In addition, The Ministry of Education will benefits if they invest in the proposed solution. This is because Technical Education is very important in any country but the few resources that are allocate to all the Technical Institutions cannot be able to buy expensive management information systems for all the Technical Training Institutions (TTI) in Kenya.

Based on the proposed information dissemination framework, I suggest that the Ministry of Education should:

- i Computer laboratories should be opened for students to access the system from the backend.
- ii Adopt and endorse the current solution to other Technical Institutions in Kenya because some modules are currently in use in MTTI.
- iii Fund this system to be able to include more functionalities.

## **7.3 Suggestions for Future Work**

As a result of the research, I have learned that there is more work that can be done with the proposed information dissemination framework model for Technical Institutions in Kenya, both in practice and in an academic setting. To build a more complete model we need to define a project and a team of developers, where each one should have a role, e.g. project manager, database administrator or a programmer to make the development process move fast. For that we need a serious involvement and investment from different stakeholders in the Ministry of Education.

In addition the researcher also noted that there was more that could be performed on the system and it includes:

- i The prototype should incorporate barcodes.
- ii The prototype should include many module like finance department.
- iii The application should be developed to run on other platforms other than Android to in corporate users using phones running on different Operating Systems.

- iv The mobile application should be further developed to allow for persistent storage of data captured. This capability will make it possible for a user's mobile device to store data when there is no INTERNET connectivity. Data can then be transmitted to the server and response back to the mobile device immediately an INTERNET connection is established.
- v More functionality should be added to the web application to incorporate daily activities that happens in a TTI.

## REFERENCES

- Asif, Muhammad, Krogstie, John (2011). *Mobile student information system, Campus-Wide Information*. Retrieved March 2<sup>nd</sup> 2017, from:  
<http://www.emeraldinsight.com/doi/abs/10.1108/10650741111097269>
- Ahmed Seah and Javahery Homa (2012). *Multiple user interfaces: cross- platform applications and\_context-aware\_interfaces*. Retrieved March 2<sup>nd</sup> 2017 from:  
<http://eu.wiley.com/WileyCDA/WileyTitle/productCd-0470854448.html>
- Android. *Android Developer* (2017). Retrieved February 22<sup>nd</sup> 2017 from:  
<https://developer.android.com/index.html>
- Boyer, Rick, and Kyle Mew (2016 ). *Android Application Development Cookbook - Second Edition*. Retrieved March 25<sup>th</sup> 2017, from: <http://www.wrox.com/WileyCDA/WroxTitle/Android-Application-Development-Cookbook-93-Recipes-for-Building-Winning-Apps.productCd-1118177673.html>
- Benard, Ronald and Andrew Musungu (2012). "Using Mobile Phones for Teaching and Learning Purposes in Higher Learning Institutions". Retrieved April 22<sup>nd</sup> 2017 from:  
<https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwj1yfOwk6XUAhUF1SwKHXqOCkAQFggguMAE&url=http%3A%2F%2Fwww.emeraldinsight.com%2Fdoi%2Fpdfplus%2F10.1108%2FPROG-01-2013-0003&usg=AFQjCNER8KY7u0G5Pfmq8-pfsMOQix7URA&sig2=WP0qHOSG9zACNwnCQML2AA.pdf>
- Camacho (2016). *Using mobile applications to support dissemination and implementation of clinical practice guidelines in Colombia*. Retrieved 21 October 2016, from <http://www.laccei.org/LACCEI2013-Cancun/TechnicalPapers/TH022.pdf>
- Durugbo (2014). *Modelling Information Flow for Organisations*. Retrieved April 22<sup>nd</sup> 2017 from:  
<http://www.sciencedirect.com/science/article/pii/S0268401213000121>.
- Dooley, John (2011) *Software Development And Professional Practice. Essential Supports for Learning*. Retrieved April 24<sup>th</sup> 2017 from:  
[https://books.google.co.ke/books?hl=en&lr=&id=Pe6RGhCXr04C&oi=fnd&pg=PR1&dq=Software+Development+And+Professional+Practice&ots=WsNC88tal-&sig=5-PXREiNJPHXwx0AOvZJ9J3a8tU&redir\\_esc=y#v=onepage&q=Software%20Development%20And%20Professional%20Practice&f=false](https://books.google.co.ke/books?hl=en&lr=&id=Pe6RGhCXr04C&oi=fnd&pg=PR1&dq=Software+Development+And+Professional+Practice&ots=WsNC88tal-&sig=5-PXREiNJPHXwx0AOvZJ9J3a8tU&redir_esc=y#v=onepage&q=Software%20Development%20And%20Professional%20Practice&f=false)

- Fisher, Marcus (2011). *Software Verification And Validation*. Retrieved 21<sup>st</sup> May 2017 from:  
[https://scholar.google.com/scholar?q=Software+Verification+And+Validation&hl=en&as\\_sdt=0&as\\_vis=1&oi=scholart&sa=X&ved=0ahUKEwjSqZmJlqXUAhVFiiwKHR4pC1wQgQMIIzAA](https://scholar.google.com/scholar?q=Software+Verification+And+Validation&hl=en&as_sdt=0&as_vis=1&oi=scholart&sa=X&ved=0ahUKEwjSqZmJlqXUAhVFiiwKHR4pC1wQgQMIIzAA)
- Finkelstein, Clive (2006). *Enterprise Architecture for Integration*. Retrieved 27<sup>th</sup> April 2017 from:  
[https://www.researchgate.net/profile/Jan\\_Hoogervorst/publication/220095201\\_Enterprise\\_Architecture\\_Enabling\\_Integration\\_Agility\\_And\\_Change/links/573adfef08ae9ace840e642e.pdf](https://www.researchgate.net/profile/Jan_Hoogervorst/publication/220095201_Enterprise_Architecture_Enabling_Integration_Agility_And_Change/links/573adfef08ae9ace840e642e.pdf)
- Gates, Bill and Collins Hemingway (2012). "Analysis of Traditional Information Dissemination and Communication Method among Rural Farmers". Retrieved 23<sup>th</sup> April 2017 from:  
<https://www.google.com/search?q=Analysis+of+Traditional+Information+Dissemination+and+Communication+Method+among+Rural+Farmers&oq=Analysis+of+Traditional+Information+Dissemination+and+Communication+Method+among+Rural+Farmers&aqs=chrome..69i57.552j0j7&sourceid=chrome&ie=UTF-8>
- Gibendi, Ramenya (2014) "*Bid To Build 60 Technical Colleges By June 2015 Starts To Take Shape*". Retrieved January 2<sup>nd</sup> 2017 from: <http://www.nation.co.ke/business/Technical-Colleges-Construction-Education/996-2430644-10wohc6/index.html>
- Henning, Heitkotter (2014). *Comparing Cross-Platform Development Approaches for Mobile Applications*. Retrieved 23<sup>rd</sup> February 2017 from: <https://www.wi1.uni-muenster.de/pi/veroeff/heitkoetter/Comparing-Cross-Platform-Development-Approaches-for-Mobile-Applications.pdf>
- IDC. *Smartphone OS Market Share, Q2 2014*. URL <http://www.idc.com/prodserv/smartphone-os-market-share.jsp>
- Kerubo, Bogonko (2012) "*Challenges of change management in secondary schools of Trans-Nzioa County, Kenya*", Retrieved January 2<sup>nd</sup> 2017 from:  
<https://www.google.com/search?q=Challenges+of+change+management+in+secondary+schools+of+Trans+Nzioa+County%2C+Kenya&oq=Challenges+of+change+management+in+secondary+schools+of+Trans+Nzioa+County%2C+Kenya&aqs=chrome..69i57.901j0j7&sourceid=chrome&ie=UTF-8>
- Kaufman, S. R. (2012). Improving Students' Relationships with Teachers. Nyerere, John. *Technical & Vocational Education and Training*. Retrieved 27<sup>th</sup> March 2017 from:  
<https://scholar.google.com/scholar?q=Improving+Students%27+Relationships+with+Teachers.+Nyer>

ere,+John.+Technical+%26+Vocational+Education+and+Training.&hl=en&as\_sdt=0&as\_vis=1&oi=scholart&sa=X&ved=0ahUKEwjaxtWImqXUAhUHXCwKHbSMBG0QgQMIIzAA

Ling, Rich and Jonathan Donner (2013). *Mobile Communication*. Retrieved from:

<https://www.google.com/search?q=Mobile+Communication&oq=Mobile+Communication&aqs=chrome..69i57j0l5.2789j0j7&sourceid=chrome&ie=UTF-8#q=Mobile+Communication+pdf>

Muthaa, Dr. George (2015) "*Improving Technical Education For Human Resource Training For The*

*Realization Of Vision 2030: A Case Of Technical Training Institutes*". Retrieved 23<sup>rd</sup> June 2017

from:<https://www.google.com/search?q=Improving+Technical+Education+For+Human+Resource+Training+For+The+Realization+Of+Vision+2030&oq=Improving+Technical+Education+For+Human+Resource+Training+For+The+Realization+Of+Vision+2030&aqs=chrome..69i57.621j0j7&sourceid=chrome&ie=UTF-8+pdf>

Norazah MohdSuki, (2013). *Students dependence on smart phones, Campus-Wide Information Systems*.

Retrieved 3<sup>rd</sup> April 2017 from:

<http://www.emeraldinsight.com/doi/full/10.1108/10650741311306309>

Nielsen, Brian, and Carsten Weise (2012). *Testing Software And Systems*. Retrieved 2<sup>nd</sup> April 2017 from:

<http://softwaretestingfundamentals.com/system-testing/>

Rada, Roy (2001) *Campus-Wide Information Systems*. Retrieved 28<sup>th</sup> March 2017 from:

[https://www.researchgate.net/profile/Elaine\\_Seeman/publication/241651794\\_Customer\\_relationship\\_management\\_in\\_higher\\_education\\_Using\\_information\\_systems\\_to\\_improve\\_the\\_student-school\\_relationship/links/540e1e430cf2d8daaacd3e07.pdf](https://www.researchgate.net/profile/Elaine_Seeman/publication/241651794_Customer_relationship_management_in_higher_education_Using_information_systems_to_improve_the_student-school_relationship/links/540e1e430cf2d8daaacd3e07.pdf)

## **APPENDICES**

### **Appendix A: Student Questionnaire:**

Information Dissemination Framework for Technical Training Institutions in Kenya

\* Required

You are invited to participate in a research study investigating the implementation of a prototype for disseminating information in Technical Training Institutions.

The information collected through your participation will be purely used for academic purposes.

### **PART I: PERSONAL INFORMATION**

1. Select your Gender

- Male
- Female

2. Select Department

- ICT.
- Mechanical
- Electrical
- Food and Beverage
- Building and Construction
- Business

3. Select Year of Study

- First
- Second
- Third

### **PART II: INFORMATION NEEDS OF STUDENTS IN A TECHNICAL TRAINING INSTITUTION**

1. What is the most important information to a student in MTTI?

- Academic results.
- Fees.
- Important downloads.
- Notifications.
- Kitchen Menu.
- Any OTHER?

2. How frequently do you need the information?

- Once a week.
- Twice a week.
- Three times a week.
- Four times a week.
- Six times a week.
- Once a term.

3. State any other relevant information to a student in MTTI?

### **PART III: EXISTING TOOLS THAT ARE USED TO DISSEMINATE INFORMATION**

1. List the tools that you frequently use to access information in MTTI?

- Noticeboard.
- Email.
- HODs.
- Class representative.
- Mobile phone.
- Website.
- Friday parade.
- ANY OTHER...

2. Are you satisfied with the tools that are used?
  - Yes.
  - NO.
  
3. Identify tools that will be the most effective to disseminate information in MTTI?
  - Noticeboard.
  - Email.
  - HODs.
  - Class representative.
  - Mobile phone.
  - Website.
  - Friday parade.
  - ANY OTHER...
  
4. How would you rate the current information dissemination tools?
  - Excellent.
  - Good.
  - Fair.
  - Poor.
  
5. How often do you visit the noticeboard?
  - Daily
  - Weekly
  - Monthly
  - Several times in a day
  
6. How often do you visit MTTI website?
  - Daily

- Weekly
- Monthly
- Several times in a day

7. Would you prefer to have a mobile application to disseminate information?

- Yes
- No

8. Do you receive timely information?

- Yes
- No

#### **PART IV: SMARTPHONE OWNERSHIP AND USAGE**

1. Do you own a Smartphone?

- Yes
- No

2. What type of operating system?

- IOS
- Android
- Windows
- Blackberry
- Symbian
- Any other

3. What do you mostly use the smartphone features for?

- Education
- Entertainment
- Personal

- Work
4. Do you download mobile apps?
- Yes
  - No
5. Do you have internet connection in MTTI?
- Yes
  - No

**PART IV: OTHER**

1. What features would you like to have in Student Mobile Application?

**(Tick)**

- View exam results.
- Urgent notifications.
- Important downloads.
- Bulk SMS Module.
- Reporting Facility.

Thank you for your participation.

## **Appendix B: User Testing Questionnaire**

### **Information Dissemination in TTIs'**

#### **User Testing Questionnaire**

1. Did you manage to perform the following task? (Indicate Yes or No)

- a) Create account
  - Yes
  - No
- b) Activate and deactivate user accounts (only for system administrators)
  - Yes
  - No
- c) Update users' profiles (only for system administrators)
  - Yes
  - No
- d) Login and logout
  - Yes
  - No
- e) Verify certificates
  - Yes
  - No
- f) Report fake certificates
  - Yes
  - No
- g) View verification reports
  - Yes
  - No
- h) Add certificates (only for university staff)
  - Yes
  - No
- i) Update certificates (only for university staff)
  - Yes
  - No
- j) Delete certificates (only for university staff)
  - Yes

- No

2. How did you find the user interface of the mobile and web application based on its look and feel?

- Attractive
- Average
- Not attractive

3. Rate the mobile and web application based on whether the application was easy to learn as a first time user and ease of using the application

- Easy
- Average
- Difficult

4. Rate the system functionality based on whether it met the user requirements (functionality)

- Good
- Fair
- Bad

5. Would you accept the system to carry out the academic certificate verification activities in this organization?

- Definitely
- Undecided
- Rejected

## Appendix C: Information Dissemination Framework Validation Questionnaire

### Mobile Application for Information Dissemination in TTIs'

1. Which category best describes you?

- TTI Academics Registrar
- Student
- Lecturer
- Head of Department

2. What is the name of your Institution? (Optional)

.....

3. Did you take part in the user testing of the mobile application for information dissemination?

- Yes
- No

4. If Yes, Does the functionalities provided by the mobile application solve the problems posed by the current systems for information dissemination?

- Yes
- No

5. What are some of the key functionalities of the mobile application that provides solution to the current problems in information dissemination?

6. Are you satisfied with the solutions provided by the mobile application as far as dissemination of information is concerned?

- Yes
- No

7. Would you recommend that the mobile application to be adopted by all Technical Training Institutions in Kenya as an application solution to current challenges encountered in dissemination of information?

- Yes
- No

## Appendix D: Related Mobile Applications

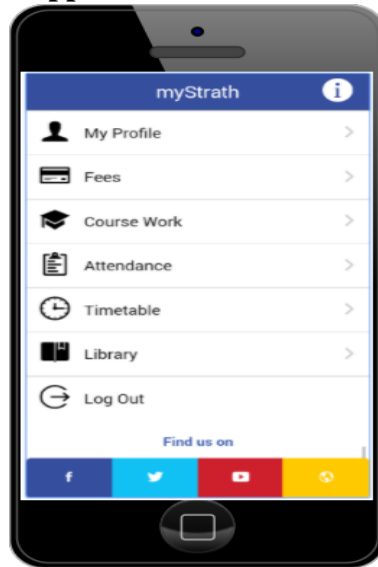


Figure D-1: myStrath Mobile Application

*Source:* Strathmore University, (2016). Kakatiya University Results application (Version 1.17.42) [Mobile Application Software]. Retrieved from <https://play.google.com/store/apps/details?id=edu.strathmore.mobile&hl=en>



Figure D-2: Kakatiya University Results application

*Source:* Kakatiya University, (2016). Kakatiya University Results application (Version 1.17.42) [Mobile Application Software]. Retrieved from <https://play.google.com/store/apps/details?id=com.rizwan.kuresults&hl=en>

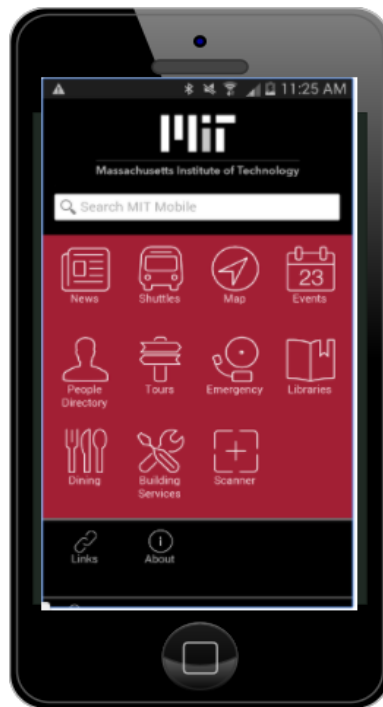


Figure D-3: MIT Mobile Application

Source: MIT Mobile. (2016) MIT Education (Version 1.18.48)[Mobile Application Software]. Retrieved from: <https://play.google.com/store/apps/details?id=edu.mit.mitmobile2&hl=en>

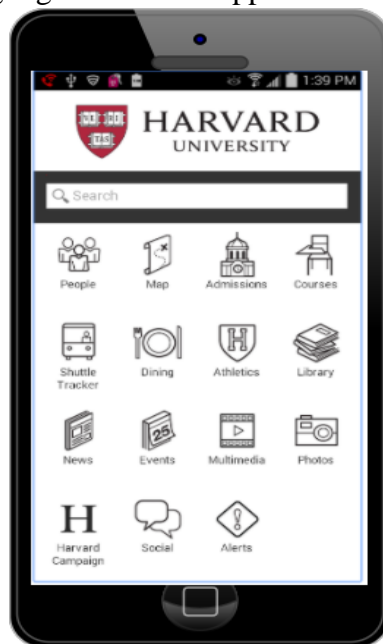


Figure D-4: Harvard Mobile Application

Source: Harvard University. (2016) Information Dissemination Application (Version 1.18.48) [Mobile Application Software]. Retrieved from <https://play.google.com/store/apps/details?id=edu.harvard.harvardmobile&hl=en>

## Appendix E: Mobile Application Wireframes



Figure E-1: Login Module



Figure E-2: Splash Screen Module

## Appendix F: Web Application Wireframes

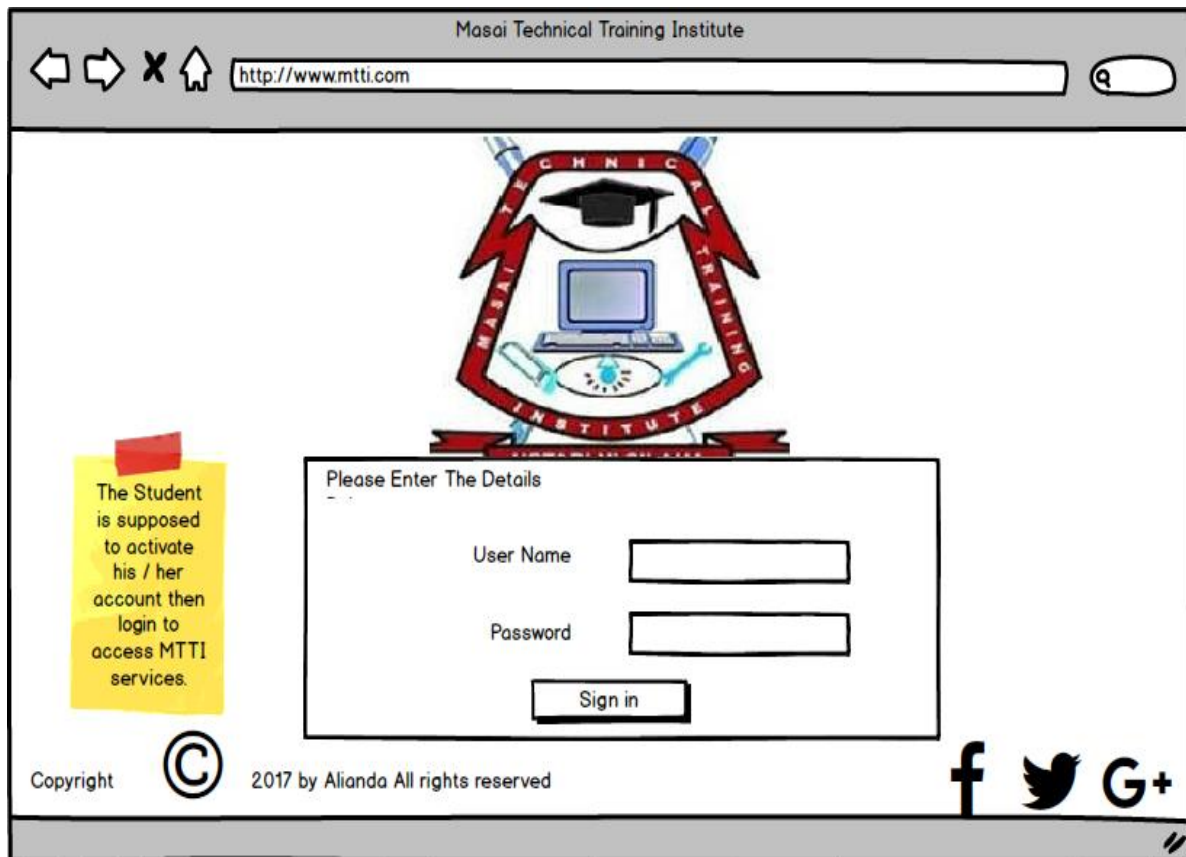


Figure F-1: Login Module

## Appendix G: Mobile Application Implementation



Figure G-1: Launch Application



Figure G-2: Splash Screen



Figure G-3: Login

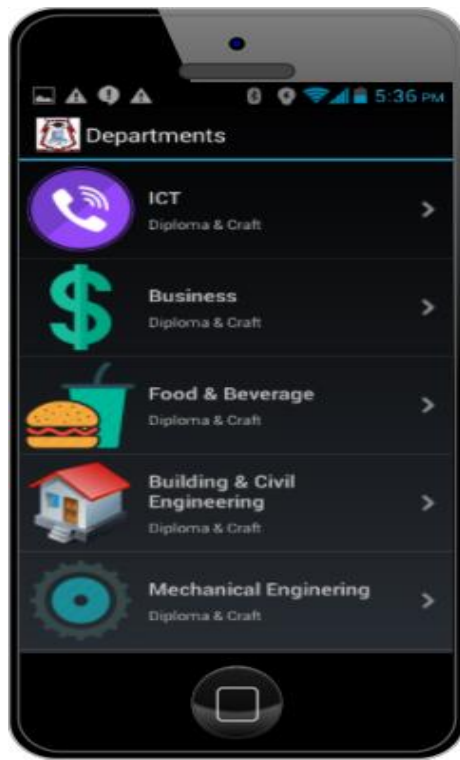
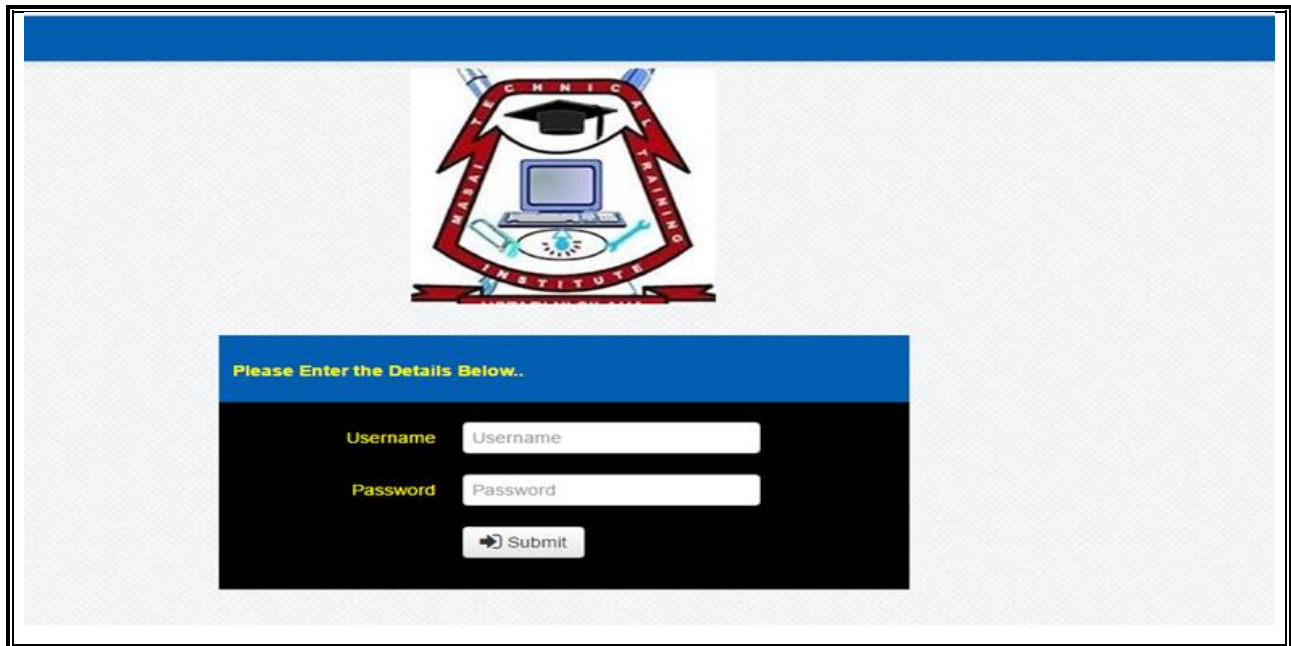


Figure G-4: Departments

## Appendix H: Web Application Implementation

Login: The User Logs into the system

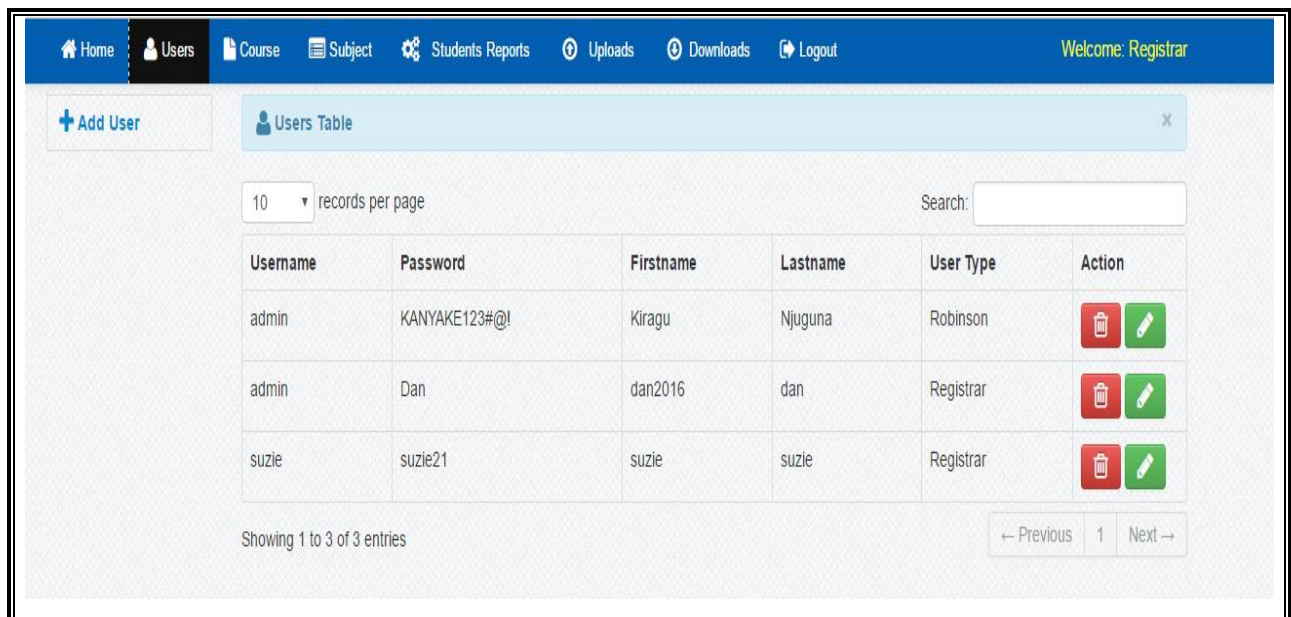


Please Enter the Details Below..

Username

Password

Figure H-1: User Login



Home Users Course Subject Students Reports Uploads Downloads Logout Welcome: Registrar

+ Add User

Users Table

10 records per page Search:

Username	Password	Firstname	Lastname	User Type	Action
admin	KANYAKE123#@!	Kiragu	Njuguna	Robinson	<input type="button" value="Delete"/> <input type="button" value="Edit"/>
admin	Dan	dan2016	dan	Registrar	<input type="button" value="Delete"/> <input type="button" value="Edit"/>
suzie	suzie21	suzie	suzie	Registrar	<input type="button" value="Delete"/> <input type="button" value="Edit"/>

Showing 1 to 3 of 3 entries

← Previous 1 Next →

Figure H-2: List of users

**Appendix I: SMS ID**

**MASAI TECHNICAL TRAINING INSTITUTE**

Our Ref: **MTTI/ICT/VOL 1/005**

Your Ref: .....



P.O BOX 125 – 01100  
KAJIADO  
Tel: 020 206 4581  
Fax: 020 231 1618  
Cell: 0727 738 161  
Email: masaitti@yahoo.com

Date: **March 31, 2016**

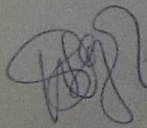
PRS Support  
Safaricom Ltd

Re: Sender ID (**MasaiTTI**)

This is to request Safaricom through Africastalking to raise the sender ID as shown above, **M** and **TTI** MUST be in capital letters. The ID will be used by Masai Technical Training Institute for their day to day communication. Africastalking will manage the bulk SMS code.

Thank you for your co-operation

Yours Faithfully

  
DEPUTY PRINCIPAL  
MASAI TECHNICAL TRAINING INSTITUTE  
P. O. Box 125 - 01100,  
KAJIADO  
TEL: 064581  
**Abdi A. Aden (Mr)**  
Principal  
Masai Technical Training Institute

## Appendix J: TURNITIN


Try the new, easy-to-use interface

FINALIST THESES/DISSERTATION... Masters Theses - 2017 Examination Sub...

Originality GradeMark PeerMark

Information Dissemination Framework for Technical Training Institutions in Kenya  
BY PATRICK ALIANDA

turnitin 17% SIMILAR -- OUT OF 100



**Strathmore**  
UNIVERSITY

Information Dissemination Framework for Technical Training Institutions in  
Kenya  
By  
Alianda Patrick (085012)

Submitted in partial fulfillment of the requirements for the Degree of Masters of  
Science in Mobile Telecommunications and Innovation at Strathmore University

No Service Currently Active

Rectangular Snip

PAGE: 1 OF 123