2016

A web-based system for bible study groups administration: a case study of focus Kenya

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A WEB-BASED SYSTEM FOR BIBLE STUDY GROUPS ADMINISTRATION: A CASE STUDY OF FOCUS KENYA

By

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A Dissertation submitted in partial fulfillment of the requirement for the award of a Master of Science Degree in Mobile Telecommunication and Innovation (MSc. MTI).

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Nairobi, Kenya

June 2016

Declaration and Approval

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the dissertation contains no material previously published or written by another person except where due reference is made in the dissertation itself.

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Abstract

Churches and Christian Unions (CUs) organize their members in small groups for effectiveness in bible study and participation in the organizations activities. The number of small groups increases as the organization has more and more members. The larger the number of groups the more it becomes complex to organize and track the performance of these groups. The primary objective of this research was to come up with a mobile and web-based system that improves bible study administration process in CUs. This research examines the bible study administration process in CUs operating under Fellowship of Christian Unions (FOCUS). It analyses the current systems used for bible study group administration and their limitations. This research proposed a USSD based interface for members' registration and members' check-in after every group meeting, a web-based system for automatic grouping of students into various groups and a report generation system. This researched used Dynamic Systems Development Method (DSDM) to implement the proposed solution.

Keywords: Fellowship of Christian Unions (FOCUS), Christian Union (CU), bible study, bible study coordinator, bible study, grouping, attendance, zones, group leaders.

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List of Abbreviations

CMS	-	Content Management System
CU	-	Christian Unions
DSDM	-	Dynamic Systems Development Method
FOCUS	-	Fellowship of Christian Unions
GSM	-	Global System for Mobile
HLR	-	Home Location Register
HTML	-	Hypertext Markup Language
HTTP	-	Hypertext Transfer Protocol
JKUATCU	-	Jomo Kenyatta University of Agriculture and Technology Christian Union
MSC	-	Mobile Switching Centre
MUCU	-	Moi University Christian Union
SMPP	-	Simple Messaging Peer-Peer
SMS	-	Short Message Service
SS7	-	Signaling System #7
SSL	-	Secure Socket Layer
UML	-	Unified Modeling Language
UoECU	-	University of Eldoret Christian Union
URL	-	Universal Resource Locator
USSD	-	Unstructured Supplementary Service Data
VLR	-	Visitor Location Register

Chapter 1 : Introduction

1.1 Background

Churches and Christian Unions (CUs) have a lot of activities and events that need to be done to achieve their objectives. Such events and activities include bible study programs, training programs, fellowship programs and many more. For effective participation especially for churches and CU having many members, they have to split their large congregation into small teams or groups, usually called fellowship groups (Lewis Center for Church leadership, 2016). Kantner (2014) says, small groups are often the glue that keeps people in a church community connected. This requires churches and CUs to organize their members into small groups; each group is assigned a leader.

Small groups (also known as "cell groups" and "home fellowship groups") are growing rapidly in Christian churches as a way for believers to make the connections with fellow believers. Small group formed in churches whether based on bible studies or on a wide variety of activities have a great impact on those who participate (Britton, 2006). Kelder (2010) defines a small group as an intentional gathering. These groups of people agree to share life together. They plan where and when to meet and arrange their schedules to be there. They have a purpose for getting together. A group can range in size from two members to thousands of members. Very small collectives, such as two members and three members are groups, but so are very large collections of people, like mobs, crowds, and congregations. Most groups tend to be relatively small, ranging from two to seven members (Forsyth, 2006).

Managing everything in small groups from meeting locations to group attendance can become cumbersome and time consuming (Kantner, 2014). Churches and CUs face a Day-to-day challenge of managing these small groups. Some of managerial duties carried out in these groups include allocating members to groups, communication within the group, collecting group attendance for every meeting, generating group attendance reports.

Fellowship of Christian Unions (FOCUS) is an umbrella body bringing together CUs from different universities and colleges in Kenya. FOCUS Kenya runs a bible study program across one hundred and thirty-four CUs (Focus Kenya, 2015). These bible studies are conducted in small groups of about ten students. CUs running FOCUS Kenya bible study program groups their congregation into small groups of seven to ten students, with a leader for each group. Group leaders submit attendance record for every meeting to CU leaders who in turn submit a periodical report, usually ten to twelve weeks' period, to FOCUS Kenya.

These CUs face a challenge of administering bible studies in small group. The major challenges are registering members, group allocation, collecting attendance record and generating attendance reports (Moi University Christian Union, n.d). FOCUS Kenya collects bible study performance data from each CU. Most of the data they get is an approximation due to inaccurate attendance records and cumbersome registration process involved.

This raises a need for a web-based solution that will provide a reliable and flexible registration interface. An automatic allocation program with little or no user involvement with interface for each group members to check-in after every meeting, a FOCUS interface where they will be able to pull attendance for any CU and overall attendance, a flexible system to easily add to or remove a CU from the system.

1.2 Problem Statement

Data collection using paper-based forms has several disadvantages, which include; logistics of printing and collecting data using paper-based forms is cumbersome and getting real-time response is difficult (Thakkar, Floretta, Dhar, Wilmink&Sen, 2016). Moi University Christian Union (MUCU) an affiliate of FOCUS Kenya collects and manages members' data using a paper-based system. All the processes including member registration, allocating members to groups and collecting attendance data are handled in a paper-based system. This has led to various problems associated with paper-based systems. There is a lack of real time data and this

has made bible study administration process cumbersome (Moi University Christian Union, n.d). Most of the CUs face a similar problem.

CUs membership is increasing on a yearly basis as the number of students joining universities increases; this widens the problem of bible study administration. The current systems used in most CUs requires members to register through paper-based forms, a team to sit down and group members and group leaders to submit weekly reports via paper-based forms. This makes the whole bible study administration cumbersome.

There is a need for a reliable way for members to register themselves, a flexible way to allocate members into small groups, an efficient way to collect attendance data and a comprehensive report generating tools. The development of Unstructured Supplementary Service Data (USSD) and web-based system for bible study registration, grouping and reporting is expected to reduce registration time and efficiency; it will reduce the time used to allocate members to groups; and improve the accuracy of attendance reports collected.

1.3 Aim

The purpose of this research was to come up with a mobile based system to improve bible study administration processes in CUs, the system handles membership registration, allocating CU members into groups, collecting weekly attendance of each group, generating attendance reports for each CU and finally submitting the reports to FOCUS Kenya.

1.4 Specific Objectives

i. To analyze the current bible study administration system used by CUs.

ii. To investigate how USSD works and how it can be integrated into web applications.

iii. To design a web-based solution with USSD integration for bible study registration, grouping and attendance reporting.

iv. To develop a web-based solution with USSD integration for bible study registration, grouping and attendance reporting.

v. To test the functionalities of the web-based solution with USSD integration for bible study registration, grouping and attendance collection.

1.5 Research Questions

i. How do the current systems used in bible study administration work?

ii. How can USSD be integrated into a web application and what is the logic behind them?

iii. How can a web-based system for bible study administration be designed?

iv. How can a web-based system for bible study administration be developed?

v. How can the functionalities of the web-based system for bible study administration be tested?

1.6 Justification

Managing many small groups of people raises some challenges, first allocating a large number of members into small groups of people, second collecting attendance reports of each group for every meeting they meet. According to FOCUS Kenya (2015), FOCUS Kenya organizes bible study for about 30,000 students in over 134 campuses. FOCUS Kenya faces a problem of collecting weekly attendance report from every CU. CUs face similar problems of grouping their members to small groups and collecting weekly attendance report from each group and submitting this report to FOCUS Kenya.

There is a need for an effective way to reduce these problems. Currently, most CUs register their members in paper-based forms, and then select a team that allocates members and appoints a leader for each group to submit weekly attendance report to CU leaders who in turn submit these reports to FOCUS Kenya. However, this process is time consuming, cumbersome and inaccurate data may be propagated. This research proposed a USSD system for bible registration and a web-based system for reporting and evaluation, which is aimed at providing an effective means of improving bible study registration, reporting and evaluation process.

1.7 Scope and Limitation

This research focused on bible study registration interface using USSD application, group attendance collection using USSD application, web-based automatic grouping and reporting system. The system generates overall and regional report for all the registered CU and incorporates a dynamic mechanism to add and remove a CU from the system.

Chapter 2 : Literature Review

2.1 Overview

This section of the research begins by covering a brief description of bible study group registration and administration process. The follow-up sections look at the various existing applications used by churches for grouping members, strengths and weaknesses of these systems. This chapter also covers an overview of USSD and Web application architecture. It gives a conclusion on the study based on the literature review by highlighting the research gap and need for an improved system.

2.2 Administration Activities and Process for Bible Study

There are various administrative roles the CU leadership carries to administer bible study, according to Moi University Christian Union (n.d) these are; members registration, group allocations, attendance recording, reporting.

2.2.1 Registration

Before grouping starts, CU registers their members first. Details captured vary depending on CU, a comparison between Jomo Kenyatta University of Agriculture and Technology (JKUAT) CU and Moi University CU shows the following fields common in almost every CU; full name, year of study, phone, gender and room of residence (Moi University Christian Union, n.d; JKUATCU, 2016).

2.2.2 Group Allocation

The second step in bible study administrative process is grouping registered members into small of about seven to ten members per group. Each group is assigned a leader who is in charge all meetings and also reporting groups attendance (Moi University Christian Union, n.d).

2.2.3 Attendance Recording

This is the number of members who attended the bible study. It is recorded on a weekly basis. It may also include the number of visitors who attended the meeting. This data is important to generate attendance reports (Moi University Christian Union, n.d).

2.2.4 Reports

Reports are generated from weekly attendance record. These reports includes: Overall attendance per CU and national performance of bible studies.

2.3 Existing Systems Used to Allocate Bible Study Groups in CUs

Currently, there are systems used to group CU members into bible study group. This study will cover some of the systems used in CU and also some of the systems used by churches to group their members into small groups called ‘cell groups’.

2.3.1 Paper Forms for Registration and Attendance Reporting System

Majorities of CUs still use this process of grouping, where members register in paper-based forms, then a team of CU leaders allocates these members into small group selecting a leader for each group, the group leader submits weekly attendance report to CU leader in charge of bible study. This section gives details of how this system is used in Moi University Main Campus CU.

Every week each group leader takes attendance record which contains the following information; Number of group members who attended the meeting, number of guests who attended the meeting, male and female students who attend the meeting.

This record is submitted to the CU leader in charge of bible study at the end of every academic semester. This data is compiled into a good presentable report and submitted to campus staff

(FOCUS Kenya regional bible study coordinator). The submitted report usually contains the total percentage of attendance as an average per meeting. These data is further submitted to FOCUS Kenya bible study director.

Advantages

The main advantage of this traditional style is the following:

i. Simple for the leaders and members to understand the process.
ii. No user training required.

Disadvantages

Despite the above strengths of this system, it has the following weaknesses:

i. It involves a lot of labor when the number of members is large.
ii. Members cannot register when they are away from registration venue.
iii. It becomes cumbersome when the CU has more and more members and they have to generate an accurate report.

This traditional style is easy to use but it faces serious weaknesses.

2.3.2 Web-based Registration with Paper Form for Attendance Reporting

In this system, registration is done remotely via a web application interface and a team sits down to do group allocation. Members register via a web application using their internet enabled computers or phones, the CU leaders group members manually into bible study groups. Jomo Kenyatta University of Science and Technology (JKUAT) CU uses this system.

Members visit a remote web-based registration hosted at http://portal.jkuatcu.org/ . New members are required to enter the following details: registration number, full name, email, phone number, gender, county, course, year of study, calendar years, ministry and entry period. After first registration, the system sends login credentials to the member. Members can login to update their details later and to register themselves for bible study. This system allows members to re-

register themselves for subsequent bible study after the member has logged in (JKUATCU, n.d.).Figure 2.1 and 2.2 are screenshots of JKUATCU registration portal

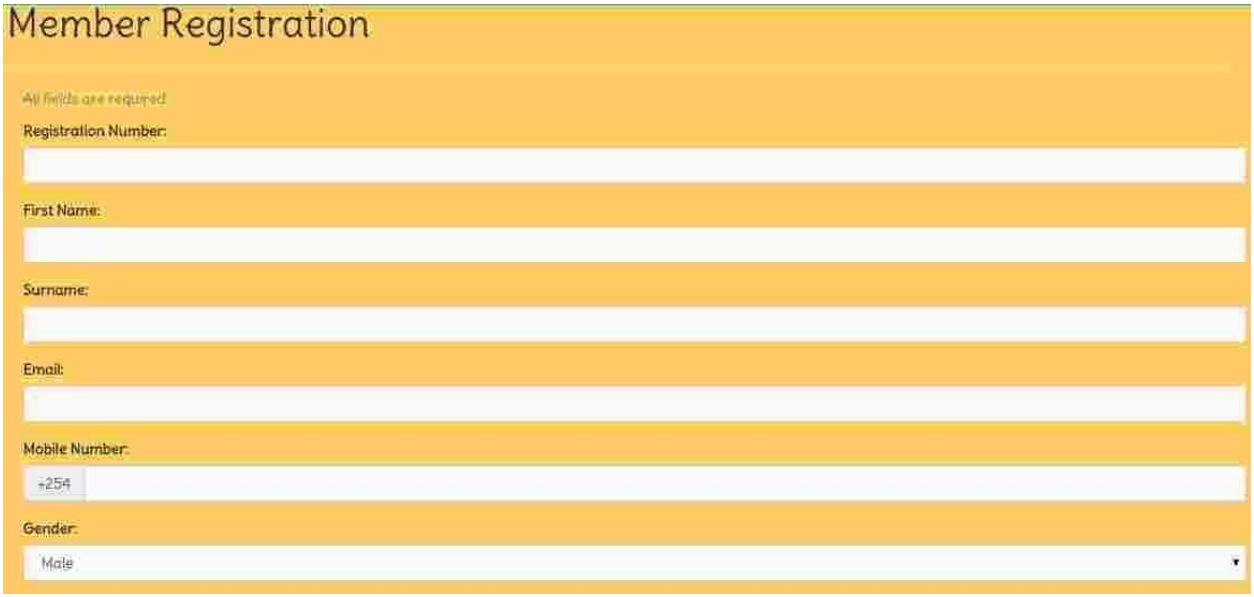

Figure 2.1 JKUAT CU Member Registration Form (Adapted from JKUATCU, n.d.)

Figure 2.2 JKUAT CU Member Registration Form (Adapted from JKUATCU, n.d.)

After a member has logged in, they are required to provide their hostel name and hostel region.

Figure 2.3 and 2.4 are screen shots demonstrating bible study registration process.

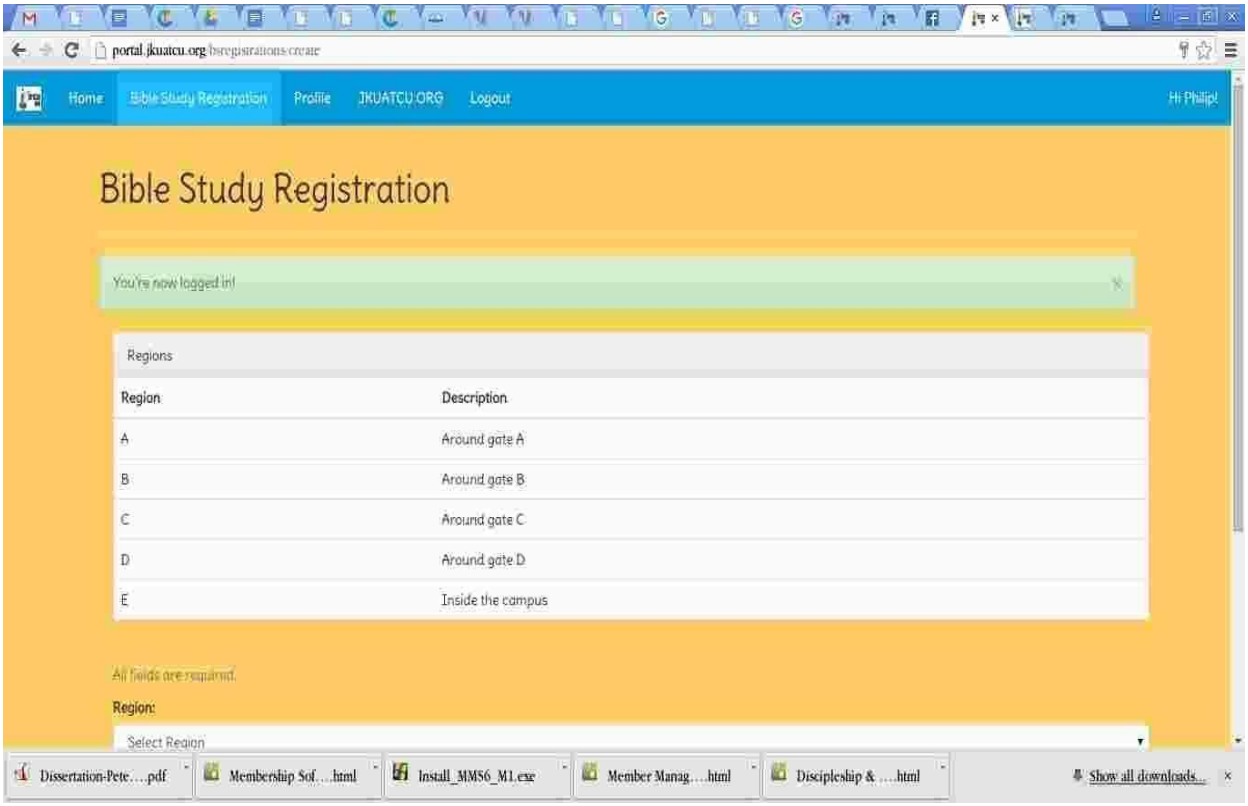

Figure 2.3 JKUAT CU Bible Study Registration (Adapted from JKUATCU, n.d.)

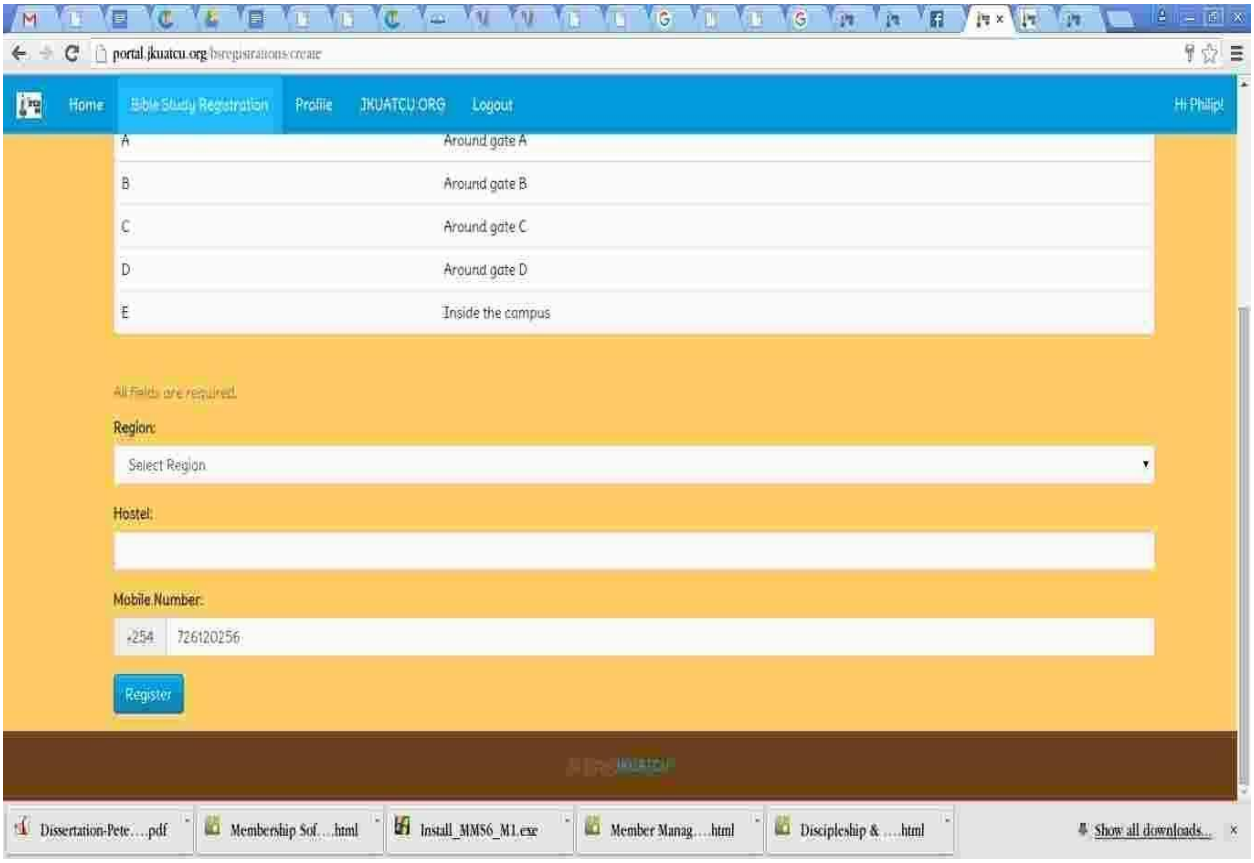

Figure 2.4 JKUAT CU Bible Study Registration Process (Adapted from JKUATCU, n.d.)

After registration, JKUAT CU leaders in charge bible study group manually allocate members to small groups with a leader for each group. Group leaders submit attendance data to CU bible study leaders.

Strengths

This system has the following features

i. Members can register remotely.
ii. Registration portal can successfully handle large number of members.
iii. Members do not need to re-enter their details for subsequent registration when a new semester begins.

Weaknesses

This system has the following weakness

i. Requires internet for registration.
ii. This system requires bible study leaders to come together and allocate members in to groups, this makes allocation of groups cumbersome.
iii. Paper-based form for collection and analysis of attendance data is cumbersome and results in loss of accuracy.

This system is an improvement of the traditional paper-based form grouping system, the improvement comes in from online registration which makes it efficient, this system still lacks a complete automation hence it is still cumbersome.

2.3.3 Excellerate Church Management System

Excellerate church management system is one of the many church management systems used by many churches. Excellerate church management is software built to manage churches it offers the following service:

i. Complete Member Tracking.
ii. Visitor Tracking and Follow-up.
iii. Detailed Small Group Tracking and Online Reporting.
iv. Classes and Attendance.
v. Volunteer Teams and Organizations.
vi. Contributions and Pledges.
vii. Spiritual Gifts, Skills, Personality Profiles.
viii. Meeting and Counseling Notes.
ix. Mass-Emails.

Excellerate Church Management Software has choice of a cloud/web-based solution or an installed solution. Some churches want everything installed on-site on their own computers

where they have total control of everything. Other churches would rather a cloud solution where we maintain everything (Excellerate, 2015). This literature review only reviews small group tracking and reporting feature of this software.

Registration Process

A member is registered first before he or she is allocated to a group. The registration entries are shown in Figure 2.5. The following fields are required; personal details, addresses, contacts, employer information, marital status and photograph. Figure 2.5 shows a screenshot of Excellerate software registration form.

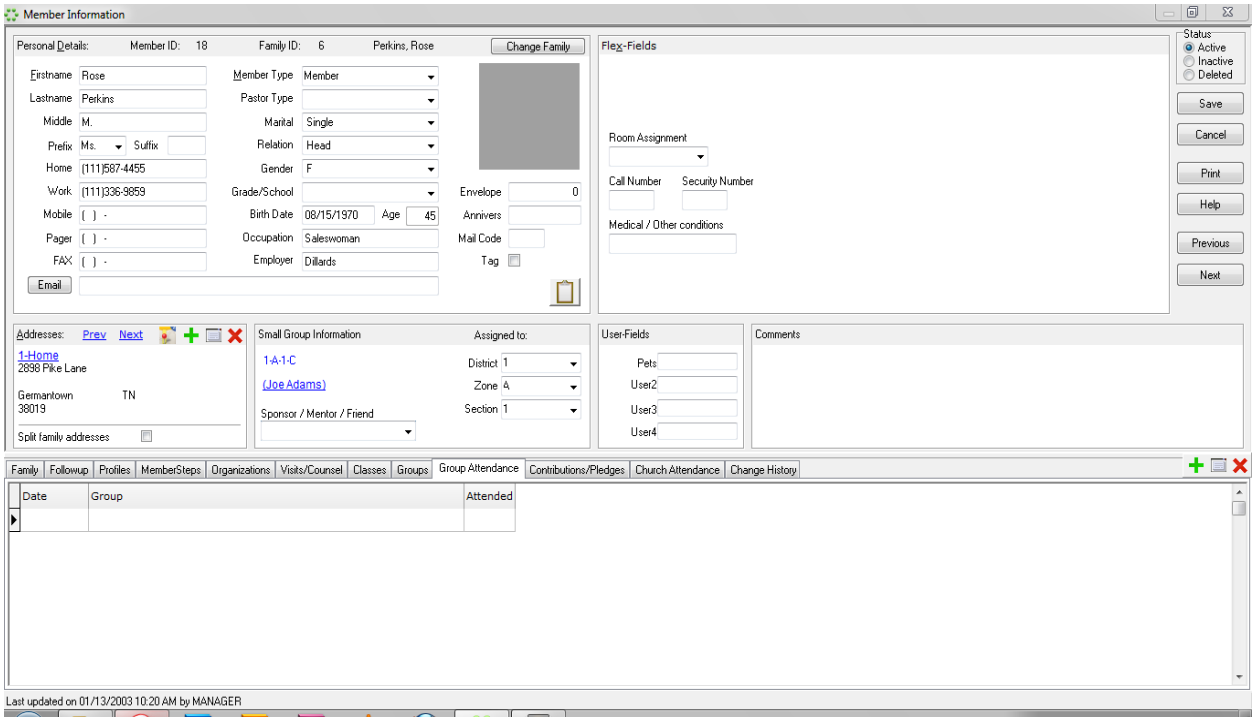

Figure 2.5 Excellerate Registration Form

A member is assigned to a group during registration or after registration. A group leader leads each group.

Group Allocation

Members are manually allocated to groups during registration or later. A system user creates groups, Figure 2.6 shows details captured during group creation. Figure 2.6 shows a form in Excellerate software to create group.

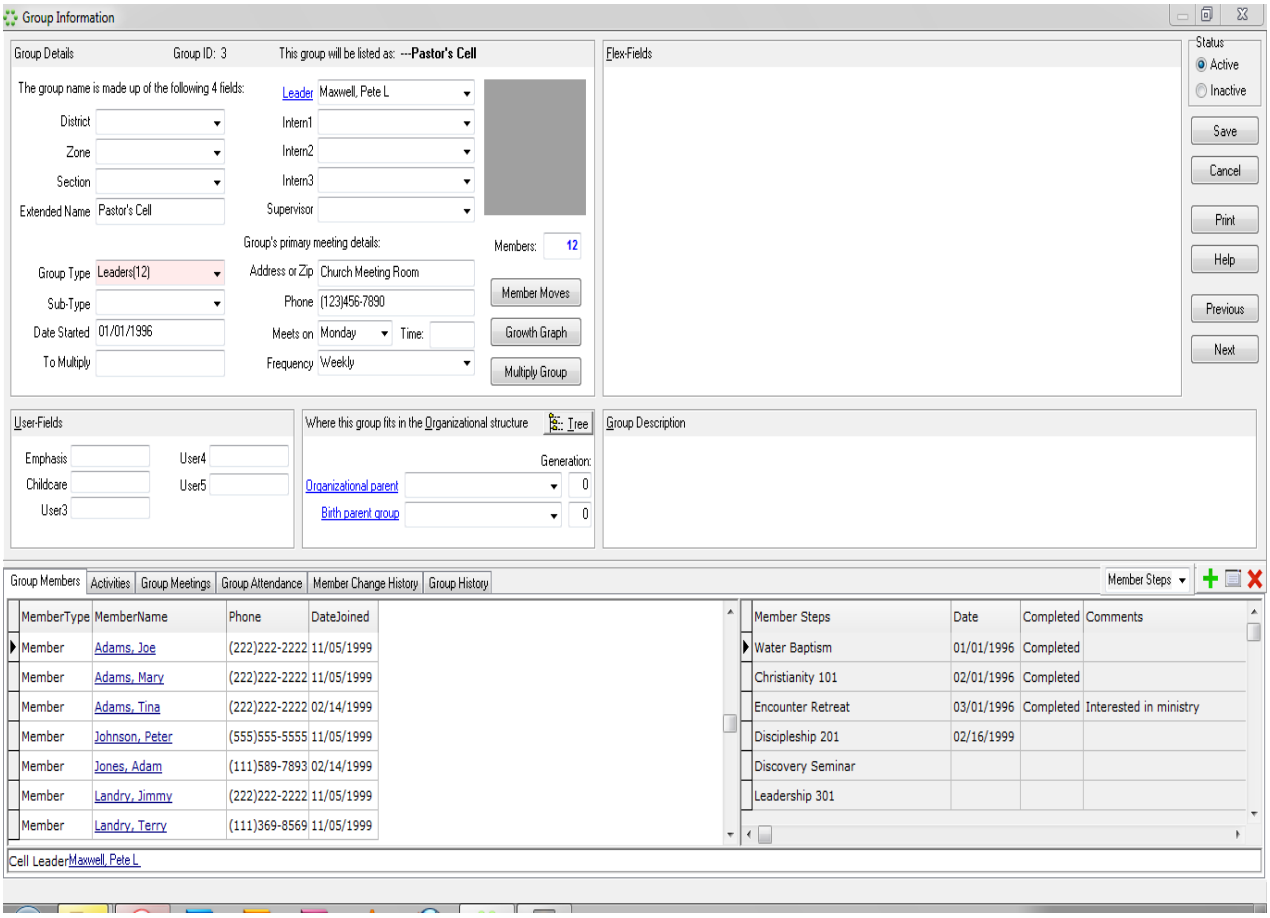

Figure 2.6 Excellerate Group Creation Form

Group Attendance

Excellerate provides an interface to record group attendance for each meeting. This interface has a form that captures the topic that was discussed, members present, visitors present, children present and other types not captured. Figure 2.7 shows a screenshot of recording attendance.

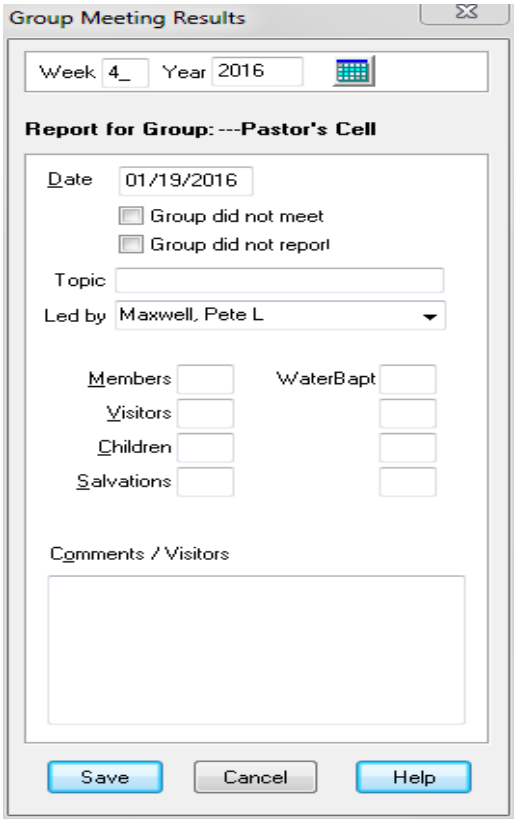

Figure 2.7 Excellerate Attendance Recording Form

Group Reports

Excellerate church management generates group attendance reports of meeting attendance. Their report captures number of visitors present, children present, members present and total persons present. A privileged system user can access this report.

Figure 2.8 is a sample graph captured from the software.

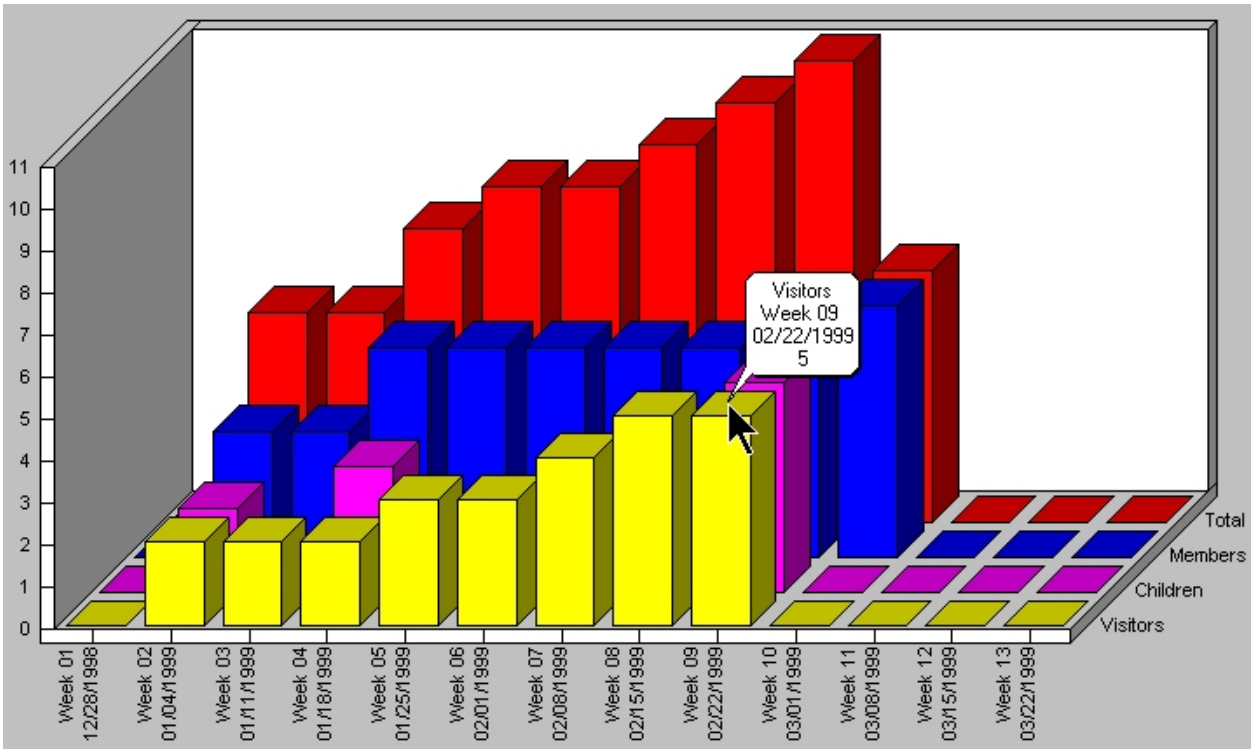

Figure 2.8 Excellerate Attendance Graph (Adapted Excellerate, 2015)

Excellerate also provides an input form for leaders to send their weekly group reports to their group supervisors.

Figure 2.9 below shows a screenshot of report submission form

The Life Church

Group leader online report form

Meeting Date:	02/07/2006 *(mm/dd/yyyy)*	Day of week: **Monday**
Topic:	five signs of a loving family	Frequency: **Weekly**
Led by:	Pete Maxwell	Cell Type: **Leaders(12)**
Didn't Meet:	☐	Location: **Church Meeting Room**

Current Cell Members:

Member name	Phone	Email	Attended	Birthday	Remove from cell
Joe Adams	(222)222-2222	joe@hometime.org	☑		☐
Mary Adams	(222)222-2222	_	☑		☐
Tina Adams	(222)222-2222	_	☑		☐
Peter Johnson	(555)555-5555	www.mychurch.org	☑	Birthday 02/08/06	☐
Adam Jones	(111)589-7893	www.mychurch.org	☑		☐
Jimmy Landry	(222)222-2222	_	☑		☐
Terry Landry	(111)369-8569	tlandry@aol.com	☑		☐

List any new Members/Visitors below:

Member/Vist	Add to my cell	FirstName	Lastname	Address	City	State	Zip	Phone	DOB
Member	☑	Sam	Phillips	100 North St	Memphis	TN	38088	901-123-3455	

Enter meeting totals below:

Members	Visitors	Children	Salvations
7	1	4	

Comments, Evaluations, Testimonies:

```
Great meeting.  The couples with children really enjoyed discussing the section
on how to teach and train your children.  Sam came with Adam, he said he
enjoyed the group and wants to come to church!
```

Submit report

Figure 2.9 Excellerate Leader's Attendance Form

Strengths

Excellerate has many attractive features and almost a complete solution for small church groups. Below are some of the strengths of Excellerate small group system.

i. Provides remote registration.
ii. Attendance report is submitted online after every meeting which ensures accuracy of submitted data.
iii. It has data visualization tools to generate attendance graphs.
iv. It provides a detailed attendance reporting interface which is comprehensive.
v. It has both a cloud implementation and stand-alone implementation.

Weaknesses

Excellerate church management has the following weaknesses:

i. It is complex to understand and use.
ii. For cloud implementation, it requires internet for all operation.
iii. Members are allocated manually to groups; these may require a lot of labor where there are more members.

Excellerate church management system provides a very good and detailed implementation of small study groups but it has several weaknesses.

2.4 Gaps and Limitations in Current Systems

The various systems that exist to group people into large group discussed in this chapter have attractive features and weaknesses too. Some of the common features of these systems are:

i. All have registration interface that captures at least full name and contact information.

ii. All allocate members into small groups, these groups size is determined by the person creating the group.

iii. All allow leaders to record meeting attendance.

Common weaknesses in the discussed grouping systems are listed below:

i. All have an allocation system that requires a lot of user interactions to allocate members into small bible study groups. This is a challenge especially when a church or a CU has many members to be allocated to study groups.

ii. The paper form for registration is location limited; one cannot register if he or she is away from the registration venue. The web-based registration with paper form for attendance reporting system and Excellerate church management system use a web-based form for registration that requires internet connection for registration, this limits members who do not have access to internet resources.

2.5 USSD

USSD is a Global System for Mobile (GSM) communication technology used to send messages between a mobile phone and an application server (Gonzalez, n.d.). USSD are interactive and session based as compared to SMS (Gupta, 2010). USSD codes comprise of asterisk (*) followed by a combination of digits (0 to 9) and a hash (#). Users can directly enter the USSD string and press the call key to send a message. The asterisk and hash code determine the beginning and end of the USSD request (Sanganagouda, 2011).

2.5.1 USSD Integration with Web Application

USSD architecture comprises of the following elements:

i. The network section, which comprises the Visitor Location Register (HLR), Home Location Register (VLR) and Mobile Switching Centre (MSC).
ii. Simple Messaging Peer-Peer (SMPP) interface to connect with web-based applications and services.

iii. USSD Gateway.

USSD Gateway can be integrated with any network system or device and the internet. The USSD gateway interfaces with the Mobile Switching Center (MSC) over the Signaling System #7 (SS7). The MSC connects to the HLR in the home network via the SS7 network. GSM network is also connected to the USSD Gateway via the SS7 link as shown in figure 2.10. The USSD Gateway communicates with all its supporting external applications via SMPP. Web applications are integrated to USSD via SMPP (Sanganagouda, 2011).

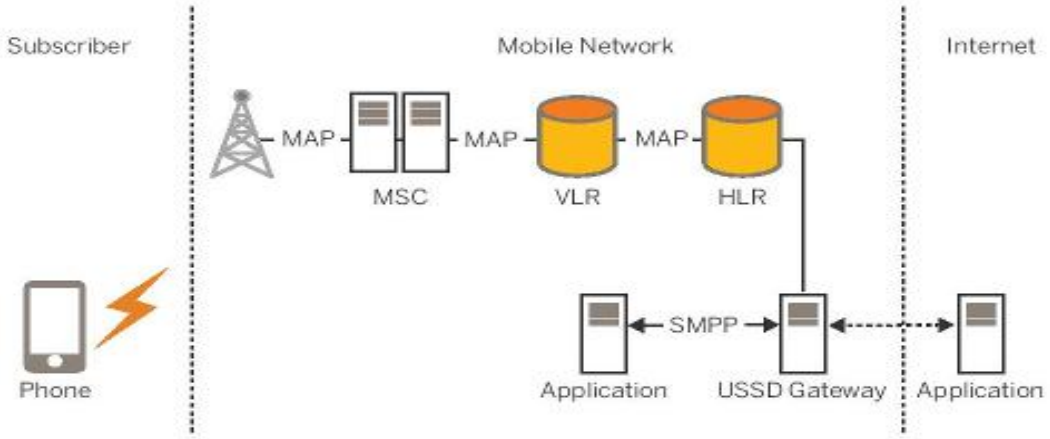

Figure 2.10 USSD Architecture (Adapted from Sanganagouda, 2011)

2.6 Web Application Architecture

A web application is an application that is accessible by users through a web browser. The browser creates Hypertext Transfer Protocol (HTTP) requests for specific Universal Resource Locators (URLs) that map to resources on a Web server. The web server returns Hypertext Mark-up Language (HTML) pages to the client, which is displayable to the browser. The heart of

a Web application is its server-side implementation. The application can contain several distinct layers (Microsoft, 2016a).

Figure 2.11 illustrates a typical Web application architecture with common components grouped by different areas of concern.

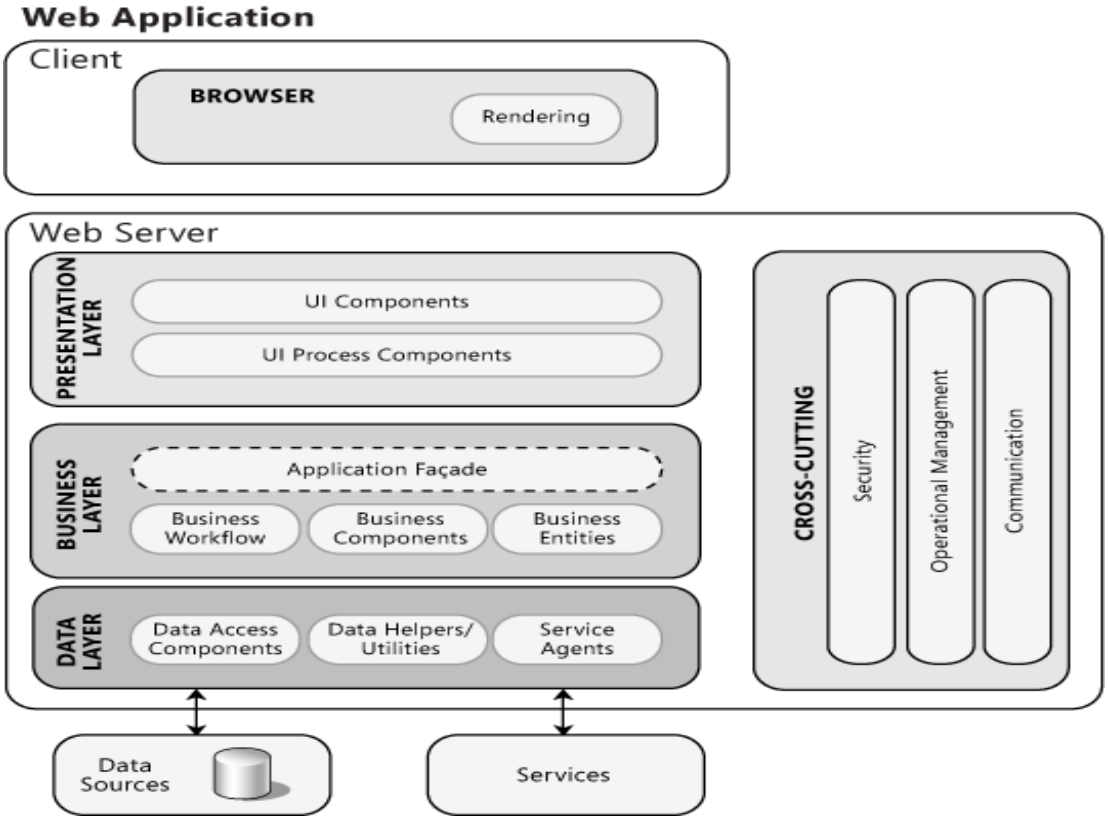

Figure 2.11 Web Application Architecture (Adapted from Microsoft, 2016a)

While designing a web application, the main goal is to minimize the complexity by separating tasks into different areas of concern while developing a secure and great performance application (Microsoft, 2016a).

The following are guidelines to ensure that a web application meets its requirements and performs efficiently:

i. **Partitioning the application logically.** Layering is used to partition the application logically into presentation, business, and data access layers. This helps to create an easy to maintain code and allows monitoring and optimizes the performance of each layer separately.

ii. **Abstraction to implement loose coupling between layers**. This is attained by specifying interface components, such as a facade with well-known inputs and outputs that translates requests into a format understood by components within the layer.

iii. **Understanding how components communicate with others**. This requires knowledge of the deployment scenarios the application must support. Determining if communication across physical boundaries or process boundaries should be supported, or if all components will run within the same process.

iv. **Caching.** Techniques such as caching and output buffering reduce round trips between the browser and the Web server and downstream servers. A well designed caching strategy is possibly the most important performance design consideration.

v. **Logging and instrumentation.** Auditing and logging of activities across the layers and tiers of the application. These logs are usually used to detect suspicious activity.

vi. **User authentication across trust boundaries.** The application should be designed to authenticate users whenever they cross a trust boundary.

vii. **Protection of data in plaintext across the network.** Whenever the Web application must pass sensitive data such as a password or authentication cookie across the network, the Web application should encrypt and sign the data or use Secure Sockets Layer (SSL) encryption.

viii. **The Web application should be designed to run using a least-privileged account.** If an attacker manages to maliciously gain control of a process, the process identity should have limited access to the file system and other system resources to reduce potential damage.

2.7 Summary

Earlier forms of bible study registration, allocation and grouping that involved using paper forms are currently being replaced software systems which include web-based forms and report generating software as seen in Excellerate church management system. All these are currently being used in different churches and CUs to manage bible study grouping.

However, these systems have weaknesses that may limit the extent of their use. The proposal to come up with software system to implement bible study administration is expected help solve some of the challenges faced by current systems. USSD has several attractive features that suit its implementation in the proposed bible study system, to provide registration interface and attendance collection interface.

Some of the attractive features of USSD are; it provides a cost-effective and flexible mechanism for offering various interactive and non-interactive mobile services to a wide subscriber base, USSD supports menu-based applications facilitating more user interactions, USSD is neither a phone-based nor a SIM-based feature. It works on almost all GSM mobile phones (from old handsets to new smartphones), USSD allows faster communication between users and network applications because messages are sent directly to the receiver allowing an instant response, USSD services available on the home network are also accessible while roaming. Unlike SMS, there are no charges for this (Sanganagouda, 2011).

This proposed system is expected to improve the registration and attendance recording process by use of USSD, the web-based interface for group allocation provides automatic allocation process with few or no user interactions, the web-based system enables FOCUS Kenya to collect a timely and accurate reports.

Chapter 3 : Research Methodology

3.1 Overview

In this chapter, this research explains the research methodology that was selected and used, why the selected method was used, location of the research, purpose of the research, data collection techniques and analysis that was used. The chapter comprises of the following key sections: software development methodology, research design, system development tools, proposed system modules and deliverables.

3.2 Software Development Methodology

A software development methodology is a structure used on the development of a software product. It includes procedures, techniques, tools and documentation aids which will help system developers in their business of realizing a new system. The purpose of a methodology is to illustrate what is being done, making it more repeatable (Hamid, 2011). Software development life-cycle methodologies provide the what (processes and deliverables), how (techniques), and who (roles) for every typical role in a software-development project, such as solution architects, business consultants, and developers (Microsoft, 2016b).

Dynamic Systems Development Method (DSDM) was adopted for this research. DSDM is a robust agile project management and delivery scheme that delivers the proper solution at the right time. According to Association of Modern Technologies Professionals (2016), DSDM favors the philosophy that nothing is developed entirely the first time and looks to software development as an exploratory endeavor.

DSDM is based on nine principles (Coffin & Lane, 2006). The DSDM process is illustrated in Figure 3.1 below.

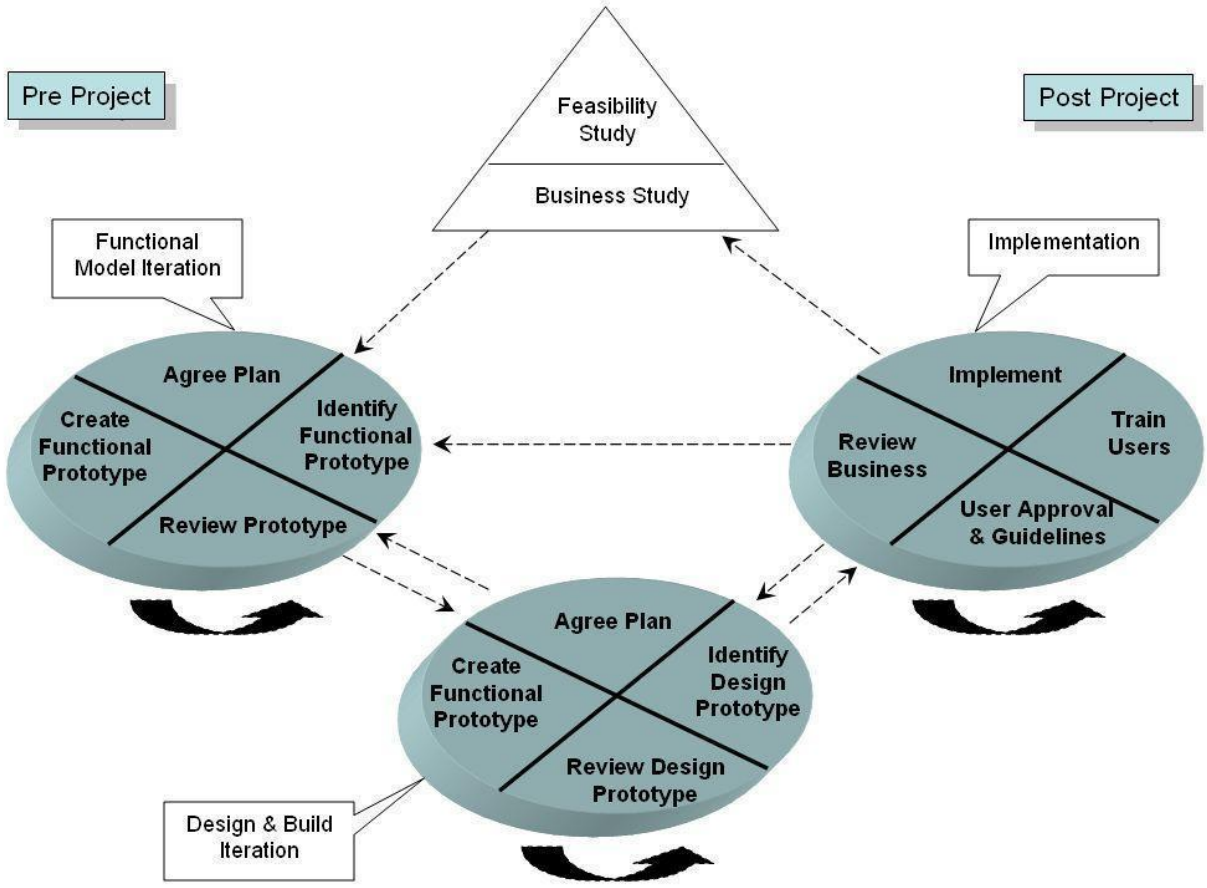

Figure 3.1 DSDM Process (Adapted from Coffin & Lane, 2006)

3.2.1 Reason for Selecting the DSDM Process

DSDM suites this research appropriately because of Agile Methods of Software Development (2011):

i. Development results are directly visible.
ii. Users get involved in system development; therefore, they are likely to take the system.

iii. Essential functionality is delivered rapidly, with more functionality being delivered at regular intervals.
iv. Because of constant feedback from the users, the system under development is more likely to meet the need it was designed to perform.
v. Early indicators of whether project will work or not, rather than an unpleasant surprise halfway through the development process.
vi. System is delivered on time and on cost.

The steps that were followed to develop the system have been outlined earlier in Figure 3.1. DSDM has four main phases; the first phase, feasibility study, was conducted by the review of literature current system used in bible study grouping, challenges faced and the process of bible study administration. This study was carried out to evaluate and analyze the potential and need of the proposed solution.

The second phase, business study. This thesis researched the business aspect of the project which includes; business sense of the proposed system, participants and technology to be used. The third phase, functional model iteration. This was used to convert system requirements identified in the second step to functional model. In the fourth phase, design and build iteration phase, a design prototype was build that users get to test.

3.3 Research Design

The purpose of this research was to design a web-based application for bible study administration. It employed quantitative techniques. Quantitative research was used to get the limitations of current systems, users expectations of the new system and to see the number of people who would like to see the new system or think it is a good idea. The findings of this

research led to the design, implementation and testing of web-based application to help in improving the efficiency of bible study administration process.

3.3.1 Location of Study

The study was carried out in two different CUs. The universities CUs that were involved were Moi University Christian Union (MUCU) and University of Eldoret Christian Union (UoECU) all based within Eldoret. The study targeted CU bible study leaders commonly referred as 'bible study coordinators', bible study group leaders and CU members. These CUs were purposively selected because of their large number of members and their active participation in bible study.

3.3.2 Target Population

The targeted population had four different groups namely:

i. CU bible study coordinators: They carry bible study group allocation process and analyze attendance reports for every group.
ii. Bible study group leaders: They collect attendance reports for their group and submit to coordination team.
iii. CU Members: They participate by registering for bible study.
iv. Campus Staff: This is FOCUS Kenya representative in a campus.

This sample population was used to get information to know if there was need for an improved system and to provide requirement specification of the system.

3.3.3 Sampling Strategy

The sampling method that was used for this research was stratified random sampling. The target population was divided into four groups based on different roles they play in bible study

administration then participants were selected randomly from these groups. This strategy was appropriate as it catered for sub-groups within the population and gave every participant equal chance to be selected.

3.3.4 Sample size

The target population was split into four categories of users. A probability sample technique was employed where, the sample population was chosen at random from the CU members and FOCUS Kenya campus representatives. Equation 3.1 was used to get the sample size.

$$n = \frac{Z^2 * P\,(1 - P)}{W^2}$$

n = required sample size

Z = Confidence level at 95%

P = 10% estimation of the need of sharing tool

W = Marginal error at 5%

According to Smith (n.d) with confidence level of 95%, Z index is 1.96.

Equation 3.1 Random Sampling (Adapted from Naing, Winn, & Rusli, 2006)

Equation 3.1 shows the formula that was used to derive the population, the population size was computed using the formula, and this came to population size of 195. The staff from FOCUS Kenya were interviewed to get a feel of their experiences and views about the current system and what they consider should be improved.

3.3.5 Methods of Data Collection

Questionnaire forms were handed to CU bible study coordinators, bible study group leaders and CU members. Campus staffs were interviewed one on one. The collected data was used to analyze the shortcoming of the current system and come up with several user requirements accordingly. Data collection techniques used was:

Questionnaires

Online Questionnaires as an online survey (as shown in Appendix A, Appendix B and Appendix C) were sent to bible study coordination team, group leaders and CU members. These were used to collect challenges faced using the current system, user expectation and user satisfaction. The forms were processed online using Google forms.

Interviews

A one-on-one interview was carried out with campus staff of MUCU and UoECU to be able to understand the methods they use to monitor bible study in campus, types of report they generate, challenges they feel and what they feel should be improved.

3.4 System Development Tools

3.4.1 Programming Tools

The following programming tools were used:

i. **Web Application**

The web application was build using Drupal 7 Content Management System (CMS) written in PHP5. Reasons for choosing Drupal 7: it is open source, it provides security and user management as part of the CMS, it offers good performance, easy to scale and customize and available community support (Burge & McCourt, 2013).

ii. **USSD**

USSD was used to implement user registration. Advantages of USSD includes: its cost efficient, it is fast and responsive; it is interactive (Taskin, 2012).

3.4.2 Database Development Tools

MySQL database management system was used to store application data for web application. Reasons for choosing MySQL database includes: it is open source; it provides full compatibility with the PHP and Drupal 7 CMS.

3.5 Proposed System Modules

The following are the systems modules:

i. Membership and registration module.
ii. Reporting module.
iii. User access and management module.
iv. Grouping module.
v. Attendance module.

3.6 Deliverables

The following items were expected to be delivered to FOCUS Kenya:

i. System requirements
ii. Bible study administration system.
iii. User manual documentation

Chapter 4 : System Analysis and Architectural Design

4.1 Overview

This chapter discusses research finding. It analyses responses from questionnaires. This section discusses data analysis and architectural design. Data analysis gives a summary of what the users expect to be addressed in the proposed system and structural design discusses the design structure.

4.2 Data Analysis

Analysis of the questionnaires was conducted online using Google forms analysis tools. Different types of charts were used to present clear visualization of the user responses and in understanding of the results. The sample size was 195 respondents from both MUCU and UoECU; this included CU members, bible study group leaders and bible study coordinators. The number of respondents who completed the survey was 158 hence the response rate was 81%. Calculated as:

$$\text{Response Rate} = \frac{\text{Number of respondents who completed the survey}}{\text{The total sample size}}$$

$$\frac{158}{195} x\ 100 = 81\%$$

Three different types of questionnaires were used, with each questionnaire targeting a specific group. Questionnaires that were used are attached in Appendix A, B and C. Questionnaires were given to four different groups of respondents as described in section 3.3.2.

4.2.1 CU Members Response on the Current Systems

i. **Number of Years Being Member in the CU**

All the CU members were asked to specify how many years they have been in the CU.

Figure 4.1 shows year distribution in all the CUs involved in the study. 34.4% were members for 2 years, 14.8% for 3 years, 42.6% for 4 years and 8.2% for 5 years. Members who have participated in CU activities for at least two years understand the process of bible study and its challenges.

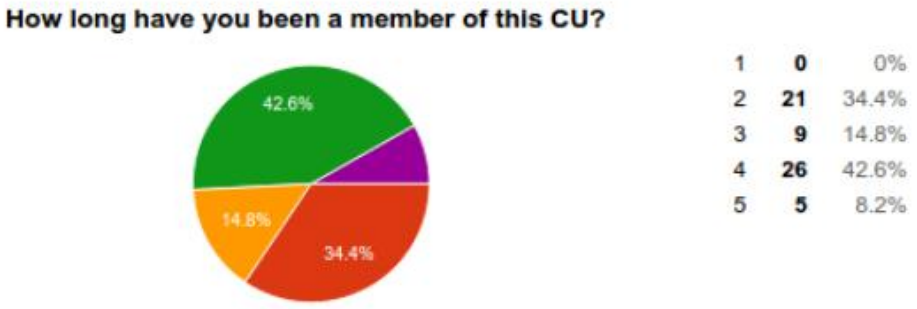

Figure 4.1 CU Membership Period

ii. Mobile Phone Ownership

The proposed system should be accessed via mobile phones hence the question that needed to be well addressed was mobile phone ownership. Figure 4.2 shows the number of members who own mobile phones, all the members sampled own mobile phones. This shows they can all access USSD application through their phones.

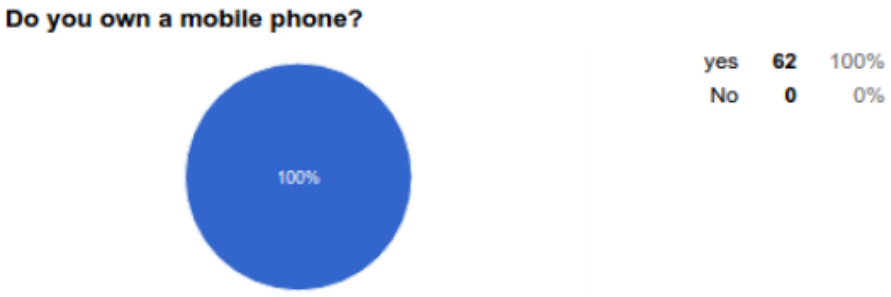

Figure 4.2 Mobile Phone Ownership

iii. Member Awareness of USSD Services

The proposed system should have USSD interface as the main registration entry for members, members were asked if they have ever used USSD services. Figure 4.3 show all sampled members have ever used USSD services. This shows that almost all members can comfortably use bible study USSD interface.

Figure 4.3 USSD Service Awareness

iv. Involvement in Bible Study Registration

Accurate and clear information on bible study registration is assumed to come from those who have ever registered for bible study. Members were asked if they have ever registered for bible study. Figure 4.4 shows all sampled members were involved in bible study registration

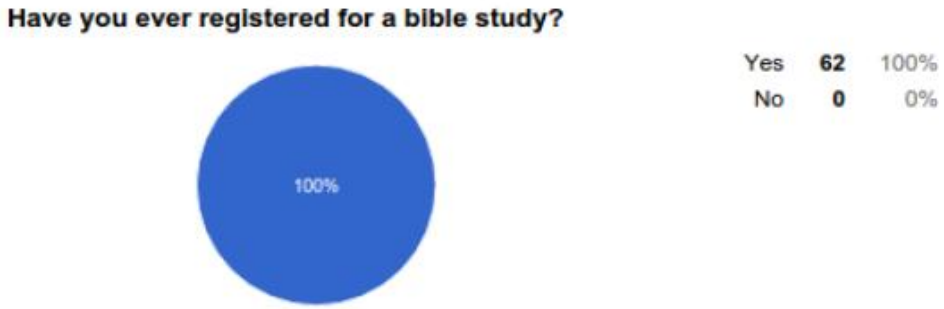

Figure 4.4 Participation in Bible Study Registration Process

v. Information Details Required During Registration

This was used to acquire members details required for registration. Members information stored for the purposes of grouping as stated by the respondents had three main categories, which were personal information, residential information and contact. The following members detailed are required for registration of bible study: admission number, name, gender, year of study, phone number, hostel and room. Some CUs had regions and members are required to specify their region number when they register for bible study.

vi. Procedure for Bible Registration

Respondents were asked how they registered for bible study, all of the respondents used paper-based forms for registration. Several Sundays are selected at the beginning of every semester, in this Sundays members are required to fill their details in paper-based forms whichare later submitted to overall bible study coordinators.

vii. Suitability of USSD based application for Bible Study Registration

To gauge the respondents' readiness to adopt a USSD based application, they were required to give a response if a USSD based application was suitable for bible study registration. As demonstrated in Figure 4.5. All the respondents indicated that a USSD based application was suitable registration.

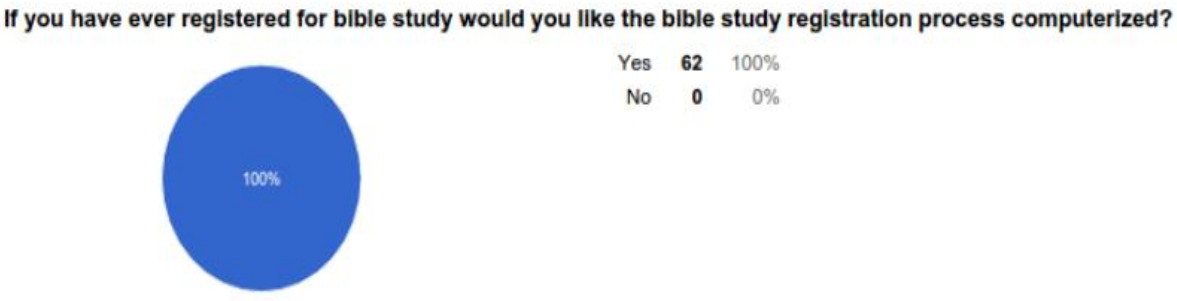

Figure 4.5 Bible Study Registration Process Computerised

viii. Challenges Faced in the Registration Process

The respondents were asked to state some of the challenges faced during registration while using current systems. Some of the challenges listed were:

(i) Remote registration is not possible
(ii) It is time consuming
(iii) Members information are not retained for subsequent use

4.2.2 Bible Study Group Leaders Response on the Current Systems

Bible study group leaders were given a separate questionnaire to get their response on the current systems used to collect meeting attendance for groups.

i. Involvement in Collection of Group Meeting Attendance Data

Respondents were asked if they have ever participated in collecting group meeting attendance information. Figure 4.6 shows 64.7% collects attendance report and 35.3% do not. The 64.7% was asked further questions about the process.

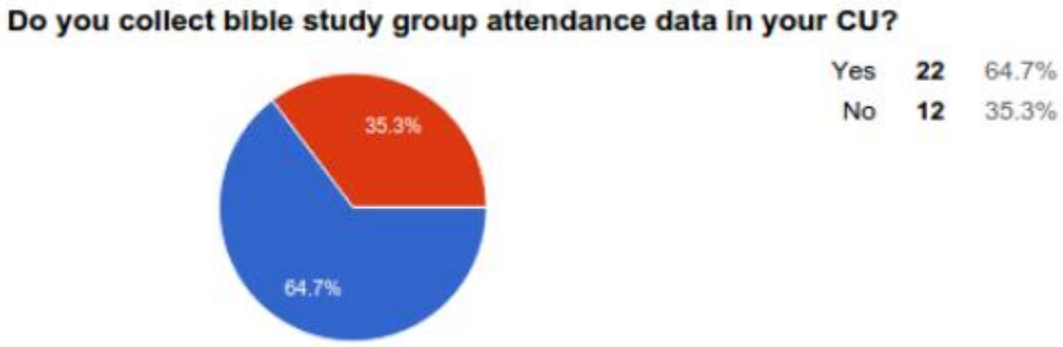

Figure 4.6 Bible Study Attendance Collection

ii. Group Meeting Attendance Information Collected

This was used to acquire attendance details that are collected by group leaders. Respondents were asked to list the details they collect after every meeting. The following information is collected after every group meeting: meeting number, number of members who attended and number of visitors who attended.

iii. Suitability of USSD based application for Attendance Collection

Members were asked to give a response if a USSD based application for collection of attendance record was suitable. Figure 4.7 demonstrates that 90% of the respondents will adopt it and the 10% did not give any response.

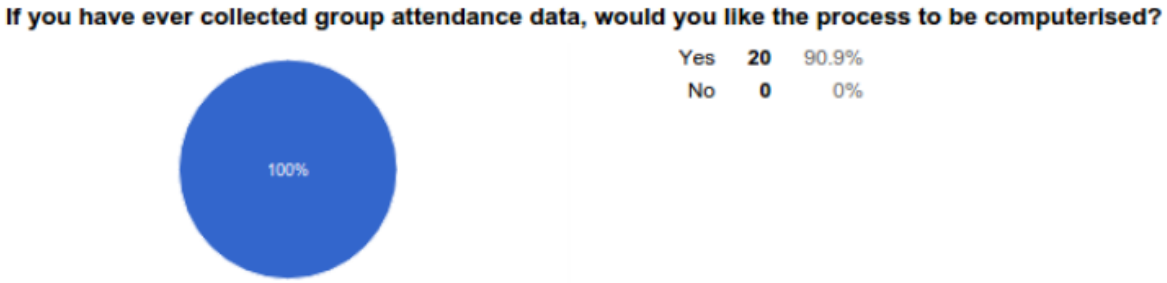

Figure 4.7Computerised Collecting Attendance Record

iv. Challenges Faced in Collecting Group Meeting Attendance Data

The respondents were asked to state some of the challenges faced during collection of attendance while using current systems. Some of the challenges listed were:

(i) Loss of data.
(ii) It is time consuming.
(iii) It is cumbersome in analyzing overall report.
(iv) Inaccuracy of collected data.

4.2.3 Bible Study Coordinators Response on the Current Systems

CU leaders who carry out grouping and generating reports were also given questionnaires to get feedback on the current process used in grouping and reporting.

i. **Number of People Registered for Bible Study per Semester**

Grouping process is dependent on the number of registered members. The leaders were asked to give a range of people they group in every semester. The larger the members the more it becomes complex to allocate members to groups. Figure 4.8 shows a pie chart of members.

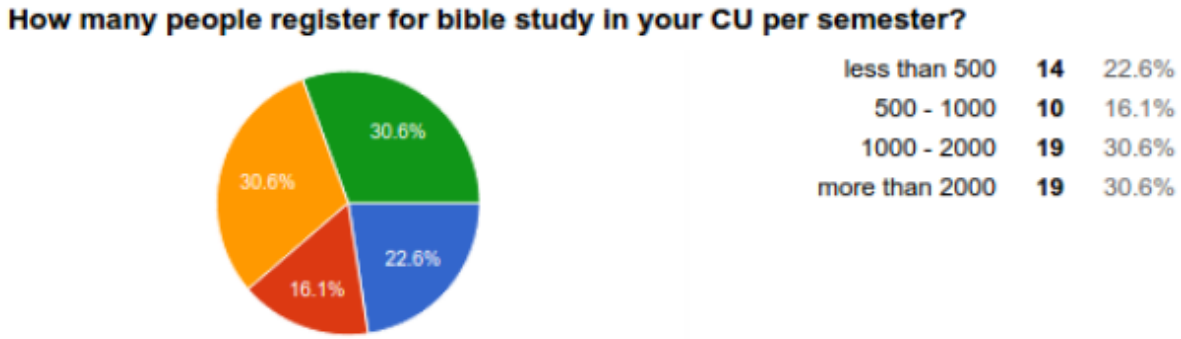

Figure 4.8 Registered Members

ii. Grouping Process

The CU leaders were asked to describe the process used in current systems to group members. Most of the respondents said they divide the registered members into zones then appoint people to allocate members in to bible study groups.

iii. Grouping Time

The CU leaders were asked to select an average time they take allocate members to bible study groups. Figure 4.9 shows the response from the respondents. Most of them use at least a day to allocate members in to bible study groups.

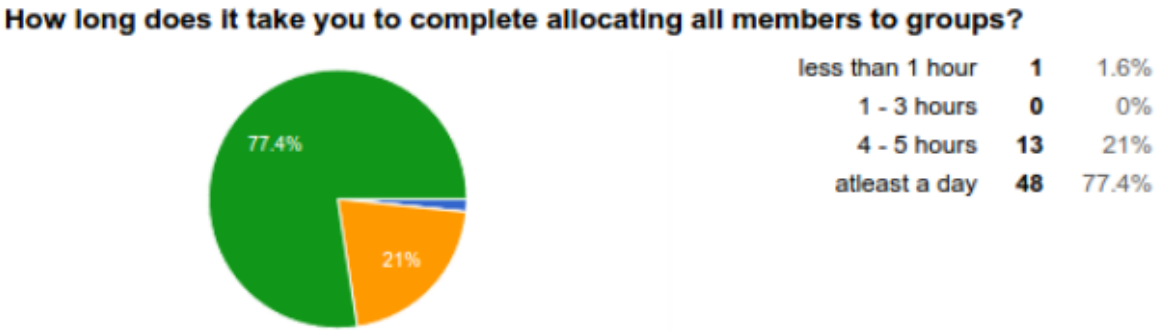

Figure 4.9 Grouping Time

iv. Suitability of Web-based Application for Grouping

Members were asked to give a response if a web-based application for grouping was suitable. Figure 4.10 demonstrates that 100% of the respondents will adopt it.

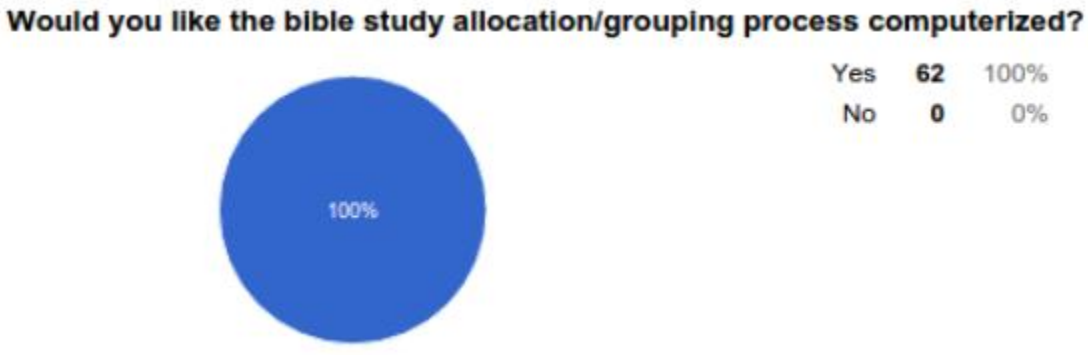

Figure 4.10 Bible Study Grouping Computerised

v. Types of reports generated

The respondents were asked the types of reports they generate, the following are types of reports that are used as key performance indicators:

(i) Attendance comparison of gender, male versus female.
(ii) Attendance comparison of years.
(iii) Overall average attendance per group per meeting.

vi. Challenges Faced in Grouping Process

The respondents were asked to state some of the challenges faced during grouping process while using current systems. Some of the challenges listed were:

(i) Its cumbersome.
(ii) It is time consuming.
(iii) Data loss when transferring data from paper-based forms.

4.2.4 Data Analysis Conclusion

Based on the analysis of the responses discussed in the previous section, the results were used to come with the following conclusion:

(i) USSD application is the preferred platform for development of bible study registration and attendance system.
(ii) Web-based application is the preferred platform for development of bible study grouping system.
(iii) Information required for bible study registration is: admission number, name, year of study, gender, phone number and room of residency.
(iv) Meeting attendance information collected is: how many members attended, male who attended. Female who attended, year distribution of those who attended.

(v) The current system for bible study administration experienced major challenges that need to be addressed.

(vi) Reports that are key for performance analysis is: attendance distribution per gender and per year of study, average attendance per group per meeting.

(vii) The proposed USSD and web-based application would be acceptable by majority of the users.

The summary described in section 4.2 was used to formulate the system requirements and was then used in system designing and implementation.

4.3 System design

4.3.1 Overview

This section covers the system design and architecture of the proposed system, it then goes through how the application is developed and tested. The design was done using UML diagrams showing elaborative design and architecture for both web application and USSD application. The design diagrams include use case diagram with detailed follow-up use case descriptions, system sequence diagram, class diagram and entity relationship diagram. Data collected was used to come up with system requirements. System requirements include functional and non-functional requirements of the system.

4.3.2 System Requirements

These are some of the functional and non-functional requirements of the system derived from data analysis conducted.

4.3.3 Functional Requirements

These define the functions that the implemented system or its components must perform successfully; they include inputs, behavior and outputs. They include:

i. Register

The system should allow CU members to register; it should provide an interface to capture all the required members' information.

ii. Grouping

After bible study coordinators login, they should be able to group the registered members into small groups; group size specified by the coordinator. This is achieved through the grouping functionality.

iii. Collect Attendance

The system should provide an interface for bible study group leaders to record general comment for every meeting and an interface for every group member to check-in after every meeting. The system should a mechanism to ensure members who have not attended the meeting are not able to check in, this will be achieved by requiring group leaders to generate attendance code and give to members who attended the meeting. When members check in, the system will prompt them attendance code, this code must match the given code for successful check in.

iv. Generate reports

Attendance data will be used to generate attendance reports; this will be generated by CU leaders and FOCUS Kenya staff.

v. Check allocated group

After grouping process, members should be able to check which group they have been allocated to and their group leaders' details.

4.3.4 Non Functional Requirements

These are the requirements that do not affect the core functionality of the system but they define the quality attributes of the system. They were constructed in agreement with functional requirements that define specific behavior or functions. They are:

i. **Security** – The system should only allow authorized users to use its functionalities.
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 tasks requested by the user.
iv. **Scalability** – The system should be able to adopt additional functionalities. Additional data should be easy to incorporate.
v. **Performance** – The system should have an acceptable response time while performing its functions.
vi. **Integrity** – the system being data oriented it should ensure that data analyzed and stored is not altered or corrupted.

4.3.5 System Architecture

This research came up with system architecture from the requirements collected; this shows how the system works. The architecture adopts a client-server model. This architecture has two modules. The web module and the USSD module. The web module has FOCUS Kenya staff interface for managing CUs, generating reports and CU bible study coordinators interface for grouping and generating report. USSD module provides the following interface; members' registration, collection of meeting report and members check in. There is a web service that helps the USSD module to communicate with the server and get the needed data. The web module can also communicate with web service.

Figure 4.11 shows the architecture of the system.

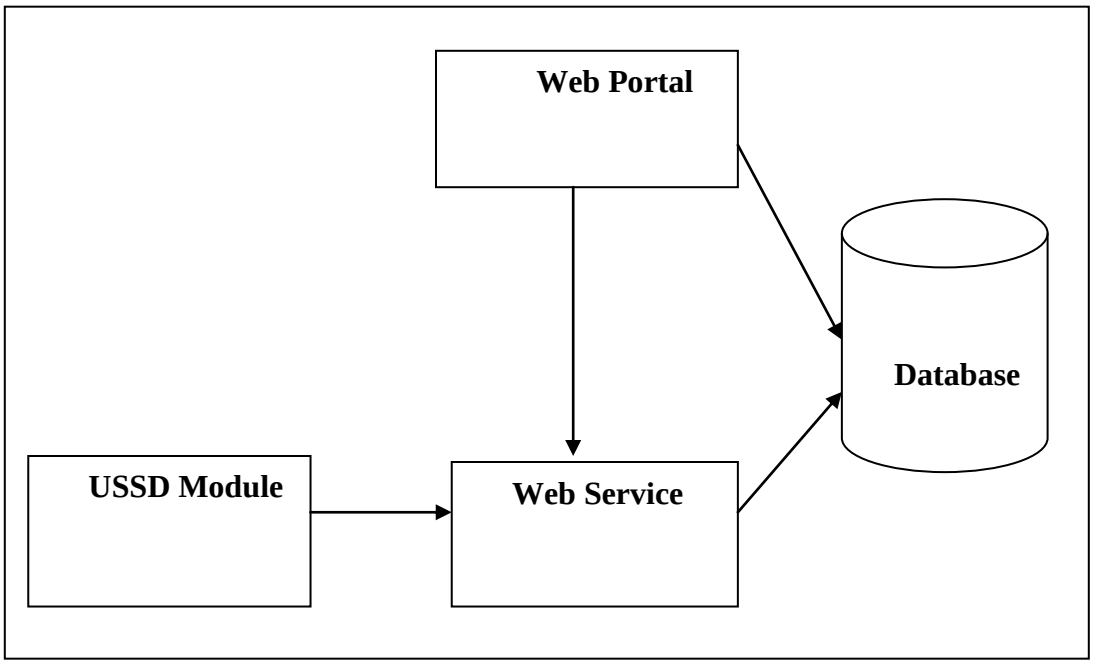

Figure 4.11 System Architecture

4.3.6 Data and Process Modeling System Design

This application comprises of a number of roles who are key to the system. FOCUS Kenya is able to view and print attendance reports. CU bible study leader is able to view, print reports and manage grouping process. Group leader is able to post general comments for every meeting, member is able to register, check allocated group , check-in after every meeting and de-register. The following sections describes how different classes and objects interact in the system and how data flows in the system.

Sequence Diagrams

Interaction diagram is used to describe interactions between different types of elements in a model (Schmidt, Matthes & Hamburg-Harburg, n.d). Sequence diagram is one of the interaction

diagrams. It shows the explicit sequence of messages that are passed between objects in a defined interaction (Dennis, Wixom & Tegarden, 2005). Figure 4.12 shows sequence diagram of how CU bible study coordinator interacts with the system during grouping and generating attendance reports.

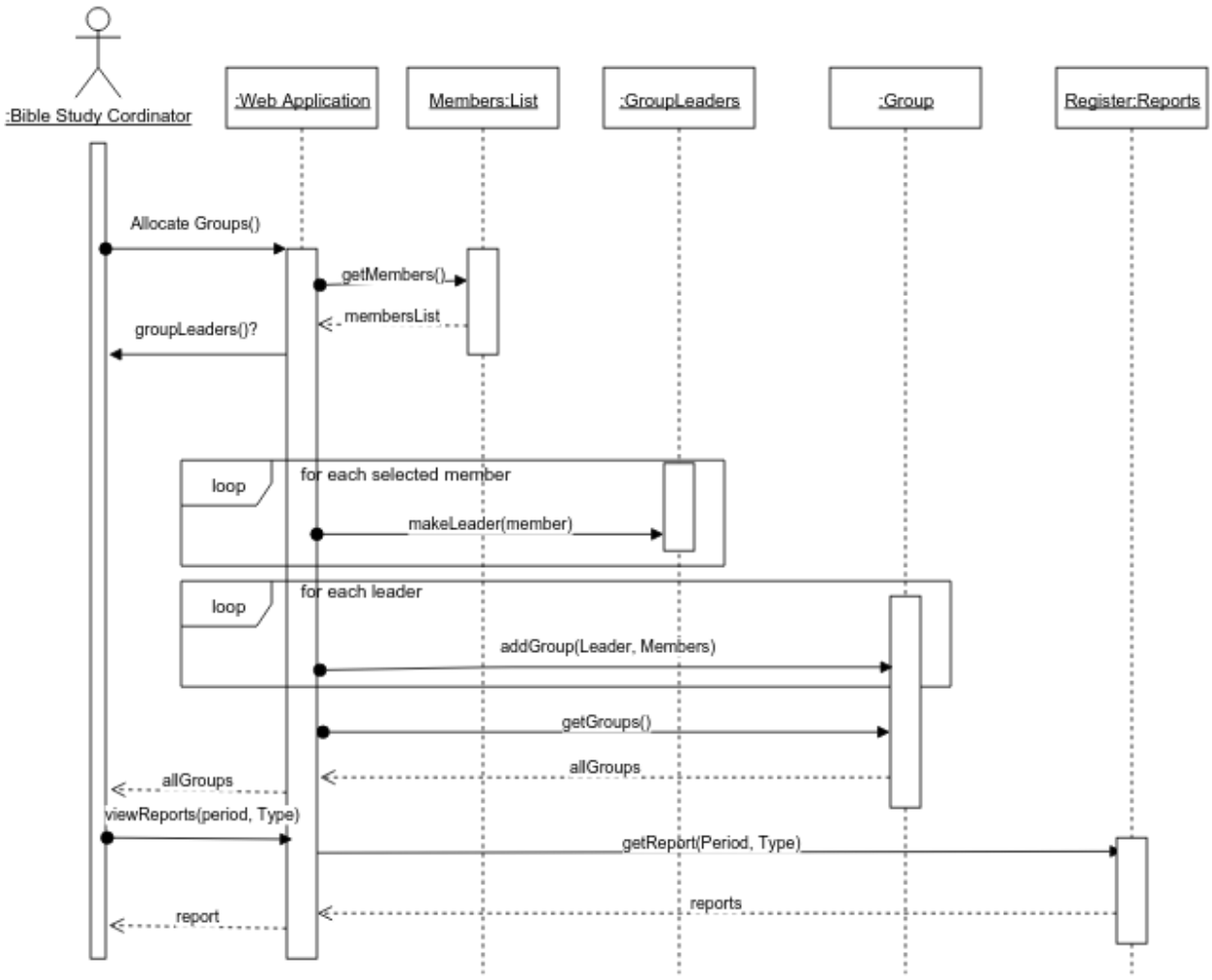

Figure 4.12 Sequence Diagram

Figure 4.13 shows sequence diagram of how CU member interacts with the system during registration and attendance check in.

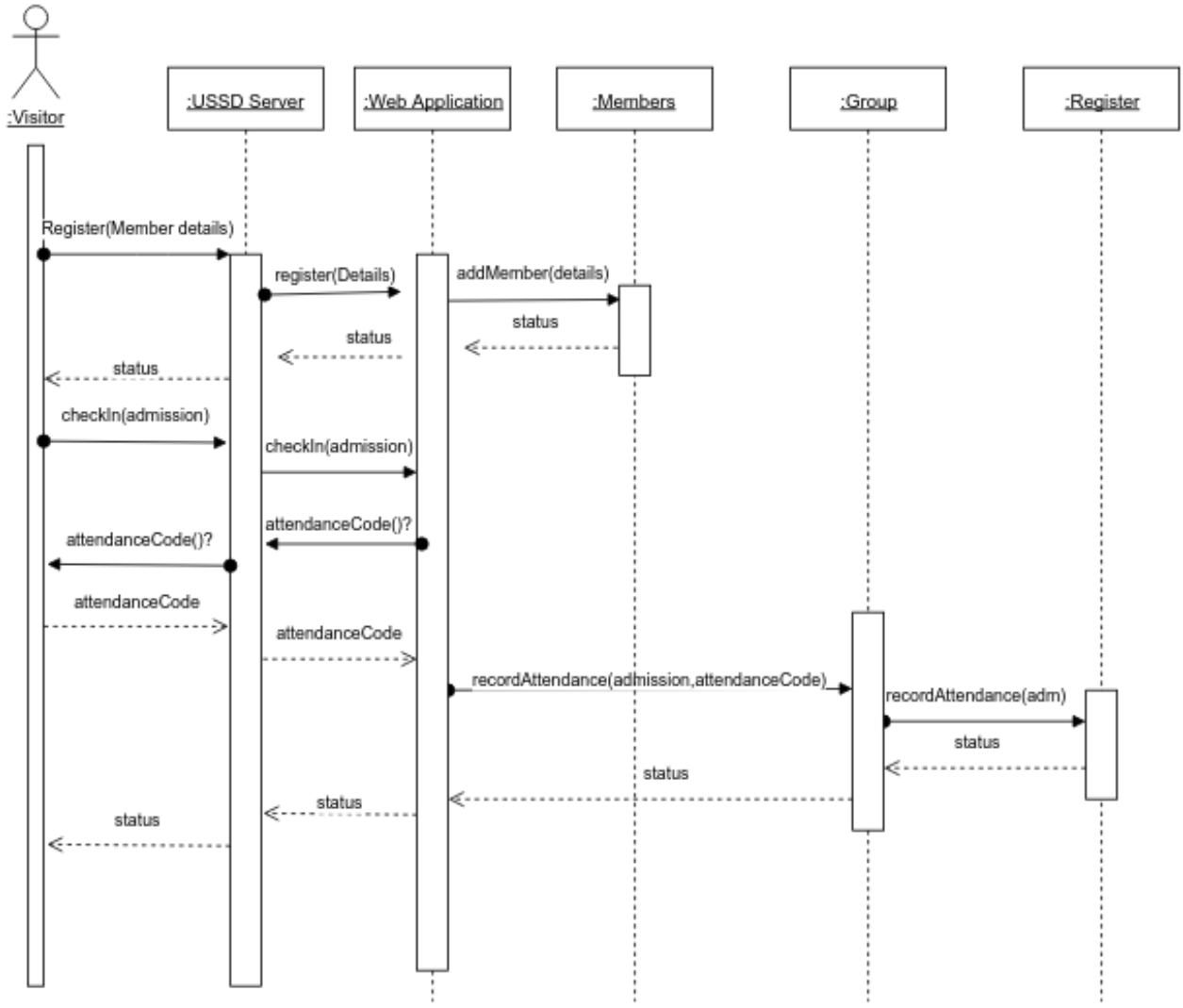

Figure 4.13 Sequence Diagram

Class Diagram

Figure 4.14 shows static models of the classes that are to be used in the application. Class attributes and the behaviors. It also shows the relationships between the various classes.

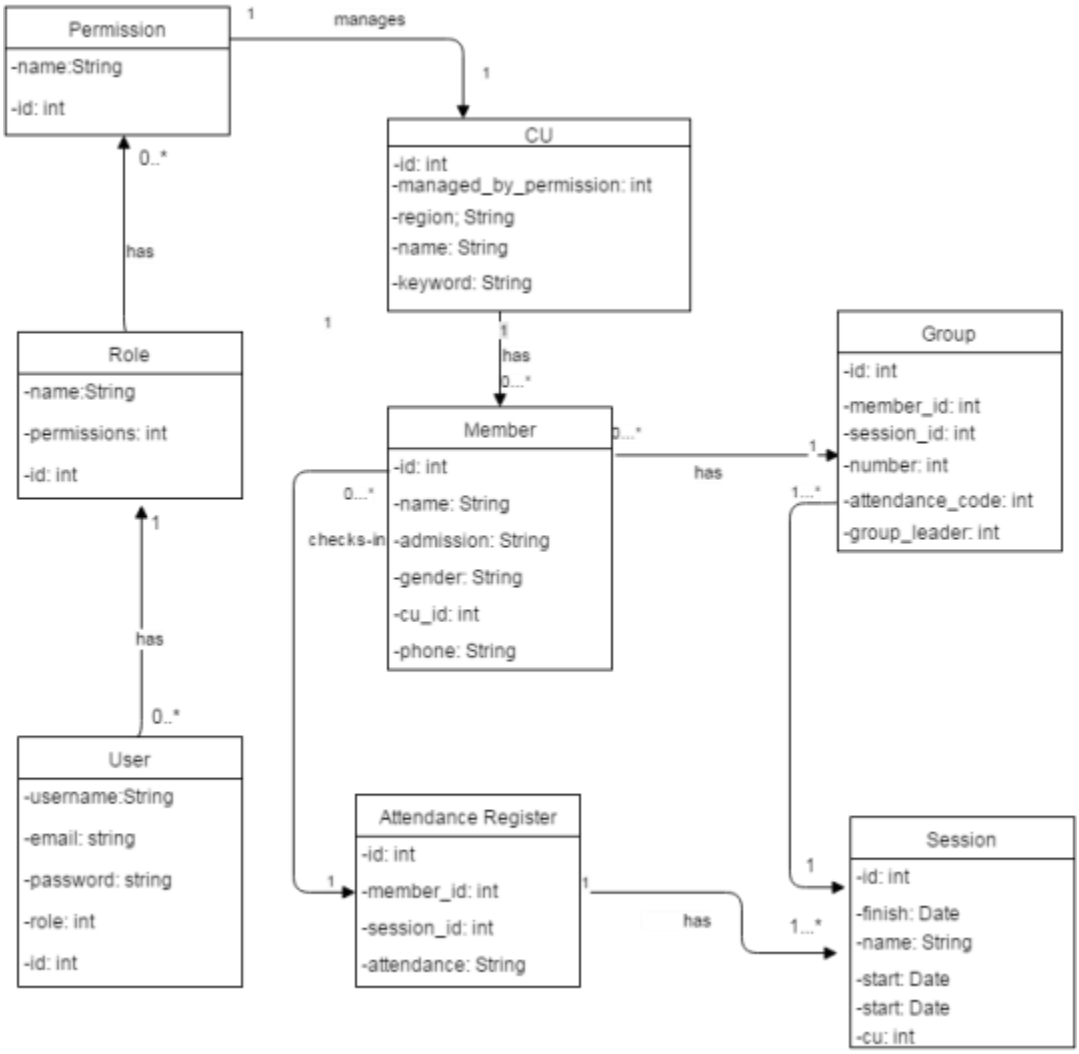

Figure 4.14 Class Diagram

Use Cases Modeling

Use cases are used to model the various processes in the system and how external entities interact with them (Dennis, Wixom & Tegarden, 2005). The actors here include FOCUS Kenya staff, CU bible study coordinator, Group leader, and CU Member.

i. Use Case Diagram

Figure 4.15 shows the use case diagram for the application. It gives the various functionalities of the application and the relationship between the functions and external users.

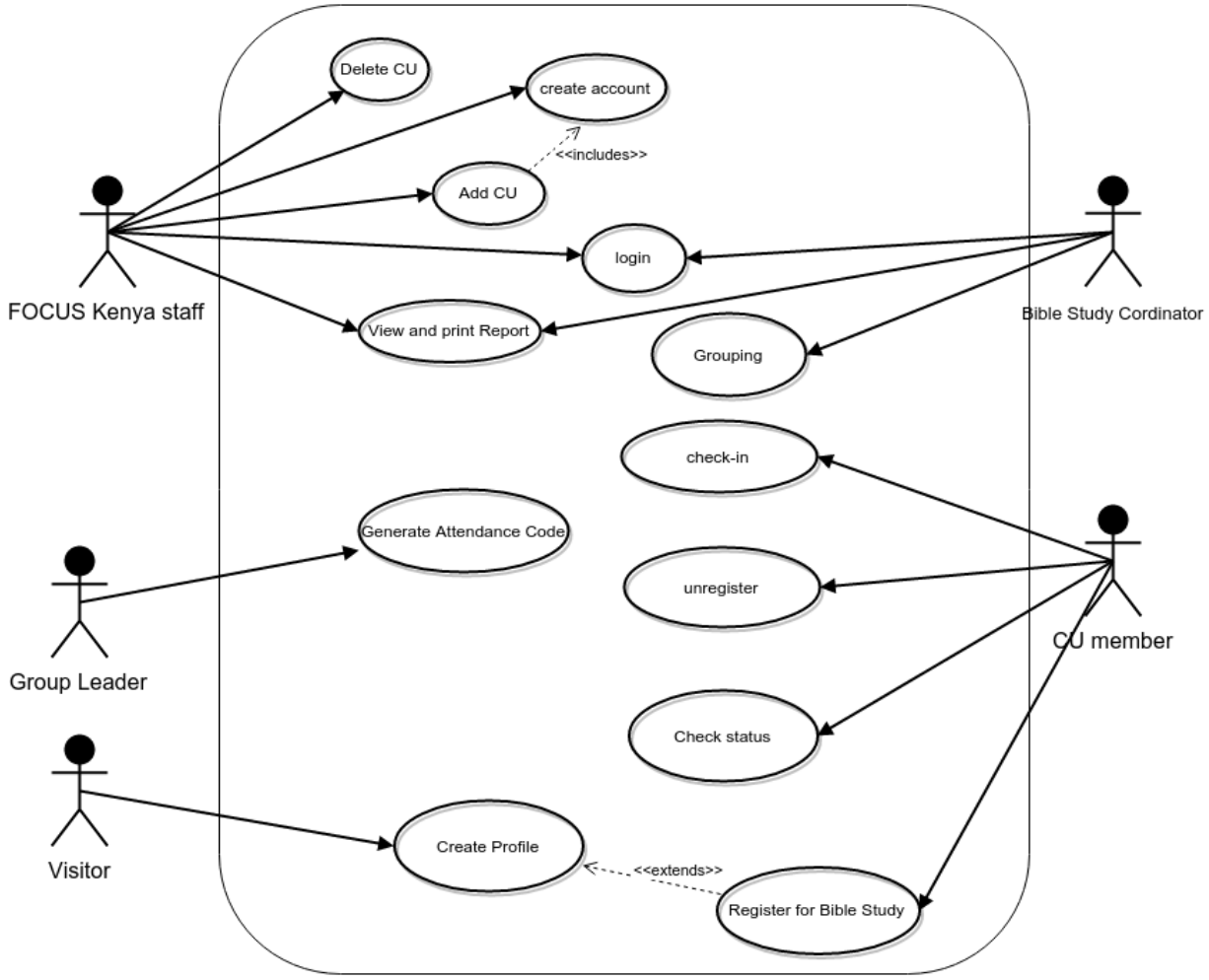

Figure 4.15 Use Case Diagram

ii. **Use Case Descriptions**

This section gives a description of the various use cases in the system, their triggers and the information that is sent by the various uses case as steps occur. The main use cases described in this section are register for bible study, create profile, grouping , check in and print reports. Table 4.1 create profile process.

Table 4.1 Create Profile Use Case

Use Case Name: Create Profile
Primary Actor: CU Member
Description: Describes how CU members creates a profile
Trigger: CU member dials USSD code and selects create profile. **Type**: External
Relationships: **Association**: CU member **Extends**: Update profile
Normal flow of events: 1. Member enters admission number 2. System checks if member profile exist 3. System asks member to enter his /her details. 4. System displays process status
Alternative flows: 2a. Member profile exists, system calls update profile use case.

Table 4.2 describes the process of registering for bible study. It shows the trigger and also the steps involved.

Table 4.2 Register for Bible Study Use Case Description

Use Case Name: Register for bible study
Primary Actor: CU Member
Description: Describes how CU members registers for bible study
Trigger: CU member dials USSD code and selects register for bible study **Type**: External
Relationships: **Association**: CU member **Extends**: Create profile
Normal flow of events: 1. Member enters admission number 2. System checks if member profile exist 3. System asks member to enter current residence details and year of study. 4. System displays process status

Alternative flows: 2a. Admission number does not exist, system calls create profile use case.

Table 4.3 demonstrates the grouping process. It shows the primary actor, event trigger and also how the process flows.

Table 4.3 Grouping Use Case Description

Use Case Name: Grouping.
Primary Actor: Bible study coordinator.
Description: Describes how a bible study coordinator allocates members to bible study groups.
Trigger: Bible study coordinator logins in to web portal and clicks grouping menu. **Type**: External
Relationships: **Association**: Bible study coordinator

Normal flow of events: 1. System displays all registered members. 2. Coordinator selects group leaders. 3. System asks coordinator to set group size. 4. System generates random groups with each with a leader. 5. System displays generated groups. 6. Coordinator prints all groups.
Alternative flows: 1a. No registered members, system exists with displaying error message.

Table 4.4 shows Use case description of check in Use case. It describes how members update their attendance records after every meeting.

Table 4.4 Check In Use Case Description

Use Case Name: Check in.
Primary Actor: CU Member.
Description: Describes how CU Member checks in his attendance after every meeting.

Trigger: CU Members dials USSD code and selects check in. **Type**: External
Relationships: **Association**: CU member.
Normal flow of events: 1. CU Member enters attendance code. 2. System validates attendance code. 3. System records attendance and displays status message.
Alternative flow: 2a. Member enters invalid attendance code. System exists with error message.

Table 4.5 shows Use case description of generate reports. Its gives steps involved in generating attendance reports.

Table 4.5 Print Report Use Case Description

Use Case Name: Print Report.
Primary Actor: FOCUS Kenya staff.
Description: Describes how FOCUS Kenya generates bible study attendance reports.
Trigger: FOCUS Kenya staff logins in to web portal and clicks reports menu. **Type**: External
Relationships: **Association**: FOCUS Kenya staff , Bible study coordinator
Normal flow of events: 1. FOCUS Kenya staff enters period to generate report. 2. FOCUS Kenya staff selects report type to generate. 3. System generates report. 4. FOCUS Kenya staff prints report. 5. System displays print status message.

Database Design

Figure 4.16 show the Entity relationship Diagram for the database used in the system. It was normalized to help improve the integrity of the data in the application. Appendix D shows the designed database schema.

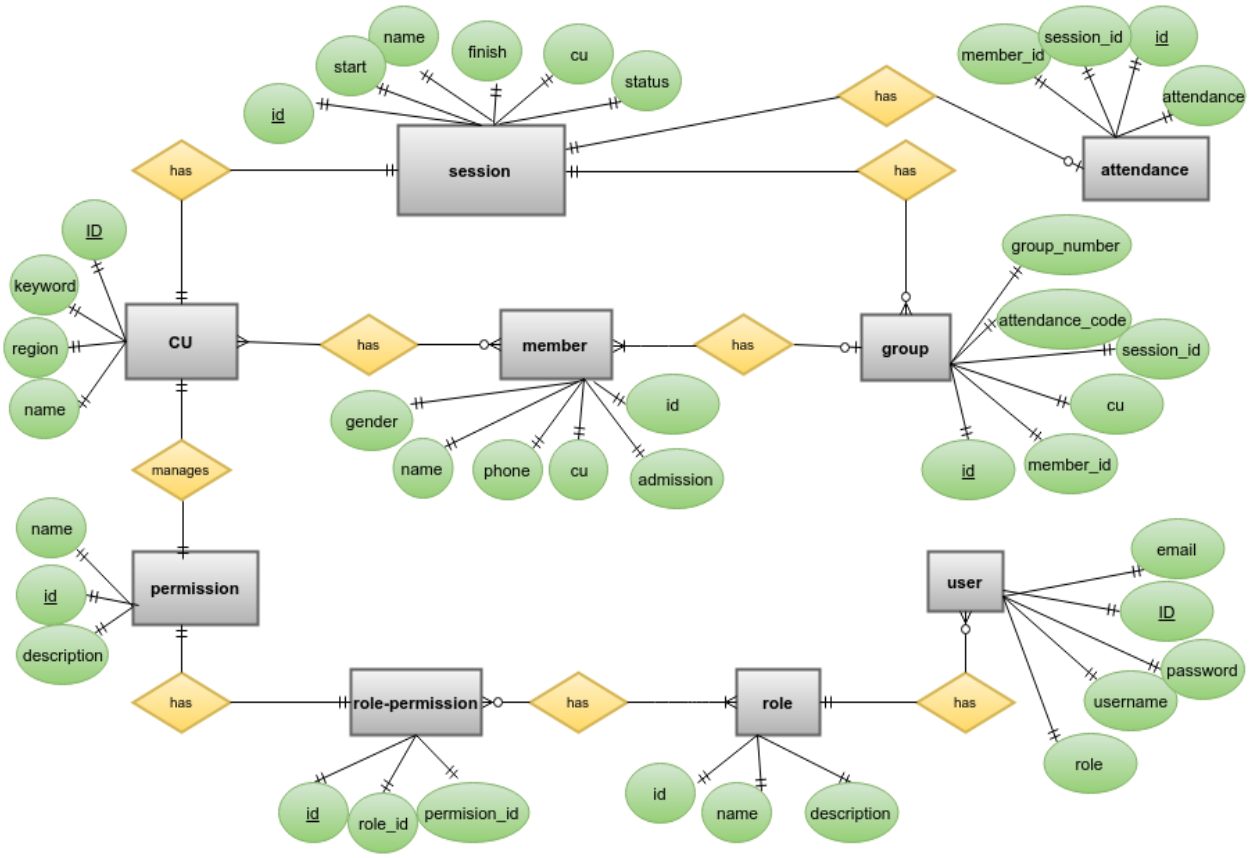

Figure 4.16Entity Relationship Diagram

4.3.7 System Design Summary

System analysis and design helps in understanding system requirements. The proposed architecture is a client server architecture where the USSD application and web portal acts as the client while the server and database acts as severs.

Chapter 5 : System Implementation and Testing

5.1 Overview

The main objective of this thesis was to develop an efficient system for bible study administration in CUs. System analysis and design was carried out in chapter four. This chapter contains the implementations of the proposed system as discussed in chapter four, web application and USSD application. This chapter also provides the system testing procedure. Design output are shown in the figures in this section.

5.2 System Development

DSDM was followed to design and implement system prototype as discussed in chapter three. Web application and USSD prototypes were implemented.

5.2.1 Web Application

The web application was built using Drupal 7 CMS due to its advantages as started in chapter three section 3.4.1. Database was implemented using MySQL 5 database. The web application is hosted on an online Apache HTTP server and running on Linux environment.

5.2.2 USSD Application

The USSD application uses a 'pull' based USSD communication. In this 'pull' based USSD type, a subscriber requests service from the USSD gateway server by dialing a given USSD code i.e *384*1259#. All end users of the system access the system via their mobile phones. The system is designed to work with all types of GSM phones.

5.3 System Implementation

5.3.1 Web Application

The web application serves requests from web users and USSD users. Web users are divided into two different categories namely; FOCUS Kenya campus staff and bible study coordinators. The web system distinguishes different types of users by checking the role attached to the user.

The main system components of the web application are:

5.3.1.1 Login

To gain access to the web application users have to login using a username and password. The username and password is authenticated and verified then access is granted or denied. After login, the system checks if user has any role, the system loads appropriate menus depending on the permissions attached to user role . This prevents against unauthorized access. Figure 5.1 shows the screen shot for logging in the web application.

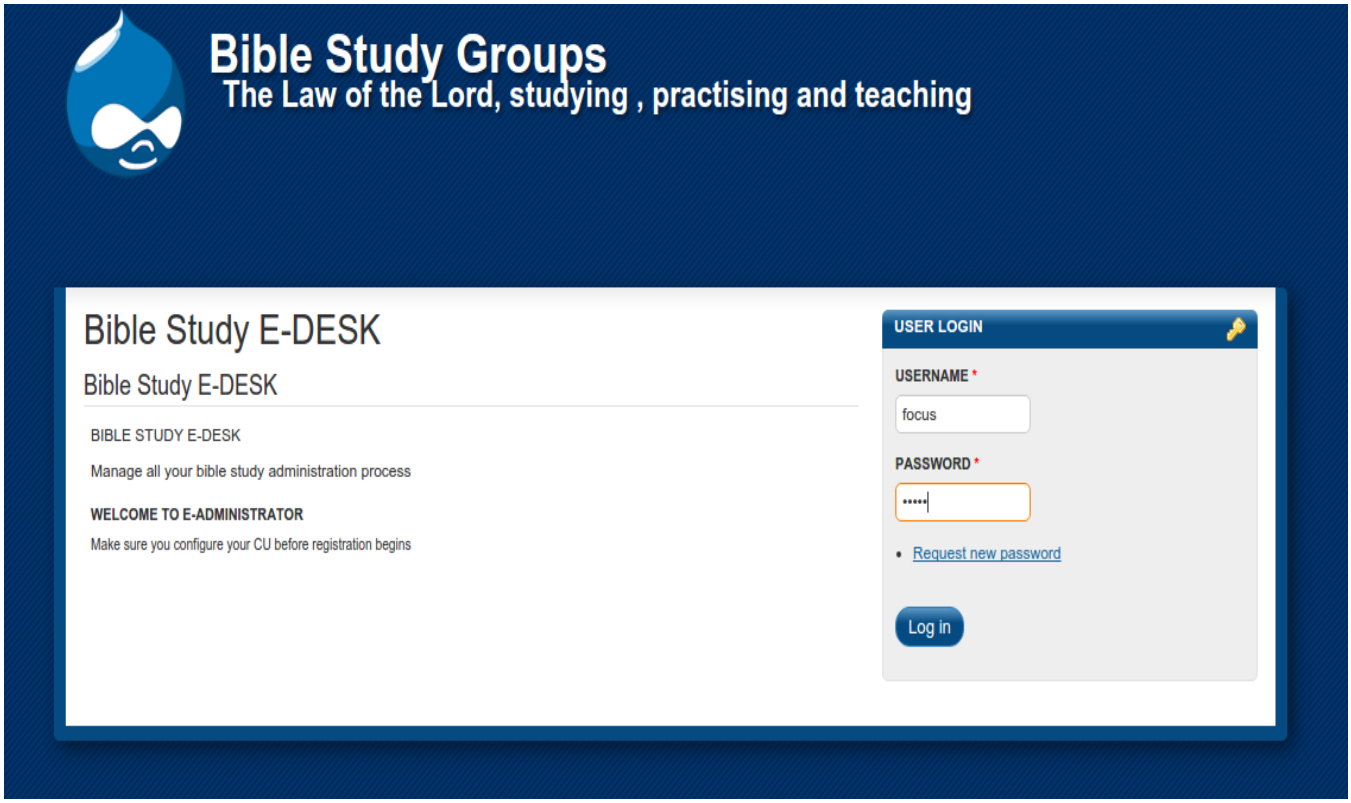

Figure 5.1 Web Application Login

5.3.1.2 FOCUS Kenya campus Staff Administrative side

FOCUS Kenya campus staff interacts with this part of the system. This part will require an authenticated user who has FOCUS Kenya role. It provides the following functionalities:

1. Add CU.
2. View, deactivate, update and delete CU.
3. Add bible study coordinator.
4. View overall attendance reports.

Add CU

This is used to create a new CU profile. The user is required to enter the following CU details;

i. CU full name
ii. CU USSD Keyword, this will be used by members to select their CU in USSD menus.
iii. CU region.
iv. Select what is the maximum year of study CU members are in.

Figure 5.2 shows add Cu form.

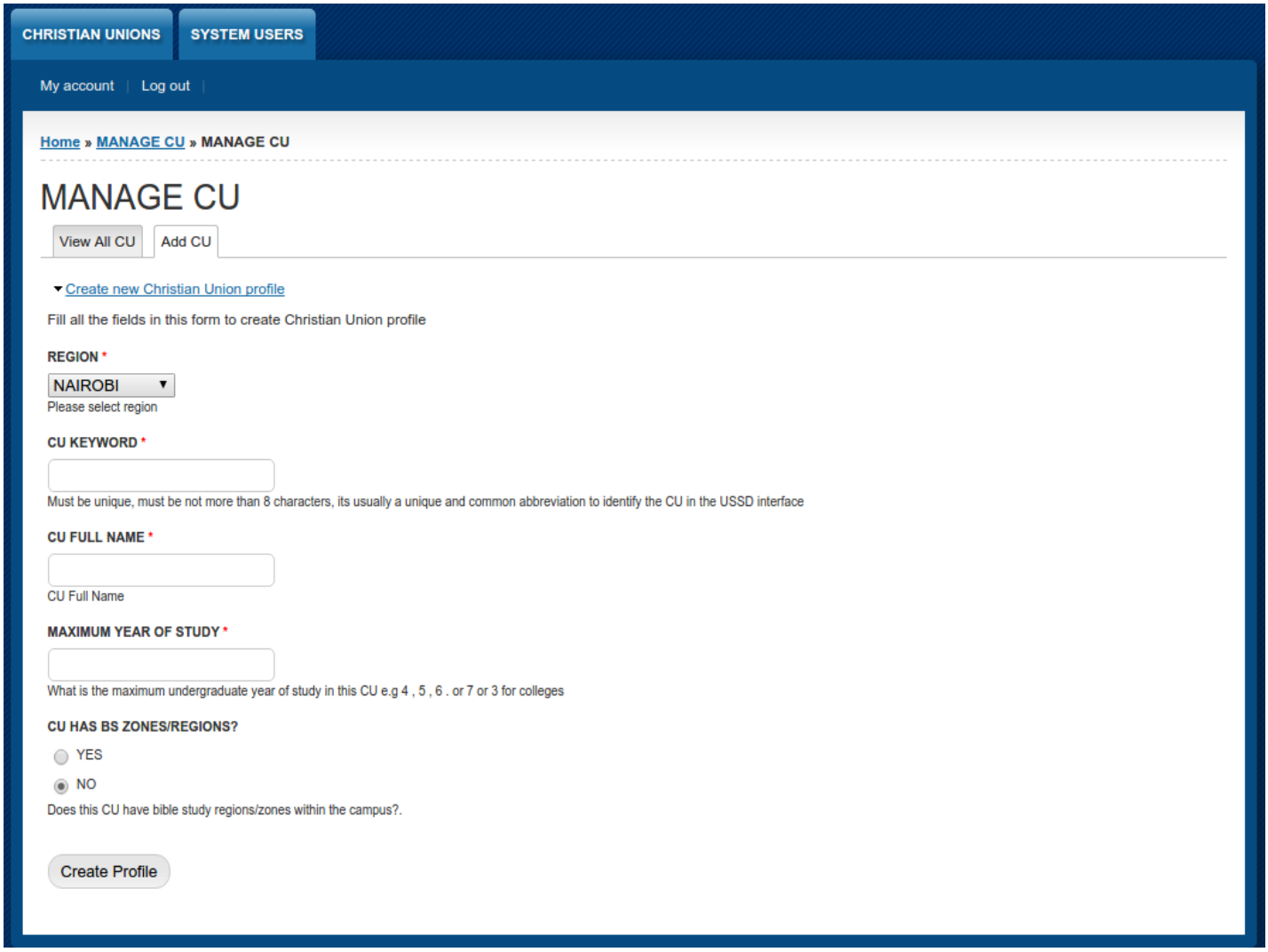

Figure 5.2 Web Application Add CU

View, Deactivate, Update and Delete CU

This provides the functionality of viewing all registered CUs, deactivating CU, update CU and delete CU from the system.

Figure 5.3 shows view CU, deactivate CU, update CU and delete CU functionality.

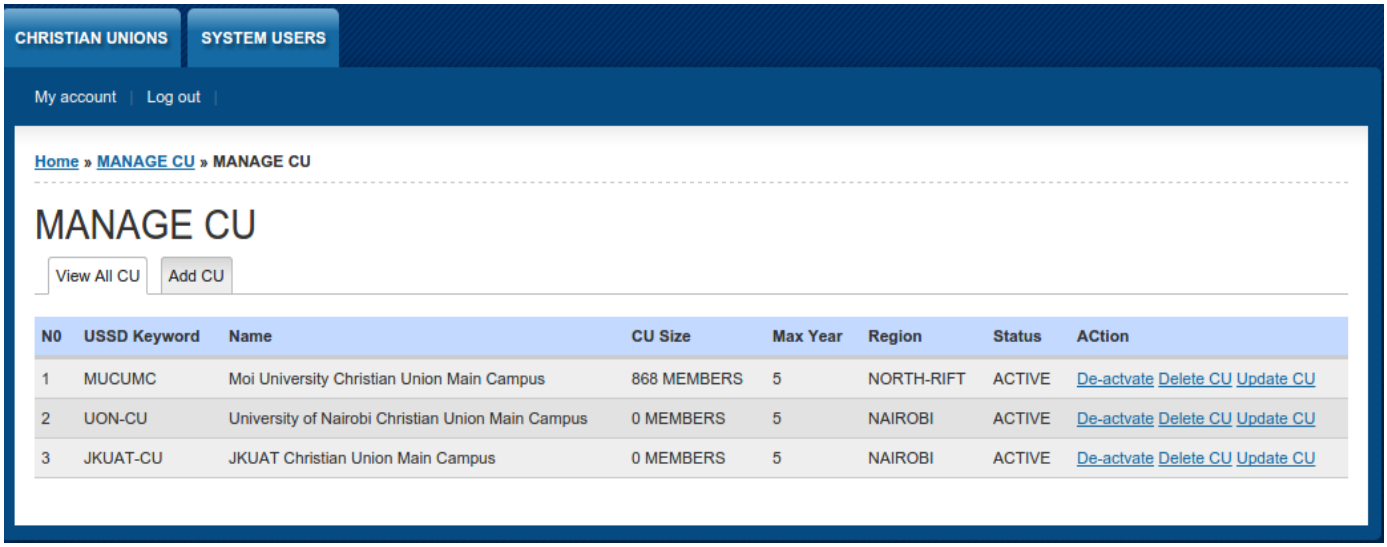

Figure 5.3 Web Application Update CU

Add bible study coordinator

This system component creates a new user with coordinator role that is attached to the selected coordinator CU. The following fields are required to create a coordinator:

i. User name.
ii. Email address.
iii. CU the coordinator manages.

After creating the coordinator, the system sends an email with one time login link requesting the bible study coordinator to set a new password. This also makes sure that the given email is valid and prevents robot users.

Figure 5.4 shows an interface with form fields to add a new bible study coordinator to the system.

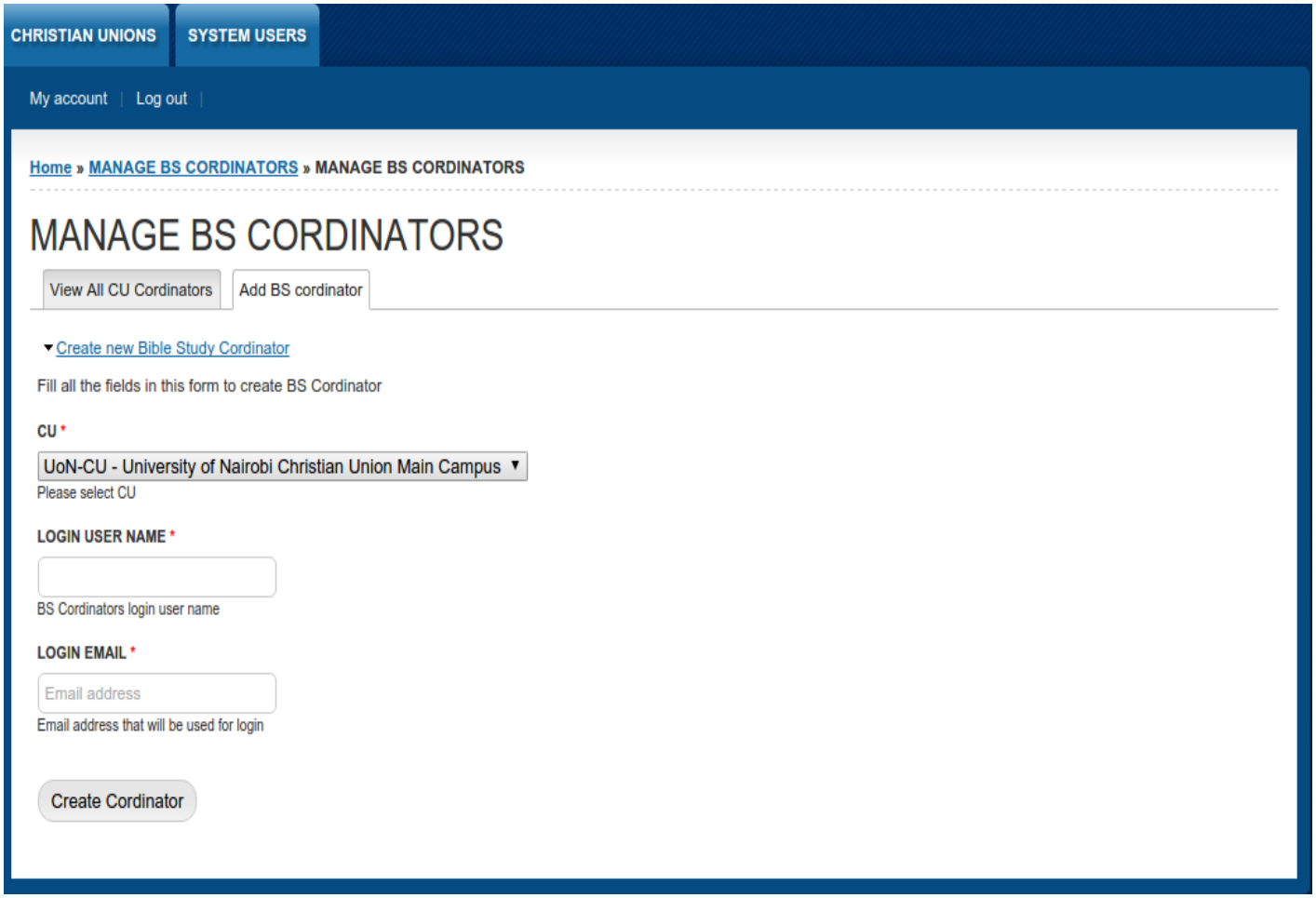

Figure 5.4 Web Application Add Coordinator Form

5.3.1.3 Bible Study Coordinators Administrative Side

Bible study coordinator interacts with this part of the system. This part will require an authenticated user who has the bible study coordinator role. It provides the following functionalities:

1. Add bible study session.
2. Add bible study zone.

3. Appoint group leaders.
4. Allocate members to groups.
5. View CU attendance reports.

Add Bible Study Session

A bible study session is the period in which bible study is conducted. Majority of CUs, have sessions that starts when academic semester begins and ends when the semester ends. By creating session, the system is able to store all bible study groups and attendance records even when a session ends. Before members start registration, coordinators are required to create a bible study session. There can only be one session at a time, when a new session is created, the other running sessions are deactivated. A session has the following fields:

i. Session name.
ii. When to start registration.
iii. When to end registration.
iv. CU, this is picked automatically from current logged in user.

Figure 5.5 shows form used to create a new session.

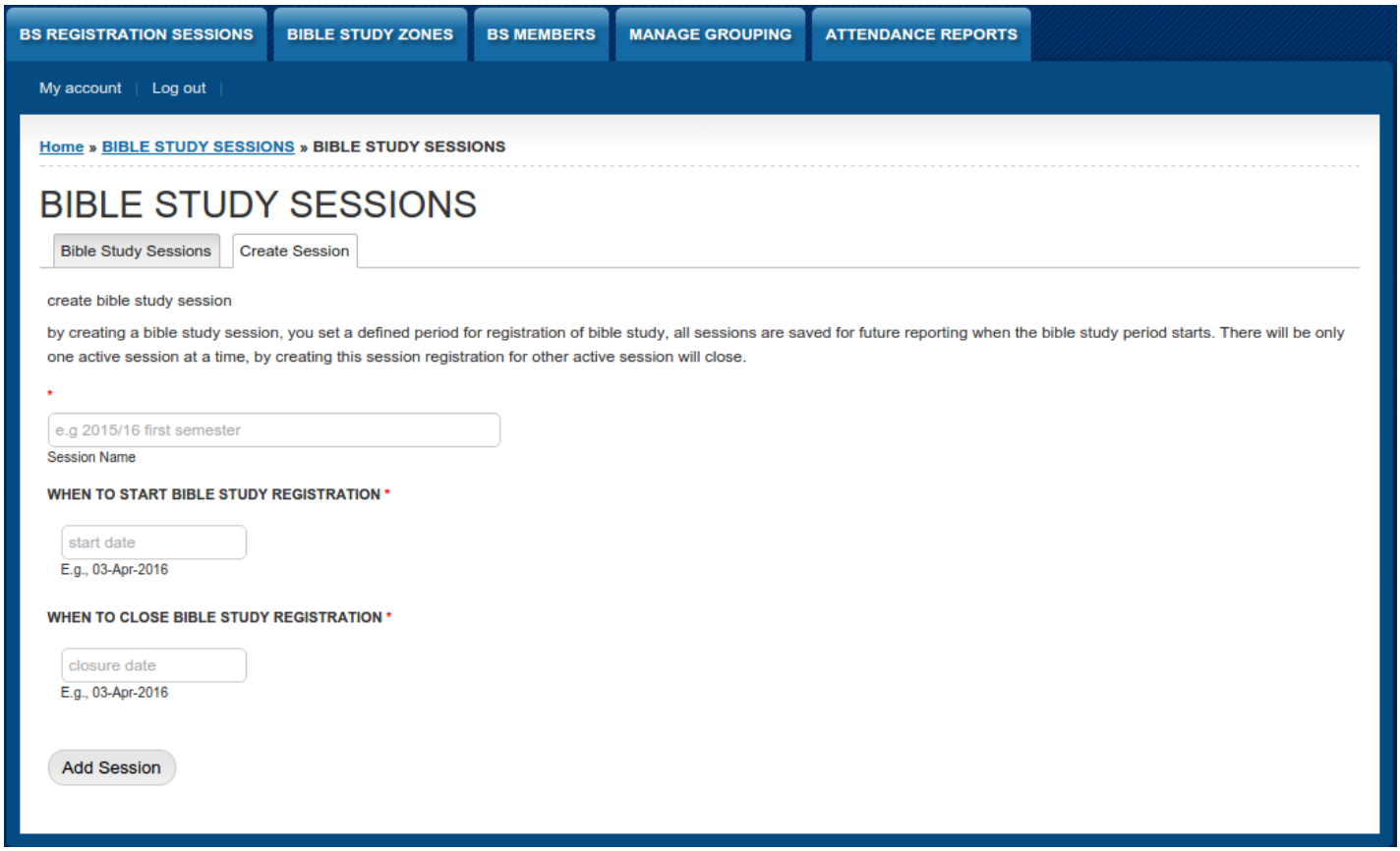

Figure 5.5 Web Application Add Session

Add Bible Study Zone

A majority of CUs allocate members of the same region in to one group. These regions are called zones. This system component creates a new zone. A zone has the following fields:

i. Zone number.
ii. Zone name.
iii. CU, this is picked automatically from the logged in user.

Figure 5.6 shows a add zone functionality.

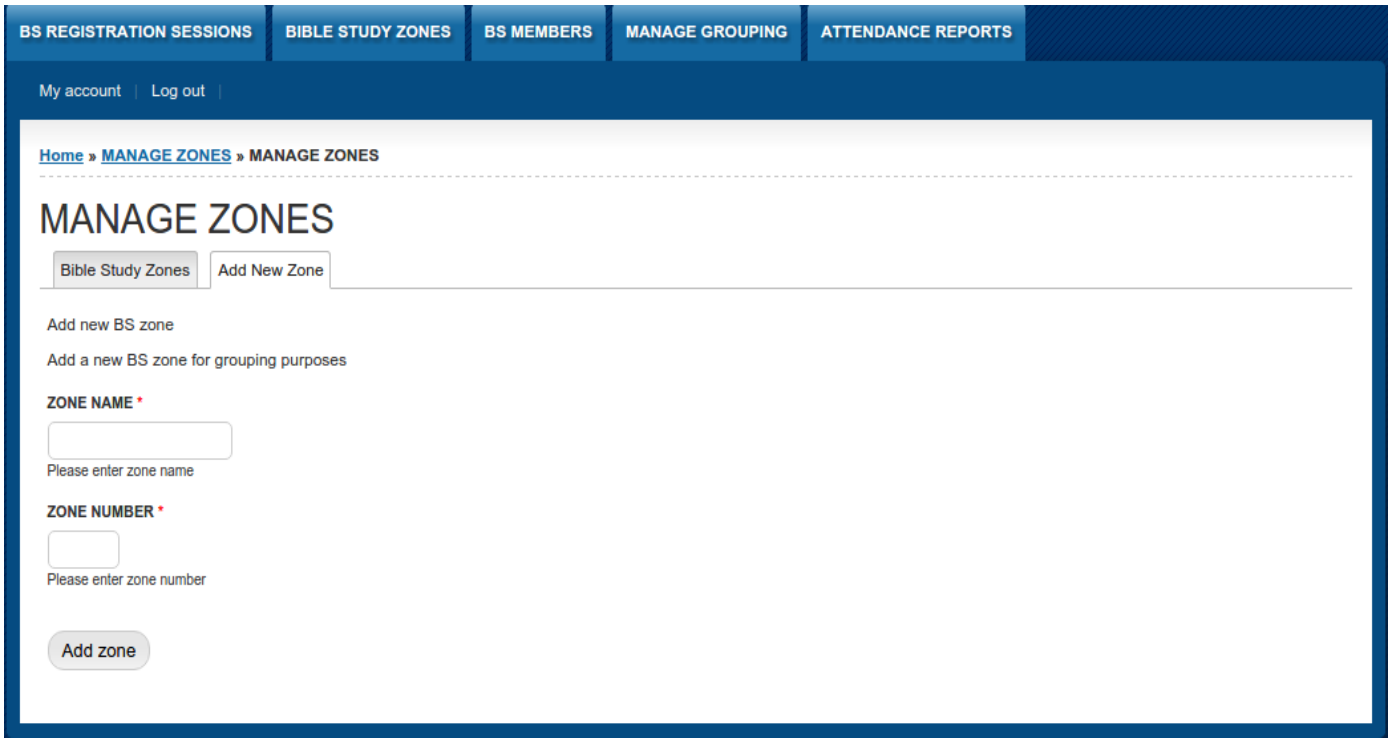

Figure 5.6 Web Application Add Zone

Appoint Group Leaders

Appointing group leaders has two steps. The first step is selecting zone which you want to appoint group leaders. After selecting zone, the second step is appointing group leaders.

i. Select Zone to Appoint Leaders

This functionality allows a coordinator to choose zone to work on. This process is skipped if a CU does not have any zone.

Figure 5.7 shows select zone interface.

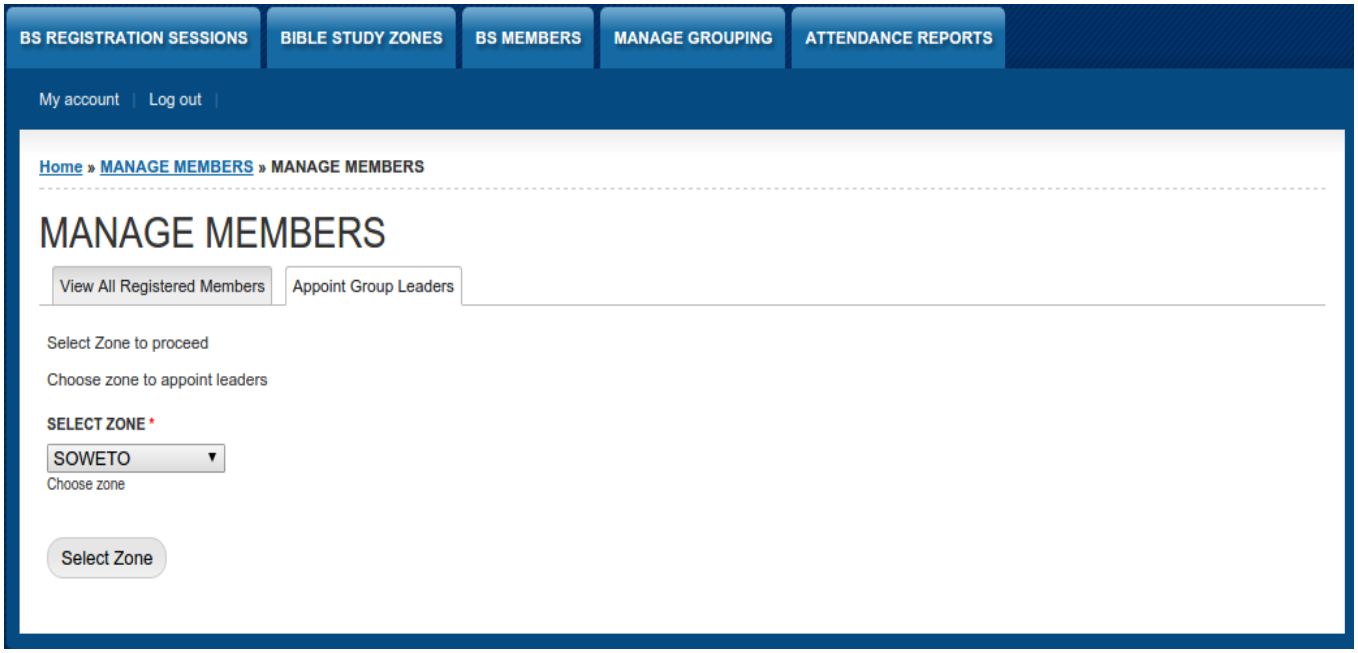

Figure 5.7 Web Application Select Zone

Bible study coordinator selects zone to work on from a dropdown list of all created zones that belong to the coordinator CU.

ii. Appoint Group Leaders

After selecting zone, the system redirects to the interface of appointing group leaders. The system loads all bible study registered members of the selected zone. The system loads a check box beside every leader, when the checkbox is checked, the member has already been made a leader. To make a leader, the coordinator checks the checkbox, to unmake a group leader, the coordinator uncheck the checkbox, and finally the coordinator clicks ‘save configuration’ button to save the leaders list.

Figure 5.8 shows a section of appoint leader interface.

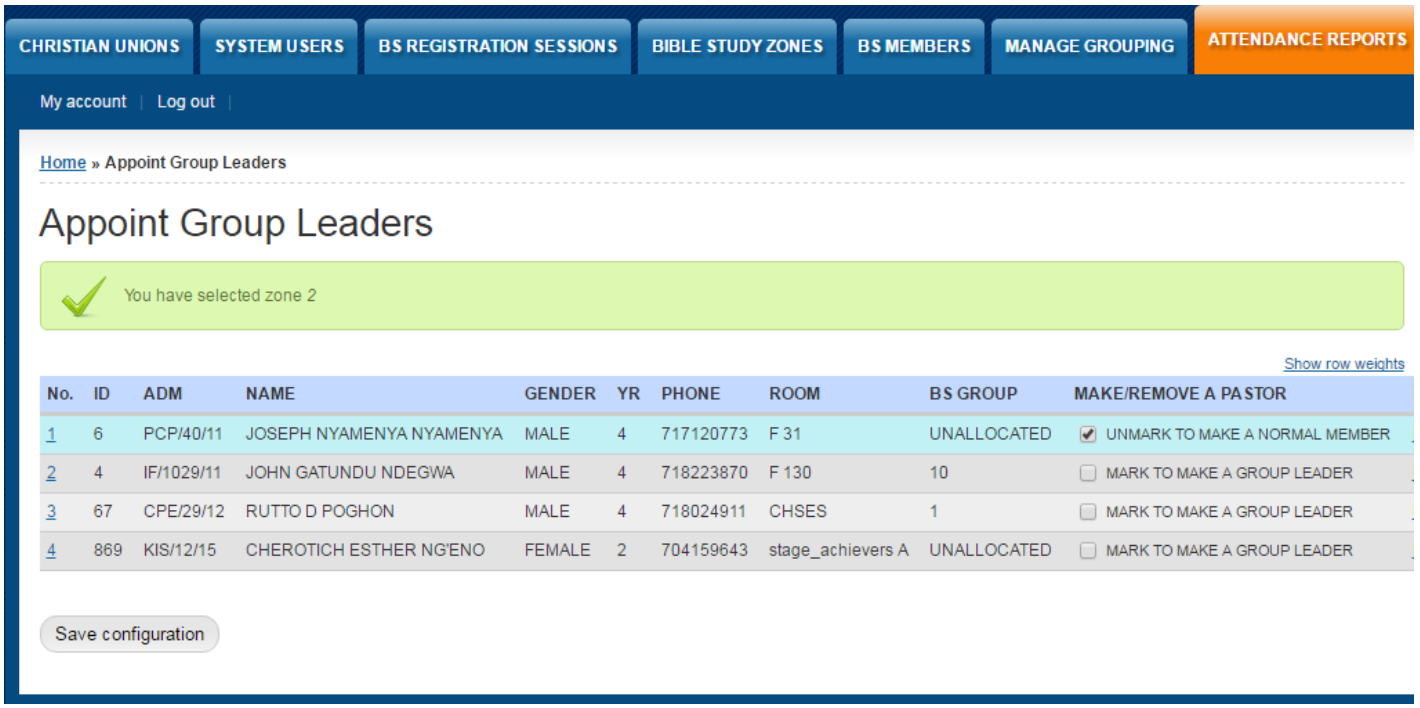

Figure 5.8 Web Application Appoint Leaders

Grouping Members

Grouping process has three steps, the first step is setting group size. A bible study coordinator can also let the system decide group size, after setting group size, the second step is selecting zone to perform grouping. After these steps, the third step, the system generates bible study groups allocating every leader number of members specified by the value set in set group size.

i. Set Group Size

This system component helps to define the required group size. The system presents an interface to enter an integer value of required group size. When a coordinator enters zero, the system automatically calculates group size by dividing total bible study registered members with number of appointed leaders.

Figure 5.9 shows an interface used to set group size.

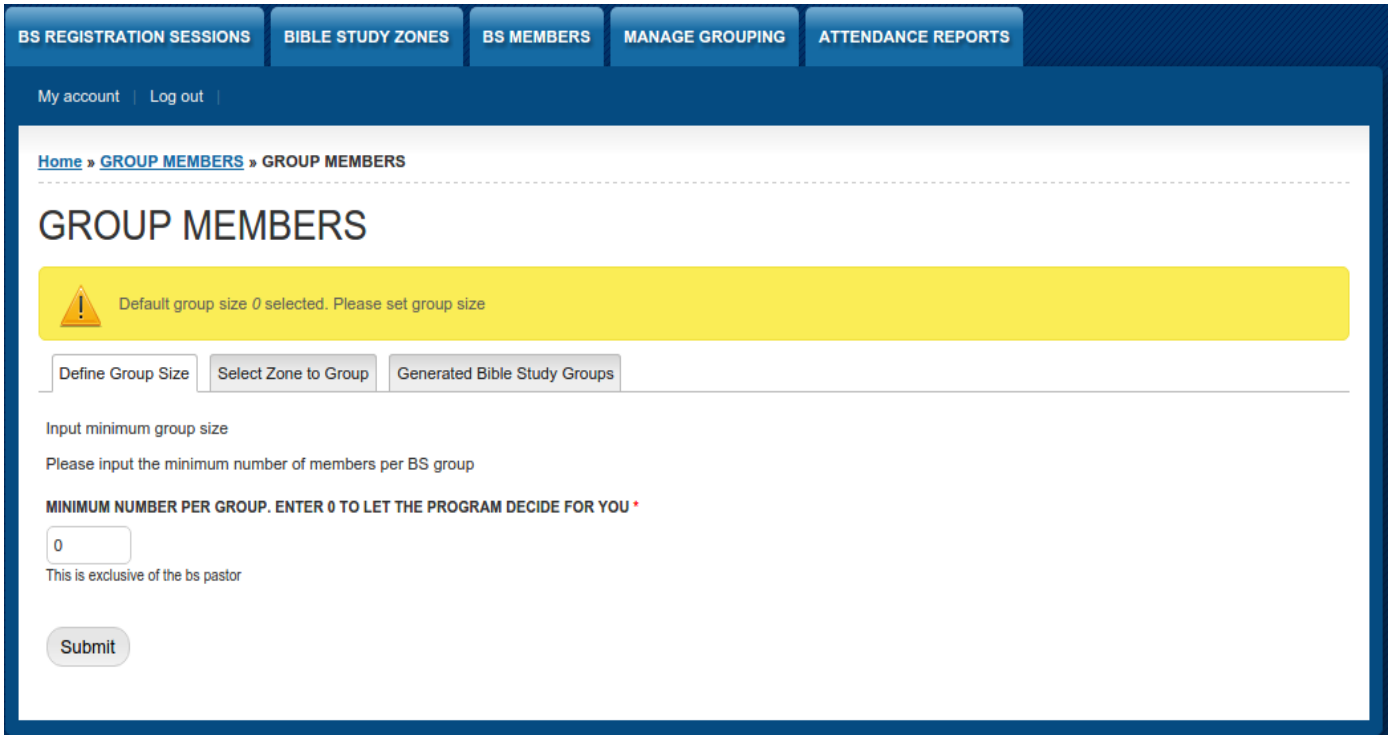

Figure 5.9 Web Application Set Group Size

ii. Select Zone to Group

After setting group size, the system redirects to select zone. Grouping is done zone after zone until all registered members are allocated to groups. Figure 5.10 shows select zone interface.

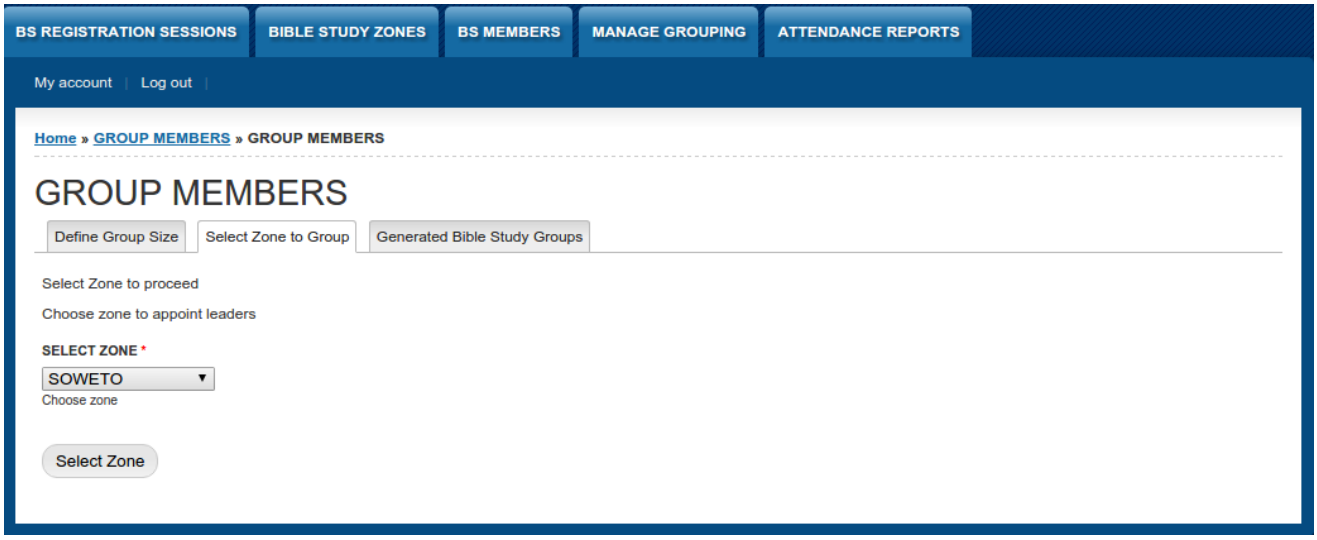

Figure 5.10 Web Application Select Zone

View CU attendance reports

The system generates overall attendance report for each session. This is a report of average attendance per meeting. Three types of reports are generated, these are:

i. Bar chart of gender attendance comparison.
ii. Bar chart of year attendance comparison.
iii. Bar chart of zone attendance comparison.
iv. Bar chart of overall attendance.

Figure 5.11 shows bar chart of overall average attendance per group.

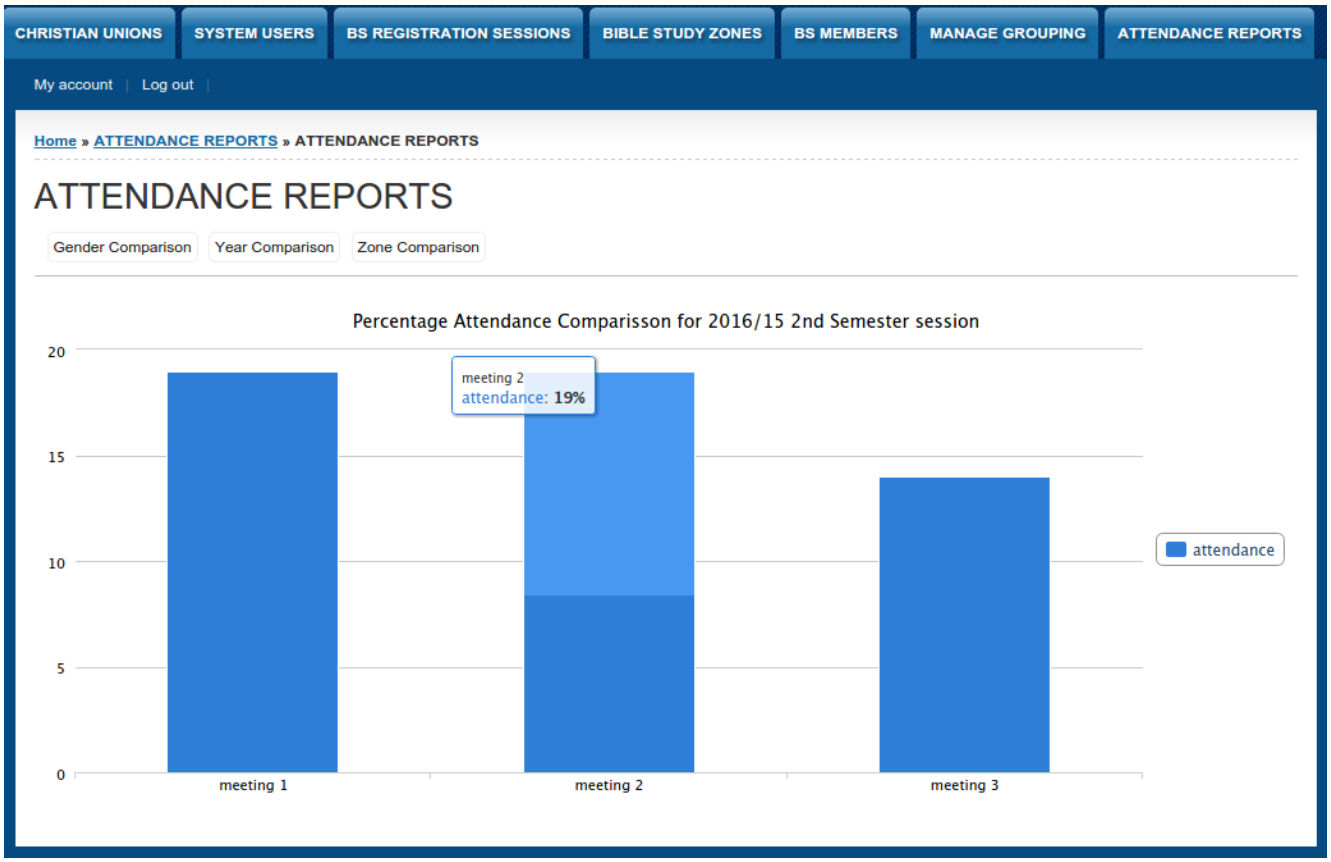

Figure 5.11 Web Application Overall Attendance Report

Figure 5.12 shows overall attendance reports with gender comparison

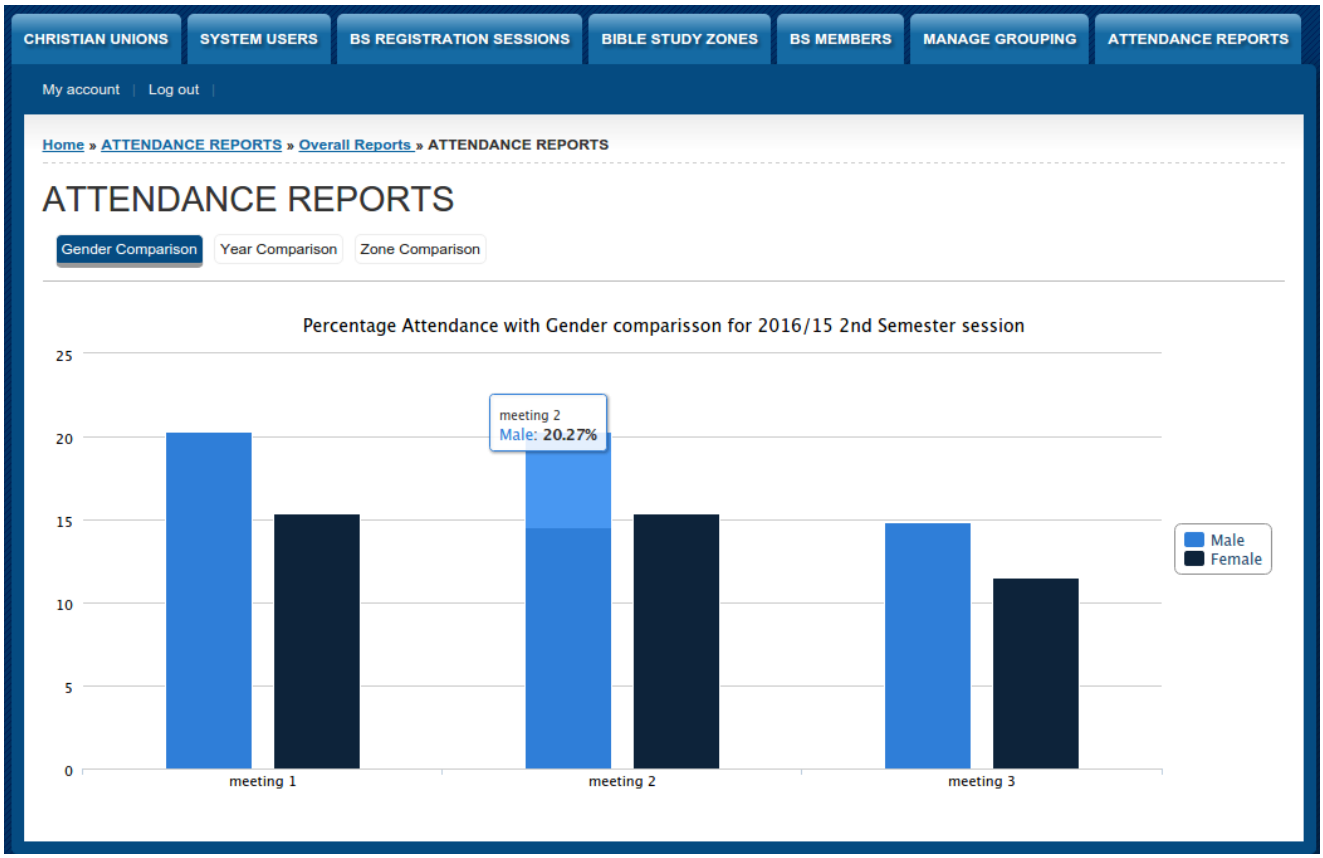

Figure 5.12 Web Application Overal Attendance Report with Gender Comparison

Figure 5.13 shows overall attendance reports with year of study comparison

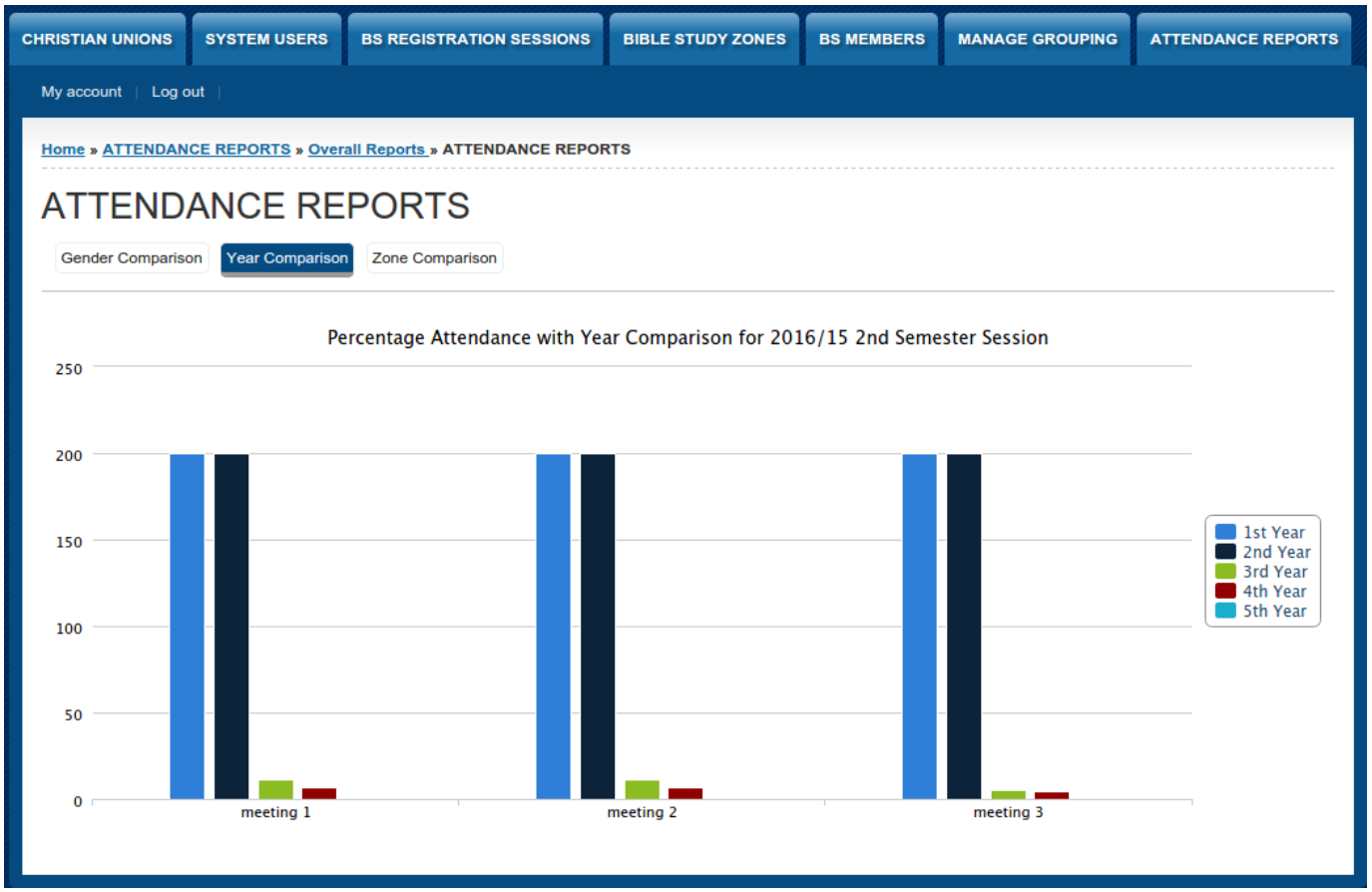

Figure 5.13 Web Application Overal Attendance Report with Year Comparison

Figure 5.14 shows overall attendance reports with zone comparison

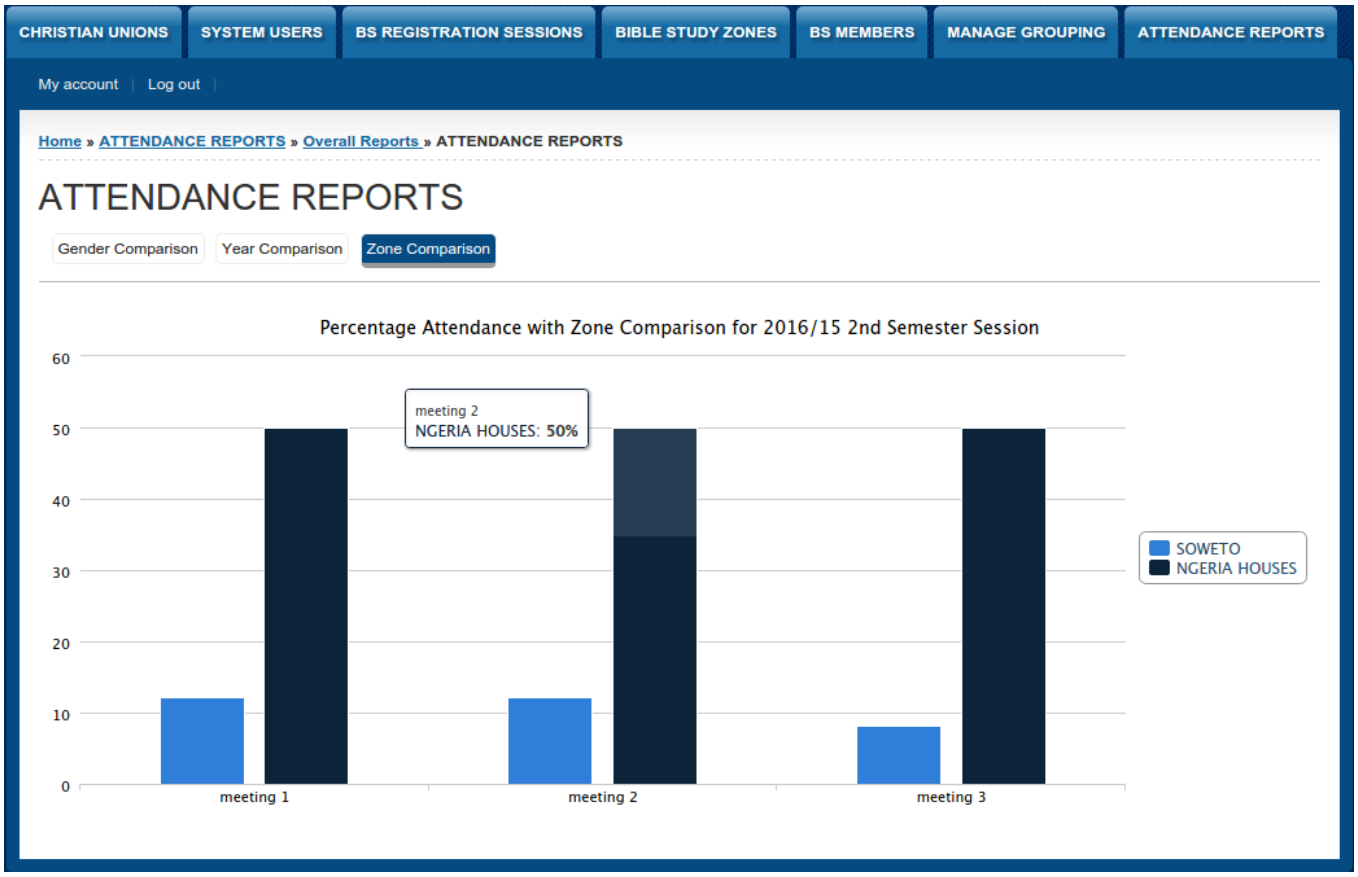

Figure 5.14 Web Application Overal Attendance Report with Zone Comparison

5.3.2 USSD Application

The USSD application serves requests from end users. This service accessed via users mobile phones by dialing a given USSD code. The main system components of the USSD application are:

1. Create profile.
2. Bible study registration.
3. Generate attendance code.
4. Check in.

5.3.2.1 Create Profile

This part of USSD application provides a user with a menu driven interface used to register a member with members CU. When the user dials the given USSD code, the system prompts the member to enter registration number, the system checks if registration number exist. When the user selects create profile, the system takes the user through the menu driven screen with each screen prompting the user to enter required user details. Figure 5.15 shows create profile screens.

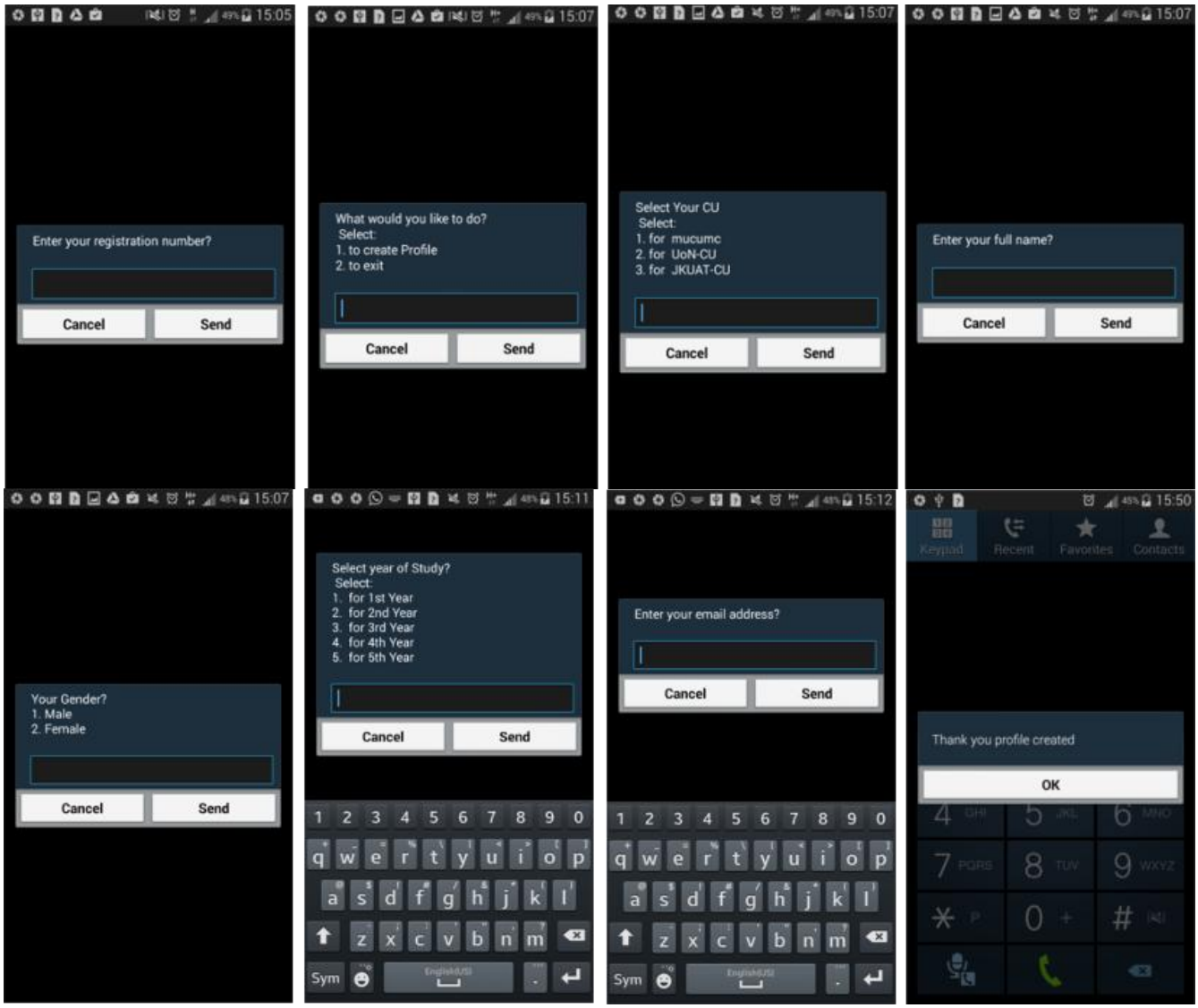

Figure 5.15 USSD Application Create Profile Screens

5.3.2.2 Bible Study Registration

This part of USSD application provides a user with a menu driven used to register a member for bible study. When the user dials the given USSD code, the system prompts the member to enter registration number, the system checks if registration number exist and if registration period is still open, if those conditions are not met, the system exits with status message. When the user selects register for bible study, the system takes the user through menu driven screen with each screen prompting the user to enter required user details. Figure 5.16 and Figure 5.17 shows bible study registration screens.

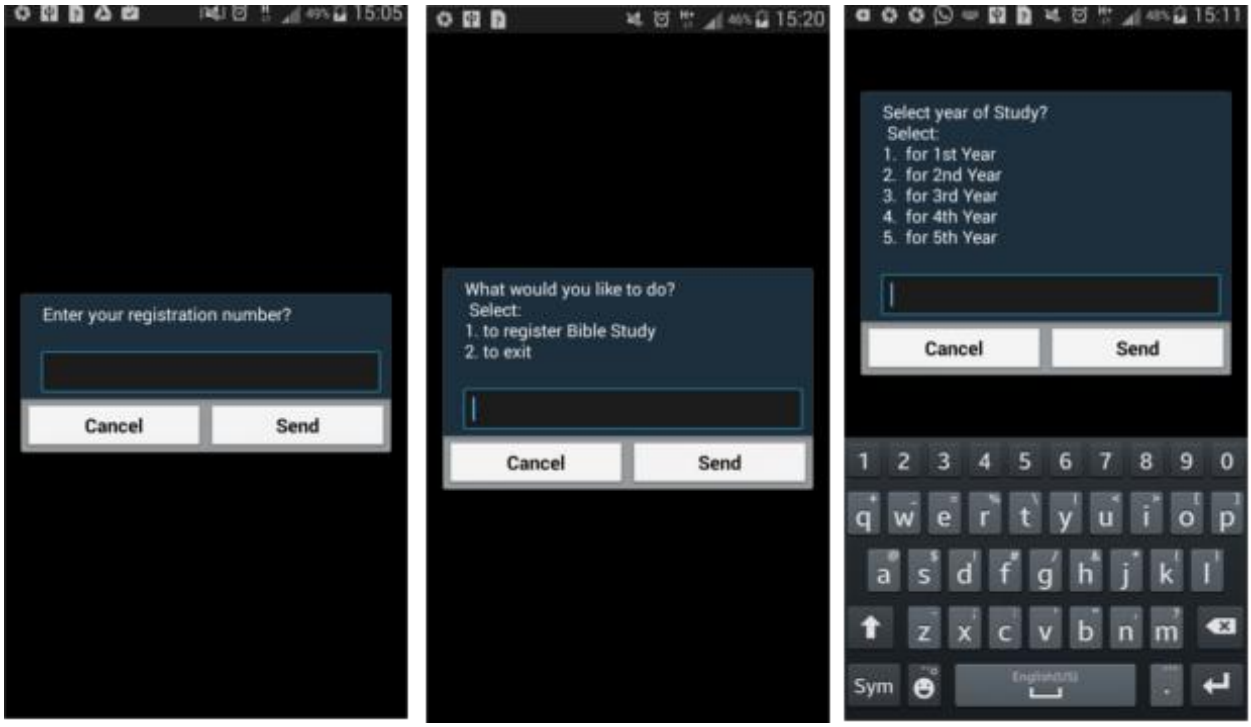

Figure 5.16 USSD Application Bible Study Registration Screens

Figure 5.17 shows bible study registration screens

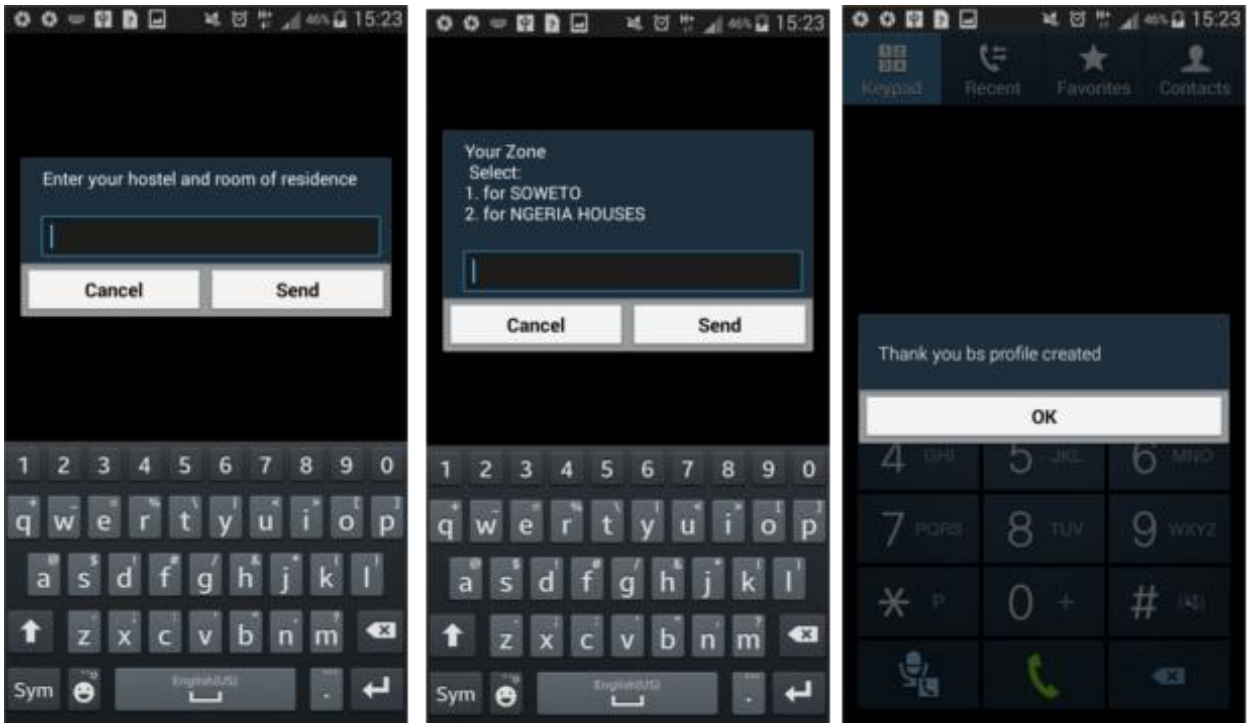

Figure 5.17 USSD Application Bible Study Registration Screens

5.3.2.3 Generate Attendance Code and Check-in

To make sure that only members who attended the meeting are the ones to check in, this system has implemented a check in verification mechanism. After the meeting, group leader generates a random three to five numeric letters as attendance code; this code expires after two hours. The leader is supposed to read this code to members. When members access check in menu, the system prompts them to enter this attendance code.

When the user dials the given USSD code, the system prompts the member to enter registration number, the system checks if registration number exist and if the member is a group leader, if those conditions are not met the system exits with status message.

The leader selects generate attendance code. The system generates attendance code and displays in the screen. Figure 5.18 shows generate attendance code screens.

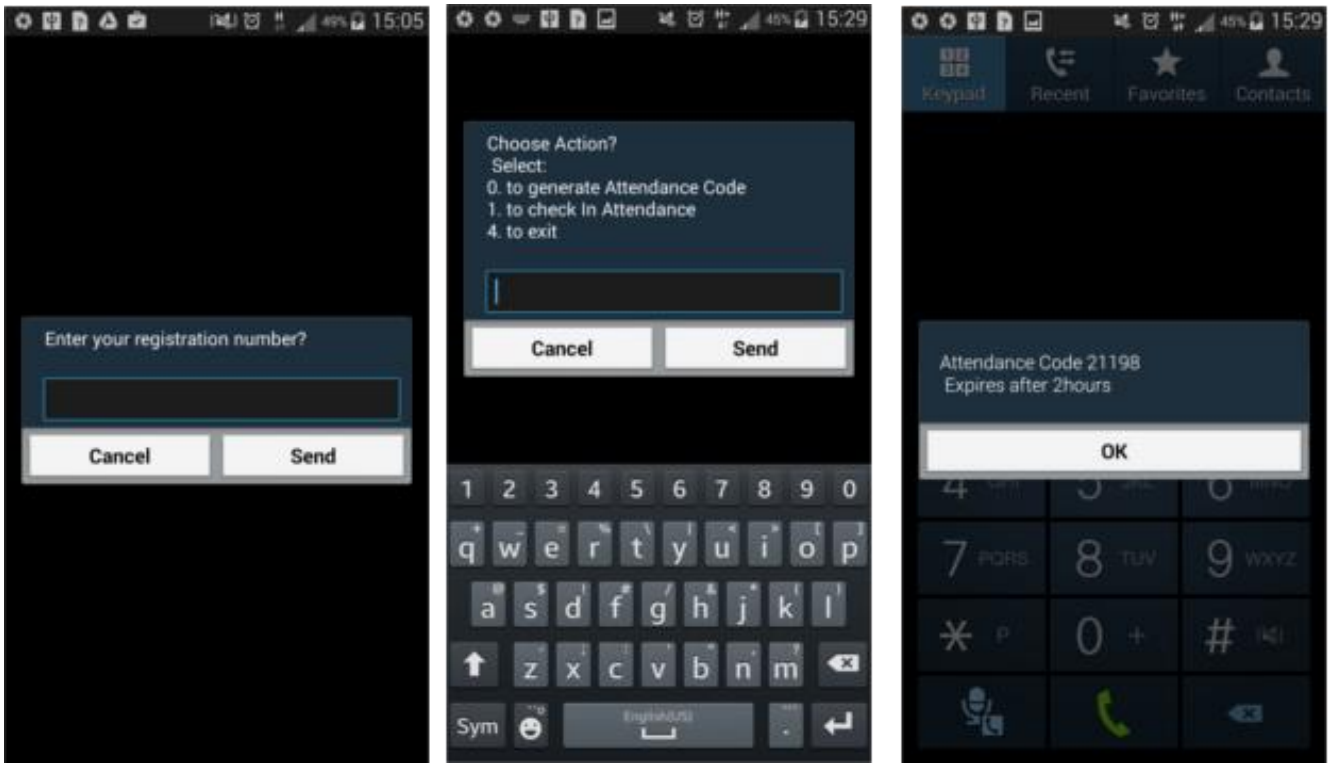

Figure 5.18 USSD Application Generate Attendance Code Screens

5.3.2.4 Check-in

When a group member dials the given USSD code, the system prompts the member to enter registration number, the system checks if registration number exist and if the member has been allocated a group, if those conditions are not met the system exits with status message. The member selects check in. The system prompts attendance code.

Figure 5.19 shows check in screens.

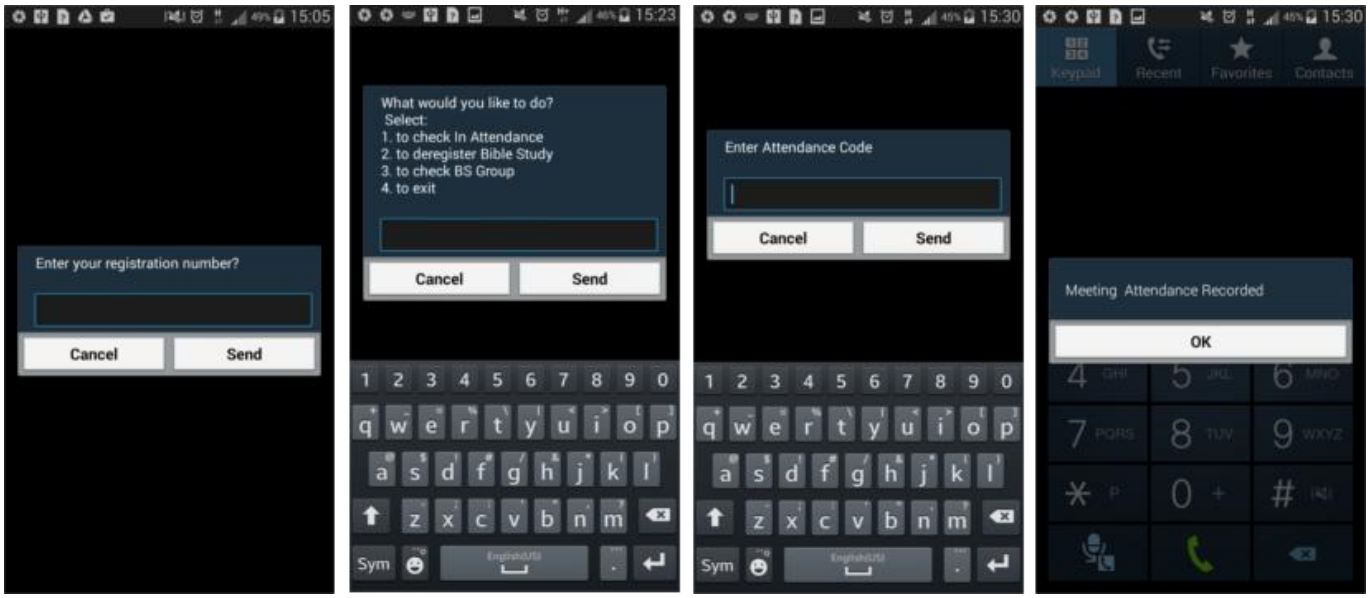

Figure 5.19 USSD Application Check-in Screens

5.4 System Testing

This section describes the tests performed on both the USSD and web application. Three types of tests were done; developer testing, compatibility test and user testing.

5.4.1 Developer Testing

The system developer to test against the functional and non-functional requirements did developer testing. Functional tests were conducted to see if the complete system was satisfactory in regard to functional and non-functional requirements. Tests were formulated for each major use case to determine the success or failure of various system components. Expected responses were set then the results were considered successful or unsuccessful.

Table 5.1 shows test case results for create profile use case

Table 5.1 Create Profile Test Case

Test Case	Create Profile
Description	Unregistered member dials a given USSD code and follows screen prompts
Utilized use Case	Create Profile.
Results	Profile successfully created
Pass/Fail	Pass

Table 5.2 shows test case results for bible study registration

Table 5.2 Bible Study Registration Test Case

Test Case	Bible study registration
Description	A registered member dials a given USSD code, then enters admission number and selects bible study registration
Utilized use Case	Register for bible study.
Results	Registration successfully created
Pass/Fail	Pass

Table 5.3 shows test case results for group allocation

Table 5.3 Grouping Test Case

Test Case	Perform Grouping
Description	A bible study coordinator logs in to the web application and click group allocation menu
Utilized use Case	Grouping.
Results	Bible study groups created
Pass/Fail	Pass

Table 5.4 shows test case results for generate attendance code

Table 5.4 Generate Attendance Code Test Case

Test Case	Generate Attendance Code
Description	A bible study group leader dials the given USSD code, enter admission number and selects generate attendance code.
Utilized use Case	Generate attendance code.
Results	System displays random three to five digits attendance code that expires after two hours

Pass/Fail	Pass

Table 5.5 shows test case results for check-in test case

Table 5.5 Check-in Test Case

Test Case	Check-in
Description	A CU members dials the USSD code then enters admission number and selects check-in.
Utilized use Case	Check-in.
Results	Attendance recorded successfully
Pass/Fail	Pass

Table 5.6 shows test case results for generate report test case

Table 5.6 Generate Report Test Case

Test Case	Generate Report

Description	Bile study coordinator or FOCUS Kenya campus staff login to the system and click generate reports menu.
Utilized use Case	Generate reports.
Results	System generates attendance reports
Pass/Fail	Pass

5.4.2 Compatibility Testing

These tests were carried to ensure the system was compatible with user devices and web browsers. The web application was tested against web browsers commonly used. Table 5.7 shows browser compatibility test results.

Table 5.7 Browser Compatibility Test

Browser	**Compatibility**
Firefox (all versions above version 8.0)	Yes
Chrome (All versions)	Yes
Internet explorer (Version 4 and above)	Yes
Opera	Yes

5.4.3 User Testing

Users were directly involved in testing. User testing questionnaires were given to MUCU students and thirty-six gave responses on their experience while using the system. Users were given USSD code to access the system and credentials to login the web application. The following are responses for user testing.

5.4.3.1 Create Profile Functionality

The first step for users to interact with the system is to create members profile. Users were asked to give a response of the easiness of creating their profile. A majority of users find it easy to create profile.

Figure 5.20 shows users response to create profile functionality.

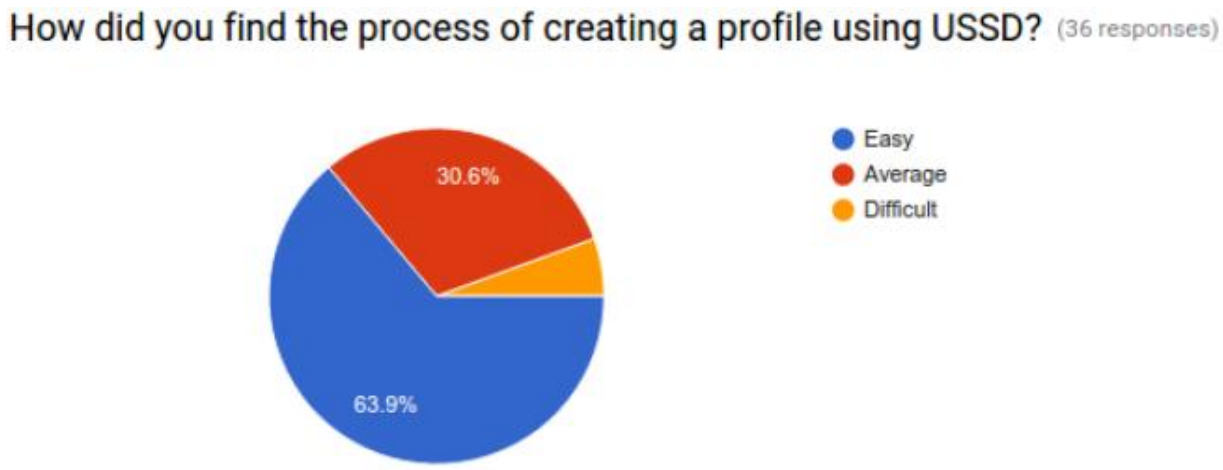

Figure 5.20 User Testing Response Create Profile

5.4.3.2 Bible Study Registration Functionality

Bible study registration is one of the functional requirements of the system. Users were asked to give their reactions to its easiness. Majority of users find it easy to register for bible study using USSD application. Figure 5.21 shows users response to bible study registration.

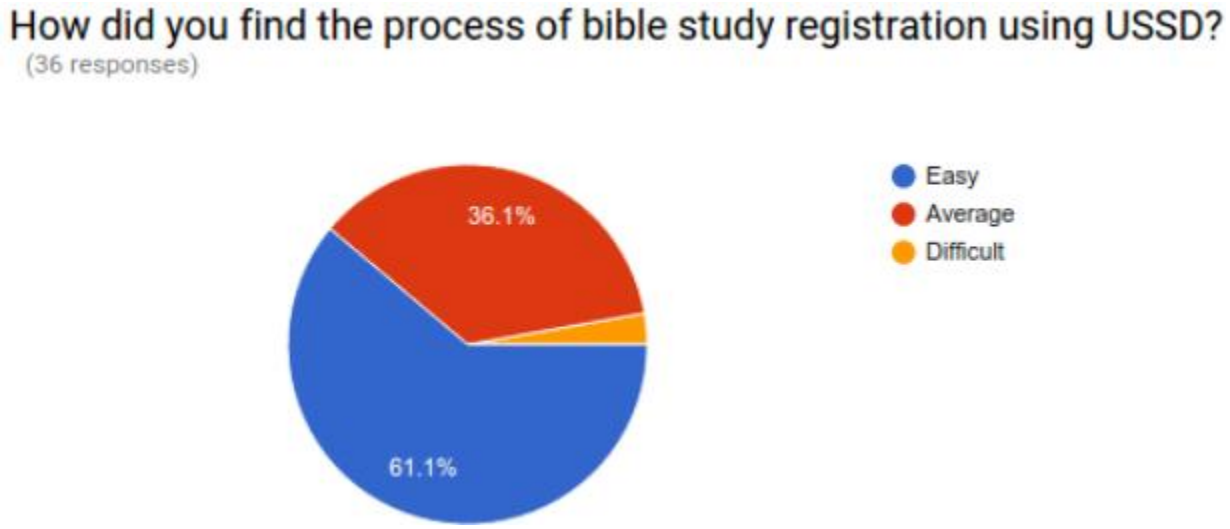

Figure 5.21 User Testing Response Bible Study Registration

5.4.3.3 Generate Attendance Functionality

Users were given group leaders credentials to access generate attendance code menu. Many users found the process easy to do. Figure 5.22 shows users response to easiness of the functionality.

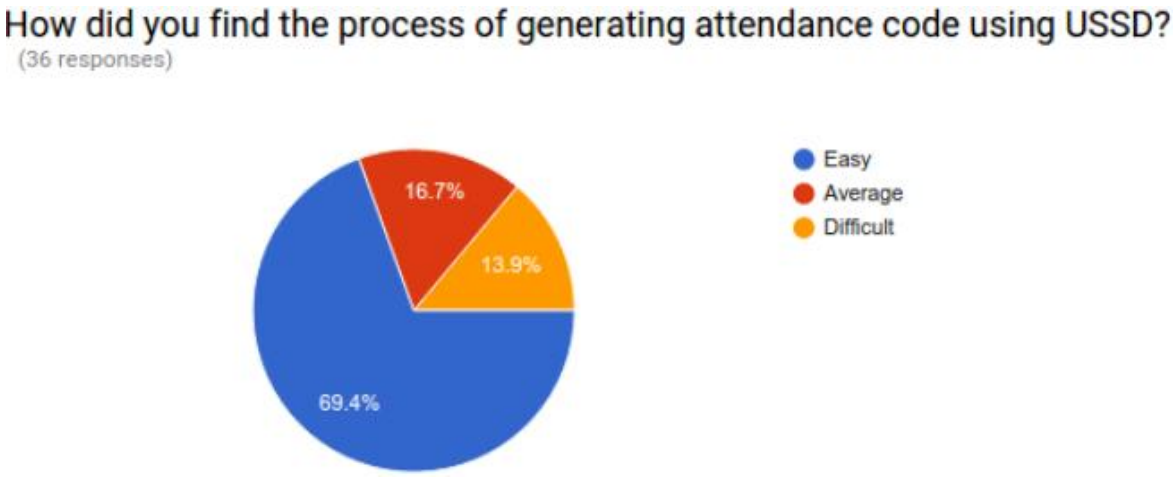

Figure 5.22 User Testing Generate Attendance Code

5.4.3.4 Check-in Functionality

Check-in is a core functionality in the system. The ease of checking in using USSD application was tested. 72.2% find the process easy 16.7% find it average while 11.1% find it difficult. Figure 5.23 shows a summary of the results.

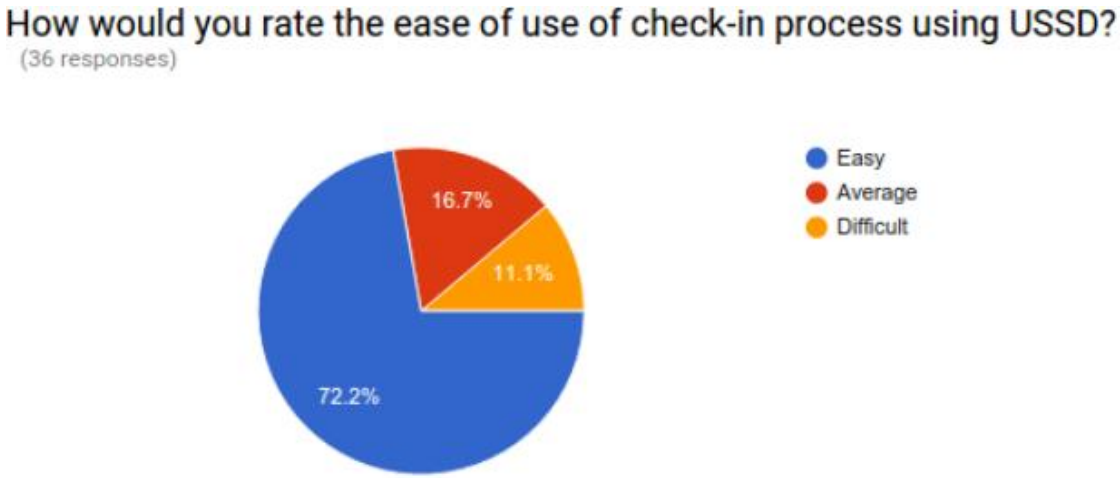

Figure 5.23 User Testing Check-in

5.4.3.5 Overall Rating of USSD Application

Users were asked to give their overall experience of the USSD Application. This was to test the overall easiness of the application. 61.1% find the whole application to be easy to use. 36.1%

find it average and 2.8% find it difficult to use the system. Figure 5.24 shows users rating of the USSD application.

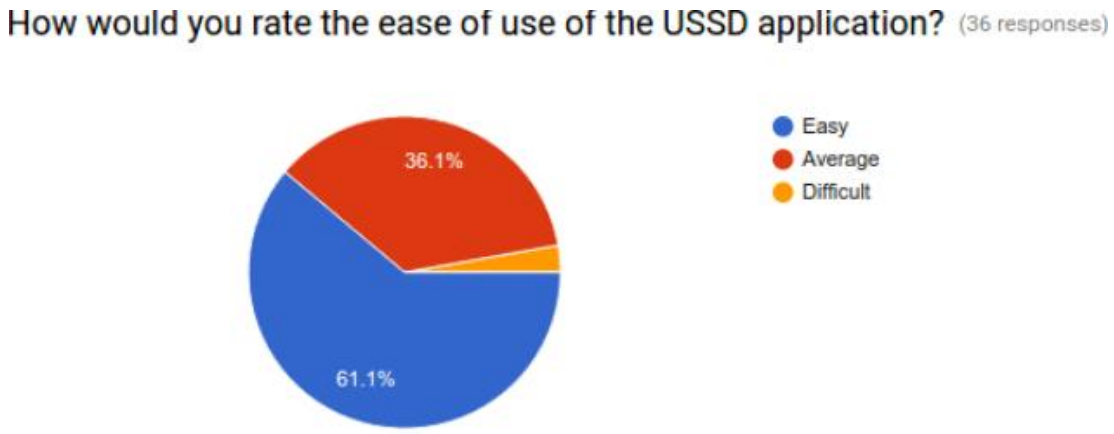

Figure 5.24 User Testing USSD Application

5.4.3.6 Web Application User Interface

Potential users of the system tested the web application user interface. They tested whether the system was attractive or not. 52.8% find the system to be attractive, 38.9% find the system to be average while 8.3% find the system not attractive. Figure 5.25 shows users response summary.

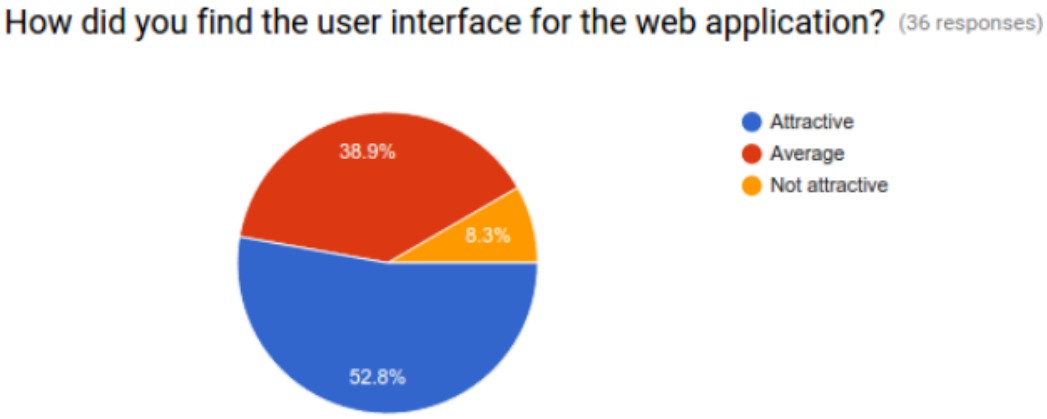

Figure 5.25 User Testing Web Application User Interface

5.4.3.7 Functional Requirements Testing

The users tested whether the system meets its functional requirements or not. 66.7% find the system good, 25% find it fair while 8.3% find it does not meet its functional requirements. Figure 5.26 shows a summary of user response.

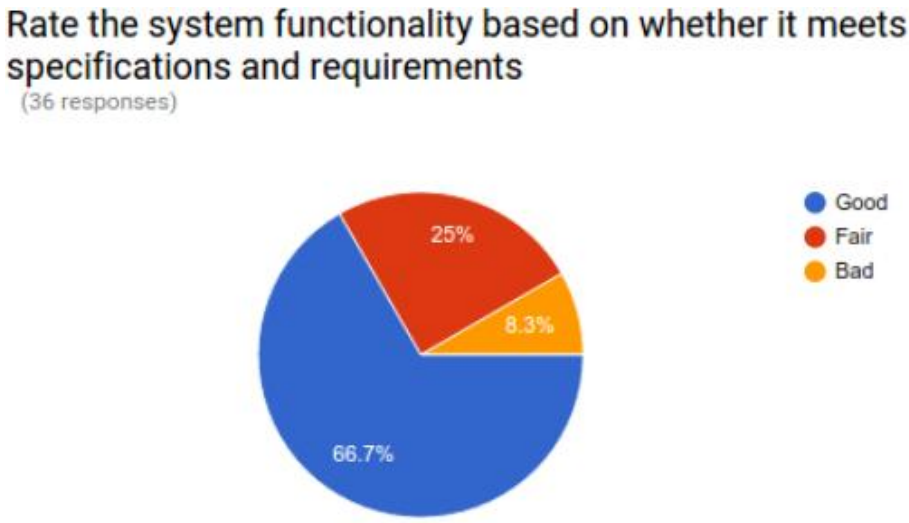

Figure 5.26 User Testing Functional Requirements Testing

5.4.3.8 Locating Core Functionality

The study sought to find out how easy it was to locate core functionality and hence users gave their response below. Figure 5.27 shows a summary of users' response.

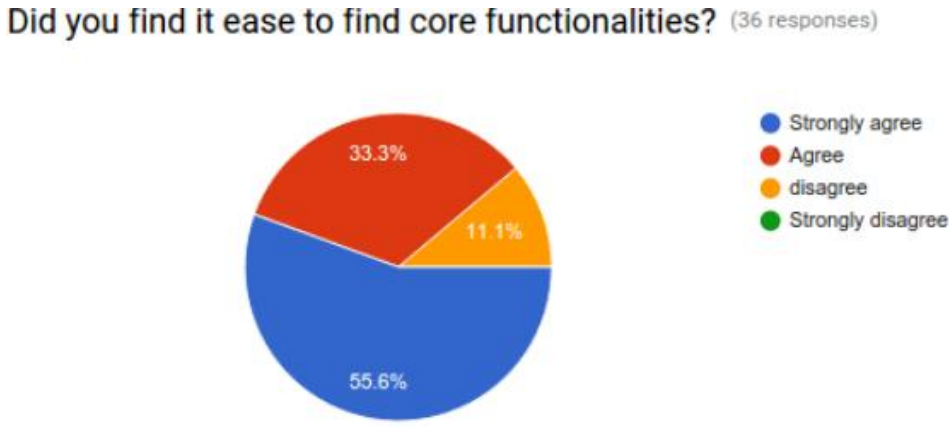

Figure 5.27 User Testing Locating Core Functionality

5.5 Summary

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. Apart from the system requirements, the research objectives and questions were put into consideration to ensure that the system was implemented to achieve user requirements provided by potential users. Majority of the objectives were fulfilled by the development of the USSD and web application. System testing was conducted where the system functionality was tested to ensure that all user requirements were met.

Chapter 6 : Conclusion, Recommendation and Future Work

6.1 Overview

The research was done with the purpose of coming up with a mobile based system to improve bible study administration processes in CUs. This chapter seeks to see if the objectives were covered and see how the application developed maps against the current system and its advantages, what improvement it has brought that make it unique.

6.2 Findings and Achievements

This study had pre-questionnaire that was used to get user requirements and see if the system was feasible. From the findings, the current systems had weaknesses that users wanted them to be addressed. This is because, with current system, a member has to be present in the registration venue to register for bible study or use internet for remote registration. The study also showed that there was no clear reporting mechanism since the current systems do not provide an efficient way of colleting attendance reports.

6.3 Recommendation

This research consisted of objectives that guided that whole research process. This section addresses how research objectives were met. The first objective in section 1.4 to analyze the current bible study administration system used by CUs. In section 2.3, the study analyses several systems used to administer bible study in CUs, their strength and weakness. It is out of this analysis that the study came up with USSD and web application for bible study administration.

The second objective was to investigate how USSD works and how it can be integrated into web applications. Section 2.5 explains how USSD works and how it can be integrated with web application. This section helped so much in the application design and it led to achievement of the third objective which was to design a web-based solution with USSD integration for bible study registration, grouping and attendance reporting. The achievement of the second objective also made it easier to achieve the fourth objective which was to develop a web-based solution with USSD integration for bible study registration, grouping and attendance reporting. In Section

4.3, the study showed the various ways through which a USSD and web application can be designed. In section 5.2, the study shows how the application was developed with regard to the requirements generated from the data collection stage in section 4.2.

The fifth objective was to test the functionalities of the web-based solution with USSD integration for bible study registration, grouping and attendance collection. Developer testing, compatibility testing and user testing were done as described in section 5.4. This helped to make sure that all the functional requirements were achieved and implemented. It was concluded that the application's functionalities worked as required.

6.4 Future Work

This study recognized the possibility of only managing bible study groups in CUs but more can be done. Below is a list of things that can be looked at;

1. This system stores CU members data which including contact information, an SMS gateway can be integrated with system to send members SMS notifications after group allocation.
2. Add functionality to allow members generate their attendance reports over a selected period.
3. Build a mobile app version of the system that pulls real time data from the backend.

6.5 Conclusion

The application received a good feedback from FOCUS Kenya staff and CU members. Most of them were impressed by the remote registration functionality and USSD interface for registration and check-in. The system met user requirements that it was designed for.

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Appendices

Appendix A: CU Members Questionnaire

Research on bible study administration process in the CUs (members questionnaires)

This questionnaire is aimed at collecting information on the bible administration process in this CU. The information you give will be of benefit to the researcher in accomplishing academic goal. Kindly answer the questions to the best of your abilities, there is no right or wrong question, your response will be highly appreciated. There is no need to give your name anywhere on the form,the information collected is used for academic purposes only.

(Please try and answer all the questions to the best of your abilities)

* Required

1. **Name of your CU? ***

   _____

2. **How long have you been a member of this CU? ***
   Mark only one oval.
   - ◯ 1
   - ◯ 2
   - ◯ 3
   - ◯ 4
   - ◯ 5

3. **Do you own a mobile phone? ***
   Mark only one oval.
   - ◯ yes
   - ◯ No

4. **What type of mobile phone do you use? ***
   Mark only one oval.
   - ◯ Smart phone
   - ◯ Feature Phone
   - ◯ Low end phone

5. **Have you ever used any USSD services in your phone, e.g checking balance using *144#? ***
   Check all that apply.
   - ☐ Yes
   - ☐ No
   - ☐ Not sure

6. **Have you ever registered for a bible study?** *
Mark only one oval.

- ◯ Yes
- ◯ No

7. **If yes what information/details are they required during registration?**

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.....

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.....

8. **If yes what procedure did you use to register for bible study (How did you register)?**

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.....

.....

9. **If you have ever registered for bible study would you like the bible study registration process computerized?**
Mark only one oval.

- ◯ Yes
- ◯ No

10. **What challenges have you faced in registering for bible?** *

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11. **Would you like bible study registration details to be retained so that members will only need to update their details on subsequent registration?**

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Appendix B: CU Bible Study Group Leaders Questionnaire

Research on bible study administration process in the CUs (Group Leaders questionnaires)

This questionnaire is aimed at collecting information on the bible administration process in this CU. The information you give will be of benefit to the researcher in accomplishing academic goal. Kindly answer the questions to the best of your abilities, there is no right or wrong question, your response will be highly appreciated. There is no need to give your name anywhere on the form,the information collected is used for academic purposes only.

(Please try and answer all the questions to the best of your abilities)

* Required

1. **Name of your CU? ***

2. **Do you collect bible study group attendance data in your CU?**
   Mark only one oval.
   - ◯ Yes
   - ◯ No

3. **If you have ever collected group attendance data, what type of attendance data do you collect?**

4. **If you have ever collected group attendance data, what challenges do you face in collecting attendance data?**

Appendix C: CU Bible Study Coordination Team Questionnaire

Research on bible study administration process in the CUs (cordinators questionnaires)

This questionnaire is aimed at collecting information on the bible administration process in this CU. The information you give will be of benefit to the researcher in accomplishing academic goal. Kindly answer the questions to the best of your abilities, there is no right or wrong question, your response will be highly appreciated. There is no need to give your name anywhere on the form,the information collected is used for academic purposes only.

(Please try and answer all the questions to the best of your abilities)

* Required

1. **Name of your CU?** *

2. **How many people register for bible study in your CU per semester?** *
   Mark only one oval.
   - ◯ less than 500
   - ◯ 500 - 1000
   - ◯ 1000 - 2000
   - ◯ more than 2000

3. **How do you allocate registered members to groups?** *

4. **How long does it take you to complete allocating all members to groups?** *
   Mark only one oval.
   - ◯ less than 1 hour
   - ◯ 1 - 3 hours
   - ◯ 4 - 5 hours
   - ◯ atleast a day

5. **What challenges have you faced in allocating members to groups?** *

6. **Would you like the bible study allocation/grouping process computerized?** *
Mark only one oval.

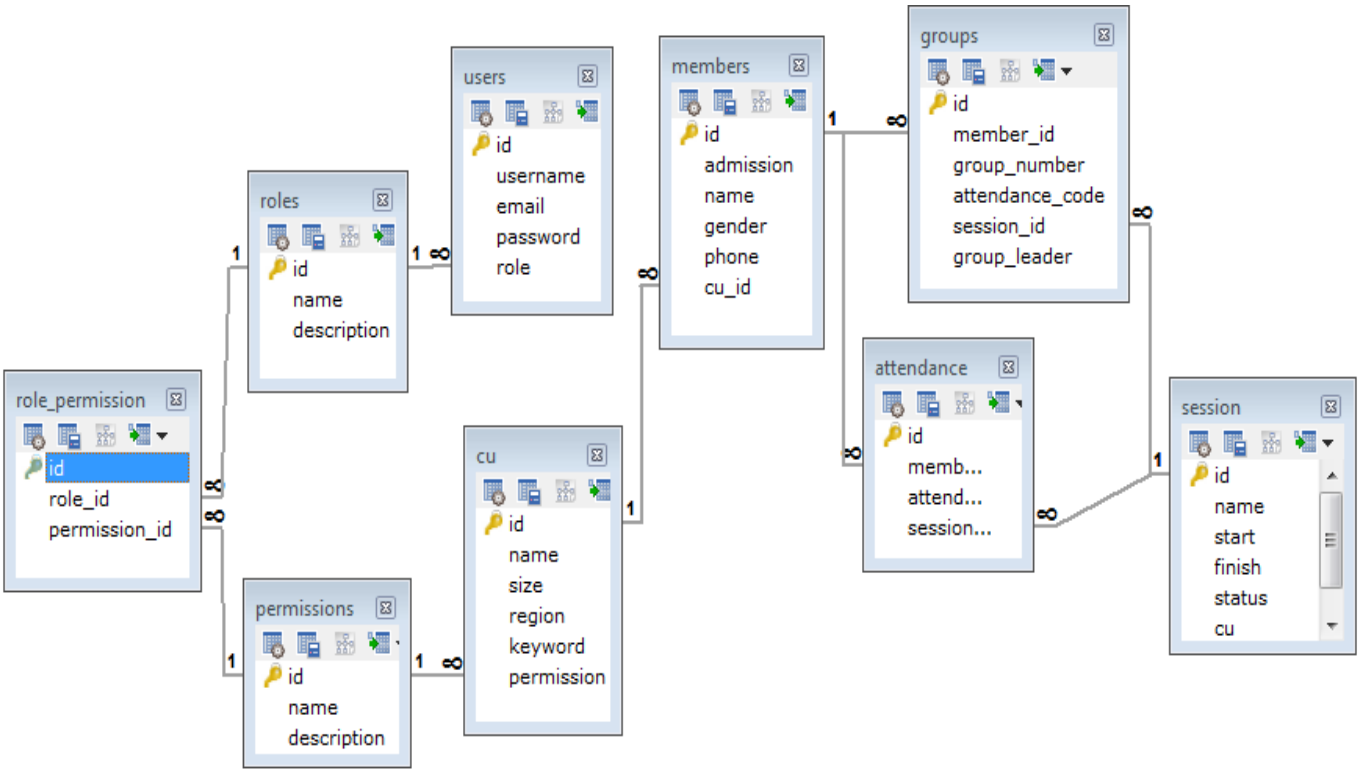
- ◯ Yes
- ◯ No

7. **How do you collect attendance data for each group?** *

8. **What bible study report do you generate at the end of bible study period (semester)?** *

9. **What challenges do you face in collecting and analysing bible study attendance report?** *

Appendix D: Database Schema



Appendix E: Turnitin Report