

**A MODEL ANDROID PHONE BASED SYSTEM FOR MANAGING
UNIVERSITY CLASS ATTENDANCE USING QR CODES AND INDOOR
LOCATION**

BY

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**A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
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DECLARATION

DECLARATION BY THE CANDIDATE

This thesis is my original work and has never been presented for any award in any other institution of learning and that no part of this work may be reproduced without the prior permission of the Author and Moi University.

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DEDICATION

I dedicate my work to my wife and family, Department of Information Technology and
Moi University.

ACKNOWLEDGMENT

My Sincere gratitude goes to my two supervisors, Prof David. Gichoya and Dr. Irene Moseti for taking their time to guide me in coming up with a refined thesis. I also thank my better half and family for their moral support throughout my period of study. I also thank Vlir-UOS Moi University chapter for their sponsorship towards my studies and support of Prof. Edwin Ataro. Outmost all the Glory to God for the strength and grace to enable me finish this work successfully.

ABSTRACT

To achieve an effective learning process, universities have emphasized the need for students not only to pass exams but also to attend at least 80% of the classes. In most universities, the core responsibility of managing class attendance of various students currently has been tasked to lecturers, and the process has not been easy mainly due to the challenges that come with many methods deployed to manage the process. This research aimed to develop a model android phone based application to manage university class attendance using QR Codes and indoor locations. The objectives of the study carried out at the Department of Information Technology, Moi University were to: determine the method of managing class attendance; establish the challenges faced by lecturers and students when it comes to complying with the set procedure of class attendance; develop a model android application to help overcome discovered challenges and manage class attendance using QR Codes and indoor locations. The research employed use of experimental research design, which involved a systematic manipulation of some characteristics, for example, the use of Android, QR codes and Indoor Positioning in the developed solution and observing the outcome. The research was guided by the RAD Prototyping methodology, which involved developing a working prototype under minimal planning with focus on analysis of requirements, design and development. The system prototype developed was reviewed by stakeholders to establish any changes that needed to be added in the next version. The system was then implemented amongst the stakeholders during a scheduled class and attendance registered. The study established that challenges that existed in managing attendance such as students signing on behalf of others can be overcome through the use of students' android phones, QR Codes and indoor locations which enhance mobility and authenticity of the recording process, real-time communication to all stakeholders via the mobile application and easy, cost-effective authentication of the students during attendance registration process. The study concluded that the developed model would help in solving the challenges experienced by lecturers and students. It is recommended that the system is implemented in a class with confined seats embedded with QR codes and centrally installed WI-FI access point to work effectively.

TABLE OF CONTENTS

DECLARATION	ii
DEDICATION	iii
ACKNOWLEDGMENT.....	iv
ABSTRACT.....	v
LIST OF FIGURES	ix
LIST OF TABLES	x
LIST OF ABBREVIATIONS.....	xi
DEFINITION OF OPERATIONAL TERMS.....	xii
CHAPTER ONE: INTRODUCTION	1
1.1. Chapter Overview	1
1.2. Background of the study	1
1.3. Background of Class Attendance Approaches	4
1.3.1 Manual signing.....	4
1.3.2 Wall mounted fingerprint based time clock	4
1.3.3 Biometric Based Access Control and Attendance management system	5
1.3.4 Mobile and web-based class roll calls.....	5
1.3.5 Biometric Attendance through use of Laptop and Finger Print Scanner	6
1.4. Problem Statement	6
1.5. Aim of the study.....	8
1.6. Objectives	8
1.7. Research Questions	9
1.8. Significance of the study.....	9
1.8.1 The Academic Institution.....	9
1.8.2 Lecturers	10
1.8.3 Students.....	10
1.8.4 Application of Android Phone Mobile Technology in class attendance.....	10
1.8.5 Policy makers and standard checkers.....	10
1.9. Research Scope	11
1.10. Limitations	11
1.11. Summary	11
CHAPTER TWO: LITERATURE REVIEW	12

2.1.	Chapter Overview	12
2.2.	Review of Technologies	12
2.2.1.	QR Code.....	12
2.2.2.	Indoor Positioning System (IPS).....	13
2.2.3.	Android Mobile Technology.....	15
2.2.2.3.	Disadvantages of Android Technology.....	16
2.3.	Existing attendance systems and their challenges.....	17
2.4.	Conceptual framework.....	20
2.5.	Summary	21
CHAPTER THREE: RESEARCH AND SYSTEM DEVELOPMENT METHODOLOGY		22
3.1.	Introduction.....	22
3.2.	Research Design.....	22
3.3.	Requirement Analysis Techniques.....	23
3.4.	System Development Methodology	23
3.5.	Research Instruments	28
3.6.	Ethical considerations	29
3.7.	Summary	29
CHAPTER FOUR: REQUIREMENT ANALYSIS AND MODELING		30
4.1.	Chapter Overview	30
4.2.	Planning	30
4.3.	Requirement Analysis	30
4.3.1	Analysis of the attendance procedure	31
4.3.2	Analysis of the questionnaires from lecturers and students	32
4.3.3	The challenges of the attendance management approach	39
4.3.4	Functional Requirements	43
4.3.4.1	Capture Student Information.....	43
4.3.5	Non Functional Requirements	45
4.3.5.1	External Interface Requirement	45
4.3.5.1.3	Hardware Interfaces	48
4.3.5.1.4	Software Interfaces	49
4.3.5.1.5	Communications Interfaces.....	49
4.3.5.2	Hardware Requirements.....	49

4.3.5.3	Security Requirements	51
4.4	Assumptions / Constraints	52
CHAPTER FIVE: SYSTEM DESIGN AND DEVELOPMENT		54
5.1.	Chapter Overview	54
5.2.	System Design	54
5.3.	System Development	57
5.4.	Review	65
5.5.	Implementation	66
5.6.	Summary	68
CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS		69
6.1.	Conclusion	69
6.2.	Recommendations	71
6.2.1.	Further Research	72
	References	73
APPENDICES		76
	Appendix 1a: Introductory Letter from the department	76
	Appendix 1a: Introductory Letter from the department	77
	Appendix 2a: Questionnaire for lecturers	78
	Appendix 2b: Questionnaire for students	79
	Appendix 3a: Representation of the source code in android	80
	Appendix 3b: Representation of similarity index	97

LIST OF FIGURES

Figure 1: QR Code image (Source: Demir et al. 2015)	13
Figure 2: Conceptual framework derived from the literature review	21
Figure 3: Prototyping Methodology (Source: Dennis et al. 2000).....	24
Figure 4: Graph for method of attendance management as reported by lecturers	33
Figure 5: Graph for effectiveness of current attendance method as reported by lecturers.....	34
Figure 6 : Graph for frequency of usage of the method of attendance management as reported by lecturers.....	35
Figure 7. Graph for technologies deployed to better attendance as reported by lecturers	36
Figure 8: Graph for frequency of attendance as reported by students	37
Figure 9: Graph for probability of recording attendance of another student as reported by students	38
Figure 10: Graph for technologies used as reported by students	38
Figure 11: Graph for probability of students signing on behalf of each other reported by lecturers.....	39
Figure 12: Graph for confirmation of sending notifications to students as reported by lecturers	40
Figure 13: Graph for effectiveness of recording and tabulation of the current method of attendance management as reported by lecturers.....	40
Figure 14: Graph for impact of change of class as reported by lecturers.....	41
Figure 15: Graph for timestamp confirmation of signing as reported by lecturers.....	41
Figure 16: Data tables (Source: www.datatables.com 2017).....	46
Figure 17: Linear Layout (Source: www.developer.android.com 2017).....	47
Figure 18: Relative Layout (Source: www.developer.android.com 2017)	47
Figure 19: Listview (Source: www.developer.android.com 2017).....	47
Figure 20: Toast View (Source: www.developer.android.com 2017)	48
Figure 21: Access point Device	50
Figure 22: Seats embedded with unique QR Codes.....	53
Figure 23: Database Entity Relationship	55
Figure 24: Conceptual Design	56
Figure 25: System Architecture	57
Figure 26: Login page.....	58
Figure 27: User management	59
Figure 28: Courses listing	60
Figure 29: Add Courses Window	61
Figure 30: Add class window	61
Figure 31: Login Screen for the lecturer.....	63
Figure 32: Dashboard.....	63
Figure 33: Timetabling and attendance rate view by lecturer and student	64
Figure 34: Attendance courses.....	65
Figure 35: Attendance data	65
Figure 36: Attendance Report.....	67

LIST OF TABLES

Table 1: Sample Size	27
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LIST OF ABBREVIATIONS

- J2ME** – Java Micro Edition
IOS – iPhone Operating System
OTG –On the Go
QR – Quick Response Code
PHP – Hypertext Preprocessor
MYSQL – Database for Structured Query Language
LAN – Local Area Network
DVM – Dalvik Virtual Machine
GPS – Global Position System
WIFI – Wireless Fidelity
HOD – Head of Department
HTML – Hyper Text Markup Language
USB – Universal Serial Bus
CUE – Commission for University Education
KEBS – Kenya Bureau of Standards
QR – Quick Response

DEFINITION OF OPERATIONAL TERMS

Android Application – a software application that can operate only in the Android Operating System

GPS – is a Global Positioning System operated by Google to determine the positioning of GPS enabled devices based on the Latitudes and Longitudes of their current position

USB On-The-Go (OTG) – Is a hardware functionality that enables connectivity of USB devices to the mobile phone

PHP –a server scripting language that can be used successfully to develop web applications

Java – an Objected Programming Language used in the development of the functionalities of the Android application.

Android Studio – an integrated development environment for Android applications

Eclipse – an integrated environment for development of Android applications

Apk – The compiled form of an android application that is installed on an Android device to run the instructions intended

CUE – Commission geared towards ensuring quality in Higher Education institutions.

KEBS – Standards regulatory body in Kenya.

HELB – Higher Education Loans Board

CHAPTER ONE: INTRODUCTION

1.1.Chapter Overview

This chapter covers background information on the study and existing attendance approaches, the problem statement, the aim of the study, objectives, research questions, research scope, the significance of the study and limitations.

1.2.Background of the study

In the recent past, there has been a rise in the number of universities in across the world due to the increased demand of higher education by students. The increase has enabled advancement of learning through technology by introduction of e-learning platforms to ease access to education (Mahmoud et.al.,2016). Technology advancement has seen many universities adopting automated solutions for enrolment and management of students to enable ease of doing business and compliance with all set regulations by the regulators in the education sector. Student management processes range from enrolment, registration, class attendance and doing examinations set by lecturers (Ali, E. S.,2016). It is a common trend for universities to make the student management processes dependent to one another and enforced via online systems such as a student will not be allowed to attend classes before paying the required amount of school fees. Maintaining all the student related processes effectively has been a challenge since most students will end up attending the classes despite having not paid school fees leading to the need of further automated enforcement by university authorities (Zhang .et .al.,2016).

In most higher education institutions in Kenya such as Moi University, attendance management has been of focus so as to allow students at the end of the semester to do exams after accomplishing the 80% required threshold set in the policy (Commission of Higher Education, 2014). This process has driven universities to adopt various means so as to ensure compliance by students. For instance, prior investigation has shown that manual attendance lists are majorly used in Moi University and Masinde Muliro University of Science and Technology. The need to perfect the process so as to ensure that all students comply and accurate information is retrieved from the method, has been of focus in order to improve the performance of students. A typical attendance management of students and lecturers is characterized by capturing of student records through manual signing of paper sheets or electronically after which the collected data is analyzed manually or electronically depending on the method deployed. The challenges experienced with existing systems for attendance registration include high implementation costs for institutions as a result of hardware used, time-consuming and poor usability amongst stakeholders (Zhi et al., 2015).

Technology use in education management has become common mainly to ensure reinforcement of the existing processes such as student registration. For instance, University of Nairobi has an online student portal (<https://smis.uonbi.ac.ke>) where by students can access most university services such as course registration using either their mobile phones or computers. The use of technology enhances convenience and effectiveness of service among students and lecturers for instance, lecturers will directly

input online the marks that will be accessed by students wherever they are. In order to boost access of information and improve higher education most institutions have adopted Internet hotspots to enable students to connect with their mobile devices and do more research. Readily available internet has led to most students buying smart phones and laptops due to their easy portability and connectivity to internet. The smart phones used contain various operating systems such as Android, iOS, Windows among others. Android Mobile technology currently holds a market share of 82% according to Twinpine Consumer Survey (2016) with the implication that most users prefer the same hence making it easier to adapt the technology amongst students and lecturers to effectively address class attendance management.

According to Zainal et al. (2014) having systems that take advantage of various features offered by Android mobile technology, can lead to the creation of an advanced solution that will help to address the problem of class attendance registration. Solutions developed using android mobile technology have partially utilized technologies such as WI-FI or Bluetooth for communication among student devices to confirm attendance or SQLite database to store class attendance information after call out by the lecturer.

The current study proposes a solution that uses embedded QR codes on classroom seats which are scanned by students via an Android application when the class is ongoing. For control purposes, the scanning will only be enabled by the lecturer when the class is ongoing. The system authenticates students via their specific mobile phones, seats in a given classroom and local WIFI connectivity set up within the classroom.

1.3. Background of Class Attendance Approaches

The following are existing class attendance management approaches being used across various institutions throughout the world and in Kenya.

1.3.1 Manual signing

This method involves the lecturer providing a class attendance list with the provision for students to sign in order to confirm their attendance during the lesson. The lecturer then processes the list for example by making manual calculations of the expected attendance percentage of the students.

According to Crede (2010), the above approach does not interfere with the ongoing class since the list can be moved within the class hence it is convenient and does not cause distraction when the class is ongoing. However, the method's disadvantages include forging of information by the students and lecturers, tedious calculations on the side of the lecturer and also time-consuming since only one list can be signed at a time (Credé et al., 2010).

1.3.2 Wall mounted fingerprint based time clock

This solution involves mounting fingerprint-based clocking-in hardware to record attendance of students as they enter the classes. The attendance data is then remitted to a centralized server where records can be manipulated via an interface for reporting. The above approach is simple and convenient for small classes (Khan et al., 2007).

However, when the class is big, the method may be inconvenient since it involves queuing. Due to its immobility, it is hard to conduct attendance in places where the

hardware has not been installed, and it is prone to delays since attendance is captured as students are entering the class.

1.3.3 Biometric Based Access Control and Attendance management system

This method provides person-specific door access via biometric and later invoke the use of the Class attendance management system (CAMS) to capture attendance biometrically. The CAMS is made up of a database, web server and user interface with various access levels. The attendance of each user maps the fingerprint to specific timestamps as they access the doors and also confirm attendance as they leave the classrooms. (Mittal, Varshney, Aggarwal, Matani, & Mittal, 2016)

The solution has challenges, which include delays in cases of large classes and also immobility of use of the same device.

1.3.4 Mobile and web-based class roll calls

This method of class attendance involves marking student attendance through reading out the names of students from an android application then confirming the attendance at a click. The output is then exported to excel or is remitted to the web server for storage in a remote database for further analysis and reporting (Anurag et al., 2013).

The method provides challenges as the users are not accurately authenticated and more work is stressed on the lecturer who is required to read out the lists leading to delays.

1.3.5 Biometric Attendance through use of Laptop and Finger Print Scanner

The solution involves the use of a laptop that has been installed with Microsoft Visual Studio and connected to a fingerprint scanner. The application can monitor attendance of students in real time after the students have placed their fingers on the scanner then real reports are relayed to the lecturer via the same application (Said et al., 2014).

The solution, however, does not address further interactions in form of notifications and feedback between the lecturer and the student, before or after the attendance. Furthermore, the lecturer is required to have a laptop to carry out the attendance not forgetting the fact that the solution may be faced with delays in case of large classes.

1.4.Problem Statement

Attendance for both students and lecturers has been critical in determining the eventual output of each student, and it is a requirement by the Commission of University Education (CUE) in Kenya for each student registered for a course. Effective attendance not only ensures that the students attend the lesson to the required 80% by the university but also addresses the fact that the lecturer attends the lesson, student attendance registered cost-effectively and reports generated easily.

Most universities are required to comply with regulator's set policies on class attendance hence have adopted various electronic or manual methods to help manage class. Electronic methods deployed to manage class attendance include the use of biometrics recognition through finger print scanners and access controlled based doors, face recognition through cameras and online recording through mobile devices

while manual methods involve manual signing lists, roll calls among others. In Kenya, preliminary observation show that universities such as Moi and Masinde Muliro University of Science and Technology, rely on Manual signing which is prone to forgery since students can sign on behalf of others. Amongst these solutions, biometric-based attendance capturing has proved to have the highest accuracy such as the Online Biometric Attendance Management Solution developed by Adetiba et al. (2013) deployed in Covenant University to help solve the problem had an accuracy rate of 89.33%. Despite the high accuracy rate, the technology in use was not cost-effective mainly due to the required hardware peripherals such as the finger print scanners and laptops that need to be acquired at an extra cost. Moreover real time communication on upcoming and postponed classes was not addressed due to lack of information integration amongst possible devices that the students and lecturers use hence only the attendance recording option was realized.

Deploying the above solutions has not effectively been able to manage attendance, and more challenges are being experienced on a daily basis which includes high hardware implementation costs, no immediate feedback easily accessible, poor or no notification mechanism for upcoming classes, delayed capturing of the records among others (Ugwoke & Anyakorah, 2015). Sometimes the systems being used to capture biometric data need to be connected directly to an electrical power source and networked via LAN for effective functioning hence may not work perfectly in cases where mobility is needed or when classes need to be held in places where there are no biometric modules installed (Mittal et al., 2016).

In a quest to better attendance management processes, technology use involving laptops and mobile devices has come in handy. Smartphone usage has increased significantly worldwide according to Twinpine consumer survey (2016), and there is need to tap in the technology which offers notifications service, wireless connectivity, Global Positioning System (GPS) to track location and Camera for scanning and picture capturing. A solution that takes advantage of some of these android mobile features mentioned above will ensure a cost-effective solution of managing class attendance by enabling authentication conveniently done through student devices while the lecturers devices are used to enable the attendance process and view reports.

1.5.Aim of the study

This study aim was to develop a model android phone based system for managing university class attendance using QR Codes and indoor location.

1.6.Objectives

The objectives guiding the study are: -

- a) To determine the method of managing class attendance at Moi University, Department of Information Technology.
- b) To establish the challenges faced by lecturers and students in complying with the set procedures of class attendance at Moi University, Department of Information Technology.
- c) To develop a model android application to manage class attendance using QR

Codes and Indoor Locations.

1.7. Research Questions

The research questions for the study are:

- a) How is attendance being managed in Moi University, Department of Information Technology?
- b) What are the challenges faced by lecturers and students in Moi University, Department of Information Technology when it comes to usage of the set in class attendance management?
- c) What solution can be developed to overcome challenges of existing class attendance management?

1.8. Significance of the study

The significance of the system can be attributed to the following categories: -

1.8.1 The Academic Institution

The system will enable automation of the process of attendance management hence reduction in paper usage and production of customized reports. The system will also be able to monitor attendance of lecturers and students of various classes on real-time hence increased accountability and productivity. The institution will also be able to effectively implement the policy for the class attendance of given courses as required by various policymakers.

1.8.2 Lecturers

The lecturers will easily be able to record attendance without being required to make manual calculations. They will also be able to view and download customized reports apart from sending automated real-time notifications via their mobile phones to students regarding upcoming lessons. Since they will also be monitored on their attendance, this will help improve their productivity and accountability for the classes they attend.

1.8.3 Students

The students will be informed via their mobile phones and be motivated to attend classes on time because someone else cannot sign on his or her behalf hence their productivity will also improve eventually. The students will also be allowed to give feedback via the same attendance application and also report on their impending non-attendance to an upcoming class.

1.8.4 Application of Android Phone Mobile Technology in class attendance

This study may be used by researchers interested in advancement of android technology towards offering better solutions in class attendance and reporting.

1.8.5 Policy makers and standard checkers

The solution will help stakeholders such as CUE, university management, and KEBS to make satisfactory follow-ups and audit on challenges faced in monitoring feedback reports on the implementation of the class attendance policy. The university policies

related to class attendance may include the use of this system.

1.9. Research Scope

The scope of this research involved the development of an android-based application divided into two parts for both the student and the lecturer. The student application can record attendance of students in class through the use of QR codes and wireless connectivity while the lecturer's application enables the process of attendance registration. The information was managed by a web-based application. The implementation was in Moi University School of Information Sciences Department of Information Technology

1.10. Limitations

The mobile application was developed only on Eclipse IDE before the preferred and recommended platform for Android Studio. This was mainly because of the QR Code library compatibility issues.

1.11. Summary

This chapter covered background information of the study and existing attendance approaches used in universities highlighting the procedures and related pros and cons. the problem statement was elaborated in details to give insight for the need of the study. other sections covered included the aim of the study, objectives, and related research questions, research scope, the significance of the study and limitations.

CHAPTER TWO: LITERATURE REVIEW

2.1. Chapter Overview

The following chapter reviews QR Codes, android technology, indoor locations, literature related to the study and conceptual framework to gain proper insight.

2.2. Review of Technologies

Technology defines how different processes are made easier in our daily lives. The following technologies are reviewed with a closer look on their advantages, disadvantages and possible application.

2.2.1. QR Code

QR code is the trademark for a type of matrix barcode designed first for the automotive industry in Japan. A barcode is a machine-readable optical label that contains information about the item to which it is attached. A QR code utilizes four standardized encoding modes mainly alphanumeric, numeric, byte/binary and kanji to enable efficient storage of data.

A QR code consists of black squares arranged in a square grid on a white background, which can be read by an imaging device such as a camera, and processed using Reed–Solomon error correction until the image can be appropriately interpreted. The required data is then extracted from patterns that are present in both horizontal and vertical components of the image. (Crompton et al., 2011)



Figure 1: QR Code image (Source: Demir et al. 2015)

The advantages offered by QR Code include ease of use since it can be embedded to anything, cost-effective since information is encoded then printed on paper or hard surface and can easily attract the curiosity of users who would like to access more information. (Demir et al. , 2015)

2.2.2. Indoor Positioning System (IPS)

IPS is a system used to locate objects inside a building using magnetic fields, radio waves or sensory information connected to mobile devices. Different technologies are used such as distance measurements to nearest anchors as beacons or WIFI access points. GPS loses required power indoors affecting the required coverage of at least four satellites hence the need of IPS for use indoors (Aida Mahiddin et al., 2013).

Wireless technologies such as WI-FI or Bluetooth can be used for locating. Different existing systems take advantage of installed wireless infrastructure for indoor positioning. There are three primary system topology options for hardware and software configuration, which include: -

- Network-based

- Terminal-based
- Terminal-assisted

Positioning accuracy can be increased at through increasing the number of installations within the given building. WI-FI based positioning system focuses on the use of access points that are identified based on the unique SSID and mac address. Various mobile devices can connect to WI-FI access points in given locations and be identified uniquely based on their unique identification IDs.(Yang & Shao, 2015).

The distance between the known wireless point the mobile devices and anchors can be calculated mathematically using trigonometric. The required variables measured from the anchor include the angle which is referred to as triangulation or distance which is referred to as trilateration. Other advanced methods used include Kalman streaming which works well under noisy condition. (Chon et al., 2014)

Indoor Positioning System usage is gaining popularity in the current world due to easy adoption of the technology. Some of the uses include accessibility aid to visually impaired persons, social networking, targeted advertising and in schools among others(Zhang et al., 2010). The usage of indoor locations has been evident in class attendance management such as one developed by Aadhaar (2017). The researcher used GSM wireless enabled fingerprint terminals to manage class attendance. The devices connected through WI-FI to relay attendance information remotely after biometric authentication.

2.2.3. Android Mobile Technology

Android is a mobile operating system based on Linux Kernel that was developed by Google and is primarily designed by Google for touch screen based devices for example smartphones and tablets. It is the bestselling OS since 2013 and has the highest installation base (Robinson & Weir, 2015)

2.2.3.1. Android Features

The Android architecture provides important technologies that can offer proper solutions to many challenges that surround many business processes (Singh et al., 2016)

- i. Effective Wireless connectivity through the use of WI-FI or Bluetooth. An Android device can connect successfully to any WI-FI hotspot or access points. The connection is identified by the device unique ID and status confirmed through a specific broadcast service though it is limited to the distance of the access point location.
- ii. The OTG USB support provides the capability to connect external hardware for communication with the OS.
- iii. The SQLite database enables local data storage for syncing with a remote database and easy confirmation locally without the requirement of the internet.
- iv. The GCM technology enables communication amongst devices through internet and sockets hence works appropriately in relaying important information to users.
- v. The camera enables taking photos and videos and scanning of encoded information such as QR and Bar Codes

2.2.3.2. Advantages of Android Technology

Android mobile technology is a product owned by Google which is a world-trusted leader in the field of internet computing and hence has played a great role in enhancing the trust on the android smart phone and tablet devices. The built confidence of the android devices among users has led to penetration of its usage (Bhardwaj et al., 2013)

According to www.slate.com, (2014) by 2014, Android has billions of users across the world as a result of its intense penetration in the market and many free-hosted applications and games in the Google App Store.

Android offers ease of access to notifications such as emails, SMS or calls on their home page. This is necessitated by the easy user interface that can easily be navigated by swiping across screens (Simon, 2012).

Android devices allow multitasking of various processes, hence making it easy for users to open many applications at once. This feature greatly improves the usability of the operating system and hence promotes proper usage of the phone processor.

2.2.2.3. Disadvantages of Android Technology

Android devices are prone to battery drain due to continuous processes that run concurrently both actively and in the background. It is hard to stop this background applications since most of them assist in system operations (Zahid, Ali, & Nassr, 2011)

For complete access to all applications on an Android device, the user is required to have a Google email address account. These restrict users who do not have Gmail accounts from using the phone unless they create one (And & Deshmukh, 2012).

Android OS, since its development has had security issues such as vulnerability to exposure of personal information in applications. Google has been improving on ensuring the security of the devices is good by the introduction of strict permissions. However, despite this positive move, the previous versions hold the highest market share yet their security is still vulnerable compared to the current releases that have the security fixes (Hoog, 2011)

2.3. Existing attendance systems and their challenges

2.3.1. Student Attendance System Based on Fingerprint Recognition and One-to-Many Matching

Trivedi et al. (2011) researched Student Attendance System Based on Fingerprint Recognition and One-to-Many Matching. Their research focused on designing an attendance system that could effectively manage attendance of students at the National Institute of Technology Rourkela. They deployed the use of biometrics through fingerprint recognition on a one to many matching algorithms. The implementation was simulated in Matlab hence they developed the scientific approach that they suggested to be used in future work by developing a computer-based application in Java and to be interfaced with the fingerprint reader.

2.3.2. Android based roll call system

Anurag et al. (2013) developed a student attendance system through mobile devices. They created a mobile application that was used by teachers to mark attendance of the respective courses they taught. The application then stores information in the devices before it could be uploaded to the centralized database. The system was partially manual since it required the teacher to read out the student's name. Authentication was not accurate, and the system was slow for classes with a large number of students.

2.3.3. Integrated biometric system for monitoring and recognizing students

Mohammad et al. (2013) suggested a solution on an integrated system for monitoring and recognizing students during the class session. Their biometric solution was based on face recognition using a camera that was pinned in front of the class. The recognition was being made as the class was ongoing after which a report was generated by the instructor. However, the upload of photos taken into the system was manual hence required the instructor to intervene and in cases where the photos have not matched the instructor was required to match the photos by dragging them manually.

2.3.4. Portable biometric device using Arduino

Zainal et al.,(2014) designed a portable biometric device using Arduino to help in recording attendance of students while they are in class. The platform developed was portable and could capture student attendance. However, the researchers suggested the need for integration of the system with existing management systems for easy analysis and reporting.

2.3.5. Biometrics Based Attendance Checking using Principal Component Analysis

Jennifer et al. (2015) suggested a solution that was called Biometrics Based Attendance Checking using Principal Component Analysis that is based on both fingerprint and face detection and recognition system. The test results improved system accuracy and automated faculty attendance. However, the researcher suggested more study is needed with detailed analysis on the faces with proper imaging. It was also noted that improving the imaging of the faces will lead to fewer data stored in the database hence the system will become less effective in large classes.

2.3.6. Biometric solution based on access control and class attendance management system

A biometric solution based on access control and class attendance management system was developed by Mittal et al. (2016) to help solve the problem of class attendance. The system had an access control system installed at the door and required biometric to enter and get out of the classroom. The biometric clocking for both the access control and class attendance management systems were relayed to a remote server for further analysis, reporting and interfacing with the online system. The solution developed was able to give an accuracy of 87% for the ACS and 92% for the CAMs. However, the researchers suggested further developments to make the system integrated with other management systems such as payments and banks. Other developments suggested are remote access control locks, home monitoring and attaching the scanner to automobiles to enable access.

2.4. Conceptual framework

The attendance management solutions discussed above have deployed the use of a database to store data and devices to collect attendance information. The suggested solution uses an android phone connected to WI-FI to get input authenticated data from students. The input data comprises of student identification, the course details being attended and QR-encoded attendance details. The data stored in the database is then analyzed for reporting purposes. The proposed method leverages on the use of Android mobile devices, indoor locations and QR-codes to register student attendance and store the data in the database for further manipulation and analysis. The moderating variables include the attendance procedures and policies that govern the attendance process while the dependent variables are the inputs from the students and lecturers to affirm attendance. The independent variables include the android application and the web-based system that will manipulate the input data. The output is the report that is analyzed and manipulated from the database.

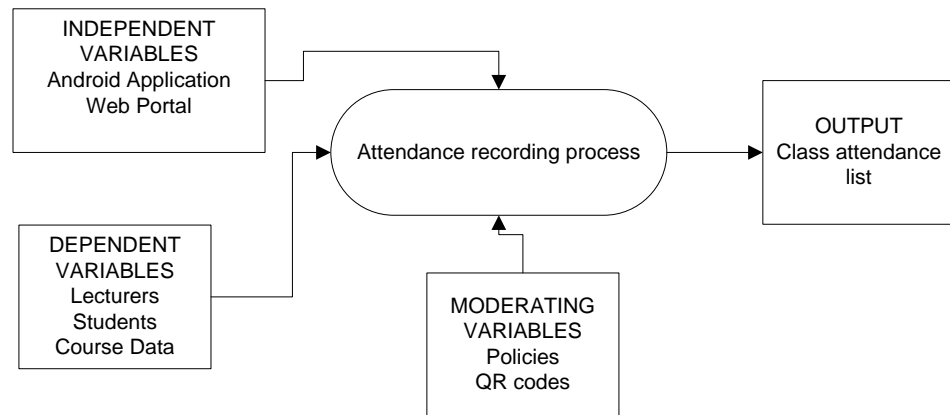


Figure 2: Conceptual framework derived from the literature review

2.5. Summary

The chapter reviewed android, QR Codes, Indoor Positioning system and various related studies to help come with a conceptual framework for use in the upcoming sections.

CHAPTER THREE: RESEARCH AND SYSTEM DEVELOPMENT

METHODOLOGY

3.1.Introduction

This chapter covers the description of methods that were applied in carrying out the research study to realize the objectives earlier set. It contains the research design, research instruments, and system development methodology. Its subsections are as follows: -

3.2. Research Design

The research was carried through the experimental research design which involves systematic manipulation of independent variables and some subjects then examining the outcome (Seltman, 2015). According to Oskar (2008), the researcher manipulates one variable, and control the rest of the variables. It is suitable for testing cause-effect relationships by manipulation of variables. In this study, the researcher analyzed the current method used in managing attendance of students in Department of Information Technology; Moi University based on the requirements of ISO and developed an advanced mobile-based system that uses QR Codes and indoor locations to register attendance. The independent variables were based on the ISO requirements for registering class attendance while the controlled variables were the enhancement of class registration management through the use of Android mobile technology, QR codes, and indoor locations. Experimentation enabled the researcher to provide

empirical evidence that the new method of class attendance was better compared to current manual method deployed in managing the attendance.

3.3.Requirement Analysis Techniques

Requirements were analyzed using qualitative and quantitative techniques, which included Microsoft Excel Spreadsheet, survey monkey online tool and thematic classifications.

3.4.System Development Methodology

This system development was done through Rapid Application Development Methodology (RAD). RAD methodology involves minimal planning to enable rapid development of prototypes; a prototype is a working model that is functionally equivalent to a component of a product. Due to lack of proper and detailed planning, it is easier to incorporate changes with time within the development process (Mnkandla, 2009). According to Martin (1991), he defines RAD as: *“a development life cycle designed to give much faster development and higher quality results than the traditional life cycle.”* The methodology is suitable because the solution developed can be modularized and be incremental in its delivery, ease availability of domain experts, i.e., the lecturers and the students and due to the easiness of requirement change upon delivery of the prototype. There are three RAD models, which include, Prototyping Methodology, Phased Development Methodology and Throwaway Prototyping Methodology. For this research, prototyping methodology was used because these methodology has a greater emphasis on unit modules and utilization of developed

prototypes with defined time limits for software development hence it was easier for the researcher to develop a simple, functional solution that could easily be enhanced.

According to Dennis et al. (2000), prototyping model performs the analysis, design and implementation phases concurrently, and all these three phases are performed in a cycle until the system is completed. In case of any changes, they are made on the prototype that was the eventual working system.

The following figure represents the steps that were taken in this research allowing maximum flexibility of doing any changes that may be needed in the eventual system

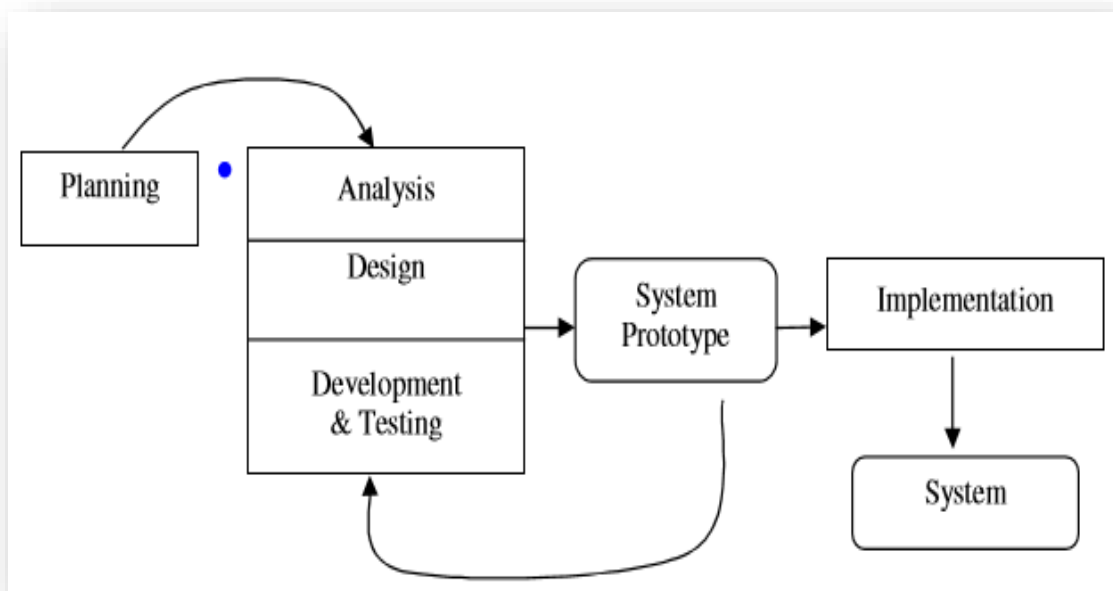


Figure 3: Prototyping Methodology (Source: Dennis et al. 2000)

The details of the processes conducted were as follows: -

1. The planning process involved determining all the processes to be followed with a key focus on the inputs and outputs of each stage. The starting point was gathering requirements based on the document analysis and questionnaires answered by students and lecturers. The focus of the study analysis was predetermined by: -

i) Target Population

The study was conducted in Moi University Department of Information Technology, third year informatics class. The target population were 35 Students who belonged to the class and 5 lecturers teaching the students atleast a course in the ongoing session. The class was chosen since they were in the current ongoing session hence it was possible to get attendance data for the study. Furthermore, the chosen student class offered additional advantage of being fully experienced of the current existing attendance procedure and challenges hence will give proper feedback.

ii) Sampling Procedure

The study employed Simple Random Sampling (SRS) technique through selecting lecturers and students from the study population without any biases. SRS is a technique that selects a sample from a sample group without any bias thus ensuring each member of the classes has an equal chance to be involved in the sample (Meng, 2013). The procedure was as follows: -

- a) The total population for both the lecturers and students were listed in form of registration numbers in an excel as separate sheets in a workbook.
- b) For each sheet three columns were made with the first one holding the serialized

number while the second one the registration details and the final one held the results for the randomized serialized number.

- c) The results for the third column were generated from using the function =RANDBETWEEN (0, 36) for student work sheet and =RANDBETWEEN (0, 6) for lecturers' worksheet.
- d) The results were then populated in the third column across all the cells with a repeat of the function being executed in the case where we have duplication of the random value down the rows.
- e) The random numbers in column three on each sheet were expected to be within the range of 1 to 25 for the students and 1 to 2 for lecturers hence determined the students and lecturers who were eligible samples to participate in the research.

iii) Sample Size

The sample consisted of 25 students of year three informatics class out of the targeted 35 students and two lecturers out of the possible 5. The sampling technique used to decide on the number of students and lecturers was based on Simple Random Sampling. The sampling done on lecturers and students was focused towards maintaining simplicity and increasing the accuracy of the study due to minimal sampling error expected from the given population.

Table 1: Sample Size

Category	Total Population	Sample generated	Percentage
Students	35	25	71.4%
Lecturers	5	2	40%
Total	40	27	69.3%

2. The information was analyzed and used in designing the model for the prototype.
3. A system prototype with minimal functional features identified initially was developed. The first prototype is a mobile application that is installed by both the students and lecturers in their android phones to capture and manage attendance respectively.
4. The developed prototype is tested then reviewed with stakeholders whose comments are used to analyze, design, and implement once again the second prototype with a few more features. This process is progressive in a cyclic manner until the designers, users, and stakeholders agree that the prototype provides enough functionality to be installed and used within the setting.
5. After the prototype has been installed, further improvements are done until user acceptance of the improved system

3.5. Research Instruments

The study relied on questionnaires and document analysis as a requirements gathering method. The selection of document analysis was guided by the availability of quality procedures manual and class attendance lists required to be complied with for effective attendance management. The questionnaires were guided by the objectives of the study. The focus of the study was to identify the existing attendance method and its core challenges and to develop a solution that will use both android and QR Technologies and Indoor Locations. The researcher sent questionnaires to participants drawn from the research population of both students and lecturers selected through simple random sampling.

The questionnaires were used to gather information from the target respondents of 25 students and two lecturers through subjecting each respondent to same questions categorically which enabled the researcher to collect necessary information regarding the attendance procedure, mobile platforms used by respondents and the challenges experienced.

The first set of questionnaire was for students which had questions geared towards establishing what the current method being used to register attendance was, the challenges experienced and also establish what kind of smartphones they have. The second set of questionnaire was specifically for lecturers. It had questions that focused on getting answers on the current method of attendance, any use of technology in the attendance management process challenges experienced and the kind of smart phones they use.

3.6.Ethical considerations

Ethics refers to moral principles governing the conduct of an individual while undertaking a given task (Block, 2001). The researcher obtained a permit from National Council of Science and Technology and sought permission from the HOD Department of Information Technology, Moi University to conduct the study. The study process details and findings were kept confidential. All parties involved in the research participated fully to ensure the required results were achieved.

3.7.Summary

The chapter covered the methods that were applied in carrying out the research study to realize the objectives that were set in the previous chapter. The system development methodology for use was based on RAD.

CHAPTER FOUR: REQUIREMENT ANALYSIS AND MODELING

4.1. Chapter Overview

This chapter deals with the results of the steps undertaken based on RAD prototyping methodology which involved a series of design processes that will help to come up with a functional prototype.

4.2. Planning

In this phase, a feasibility study was done to determine the scope of the project and be able to understand the business problems to come up with a defined solution. To be able to collect the requirements accurately the instruments used included document analysis of the ISO document at the school department to establish the standard procedure of attendance registration. The questionnaires had questions that provided feedback on the challenges experienced by both students and lecturers while undertaking attendance. The collected information was used to quantify the need for having the new system and in turn forming the input for the next phase.

4.3. Requirement Analysis

The process of requirement analysis was important since it helped in establishing the functional and non-functional requirements to be used in the development of the system.

4.3.1 Analysis of the attendance procedure

In line with the first objective which required the analysis of an existing class attendance method in the Department of Information technology. To achieve this objective, document analysis had to be done on the Moi University ISO9001:2008 Quality and Manual Procedures and questionnaires given to the lecturers and students.

The defined procedure for class attendance according to Moi University ISO9001:2008 Quality and Manual Procedures Document (2010) is as follows: -

- a) The HOD shall convene a departmental meeting at which course allocation to lecturers is done at least one month before the beginning of the semester/term.
- b) Each lecturer/course instructor shall generate course outline guided by the course description and submit a copy to the HOD one week before the semester/term begins.
- c) At the start of the teaching, the course lecturer in the department/school shall give a copy of the course outline to the students.
- d) The course lecturer/tutor shall deliver the course content guided by the curriculum and the teaching timetable.
- e) The lecturer/tutor shall maintain a minimum of five times class attendance registers for all teaching within the semester/term and analyze the percentage of attendance for the examination process

4.3.2 Analysis of the questionnaires from lecturers and students

The lecturers and students were also subjected to questions to establish how exactly the attendance is managed.

The lecturers' questions were: -

- 1) What are the methods currently adapted for managing class attendance?
- 2) On a scale of 1 to 5 how effective is the current method being used in making the attendance recording and tabulation tasks easier?
- 3) How often do you use the method at a threshold of 8 classes?
- 4) What other technologies do you deploy to make the method effective?

The student questions were: -

- 1) How do lecturers manage class attendance?
- 2) How often do you record your attendance using the approach out of a threshold of 8 lessons?
- 3) Can you be able to record attendance for another student in their absence?

The lecturers confirmed that the current attendance management approach was based on signing of manual attendance class lists by students. The signing was done for each class attendance made by the student and in the case where the student was not available the lecturer would cross the field to be signed. The students also confirmed the procedure as stated by the lecturer. The lecturer then tabulates the information in softcopy using tools such as excel in order to determine the percentage of attendance of the student.

The average rating of the effectiveness of the system in making work easier for the lecturers was at 2.5. This implied that the effectiveness of the system was average. The lecturers also admitted that the usage of the method was not in all occurrences set at an average of 1/2 of the possible occurrences and this could be attributed to the fact that the lists are usually forgotten.

The lecturers also confirmed they required use of excel to tabulate the attendance percentages of students and this is only achievable after the manual data has been converted to soft data through manual data entry.

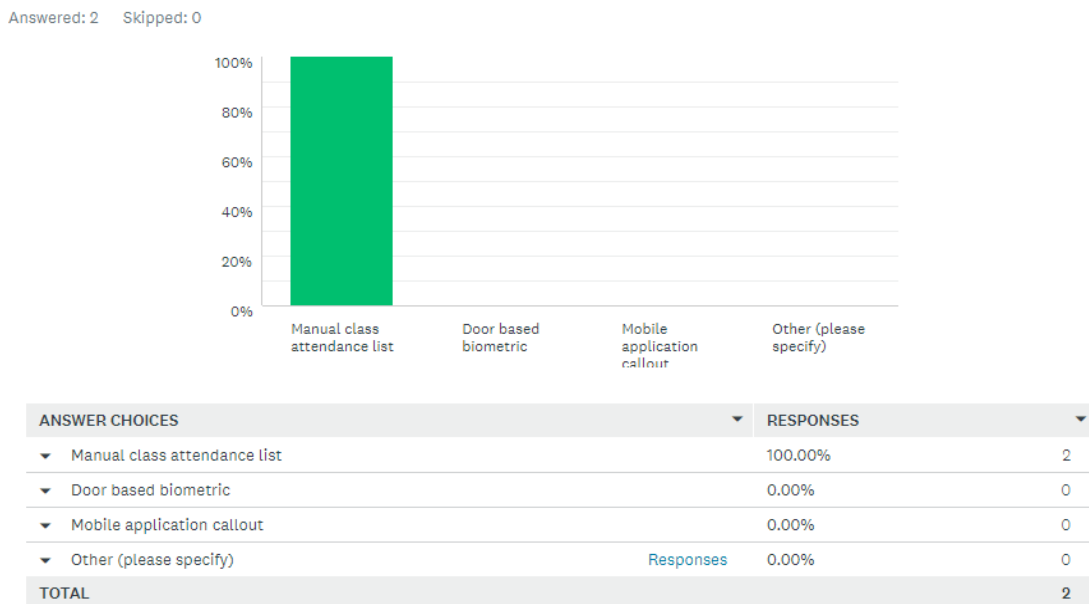
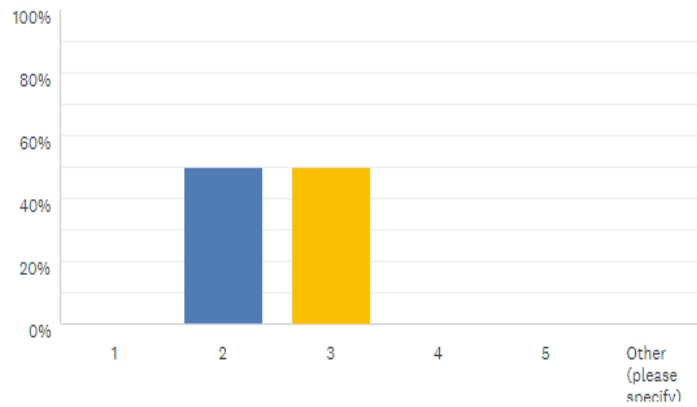


Figure 4: Graph for method of attendance management as reported by lecturers

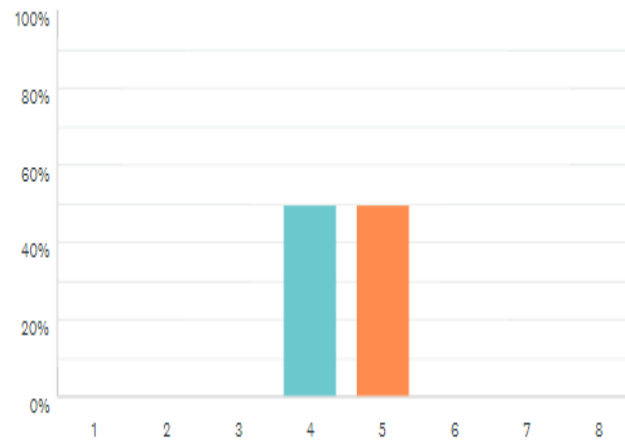
From the results above the lecturers were able to confirm the method of managing attendance currently in use was the use of manual attendance lists.



ANSWER CHOICES	RESPONSES
▼ 1	0.00% 0
▼ 2	50.00% 1
▼ 3	50.00% 1
▼ 4	0.00% 0
▼ 5	0.00% 0
▼ Other (please specify)	Responses 0.00% 0
TOTAL	2

Figure 5: Graph for effectiveness of current attendance method as reported by lecturers

The lecturers confirmed the method in use was average in its effectiveness by giving it a mean score of 2.5 out of 5. This could mainly be attributed to the fact that the method pros and cons are of equal measure.



ANSWER CHOICES	RESPONSES
▼ 1	0.00% 0
▼ 2	0.00% 0
▼ 3	0.00% 0
▼ 4	50.00% 1
▼ 5	50.00% 1
▼ 6	0.00% 0
▼ 7	0.00% 0
▼ 8	0.00% 0
TOTAL	2

Figure 6 : Graph for frequency of usage of the method of attendance management as reported by lecturers

According to the above results the lecturers confirmed they do not frequently use the method of attendance implying the outcome presented at the end of each semester is not a true reflection of the actual attendance. This could also imply the lecturer's class attendance time could not easily be accounted for since the records can easily be forged to cover for the sessions whose attendance records were not captured. The developed solution will ensure all time usage whenever a class is ongoing since physical requirement at the given class is required.

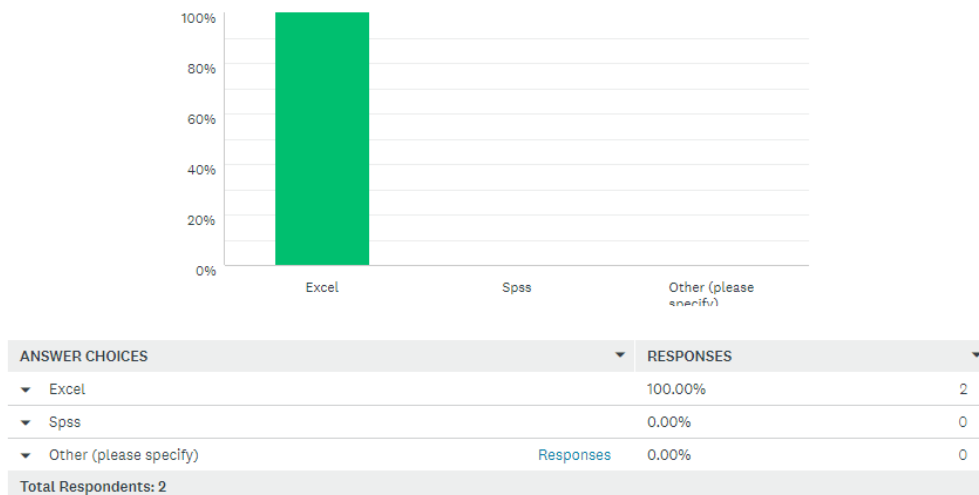


Figure 7. Graph for technologies deployed to better attendance as reported by lecturers

The results above confirmed that the lecturers analyzed the attendance using excel tool to compliment the manual signed lists hence a good indication of the desire to embrace technology.

The highest number of students in their response confirmed that manual signing lists were used for attendance. On attendance rate, they signed only for 5/8 of the classes they attended for a given course. They also confirmed that the method could allow the students to sign for others in their absence. Given the general weakness of lack of authentication for the method, it was easier for students to sign on behalf of others hence promoting non-attendance for some classes among students. From the results, it was clear at least all the students had to attend a class which could probably mean there is willingness amongst students to attend classes but due to weakness posed by the method used, the students end up not attending all classes. The suggested solution will seek to uniquely identify each student through their mobile devices while seated in a given class. The results are summarized as below: -

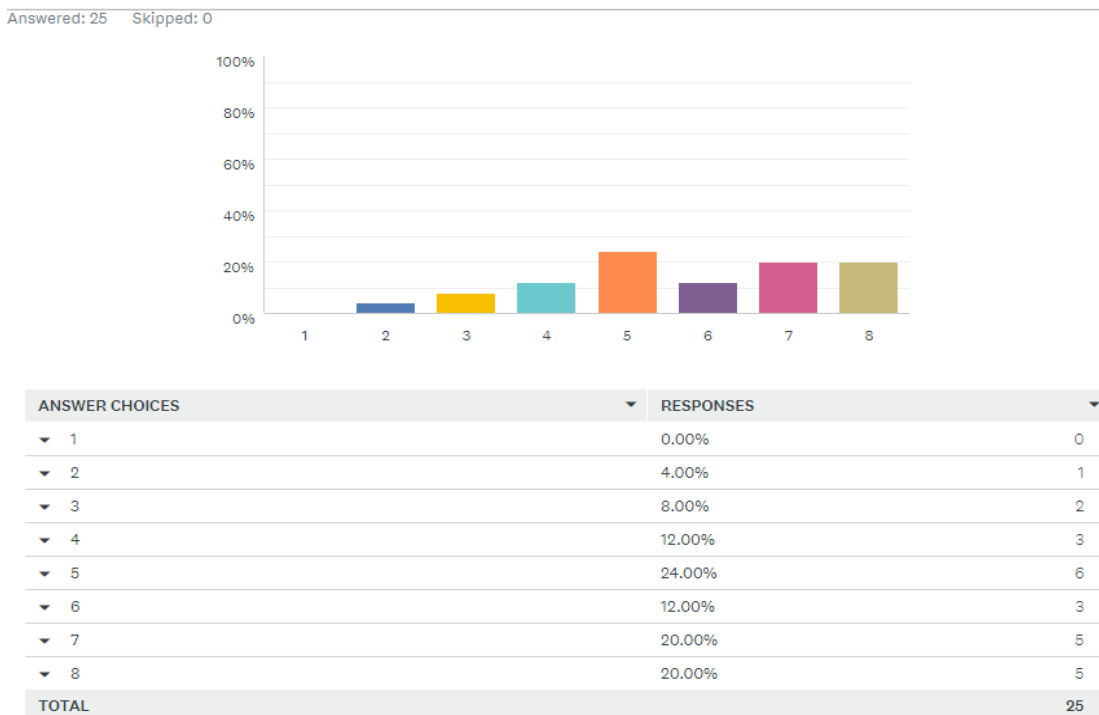


Figure 8: Graph for frequency of attendance as reported by students

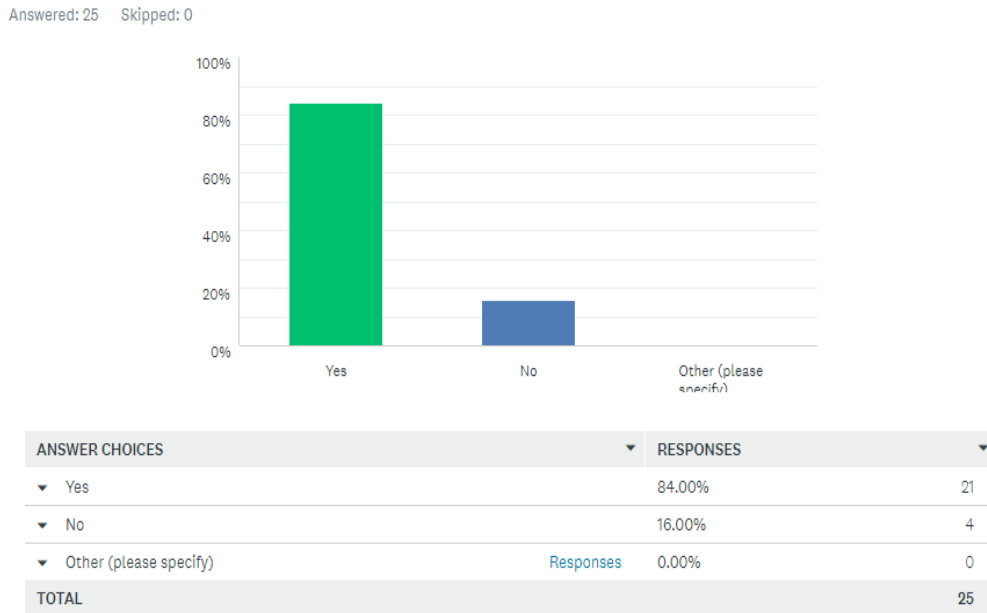


Figure 9: Graph for probability of recording attendance of another student as reported by students

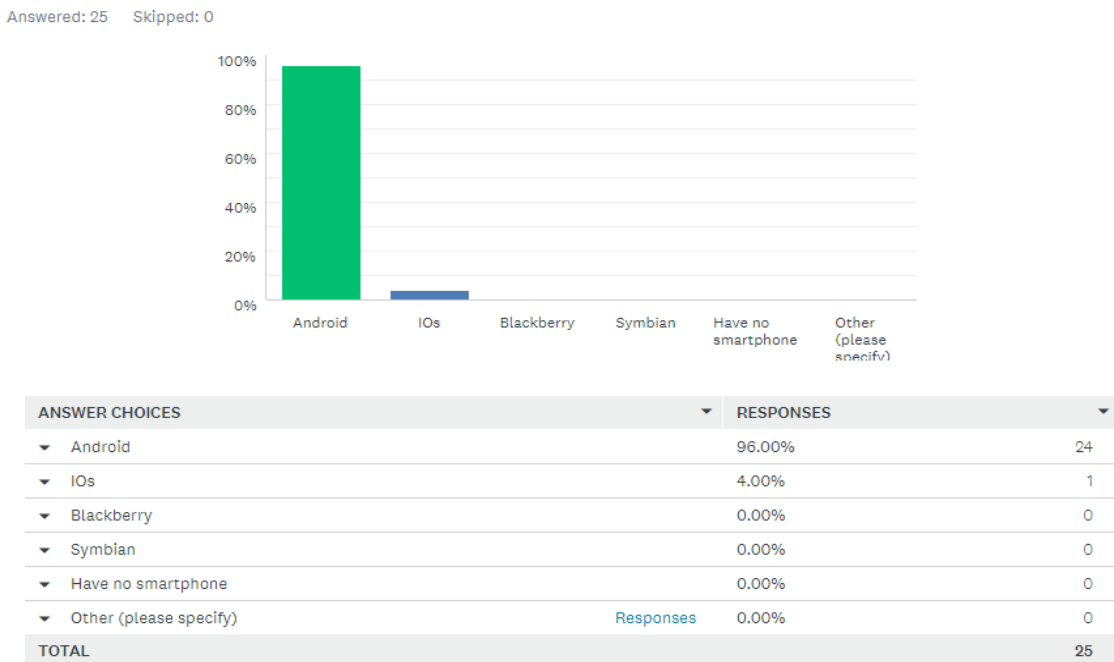


Figure 10: Graph for technologies used as reported by students

4.3.3 The challenges of the attendance management approach

The students and lecturers responded to challenges they faced in using the above method of attendance recording and management and their responses were based of the following tabulated close-ended questionnaire.

The lecturer responses were summarized as follows: -

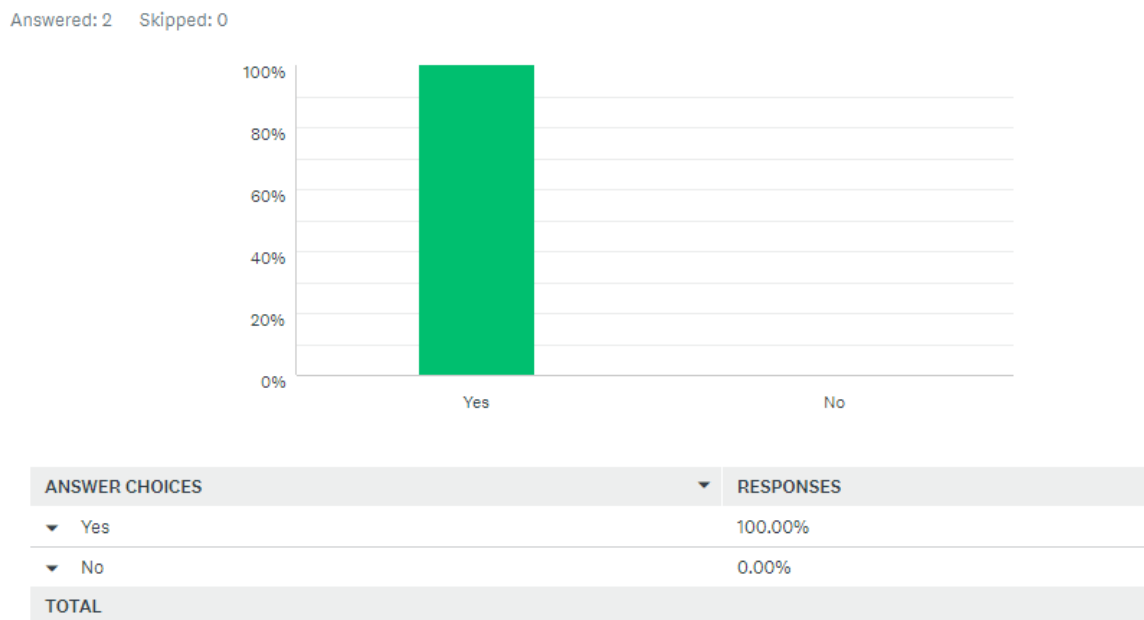
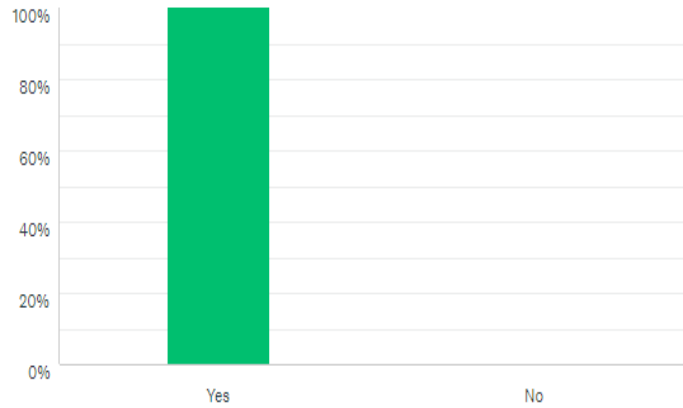


Figure 11: Graph for probability of students signing on behalf of each other reported by lecturers

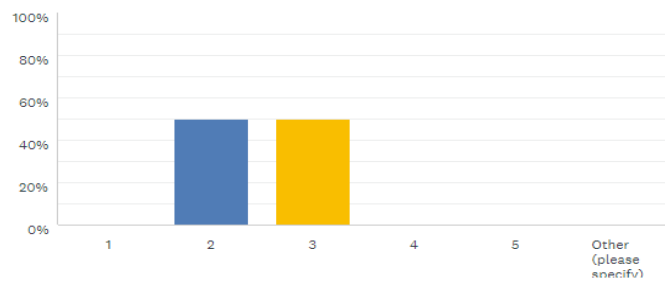
Answered: 2 Skipped: 0



ANSWER CHOICES	RESPONSES
▼ Yes	100.00% 2
▼ No	0.00% 0
TOTAL	2

Figure 12: Graph for confirmation of sending notifications to students as reported by lecturers

Answered: 2 Skipped: 0



ANSWER CHOICES	RESPONSES
▼ 1	0.00% 0
▼ 2	50.00% 1
▼ 3	50.00% 1
▼ 4	0.00% 0
▼ 5	0.00% 0
▼ Other (please specify)	Responses 0.00% 0
TOTAL	2

Figure 13: Graph for effectiveness of recording and tabulation of the current method of attendance management as reported by lecturers

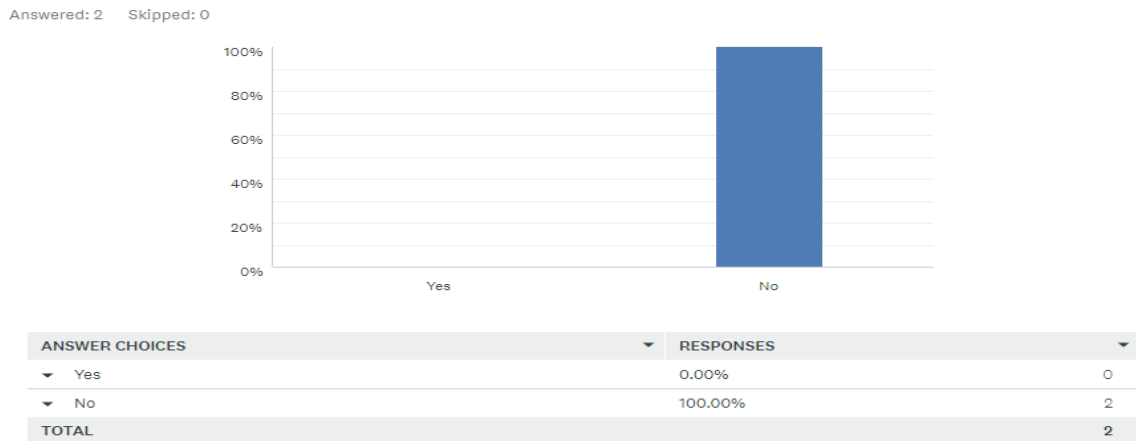


Figure 14: Graph for impact of change of class as reported by lecturers

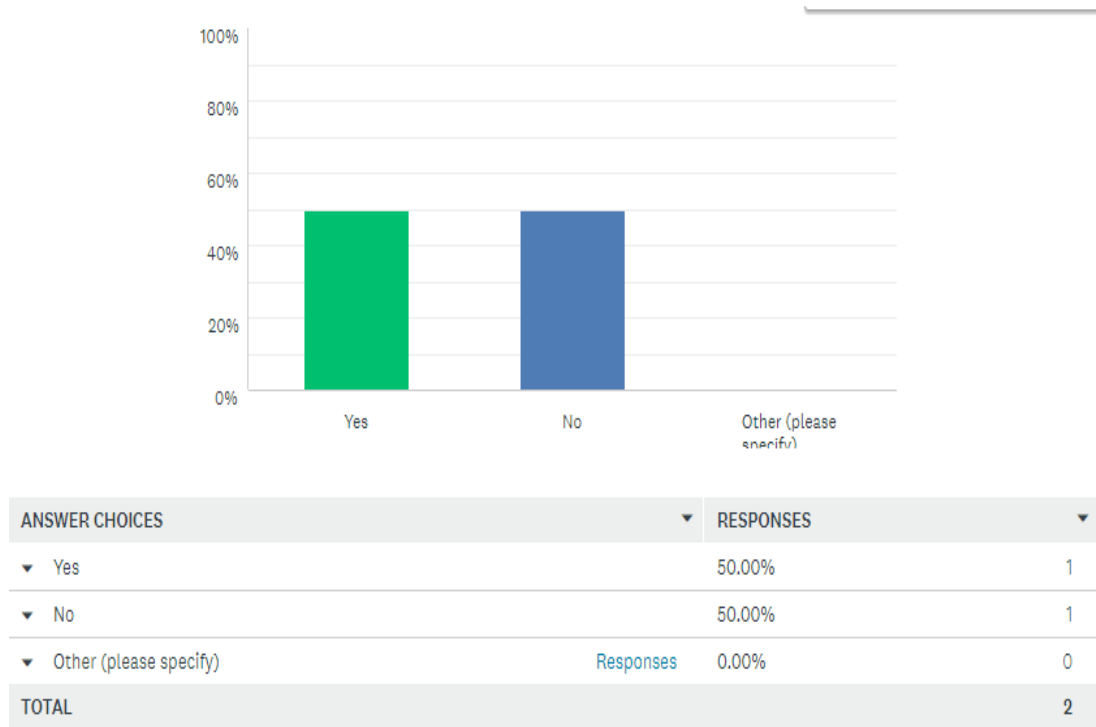


Figure 15: Graph for timestamp confirmation of signing as reported by lecturers

The student questions and responses were as follows

From the answers provided by the respondents on the questionnaires the following were the challenges experienced by stakeholders

- i. The method was not fully authenticated since students could sign for other students without the lecturer recognizing the same. The students signature was the only way to confirm the student's attendance to a given class. Through practice, students can memorize each other signatures and in turn sign during an ongoing class. The suggested solution will seek to overcome these challenges by uniquely tying students to the devices and their physical availability in a given class.
- ii. The research illuminated the need to send and receive notifications in cases where the class has been postponed, and this is usually done by a further external system such as a message to the class representative. Most students confirmed to have received the notifications via WhatsApp, while others through SMS and email. However, most students missed classes that were postponed due to the failure of receiving notifications of the changes in the class. These facts aroused the need for automated notifications amongst stakeholders in attendance management.
- iii. Even though the students find it easy to sign the lists, the lecturers find it hard to indulge the approach because data migration from hard to soft copy needs to be done. The already printed attendance lists contain only the students' admission numbers, name details, course information and signature.
- iv. The method does not tie the signing to a given date in an authenticated way that

means the signing can be done in any day this was confirmed by most students indicating they can sign for a different class on the non-due day.

- v. The tracking of attendance is easier for students since they only need to sign in the subsequent fields, but the task is hard for lecturers who need to tabulate the data eventually to establish the required percentage threshold.

The requirements were further classified into functional and non-functional requirements to help achieve the minimum functionality of the system

4.3.4 Functional Requirements

Functional requirements capture the intended behaviour of a system about the data and the user interfaces that will help in the manipulation of data (Malan & Bredemeyer, 2001) The following are the identified functional requirements of the system.

4.3.4.1 Capture Student Information

The system will enable storage of student biodata which includes the name, registration number, year of study, degree program, campus, gender, school and activation status.

4.3.4.2 Capture Students Phone details and number

All the data of students in the system will require to be mapped to respective phone data such as the IMEI number which will be verified during attendance time.

4.3.4.3 Capture Staff Information

The system will enable storage of staff bio data which includes the name, staff number, designation, department, specialty and activation status.

4.3.4.4 Timetabling

This function ensures that all the data necessary for attendance such as the courses, lecturers, venues, time and registered students will have to be provided to necessitate the attendance process of both the students and lecturers.

4.3.4.5 Capture all the classes, venues and time

All this data will need to be input into the system to help set up the timetables that will be used by the lecturers to capture the attendance via the mobile device. The information will have to be added, edited and deleted via a customized web interface by the head of department. The venues are mapped to specific unique WI-FI access points for use during the recording of attendance.

4.3.4.6 Attendance management

The attendance management procedure invokes the following procedures

4.3.4.6.1 Capture attendance

The attendance information containing the details of the QR code of the seat in the attendance venue, student mobile device information, the lesson, the lecturer and time will be relayed via the WI-FI access point as the lesson is ongoing. For attendance to be recorded the student will need to login via the mobile application then scan the QR Code embedded on the seat.

4.3.4.6.2 Postpone classes

This option allows lecturers to postpone attendance of a given class to a later date and venue and sends notifications directly to students. The system will automatically

schedule to the indicated date the postponed class.

4.3.4.6.3. View Report

Customized attendance reports and analysis will be accessible through the web interface while the mobile app offers individual student attendance progress.

4.3.5 Non Functional Requirements

Non-functional requirements refer to various constraints, standards, limitations, performance requirements, verification requirements and validation criteria (Dawson, 2009). The following were identified functional requirements: -

4.3.5.1 External Interface Requirement

The requirement ensures that the usability of the system is addressed for easy usage by lecturers and students.

4.3.5.1.1 Web User Interface

The user interfaces design for the web application was designed by use of Bootstrap 3.0 framework which guided in the usage of the responsive and custom alert boxes, buttons, icons, tables, and menus. The framework was used in the web interface together with HTML5 to enable a responsive and interactive interface for the user via the desktop and mobile devices.

The interfaces for data listing involved the use of data tables which contain a custom search field with paging at the bottom to manoeuvre through the records. The tables

also provide a custom number of records that can be shown per view. The characteristics are as shown below:-

#	NAME	REG NO	SCHOOL	YEAR	ACTION
1	ADONGO POLYCARP RAILA	IS/01/14	Information Sciences	1	Report Edit
2	ARGUT GEOFFREY KIPYEGON	IS/02/14	Information Sciences	1	Report Edit
3	BENARD CHERUIYOT LANGAT	IS/03/14	Information Sciences	1	Report Edit
4	BRIAN K SOY	IS/04/14	Information Sciences	1	Report Edit
5	CHEGE NJUGUNA NELSON	IS/05/14	Information Sciences	1	Report Edit
6	CHEPKWEMOI CYNTHIA KOTON	IS/06/14	Information Sciences	1	Report Edit
7	CHESANG PHILIP	IS/07/14	Information Sciences	1	Report Edit
8	GICHANA KELVIN	IS/08/14	Information Sciences	1	Report Edit
9	GITAU K JAMES	IS/09/14	Information Sciences	1	Report Edit
10	GITUGA BONFACE NDUNGU	IS/10/14	Information Sciences	1	Report Edit

Figure 16: Data tables (Source: www.datatables.com 2017)

4.3.5.1.2 Mobile User Interface

The mobile user interface developed is based on the use of XML to represent the layout for various interfaces. The Android framework supports various layouts that can be used to present the desired functionality to the user.

The linear layout helps in aligning content in a single direction either vertically or horizontally. The layout can adapt to the height of the mobile device by either matching the parent device or wrapping the content. With the help of a parent scroll view the contents of a linear layout matching the parent can be scrollable.



Figure 17: Linear Layout (Source: www.developer.android.com 2017)

The relative layout helps in displaying child items in relative positions to one another. It helps in designing complicated interfaces where items will be required to be in a position relative to one another. The layout adapts to the height of the parent device and sometimes it can be set to wrap content.



Figure 18: Relative Layout (Source: www.developer.android.com 2017)

The list view is used to present items in a list to enable easy scrolling. The items are mapped with data adapters to specific text views and buttons. The list view is embedded with linear and relative layouts.



Figure 19: Listview (Source: www.developer.android.com 2017)

Toast provides simple feedback about an operation in a small popup. It only fills the amount of space required for the message and the current activity remains visible and interactive as shown below: -



Figure 20: Toast View (Source: www.developer.android.com 2017)

The input will have to be entered via the input boxes and text is shown via text view. For the user to input content, the keyboard will have to pop-up as shown. The toast is good to display feedback message to the users without distracting them. The toast attributes include timed display for short and long durations.

4.3.5.1.3 Hardware Interfaces

The mobile application is to be interfaced with the camera and WIFI connectivity provided by the access point. The wireless connectivity will be specific to different venues for conformity purposes.

4.3.5.1.4 Software Interfaces

The mobile application required the QR Code library be integrated with the camera in order to read QR Codes embedded on the desks. The centralized server computer is installed with Windows 7 installed with Xampp Server bundled with PHP, MYSQL and Apache2. The server synchronized the attendance data for both the mobile device and the desktop application. The data for students and staff was imported into the system after being fetched from the existing databases in the university.

4.3.5.1.5 Communications Interfaces

The mobile device will communicate to the centralized server computer via the HyperText Transfer Protocol initiated through WI-FI or Internet Connectivity. The mobile device will first capture the data in the local storage SQLite then it will sync when internet connectivity is available to a remote host with the data being sent encrypted end to end. The communication port of the server was set at port 80.

4.3.5.2 Hardware Requirements

Hardware requirements focus on all the hardware components that will be used to enable full functionality of the system. Every software component needs to be complimented with an effective working hardware so as the functionality is to be realized.

4.3.5.2.1 WIFI Access point

The device is used to connect the mobile devices to the centralized server for identification and management of the attendance. The access point will act as a default gateway to the server mapped within the same subnet mask.



Figure 21: Access point Device

Hardware requirements

Support: One 10/100M Ethernet Port (RJ45) Support Passive PoE

External Power Supply: 9VDC / 0.6A

Wireless Standards: IEEE 802.11n, IEEE 802.11g, IEEE 802.11b

Antenna Type: 2*5dBi Detachable Omni Directional (RP-SMA)

4.3.5.2.2 Android phone

The device was installed with the mobile application to enable routing of attendance data to the remote server. The device is uniquely identified to a given student. The device should have GPS, Wi-Fi 802.11 a/b/g/n, dual-band, Wi-Fi Direct, hotspot, TFT Screen, micro USB V2.0, Bluetooth V4.0, either or both back and front cameras.

4.3.5.3 Security Requirements

The requirements ensure authenticated access to information and the system through verified access. Security is key to prevent unauthorized access and is basically archived through use of passwords and security certificates for Hyper Text Transfer Protocol secure port 443.

4.3.5.3.1 Use of Staff/Student ID and Password

The access to both the mobile and web applications will require the use of staff id and password to view required content. The lecturers will be required to log in to capture attendance and view reports while the Head of Department office will be responsible for the entrance of the timetabling and student data. The student will use their registration number and unique password to log in and view notifications, report on intended missing of a class and view general and summarized individual reports. The passwords are encrypted with md5 hashing method to prevent viewing from prying eyes.

4.3.5.3.2 Phone enrollment

The students will be required to be enrolled in the system using their phones before their attendance can be recorded since the authentication for a given attendance will require the same phone. The enrollment captures the phone IMEI number and the student details which are stored in the database.

4.3.5.3.3 QR Code enrollment

The seats will uniquely be identified per class through the use of generated unique QR codes that will identify the chairs per venue. The encoded details mapped to specific seats are stored in the database for retrieval during validation process.

4.4 Assumptions / Constraints

The following are assumptions and constraints put into consideration.

4.4.1 The WI-FI Access points Configuration

It will be assumed that the access points are preconfigured with a unique SSID and mapped to specific classes where they have been installed at specific points. The access point is configured with a default Internet Protocol address within a given subnet mask.

4.4.2 Embedded QR Codes on seats

It is assumed that the seats belong to a given classroom will be embedded with functional, unique QR codes that can easily be scanned by any mobile device camera within the proximity once the class registration has been activated by the lecturer.



Figure 22: Seats embedded with unique QR Codes

4.5 Summary

The chapter covered the gathering and modelling of various functional and non-functional requirements that were key towards design and development of the system. Various requirements were considered which included security, communication interfaces and hardware. The requirements help to establish a fully functional and robust system.

CHAPTER FIVE: SYSTEM DESIGN AND DEVELOPMENT

5.1. Chapter Overview

The chapter states the steps taken in the development of the system using the functional and non-functional requirements stated in the previous chapter. The sections covered include system design, development, review and implementation.

5.2. System Design

The system design covers the database design, conceptual design and then system architectural design.

5.2.1. The database Design

To manage the data effectively amongst the applications two models will be deployed mainly local storage running in the mobile device using local and remote storage in the remote server and it will be based on MySQL. The two will be synced based on remote action.

The study used an entity relationship diagram to show how the entities relate. The entity relationship diagram shows the relationship between attributes and entities(Moss, 2012). Entities are the data objects such as person or place about which information is to be collected. Relationships represent real-world associations among one or more entities. Attributes are characteristics of given entities that describe them. (Earp & Bagui, 2012)

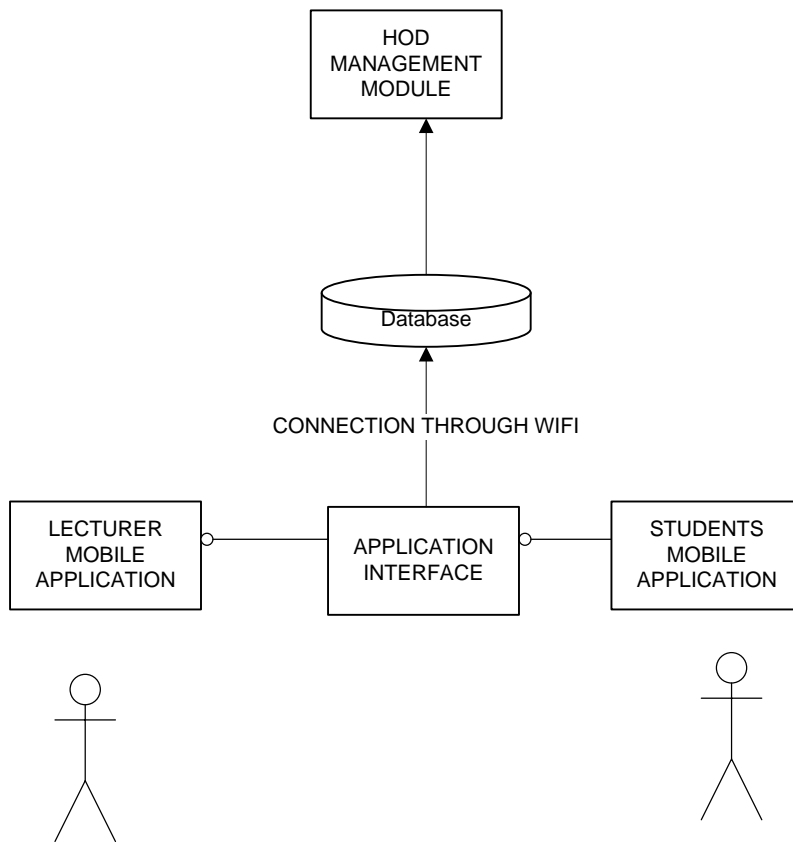


Figure 24: Conceptual Design

5.2.3. System architecture

The system will be set up on a centralized server which will be accessed via the Local Area Network for the administrator computer for managing the reporting and monitoring the web application. The mobile devices will be connected to their respective local storage and will be synced to the remote database through the wireless network. The communication to the remote server will be through port 80 and 443 for secured access.

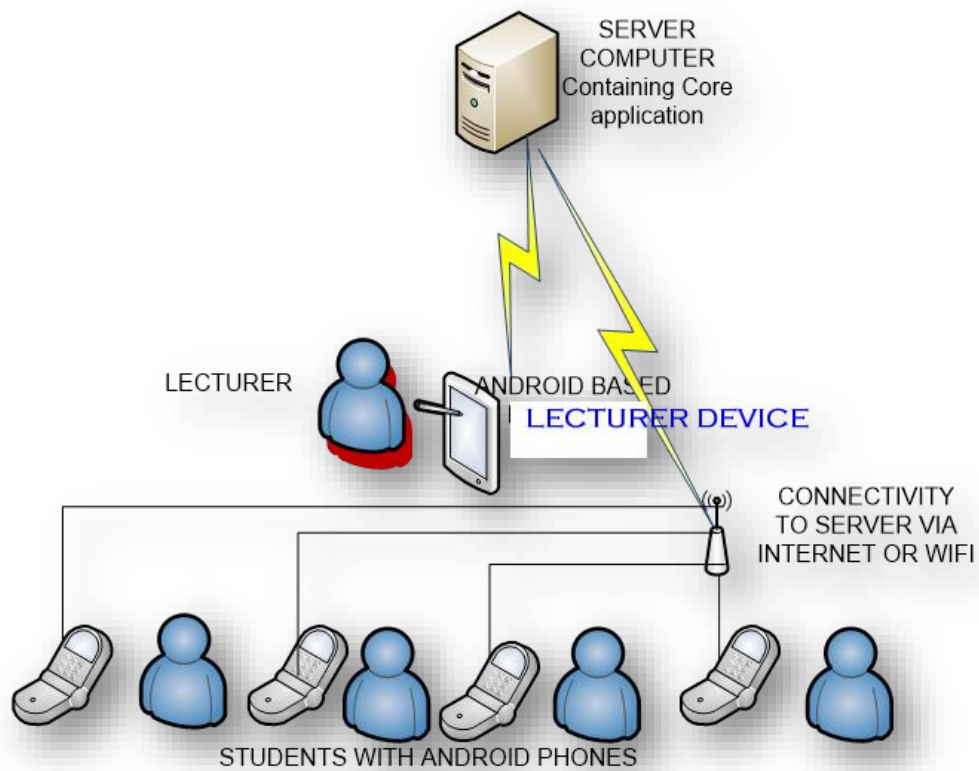


Figure 25: System Architecture

5.3. System Development

The backend web application was developed using PHP, JQuery, Ajax and CodeIgniter Framework. The development and production were hosted on an Apache server. The tool used in development was NetBeans IDE which supports web development. The mobile application, on the other hand, was developed on Android Platform using the android studio. Various tests were done to ensure the developed program was meeting the requirements. The following modules were developed for the prototype: -

5.3.1 User Management

The users accessing the system include the lecturers, students and the head of department. They all require the use of a password and a unique identifier as their username which is mainly either the student registration number or the staff number. The password for each user is encrypted using *md5*; on successful login, the authentication of access to restricted areas is managed through sessions which expire after 3 minutes of inactivity. The use of a wrong username or password redirects the user to the login page and gives the error. For usability purposes, errors generated after entering wrong login credentials, result into a pop window which lasts for a few seconds before fading away. The password characters are supposed to be a minimum of 6 otherwise an automatic login error will be generated on proceeding.

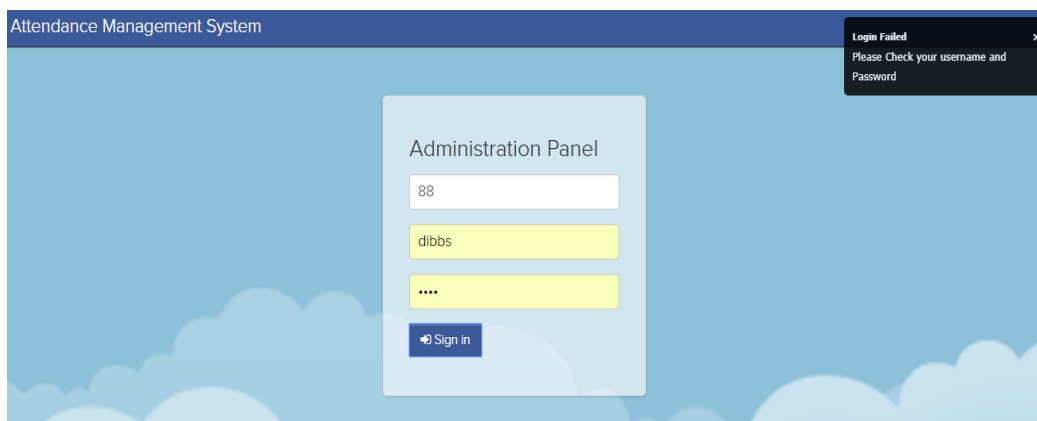


Figure 26: Login page

The screenshot shows a user management interface. At the top left, there is a blue button labeled '+ Add User'. Below this is a header bar with the text 'Users'. Underneath the header, there are two links: 'Add Courses' and 'Records' with a badge showing '1'. To the right of these links is a dropdown menu showing '10' and a search input field labeled 'Search here...'. The main content is a table with the following columns: '#', 'NAME', 'STAFF NO', 'ID NO', 'LEVEL', and 'ACTION'. There is one row of data with the following values: '# 1', 'NAME mike', 'STAFF NO 78', 'ID NO 27314825', 'LEVEL LECTURER', and 'ACTION' containing two buttons: 'Locate' (red) and 'Audit' (blue). At the bottom left of the table area, it says '1 to 1 of 1 entries'. At the bottom right, there are navigation buttons: '+ Previous', '1', and 'Next +>'.

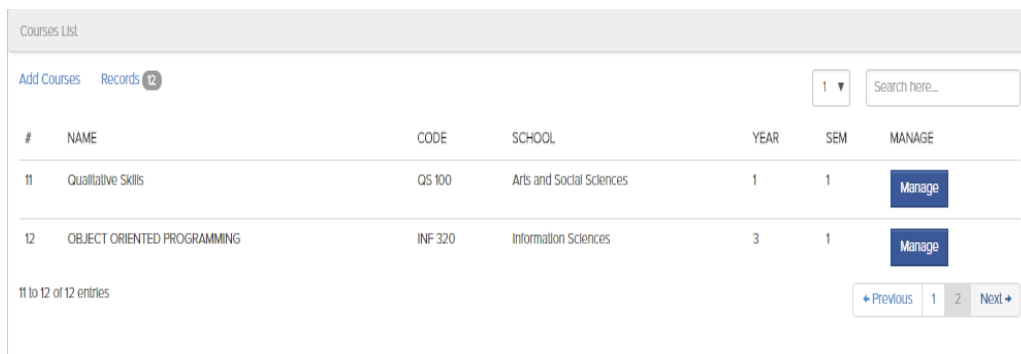
#	NAME	STAFF NO	ID NO	LEVEL	ACTION
1	mike	78	27314825	LECTURER	Locate Audit

Figure 27: User management

Each user is tracked through the use of audit trails to ensure accountability and security of the system. The tracking is based on mapping user's actions to specific timestamps generated and stored by the system within the database. The system has various user roles which include students, lecturers and the administrator who is considered as the HOD. The students are only able to access the system via the mobile platform while the lecturer is able to access both through the mobile application and the web portal. The administrator who manages the users and generates the report, accesses the system only through the online portal. By accessing the top left add menu, the user will be presented with a screen to add the details of the user which will include the name, registration number, identification number and the access level.

5.3.2 Course Management

The module helps in the management of courses to be used in timetabling and allocation lecturers for attendance to be taken. The courses consist of the course initials, year and semester of offer, the school and the department where they are hosted. From the course table listing presented in the table, users can search via the top right input box, for specific courses using any combination of letters that can define what they are searching e.g. search INF will display all courses that contain INF as part of the nomenclature.



#	NAME	CODE	SCHOOL	YEAR	SEM	MANAGE
11	Qualitative Skills	QS 100	Arts and Social Sciences	1	1	Manage
12	OBJECT ORIENTED PROGRAMMING	INF 320	Information Sciences	3	1	Manage

11 to 12 of 12 entries

← Previous 1 2 Next →

Figure 28: Courses listing

The 'Add Course' window is a light gray interface. At the top left, there is a 'Back' button with a left-pointing arrow. Below it, the form fields are arranged vertically. The 'Course Name' field is a wide text input with a blue border. The 'Course Code' field is a standard text input. The 'School', 'Department', 'Year', and 'Semester' fields are dropdown menus with a downward arrow on the right. At the bottom center, there is a gray 'ADD' button.

Figure 29: Add Courses Window

5.3.3 Timetabling management

The courses are mapped to a venue and time to define a given timetable that can be used by the lecturers to record attendance. The time is crucial to enable automated notifications to both the lecturer and the student on the upcoming classes.

The 'Add Class' window is a light gray interface. It features a title bar with a plus icon and the text 'Add Class'. The form fields are arranged vertically. The 'Course:' field is a dropdown menu with 'Choose' selected. The 'Date:' field is a text input with 'Date Start' entered. The 'Time:' field is a text input with 'Date End' entered. The 'Lecturer:' field is a dropdown menu with 'Choose' selected. The 'hours:' field is a text input with 'Date End' entered. The 'Venue:' field is a dropdown menu with 'Choose' selected. At the bottom left, there is a blue 'Save' button with a floppy disk icon.

Figure 30: Add class window

5.3.4 Attendance registration and monitoring reporting

The module is used to map the individual mobile devices to lecturers and students. The mapping process will require the unique identifier username which could be the student registration number, and then the user is prompted through the mobile application to register the mobile device via the WIFI access point. Once the device has been stored the data can be used anytime, the lecturer will want to capture attendance and when the students will be required to register.

During an ongoing class, the lecturer will login then proceeds to check the lessons on progress then initiates the process of attendance. The initiation activates all the seats' QR codes hence the students can use their wireless connected mobile phones to scan and confirm their attendance. The process is self- guided by the application in that; once the student opens the application, if not connected to the classroom WIFI access point, they are prompted to connect then they scan the seat QR code and automatically they are registered to the given class.

The lecturer can monitor the progress through the application for the total students registered so far for the attendance. The other options available to the lecturer is to confirm attendance of an upcoming class or choose to postpone a given class. This option directly relays notifications to respective student accounts to know the lessons upcoming and postponed for the day hence helping to solve the challenges experienced by students for lack of personalized communication regarding lessons.

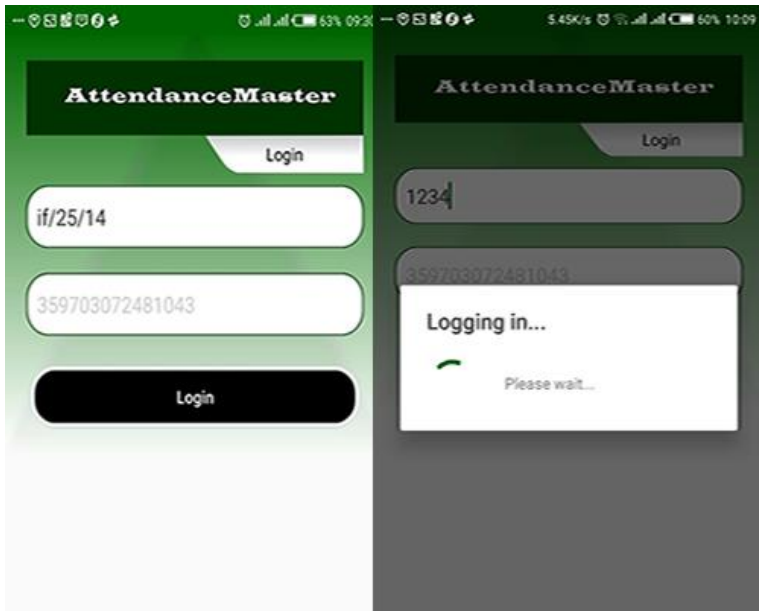


Figure 31: Login Screen for the lecturer



Figure 32: Dashboard

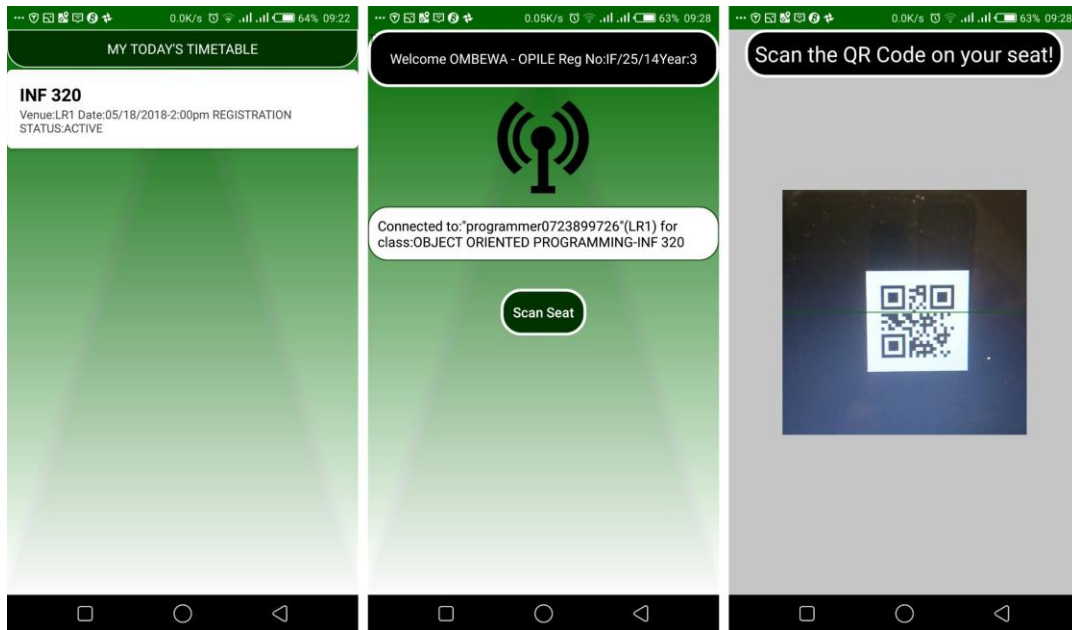


Figure 33: Timetabling and attendance rate view by lecturer and student

5.3.5 Attendance reporting module

The attendance reporting module gives attendance report of given courses and has options of exporting the data to excel. The attendance report functionality is also available at the student's account and can be accessed anytime making it easy to relay warning notifications as per the ISO requirements on the total attendance expected to be attended by the students.

The reporting module has been represented in a table format with columns that contain information of the course name, code, year and semester due for offer. The administrator or the lecturer clicks on the search input box and enters the course code in order to filter the information. Once the course has been filtered, one needs to click on the manage button in order to view further details of the course and export the

necessary attendance report for a given session. The attendance data is generated in a table format with rows containing the student registration number, attendance hours and percentage ratings. The page has links to export the content to excel csv format for printing and further analysis. The back link takes the user to the previous window.

#	NAME	CODE	SCHOOL	YEAR	SEM	MANAGE
11	Qualitative Skills	QS 100	Arts and Social Sciences	1	1	Manage
12	OBJECT ORIENTED PROGRAMMING	INF 320	Information Sciences	3	1	Manage

11 to 12 of 12 entries

[← Previous](#) [1](#) [2](#) [Next →](#)

Figure 34: Attendance courses

[Back](#) [Excel Export](#)

Courses Attendance for course INF 320

[Back](#) [Records 9](#) 1C

#	STUDENT	ATTENDED HRS	RATING
1	IF/06/14	3	100%
2	IF/10/14	3	100%
3	IF/14/14	3	100%
4	IF/15/14	3	100%
5	IF/19/14	3	100%
6	IF/20/14	3	100%
7	IF/21/14	3	100%
8	IF/22/14	3	100%
9	IF/25/14	3	100%

1 to 9 of 9 entries

[← Previous](#) [1](#) [Next →](#)

Figure 35: Attendance data

5.4. Review

The prototype was reviewed by stakeholders to establish if there was a need to make any improvements. A few changes were suggested such as allowing the signing to be done through the internet although this posed a risk of other students signing on behalf

of others. Other suggested improvements included students to sign out once the class is over. The changes were incorporated in the final prototype which was implemented.

5.5. Implementation

The implementation was done in one of the classrooms within the department. The challenges experienced in implementation were the installation of the mobile application on individual phones and less camera megapixel in certain models of phones such as wigo. The process had to be done manually since the application was not available in the app store for global access. The process of installation on both the lecturer and student devices was as follows: -

1. Download the provided installation using the Android device file using Google Chrome
2. Proceed to settings window and enable the developer mode by tapping on about phone then tapping three times on the build number. Once the mode has been enabled the user will then enable install from unknown sources.
3. Proceed to downloads folder and tap on the downloaded file of apk extension to install
4. Follow the installation wizard by clicking on next till the final step which confirms successful installation of the application.
5. Click finish then launch the application.

For the identification process to be initiated the phones had to connect through a wireless access point installed within the classroom. The registration of a student's devices involved a student login into the mobile application using his/her phone then

following the prompts on the screen to register the device under his/her name. The lecturer was required only to initiate the attendance process from the mobile application for the students to be able to record attendance during the lesson. The students were able to mark the attendance using their phones by scanning the QR embedded on the seats of the classroom and after that confirming to the prompt on the mobile application, and in turn, a report was generated on the lecturer end as shown below.

	A	B	C	D	E
3					
4	STUDENT CLASS ATTENDANCE REPORT				
5					
6	INF 320				
7					
8	Name	Reg No	Attended Hours	Rate	session
9					
10	GEORGE EVELYNE KEJI	IF/06/14	3	100%	3
11	KEMBOI KIMELI CORNEL	IF/10/14	3	100%	3
12	MUCHIRI MARVIN MAINA	IF/14/14	3	100%	3
13	MUTUKU LAWRENCE MALEL	IF/15/14	3	100%	3
14	NJOROGE BEN WAITHAKA	IF/19/14	3	100%	3
15	NJOROGE NAHASHON NJEN	IF/20/14	3	100%	3
16	NYAUNCHO SIRO LAWRENC	IF/21/14	3	100%	3
17	OGEMBO HILLARY OKERIO	IF/22/14	3	100%	3
18	OMBEWA AMOS OPILE	IF/25/14	3	100%	3
19					

Figure 36: Attendance Report

The reporting was enough proof that the prototype had produced the expected result and was due to be fully implemented within the department. The report comprises of the course details, student details, attended hours and the percentage rate calculated from the total hours of attendance expected.

5.6. Summary

The chapter covered the design and development of the system based on the functional and functional requirements modelled in the previous chapter. The concepts covered included design, development, review and implementation. The model developed is able to allow the lecturer to effectively administer attendance conveniently using their own mobile phones and in turn generate an excel report of the students who have attended a given class. The attendance registration of students is also authenticated via their individual devices and QR codes hence preventing students from signing on behalf of others. The use of mobile phones conveniently informs students of upcoming classes once the lecturer has activated the same hence a change in venue has no impact on the attendance process since the system is flexible to easily accommodate changes in terms of the venues and the upcoming classes. The implementation cost of the system is low since it is focused on setting up accurately the Wireless Access points and the QR codes on the seats while the lecturers and students will need to use their mobile phones to make the process work which is in line with the Moi University policy of Bring Your Own Device (BYOD).

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1. Conclusion

The study focused on the development of a model of android mobile application based on QR Codes and indoor locations to help solve the problem of class attendance effectively in Moi University Department of Information Technology. The researcher examined the due process of attendance management as required by CUE and further how class attendance was being managed currently and established the challenges. The process involved carrying out a comprehensive literature review of all the existing attendance approaches pros and cons, and later requirements were gathered through questionnaires answered by lecturers and students in regard of the current attendance method and quality requirements also gathered through document analysis of the ISO document in the department. The findings were then analyzed and interpreted to act as input for the system developed which was to effectively help solve the problem of class attendance through use of Android mobile phones. Some of the cons of biometrics modules are that they are relatively expensive; the research presents a cost-effective way of using the phone device known to the student hence transferring any extra costs that may be incurred by the institution in purchasing extra gadgets. Another advantage offered by the study is the aspect of asset management. The tagging of seats with QR Codes enhances the seat tracking since they can be identified per given class and at attendance report accurately record on which seat a given student was seated.

Given the objectives set initially,

- 1) The researcher stated the first objective as to determine the existing method of class attendance. The researcher conducted document analysis of the ISO Document to establish the class attendance quality procedures and then send questionnaires to a sample of 25 students, and two lecturers and the results were documented in chapter four. More insight was also given from the literature review regarding other existing methods of class attendance.
- 2) The second objective was stated as identification of challenges in the method used in class attendance; the research was able to illuminate that the current method was not effective, no proper authentication of users since students could sign for one another. It was also noted that lecturers found it hard to manipulate the data when deriving the attendance percentages of student attendance records. The challenges had to be overcome by the system developed.
- 3) The third objective is to develop a solution that was based on both Android and used QR Codes embedded on seats and indoor locations to capture the student attendance. In turn, a web-based back-end management application was developed by the researcher and was complemented by the android applications that were used by the lecturer and student. The lecturer application was to mainly initiate the registration process for students for a given class. The students used their devices to confirm attendance and the QR codes were used to affirm the action that the students were physically present in class. Both devices were required to connect to the available mapped class WIFI access point in order to confirm the registration.

6.2. Recommendations

The following are the recommendations for the study

1. Indoor locations have proved to be advantageous in identifying the location of specific classes within the setup of the university. Much emphasis needs to be done to ensure all access points can be accessed per given class only. This will be dependent on the propagation of the signal energy levels inside the building. The central location of the access points will ensure the required radius is covered and through use of repeaters the signal can be boosted for distances beyond the radius within the class.
2. The system that has been developed can record attendance of students who are in a class through the use of their mobile phones and QR Codes embedded on seats. Since the implementation helps in tracking of the assets, i.e., seats in class, much emphasis should be made on tagging the seats clearly and ensuring the tagged chairs are permanently in a given class to ensure the students are identified correctly when a given class is ongoing. The phones are also tagged to specific students hence will help in reduction of theft cases of the devices in the long run.
3. QR codes enable easy accessed of encoded information and it is recommended the sticker containing the code should be water resistance to increase their durability. A backup machine-readable (MRZ) code should also be included just in case the QR code fails. This will encourage entry to the system to be guided by the phone and not human input. In cases where the QR codes may end up

missing the lecturer may be required to have back up codes pre-generated and printed.

4. The Android mobile applications will need to be installed by students and lecturers only after the settings of their installations are set to install from unknown sources this is because the installation file will be available via a link and not necessarily on the Google app store. This is mainly because the application has been made available on the already compiled form that is downloadable from the web link hence the Android operating system considers the same as an external source that may be vulnerable.

6.2.1. Further Research

1. The study represents a notion that it is a must for students to have an Android smartphone to be authenticated. Further research can be done to scale the options to so that a student can use devices of the friend, only after entering authenticated information received via the unsupported individual phone.
2. The research suggests that a solution is developed to help manage the challenges posed by movable seats that can be easily be transferred to a new venue where they do not belong to hence inconveniencing the scanning during an ongoing class.
3. The system can be cascaded to help manage attendance at churches and other official gatherings such as in membership clubs. Furthermore, the system can also be used for phone tracking and asset management in buildings through mapping of seats to specific venues.

REFERENCES

- Adetiba, E., Ortim, O., Olajide, A. T., & Awoseyin, R. (2013). OBCAMS: An Online Biometrics-based Class Attendance Management System. *African Journal of Computing & ICT African Journal of Computing & ICT Reference Format: Afr J. of Comp & ICTs*, 6(3), 25–38. Retrieved from www.ajocict.net
- Aida Mahiddin, N., Nadia Madi, E., Dhalila, S., Fadzli Hasan, E. F., Safie, S., & Safie, N. (2013). User position detection in an indoor environment. *International Journal of Multimedia and Ubiquitous Engineering*, 8(5), 303–311.
- Ali, E. S. (2016). Alkan University College Student Information Management System. *American Journal of Operations Management and Information Systems*, 1(1), 1-6.
- And, N. C., & Deshmukh H R. (2012). ANDROID OPERATING SYSTEM. *Software Engineering*, 3(1), 2229–4007.
- Android Developers. (2017). Retrieved from <https://developer.android.com/design/>
- Bhardwaj, S., Sharma, R., Chouhan, P., & Sharma, P. (2013). Android Operating Systems. *International Journal of Engineering Technology & Management Research*, 1(1), 147–150.
- Block, A. J. (2001). Ethics. *Chest*, 119(2), 321.
- Chon, Y., Kim, S., Lee, S., Kim, D., Kim, Y., & Cha, H. (2014). Sensing WiFi packets in the air. In *Proceedings of the 2014 ACM International Joint Conference on Pervasive and Ubiquitous Computing - UbiComp '14 Adjunct* (pp. 189–200).
- Credé, M., Roch, S. G., & Kieszczyńska, U. M. (2010). Class Attendance in College: A Meta-Analytic Review of the Relationship of Class Attendance With Grades and Student Characteristics. *Review of Educational Research*, 80, 272–295.
- Crompton, H., LaFrance, J., & van 't Hooft, M. (2011). QR Codes 101. *Learning & Leading with Technology*, 39(8), 22–25.
- Datatables. (2017). Retrieved from <https://datatables.com/>
- Demir, S., Kaynak, R., & Demir, K. A. (2015). Usage Level and Future Intent of Use of Quick Response (QR) Codes for Mobile Marketing among College Students in Turkey. *Procedia - Social and Behavioral Sciences*, 181, 405–413.
- Earp, R., & Bagui, S. (2012). *Database Design Using Entity-Relationship Diagrams*. Library (Vol. 2012).
- Hoog, A. (2011). *Android Forensics: Investigation, Analysis and Mobile Security for Google Android*. Security.

- Johnson, J., & Henderson, A. (2002). Conceptual Models: Begin by Designing What to Design. *Interactions*, 9(1), 25–32.
- Khan, A. A., Ahmed, S. F., Abeer, A. N., Afzal, A., & Ul Haq Malik, K. (2007). Digital attendance recording system. In *2007 International Conference on Information and Emerging Technologies, ICIET* (pp. 111–115).
- Mahmoud, A. Y., Barakat, M. S., & Ajjour, M. J. (2016). Design and development of elearning university system. *Journal of multidisciplinary engineering science studies (JMESS)*, 2(5), 498-504.
- Malan, R., & Bredemeyer, D. (2001). Functional Requirements and Use Cases. *White Paper*, (8/3/01), 1–10.
- Meng, X. (2013). Scalable Simple Random Sampling and Stratified Sampling. *Proceedings of the 30th International Conference on Machine Learning*, 28(1), 1–9.
- Mittal, Y., Varshney, A., Aggarwal, P., Matani, K., & Mittal, V. K. (2016). Fingerprint biometric based Access Control and Classroom Attendance Management System. In *12th IEEE International Conference Electronics, Energy, Environment, Communication, Computer, Control: (E3-C3), INDICON 2015*.
- Mnkandla, E. (2009). About software engineering frameworks and methodologies. In *IEEE AFRICON Conference*.
- Moss, K. (2012). The Entity-Relationship model. In *IEEE Global Engineering Education Conference, EDUCON*.
- Newman, L. (2014). Android Users Won't Drop Money on Just Any App. Retrieved from <http://www.slate.com/news-and-politics/2018/06/parkland-activist-david-hogg-swatting-call.html>
- Robinson, G., & Weir, G. R. S. (2015). Understanding android security. In *Communications in Computer and Information Science* (Vol. 534, pp. 189–199). http://doi.org/10.1007/978-3-319-23276-8_17
- Said, M. A. M., Misran, M. H., Othman, M. A., Ismail, M. M., Sulaiman, H. A., Salleh, A., & Yusop, N. (2014). Biometric attendance. In *ISTMET 2014 - 1st International Symposium on Technology Management and Emerging Technologies, Proceedings* (pp. 258–263).
- Seltman, H. (2015). Experimental Design and Analysis. *Online Book*, 428.
- Simon, J. (2012). *Head First Android Development. Android SDK*. <http://doi.org/978-1-4493-6218>
- Singh, A., Sharma, S., & Singh, S. (2016). Android Application Development using Android Studio and PHP Framework. *International Journal of Computer Applications Recent Trends in Future Prospective in Engineering & Management Technology*, 975–8887.
- Ugwoke, F. ., & Anyakorah, O. . (2015). Biometric System for Class Attendance. *International Journal of Current Research and Academic Review*, 3, 261–281.
- Yang, C., & Shao, H. R. (2015). WiFi-based indoor positioning. *IEEE Communications*

Magazine, 53(3), 150–157.

- Zahid, I., Ali, M. A., & Nassr, R. (2011). Android Smartphone: Battery saving service. In *2011 International Conference on Research and Innovation in Information Systems, ICRIS'11*.
- Zainal, N. I., Sidek, K. A., Gunawan, T. S., Manser, H., & Kartiwi, M. (2014). Design and development of portable classroom attendance system based on Arduino and fingerprint biometric. In *The 5th International Conference on Information and Communication Technology for The Muslim World (ICT4M)* (pp. 1–4). IEEE.
- Zhang, D., Xia, F., Yang, Z., Yao, L., & Zhao, W. (2010). Localization technologies for indoor human tracking. In *2010 5th International Conference on Future Information Technology, FutureTech 2010 - Proceedings*.
- Zhang, J. J., Zhang, Y. Q., Yan, S. S., & Zhang, X. J. (2015). The Design and Implementation of University Student Status Management Systems in China. *Journal of Higher Education Theory & Practice*, 15(1).
- Zhi, T. J., Ibrahim, Z., & Aris, H. (2015). Effective and efficient attendance tracking system using secret code. In *Conference Proceedings - 6th International Conference on Information Technology and Multimedia at UNITEN: Cultivating Creativity and Enabling Technology Through the Internet of Things, ICIMU 2014* (pp. 108–112).

APPENDICES

Appendix 1a: Introductory Letter from the department



MOI UNIVERSITY
DEPARTMENT OF INFORMATION TECHNOLOGY

Tel. 053-43720,43620,43231
Fax No. 053-43047,43360
Telex No. MOIVERSITY 35047
Email: dit@mu.ac.ke or irenemorara@gmail.com

P.O. Box 3900
Eldoret - 30100
Kenya

11th November 2016

The Director,
National Research Fund
Kenya

Dear Sir/Madam

RE: WAFULA, MICHAEL MASIBO (IS/MS/IT/01/15)

This is to confirm that the above named person is a bona fide student in this institution pursuing his **Master of Science (MSc) in Information Technology**. The programme consists of course work, examination and thesis.

Michael has successfully defended his proposal entitled: "**An Android Technology and Biometric for managing Class Attendance**" and was approved by the School.

Any assistance accorded to him will be highly appreciated. Please do not hesitate to contact the undersigned for any further information and/or clarification.

Thank you,

Yours faithfully,

DR. IRENE MOSETI
Head,
DEPARTMENT OF INFORMATION TECHNOLOGY



IM/ej

Appendix 1a: Introductory Letter from the department



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: 020 400 7000.
0713 788787,0735404245
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Email: dg@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Wanyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref. No. **NACOSTI/P/17/18184/19634**

Date **3rd November, 2017**

Michael Masibo Wafula
Moi University
P.O. Box 3900-30100
ELDORET.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "*A model mobile phone based biometric system for managing class attendance*" I am pleased to inform you that you have been authorized to undertake research in **Uasin-Gishu County** for the period ending **3rd November, 2018.**

You are advised to report to **the County Commissioner and the County Director of Education, Uasin-Gishu County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

**GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO**

Copy to:

The County Commissioner
Uasin-Gishu County.

The County Director of Education
Uasin-Gishu County.

Appendix 2a: Questionnaire for lecturers

- 1) What are the methods currently adapted for managing class attendance?
 - a) Manual Signing b) Door-based Biometric c) Mobile Application Call out
- 2) On a scale of 1 to 5 how effective is the current method being used in making the attendance recording and tabulation tasks easier?
 - a) 1 b) 2 c) 3 d) 4 e) 5
- 3) How often do you use the method out of a 8 lessons?
 - a) 1 b) 2 c) 3 d) 4 e) 5 f) 6 g) 7 i) 8
- 4) What other technologies do you deploy to make the method effective?
 - a) Excel b) SPSS c) Other _____
- 5) Can a student sign for another student?
 - a) Yes b) No
- 6) Do you send attendance notifications to students on upcoming classes?
 - a) Yes b) No
- 7) What are the key challenges of the current method of attendance management?

- 8) Does change of class venue have any impact on signing?
 - a) Yes b) No

- 9) Is signing on the class due day and date confirmed?
 - a) Yes b) No

- 10) How do you send notifications to students?
 - a) SMS b) Phone Call c) Whatsapp d) Email

Appendix 2b: Questionnaire for students

- 1) How do lecturers manage class attendance?
 - a) Manual Signing b) Door-based Biometric c) Mobile Application Call out
- 2) How often do you attend lessons and record attendance lists out of 8 class lessons?
 - a) 1 b) 2 c) 3 d) 4 e) 5 f) 6 g) 7 i) 8
- 3) Can you be able to record attendance for another student in their absence?
 - a) Yes b) No
- 4) Do you receive attendance notifications on upcoming classes?
 - a) Yes b) No
- 5) Is the current approach easy to sign?
 - a) Yes b) No
- 6) Have you ever missed class due to postponed class that you were not notified on?
 - a) Yes b) No
- 7) Is it easy to track your attendance progress on your own?
 - a) Yes b) No
- 8) How do you receive notifications send?
 - a) SMS b) Phone Call c) Whatsapp d) Email
- 9) What is the operating system of your smart phone?
 - a) Android b) iOs c) Blackberry d) Symbian e) No Smart Phone
- f)Others (Specify)
- 10) In view of the current procedures and method of attendance in place, what is the key reason that may make you miss class (e.g. a student may miss because someone can sign on their behalf) other than sickness?

Appendix 3a: Representation of the source code in android

```

package com.leagpro.com.attendancemaster;

import android.app.ProgressDialog;
import android.content.DialogInterface;
import android.content.Intent;
import android.content.SharedPreferences;
import android.content.pm.PackageManager;
import android.os.Bundle;
import android.preference.PreferenceManager;
import android.support.v7.app.AlertDialog;
import android.support.v7.app.AppCompatActivity;
import android.support.v7.widget.Toolbar;
import android.util.Base64;
import android.view.KeyEvent;
import android.view.View;
import android.widget.Button;
import android.widget.Toast;

import com.android.volley.AuthFailureError;
import com.android.volley.Request;
import com.android.volley.RequestQueue;
import com.android.volley.Response;
import com.android.volley.VolleyError;
import com.android.volley.toolbox.StringRequest;
import com.android.volley.toolbox.Volley;
import com.google.zxing.ResultPoint;
import com.journeyapps.barcodescanner.BarcodeCallback;
import com.journeyapps.barcodescanner.BarcodeResult;
import com.journeyapps.barcodescanner.CaptureManager;
import com.journeyapps.barcodescanner.DecoratedBarcodeView;

import java.util.HashMap;
import java.util.List;
import java.util.Map;

import static com.leagpro.com.attendancemaster.CommonMethods.getUrlAll;

//import com.leagpro.com.attendancemaster.R;

public class ScannerActivity extends AppCompatActivity implements
    DecoratedBarcodeView.TorchListener {

    private CaptureManager capture;
    private DecoratedBarcodeView barcodeScannerView;
    private Button switchFlashlightButton;
    private boolean isFlashLightOn = false;
    private BarcodeResult mResult;

    private BarcodeCallback callback = new BarcodeCallback() {
        @Override
        public void barcodeResult(BarcodeResult result) {
            if (result.getText() != null) {
                pauseScan();
                handleResult(result);
            }
        }
    }
}

```

```

    @Override
    public void possibleResultPoints(List<ResultPoint> resultPoints) {
    }
};
@Override
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_scanner);
    Toolbar toolbar = findViewById(R.id.toolbar);
    //setSupportActionBar(toolbar);

    //Initialize barcode scanner view
    barcodeScannerView = findViewById(R.id.zxing_barcode_scanner);

    //set torch listener
    barcodeScannerView.setTorchListener(this);

    //switch flashlight button
    switchFlashlightButton = (Button) findViewById(R.id.switch_flashlight);

    //if the device does not have flashlight in its camera,
    //then remove the switch flashlight button...
    if (!hasFlash()) {
        switchFlashlightButton.setVisibility(View.GONE);
    } else {
        switchFlashlightButton.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View view) {
                switchFlashlight();
            }
        });
    }

    //start capture
    //capture = new CaptureManager(this, barcodeScannerView);
    //capture.initializeFromIntent(getIntent(), savedInstanceState);
    //capture.decode();
    barcodeScannerView.decodeContinuous(callback);
}

/**
 * Check if the device's camera has a Flashlight.
 *
 * @return true if there is Flashlight, otherwise false.
 */
private boolean hasFlash() {
    return getApplicationContext().getPackageManager()
        .hasSystemFeature(PackageManager.FEATURE_CAMERA_FLASH);
}

public void switchFlashlight() {
    if (isFlashLightOn) {
        barcodeScannerView.setTorchOff();
        isFlashLightOn = false;
    } else {
        barcodeScannerView.setTorchOn();
        isFlashLightOn = true;
    }
}
}

```

```

@Override
public void onTorchOn() {
    switchFlashlightButton.setText("turn off flash");
}

@Override
public void onTorchOff() {
    switchFlashlightButton.setText("turn on flash");
}

@Override
protected void onResume() {
    super.onResume();
    // capture.onResume();
    barcodeScannerView.resume();
}

@Override
protected void onPause() {
    super.onPause();
    barcodeScannerView.pause();
    //capture.onPause();
}

@Override
protected void onDestroy() {
    super.onDestroy();
    //capture.onDestroy();
    //barcodeScannerView.destroyDrawingCache();
}

@Override
protected void onSaveInstanceState(Bundle outState) {
    super.onSaveInstanceState(outState);
    capture.onSaveInstanceState(outState);
}

@Override
public boolean onKeyDown(int keyCode, KeyEvent event) {
    return barcodeScannerView.onKeyDown(keyCode, event) || super.onKeyDown(keyCode, event);
}

public void triggerScan() {
    barcodeScannerView.decodeSingle(callback);
}

public void pauseScan() {
    barcodeScannerView.pause();
}

public void resumeScanning() {
    barcodeScannerView.resume();
}

private void handleResult(BarcodeResult result) {
    mResult = result;

    StringBuilder sb = new StringBuilder();
    sb.append(result.getText())//.append("\n")
        //append("Data:")
        //append(" ")
        .append(result.getBarcodeFormat()
            .toString());

    Toast.makeText(this,result.getText().toString().trim(),Toast.LENGTH_LONG).show();
}

```

```

registerUser(result.getText().toString().trim());
resumeScanning();
// showDialog(this, dialogTitle, sb.toString(), dialogBtnSaveResult, dialogBtnCancel, dialogBtnRescan);
}
public void registerUser(final String code){
final SharedPreferences preferences = PreferenceManager.getDefaultSharedPreferences(this);
final String course = preferences.getString("course", "");
final String reg= preferences.getString("id", "");
final String tid= preferences.getString("tid", "");
//final String pass=phone;
if (reg.length()>0) {
final ProgressDialog loading = ProgressDialog.show(this, "Registering attendance...", "Please wait...",
false, false);
loading.setCancelable(false);
StringRequest stringRequest = new StringRequest(Request.Method.POST, getUrlAll() +
"registerclass.php",
new Response.Listener<String>() {
@Override
public void onResponse(String response) {
loading.dismiss();
if (response.trim().equals("4")) {
//String [] x=response.split(",");
//String pass=x[0];
AlertDialog.Builder builder = new AlertDialog.Builder(ScannerActivity.this);
builder.setTitle("Message");
builder.setCancelable(false);
builder.setMessage("Details were found you cannot register twice");
builder.setNegativeButton("OK", new DialogInterface.OnClickListener() {
@Override
public void onClick(DialogInterface dialog, int id) {
// TODO Auto-generated method stub
// dialog.dismiss();
Intent homeIntent = new Intent(getApplicationContext(), LoginActivity.class);
homeIntent.addFlags(Intent.FLAG_ACTIVITY_CLEAR_TOP);
startActivity(homeIntent);
/*Intent homeIntent = new Intent(getApplicationContext(), MainActivity.class);
homeIntent.addFlags(Intent.FLAG_ACTIVITY_CLEAR_TOP);
startActivity(homeIntent);*/
}
});
AlertDialog alertDialog = builder.create();
alertDialog.show();
//Toast.makeText(RegisterActivity.this,response,Toast.LENGTH_LONG).show();
}
else if (response.trim().equals("21")) {
//String [] x=response.split(",");
//String pass=x[0];
AlertDialog.Builder builder = new AlertDialog.Builder(ScannerActivity.this);
builder.setTitle("Message");
builder.setCancelable(false);
builder.setMessage("Seat was not found to belong to the venue!");
builder.setNegativeButton("OK", new DialogInterface.OnClickListener() {
@Override
public void onClick(DialogInterface dialog, int id) {
// TODO Auto-generated method stub
dialog.dismiss();
}
});
AlertDialog alertDialog = builder.create();
alertDialog.show();
//Toast.makeText(RegisterActivity.this,response,Toast.LENGTH_LONG).show();
}
}

```

```

else if (response.trim().equals("3")) {
    //String [] x=response.split(",");
    //String pass=x[0];
    AlertDialog.Builder builder = new AlertDialog.Builder(ScannerActivity.this);
    builder.setTitle("Message");
    builder.setCancelable(false);
    builder.setMessage("Attendance was successfully captured! You will be logged out
shortly!");
    builder.setNegativeButton("OK", new DialogInterface.OnClickListener() {
        @Override
        public void onClick(DialogInterface dialog, int id) {
            // TODO Auto-generated method stub
            // dialog.dismiss();

            Intent homeIntent = new Intent(getApplicationContext(), LoginActivity.class);
            homeIntent.addFlags(Intent.FLAG_ACTIVITY_CLEAR_TOP);
            startActivity(homeIntent);
        }
    });
    AlertDialog alertDialog = builder.create();
    alertDialog.show();
    //Toast.makeText(RegisterActivity.this, response, Toast.LENGTH_LONG).show();
}
else {

    AlertDialog.Builder builder = new AlertDialog.Builder(ScannerActivity.this);
    builder.setTitle("Message");
    builder.setCancelable(false);
    builder.setMessage("Error occured please retry! Or probably you already registered for the
class!");
    builder.setNegativeButton("OK", new DialogInterface.OnClickListener() {
        @Override
        public void onClick(DialogInterface dialog, int id) {
            // TODO Auto-generated method stub
            // dialog.dismiss();
            /*Intent homeIntent = new Intent(getApplicationContext(), MainActivity.class);
            homeIntent.addFlags(Intent.FLAG_ACTIVITY_CLEAR_TOP);
            startActivity(homeIntent);*/
            Intent homeIntent = new Intent(getApplicationContext(), LoginActivity.class);
            homeIntent.addFlags(Intent.FLAG_ACTIVITY_CLEAR_TOP);
            startActivity(homeIntent);
        }
    });
    AlertDialog alertDialog = builder.create();
    alertDialog.show();

    //}
}
},
new Response.ErrorListener() {
    @Override
    public void onErrorResponse(VolleyError error) {
        loading.dismiss();
        Toast.makeText(ScannerActivity.this, "Error in recording your attendance kindly check your
credentials", Toast.LENGTH_LONG).show();
    }
}) {
    @Override
    protected Map<String, String> getParams() {
        Map<String, String> params = new HashMap<String, String>();
        params.put("course", course);

```



```

        params.put("reg", reg);
        params.put("code", code);
        params.put("tid", tid);
        return params;
    }
    @Override
    public Map<String, String> getHeaders() throws AuthFailureError {
        Map<String, String> headers = new HashMap<String, String>();
        // add headers <key,value>
        String credentials = "dibbs:adminDibbs2018";
        String auth = "Basic "
            + Base64.encodeToString(credentials.getBytes(),
                Base64.NO_WRAP);
        headers.put("Authorization", auth);
        return headers;
    }
};
RequestQueue requestQueue = Volley.newRequestQueue(this);
requestQueue.add(stringRequest);
}
else {
    Toast.makeText(ScannerActivity.this, "Enter appropriately all the required fields",
        Toast.LENGTH_LONG).show();
}
}
}
}

```

apply plugin: 'com.android.application'

```

android {
    compileSdkVersion 26
    defaultConfig {
        applicationId "com.leagpro.com.attendancemaster"
        minSdkVersion 15
        targetSdkVersion 26
        versionCode 1
        versionName "2.0"
        testInstrumentationRunner "android.support.test.runner.AndroidJUnitRunner"
    }
    buildTypes {
        release {
            minifyEnabled false
            proguardFiles getDefaultProguardFile('proguard-android.txt'), 'proguard-rules.pro'
        }
    }
}

dependencies {
    implementation fileTree(dir: 'libs', include: ['*.jar'])
    implementation 'com.android.support:appcompat-v7:26.1.0'
    implementation 'com.android.support.constraint:constraint-layout:1.0.2'
    implementation 'com.android.support:design:26.1.0'
    testImplementation 'junit:junit:4.12'
    androidTestImplementation 'com.android.support.test:runner:1.0.1'
    androidTestImplementation 'com.android.support.test.espresso:espresso-core:3.0.1'

    implementation 'com.journeyapps:zxing-android-embedded:3.5.0'
}

```

```

<?xml version="1.0" encoding="utf-8"?>
<android.support.design.widget.CoordinatorLayout
xmlns:android="http://schemas.android.com/apk/res/android"
xmlns:app="http://schemas.android.com/apk/res-auto"
xmlns:tools="http://schemas.android.com/tools"
android:layout_width="match_parent"
android:layout_height="match_parent"
tools:context="com.leagpro.com.attendancemaster.MainActivity">

    <android.support.design.widget.AppBarLayout
        android:layout_width="match_parent"
        android:layout_height="wrap_content">

        <android.support.v7.widget.Toolbar
            android:id="@+id/toolbar"
            android:layout_width="match_parent"
            android:layout_height="?attr/actionBarSize"
            android:background="?attr/colorPrimary" />

    </android.support.design.widget.AppBarLayout>

    <include layout="@layout/content_main" />

</android.support.design.widget.CoordinatorLayout>

<?xml version="1.0" encoding="utf-8"?>
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
xmlns:app="http://schemas.android.com/apk/res-auto"
xmlns:tools="http://schemas.android.com/tools"
android:layout_width="match_parent"
android:layout_height="match_parent"
tools:context="com.leagpro.com.attendancemaster.ScannerActivity"
tools:showIn="@layout/activity_scanner">

    <!-- set custom layout for scanner-->
    <com.journeyapps.barcodescanner.DecoratedBarcodeView
        android:id="@+id/zxing_barcode_scanner"
        android:layout_width="match_parent"
        android:layout_height="match_parent"
        app:zxing_scanner_layout="@layout/custom_scanner" />

    <!-- FlashLight Button-->
    <Button
        android:id="@+id/switch_flashlight"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_alignParentBottom="true"
        android:layout_centerHorizontal="true"
        android:text="turn_off_flashlight" />

</RelativeLayout>

package com.leagpro.com.attendancemaster;

import android.app.ProgressDialog;
import android.content.DialogInterface;

```

```

import android.content.Intent;
import android.content.SharedPreferences;
import android.os.Bundle;
import android.preference.PreferenceManager;
import android.support.v4.app.NavUtils;
import android.support.v4.view.MenuItemCompat;
import android.support.v7.app.AlertDialog;
import android.support.v7.app.AppCompatActivity;
import android.support.v7.widget.LinearLayoutManager;
import android.support.v7.widget.RecyclerView;
import android.support.v7.widget.SearchView;
import android.text.InputFilter;
import android.util.Base64;
import android.view.Gravity;
import android.view.Menu;
import android.view.MenuItem;
import android.view.View;
import android.widget.EditText;
import android.widget.TextView;
import android.widget.Toast;

import com.android.volley.AuthFailureError;
import com.android.volley.Request;
import com.android.volley.RequestQueue;
import com.android.volley.Response;
import com.android.volley.VolleyError;
import com.android.volley.toolbox.JsonArrayRequest;
import com.android.volley.toolbox.StringRequest;
import com.android.volley.toolbox.Volley;
import com.loopj.android.http.AsyncHttpClient;
import com.loopj.android.http.RequestParams;
import com.loopj.android.http.TextHttpResponseHandler;

import org.json.JSONArray;
import org.json.JSONException;
import org.json.JSONObject;

import java.util.ArrayList;
import java.util.HashMap;
import java.util.List;
import java.util.Map;

import cz.msebera.android.httpclient.Header;

import static com.leagro.com.attendancemaster.CommonMethods.getUrlAll;

;

public class CourseAllActivity extends AppCompatActivity {
    TextView name, desc, phone;

    List<GetDataAdapter3> GetDataAdapter1;
    RecyclerView recyclerView;
    RecyclerView.LayoutManager recyclerViewLayoutManager;
    RecyclerView.Adapter3 recyclerViewAdapter;
    String GET_JSON_DATA_HTTP_URL = getUrlAll()+"customerall.php";
    String JSON_IMAGE_TITLE_NAME = "name";
    String JSON_IMAGE_URL = "logo";
    String JSON_IMAGE_DESC = "description";
    String JSON_COST="cost";
    String JSON_ID="id";
    JsonArrayRequest jsonArrayRequest ;

```

```

RequestQueue requestQueue ;
@Override
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_all_customer);
    GetDataAdapter1 = new ArrayList<>();
    final SharedPreferences preferences =
PreferenceManager.getDefaultSharedPreferences(this);
    final String staffid = preferences.getString("staffid", "");
    recyclerView = (RecyclerView) findViewById(R.id.recyclerview1);
    recyclerView.setHasFixedSize(true);
    recyclerViewLayoutManager = new LinearLayoutManager(this);
    recyclerView.setLayoutManager(recyclerViewLayoutManager);
    JSON_DATA_WEB_CALL(staffid);
    ItemClickSupport.addTo(recyclerView).setOnItemClickListener(new
ItemClickSupport.OnItemClickListener() {
        @Override
        public void onItemClick(RecyclerView recyclerView, int position,
View v) {
            // do it
            TextView named=(TextView)
v.findViewById(R.id.textDescription);
            final String phon=named.getText().toString();
            TextView nam=(TextView) v.findViewById(R.id.textView_item);
            final String desc=nam.getText().toString();
            TextView name=(TextView) v.findViewById(R.id.id);
            final String x=name.getText().toString();
            final CharSequence[] options = { "End Registration",
"Report","Cancel" };

            AlertDialog.Builder builder = new
AlertDialog.Builder(CourseAllActivity.this);
            builder.setTitle("Select option for course - "+desc);
            builder.setItems(options, new
DialogInterface.OnClickListener() {
                @Override
                public void onClick(DialogInterface dialog, int item) {
                    if (options[item].equals("Activate For Attendance"))
                    {
                        //String phone = phon;
                        registerUser(x,"1");
                        //Intent intent = new Intent(Intent.ACTION_DIAL,
Uri.fromParts("tel", phone, null));
                        // startActivity(intent);*/
                    }
                    else if (options[item].equals("End Registration"))
                    {
                        registerUser(x,"2");
                    }
                    else if (options[item].equals("Report")) {
                        //final String number = phon; // The number on
which you want to send SMS
                        repo(x, "3");
                        // startActivity(new Intent(Intent.ACTION_VIEW,
Uri.fromParts("sms", number, null)));
                    }
                    else if (options[item].equals("Message")) {
                        final String number = phon; // The number on
which you want to send SMS
                        //startActivity(new Intent(Intent.ACTION_VIEW,
Uri.fromParts("sms", number, null)));
                        AlertDialog.Builder builder = new

```



```

Intent(getApplicationContext(), MessageActivity.class);
//startActivity(objIntent);

Toast.makeText(getApplicationContext(), "Successful Sync activity",
Toast.LENGTH_LONG).show();

    }
    else {
        prgDialog.hide();
        AlertDialog.Builder builder = new
AlertDialog.Builder(CourseAllActivity.this);
        builder.setTitle("Message");
        builder.setMessage(resp[1]);
        builder.setNegativeButton("OK", new
DialogInterface.OnClickListener() {

            @Override
            public void
onClick(DialogInterface dialog, int id) {
                // TODO Auto-generated method
                stub
            }
        });
        AlertDialog alertDialog =
builder.create();
        alertDialog.show();

//Toast.makeText(getApplicationContext(), "Top up required",
Toast.LENGTH_LONG).show();
    }
}

@Override
public void onFailure(int statusCode, Header[]
headers, String response, Throwable error) {
    Toast.makeText(getApplicationContext(),
"Error Occured", Toast.LENGTH_LONG).show();
}

});

}
});
AlertDialog alertDialog = builder.create();
alertDialog.show();

}
else if (options[item].equals("Cancel")) {
    dialog.dismiss();
}
}
});
builder.show();

}
});
recyclerView.setOnClickListener(new View.OnClickListener() {
    @Override
    public void onClick(View view) {
        TextView name=(TextView) findViewById(R.id.textDescription);
        String x=name.getText().toString();

```

```

        Toast.makeText(getApplicationContext(),"id",
        Toast.LENGTH_LONG).show();
    }
});

}

public void JSON_DATA_WEB_CALL(String x){

    jsonArrayRequest = new
    JsonRequest(GET_JSON_DATA_HTTP_URL+"?biz="+x,
        new Response.Listener<JSONArray>() {
            @Override
            public void onResponse(JSONArray response) {
                JSON_PARSE_DATA_AFTER_WEBCALL(response);
            }
        },
        new Response.ErrorListener() {
            @Override
            public void onErrorResponse(VolleyError error) {

            }
        }) {
        @Override
        public Map<String, String> getHeaders() throws AuthFailureError {
            Map<String, String> headers = new HashMap<String, String>();
            // add headers <key,value>
            String credentials = "dibbs:adminDibbs2018";
            String auth = "Basic "
                + Base64.encodeToString(credentials.getBytes(),
                    Base64.NO_WRAP);
            headers.put("Authorization", auth);
            return headers;
        }
    };

    requestQueue = Volley.newRequestQueue(this);

    requestQueue.add(jsonArrayRequest);
}

public void JSON_PARSE_DATA_AFTER_WEBCALL(JSONArray array){

    for(int i = 0; i<array.length(); i++) {

        GetDataAdapter3 GetDataAdapter2 = new GetDataAdapter3();

        JSONObject json = null;
        try {

            json = array.getJSONObject(i);

            GetDataAdapter2.setPhone(json.getString(JSON_IMAGE_TITLE_NAME));
            GetDataAdapter2.setName(json.getString(JSON_IMAGE_DESC));
            GetDataAdapter2.setId(json.getString(JSON_ID));

            //GetDataAdapter2.setImageServerUrl(json.getString(JSON_IMAGE_URL));

        } catch (JSONException e) {

            e.printStackTrace();
        }
    }
}

```

```

    }
    GetDataAdapter1.add(GetDataAdapter2);
}

recyclerViewadapter = new RecyclerViewAdapter3(GetDataAdapter1, this);

recyclerView.setAdapter(recyclerViewadapter);
}
public void navigatetoAddServiceActivity(View v){
}
public void navigatetoCustomerStylesActivity(View v){
}
}
public void navigatetoHomesActivity(View v){
}
@Override
public boolean onOptionsItemSelected(MenuItem item) {
    switch (item.getItemId()) {
        // Respond to the action bar's Up/Home button
        case android.R.id.home:
            NavUtils.navigateUpFromSameTask(this);
            return true;
    }
    return super.onOptionsItemSelected(item);
}
@Override
public boolean onCreateOptionsMenu(Menu menu) {

    getMenuInflater().inflate(R.menu.search, menu);

    MenuItem search = menu.findItem(R.id.search);
    SearchView searchView = (SearchView)
MenuItemCompat.getActionView(search);
    search(searchView);
    return true;
}

private void search(SearchView searchView) {

    searchView.setOnQueryTextListener(new SearchView.OnQueryTextListener()
{
    @Override
    public boolean onQueryTextSubmit(String query) {

        return false;
    }

    @Override
    public boolean onQueryTextChange(String newText) {
        if(recyclerViewadapter!=null) {
            recyclerViewadapter.getFilter().filter(newText);
        }
        return true;
    }
});
}
public void registerUser(String xy,String yy){
    final String x=xy;
    final String y=yy;
    if (x.length()>0) {
        final ProgressDialog loading = ProgressDialog.show(this,

```



```

"Performing requested action on course...", "Please wait...", false, false);
    StringRequest stringRequest = new
StringRequest(Request.Method.POST, getUrlAll() + "activateclass.php",
    new Response.Listener<String>() {
        @Override
        public void onResponse(String response) {
            loading.dismiss();
            if (response.trim().equals("0")) {
                //String [] x=response.split(",");
                //String pass=x[0];
                AlertDialog.Builder builder = new
AlertDialog.Builder(CourseAllActivity.this);
                builder.setTitle("Message");
                builder.setMessage("Error in execution!");
                builder.setNegativeButton("OK", new
DialogInterface.OnClickListener() {
                    @Override
                    public void onClick(DialogInterface
dialog, int id) {
                        // TODO Auto-generated method stub
                        dialog.dismiss();
                    }
                });
                AlertDialog alertDialog = builder.create();
                alertDialog.show();

//Toast.makeText(RegisterActivity.this,response,Toast.LENGTH_LONG).show();
            }
            else if (response.trim().equals("1")) {
                //String [] x=response.split(",");
                //String pass=x[0];
                AlertDialog.Builder builder = new
AlertDialog.Builder(CourseAllActivity.this);
                builder.setTitle("Message");
                builder.setMessage("Successful execution!");
                builder.setNegativeButton("OK", new
DialogInterface.OnClickListener() {
                    @Override
                    public void onClick(DialogInterface
dialog, int id) {
                        // TODO Auto-generated method stub
                        dialog.dismiss();
                        /*Intent homeIntent = new
Intent(getApplicationContext(), MainActivity.class);
homeIntent.addFlags(Intent.FLAG_ACTIVITY_CLEAR_TOP);
startActivity(homeIntent);*/
                    }
                });
                AlertDialog alertDialog = builder.create();
                alertDialog.show();

//Toast.makeText(RegisterActivity.this,response,Toast.LENGTH_LONG).show();
            }
            else if (response.contains("11")) {
                String[] x = response.split(",");
                String no = x[1];
                String name = x[2];
                String staffid = x[3];
                SharedPreferences preferences =
PreferenceManager.getDefaultSharedPreferences(CourseAllActivity.this);
                SharedPreferences.Editor editor =

```

```

preferences.edit();

// editor.putString("phone", pho);
editor.putString("sname", name);
editor.putString("sno", no);
editor.putString("staffid", staffid);
editor.apply();

Intent homeIntent = new
Intent(getApplicationContext(), DashBoardActivity.class);

homeIntent.addFlags(Intent.FLAG_ACTIVITY_CLEAR_TOP);
startActivity(homeIntent);

}

}

},
new Response.ErrorListener() {
@Override
public void onErrorResponse(VolleyError error) {
loading.dismiss();
Toast.makeText(CourseAllActivity.this, "Error in
Logging kindly check your credentials and ensure you are connected to the
defined access point within the venue!", Toast.LENGTH_LONG).show();
}
}) {
@Override
protected Map<String, String> getParams() {
Map<String, String> params = new HashMap<String,
String>();

params.put("id", x);
params.put("status", y);
return params;
}
@Override
public Map<String, String> getHeaders() throws
AuthFailureError {
Map<String, String> headers = new HashMap<String, String>
>();

// add headers <key,value>
String credentials = "dibbs:adminDibbs2018";
String auth = "Basic "
+ Base64.encodeToString(credentials.getBytes(),
Base64.NO_WRAP);
headers.put("Authorization", auth);
return headers;
}
};
RequestQueue requestQueue = Volley.newRequestQueue(this);
requestQueue.add(stringRequest);
}
else {
Toast.makeText(CourseAllActivity.this, "Enter appropriately all
the required fields", Toast.LENGTH_LONG).show();
}
}
public void repo(String xy, String yy) {
final String x=xy;
final String y=yy;
if (x.length()>0) {
final ProgressDialog loading = ProgressDialog.show(this, "Getting
registration progress for course...", "Please wait...", false, false);
StringRequest stringRequest = new

```

```

StringRequest(Request.Method.POST, getUrlAll() + "repo.php",
    new Response.Listener<String>() {
        @Override
        public void onResponse(String response) {
            loading.dismiss();
            if (response.trim().equals("0")) {
                //String [] x=response.split(",");
                //String pass=x[0];
                AlertDialog.Builder builder = new
AlertDialog.Builder(CourseAllActivity.this);
                builder.setTitle("Message");
                builder.setMessage("Error in execution!");
                builder.setNegativeButton("OK", new
DialogInterface.OnClickListener() {
                    @Override
                    public void onClick(DialogInterface
dialog, int id) {
                        // TODO Auto-generated method stub
                        dialog.dismiss();
                    }
                });
                AlertDialog alertDialog = builder.create();
                alertDialog.show();

                //Toast.makeText(RegisterActivity.this,response,Toast.LENGTH_LONG).show();
            }
            else if (response.trim().startsWith("1")) {
                String [] x=response.split(",");
                String pass=x[1];
                AlertDialog.Builder builder = new
AlertDialog.Builder(CourseAllActivity.this);
                builder.setTitle("Message");
                builder.setMessage("Successful execution!Total
registered "+pass+" Students! Login to web portal to print report");
                builder.setNegativeButton("OK", new
DialogInterface.OnClickListener() {
                    @Override
                    public void onClick(DialogInterface
dialog, int id) {
                        // TODO Auto-generated method stub
                        dialog.dismiss();
                    }
                });
                AlertDialog alertDialog = builder.create();
                alertDialog.show();

                //Toast.makeText(RegisterActivity.this,response,Toast.LENGTH_LONG).show();
            }
            else if (response.contains("11")) {
                String[] x = response.split(",");
                String no = x[1];
                String name = x[2];
                String staffid = x[3];
                PreferenceManager.getDefaultSharedPreferences(CourseAllActivity.this);
                SharedPreferences.Editor editor =
preferences.edit();

                // editor.putString("phone", pho);
                editor.putString("sname", name);
                editor.putString("sno", no);
                editor.putString("staffid", staffid);

                editor.apply();
                Intent homeIntent = new

```

```

Intent(getApplicationContext(), DashboardActivity.class);

homeIntent.addFlags(Intent.FLAG_ACTIVITY_CLEAR_TOP);
                    startActivity(homeIntent);

                }

            }
        },
        new Response.ErrorListener() {
            @Override
            public void onErrorResponse(VolleyError error) {
                loading.dismiss();
                Toast.makeText(CourseAllActivity.this, "Error in
Logging kindly check your credentials and ensure you are connected to the
defined access point within the venue!", Toast.LENGTH_LONG).show();
            }
        }) {
            @Override
            protected Map<String, String> getParams() {
                Map<String, String> params = new HashMap<String,
String>();

                params.put("id", x);
                params.put("status", y);
                return params;
            }
            @Override
            public Map<String, String> getHeaders() throws
AuthFailureError {
                Map<String, String> headers = new HashMap<String, String
>();

                // add headers <key,value>
                String credentials = "dibbs:adminDibbs2018";
                String auth = "Basic "
                    + Base64.encodeToString(credentials.getBytes(),
                    Base64.NO_WRAP);
                headers.put("Authorization", auth);
                return headers;
            }
        };
        RequestQueue requestQueue = Volley.newRequestQueue(this);
        requestQueue.add(stringRequest);
    }
    else {
        Toast.makeText(CourseAllActivity.this, "Enter appropriately all
the required fields", Toast.LENGTH_LONG).show();
    }
}
}
}

```

Appendix 3b: Representation of similarity index

A MODEL ANDROID PHONE BASED SYSTEM FOR MANAGING UNIVERSITY CLASS ATTENDANCE USING QR CODES AND INDOOR LOCATION

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A MODEL ANDROID PHONE BASED SYSTEM FOR
MANAGING UNIVERSITY CLASS ATTENDANCE USING
QR CODES AND INDOOR LOCATION

BY

MICHAEL MASIBO WAFULA
MSc

A Thesis Submitted in Partial Fulfillment of the
Requirements for the Degree of Master of Science in
Information Technology, of the Department of Information
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2019