2017

Mobile based County revenue collection system

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A dissertation submitted in partial fulfilment of the requirements for the Degree of Master of Science in Mobile Telecommunication and Innovation

Faculty of Information Technology
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Nairobi, Kenya

April, 2014

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Declaration

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

..... Gabriel Kimotho Njenga

..... Signature

..... Date

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Dedication

I would like to dedicate this thesis to my family, who made my dreams and education valid and possible.

Acknowledgements

I would like to express my sincerest gratitude to my thesis supervisor Dr. Humphrey Njogu for his exceptional monitoring, guidance and moral support throughout the duration of this thesis.

I would also like to thank God and my family for their support and encouragement .This assignment would not have been made possible without them.

Abstract

Today more than ever, different entities are relying on information technology to enhance the performance of their operations. At the forefront of this reliance is mobile technology which possesses versatile and comprehensive solutions for service delivery. In Kenya today, thousands if not millions of individuals can access an array of services and goods with just a click of a button from their mobile devices. With the process of devolution underway, it is about time that the various government organs, such as county governments, equally adopt mobile based solutions. This study has found that the existing manual and semi-automated systems that are currently operational contain a cluster of problems such as: lack of reliability, slow processing time, poor inter-departmental integration, lack of adequate decision making reports and proneness to errors.

During the course of the study a mobile solution called M-County was implemented so as to provide Kenyan citizens with a dynamic mobile platform that fundamentally allowed them to make various county payments, such as parking fees, with the use of mobile money platforms i.e. M-Pesa. Ultimately the payments made via the platform allowed county revenue officials to access real time revenue information and reports for analytical decision making purposes. A quantitative research method approach was fundamentally used to test the system as well as collect primary data. The sample size used was

The outcome of the study shows a significant willingness of the public to adopt M-County. This willingness was mainly due to the ease of use of the application along with its functionalities. The users of the system made various recommendations that would essentially make the application more suitable to their needs. The potential for success of the system is generally very high mainly due to the exponential usage of mobile applications in Kenya presently.

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Abbreviations

IFMIS-Integrated Financial Management Information System

LAIFMOS- Local Authorities Integrated Financial Operations Management System

GIS- Geographic Information System

HTML- Hyper text Markup Language

JSP- Java server Pages

CHAPTER 1: INTRODUCTION

1.1 Background of the study

On 4th August 2010, Kenyans overwhelmingly voted yes for a new constitution.67.25% of the total votes cast were for "YES" - 5,954,767(Diallo, 2010).Consequently, on27 August 2010,Kenya promulgated its new constitution paving way for a new era of governance. This new era of governance was structured in a manner that entailed splitting administrative powers and responsibilities into different territories known as counties. The powers and roles of these administrative territories are provided in Articles 191 and 192, and in The Fourth Schedule of The Constitution of Kenya and The County Government Act of 2012(Republic of Kenya, 2010).Although Kenya still stands as a unitary state, it contains 47 different governments within it whose powers are limited by geographical boundaries. These 47 governments are a replica of The National Government in terms of their administrative structure as shown in Figure 1.1 below(The Institute of Social Accountability, 2014). The fundamental aim of this system of governance is to devolve most of the functions provided by The National Government so as to ensure equitable distribution of resources across Kenya.

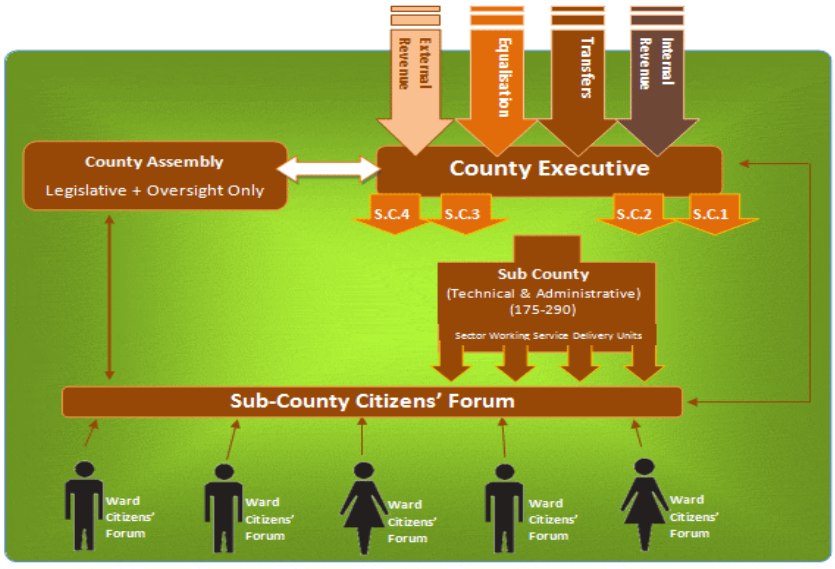

Figure 1.1 Devolution Structure

In the spirit of replicating the National Government, counties need to equally generate their own revenue just as the National Government does. According a recent analysis, counties receive 69% of their funds from the national government and generate the remaining 31% (Commision On Revenue Allocation, 2013).These figures show a significant reliance on the national government which counties must strive to deviate from as they attempt to operate autonomously.

Most counties have inherited a variety of problems that have proven to be a hindrance in their devolution ambition, with the major problem revolving around inheritance of huge debts. Upon conception, the county governments were meant to inherit Ksh.17 billion in debt (Sangira, 2012). These are debts that had been previously been accumulated by the preceding municipalities due to poor management skills and corruption. The previous municipal structures contained huge loop holes that allowed huge leakage of funds that were simply unaccounted for. This leakage of funds was coupled up with massive operational inefficiencies that were a result of archaic manual systems and operations. Counties must now find new and innovative ways to ensure that their revenue streams are adequate enough to pay their debts and at the same time provide development to the society that is critically needed on all fronts (The World Bank, 2014).

The need for tamper proof revenue collection systems warrants a shift from manual to computerized systems now more than ever. According to (Maina, 2012) collection of the rates listed below falls within a county's mandate:

- Parking Fees
- Land Rates
- Market Fees
- Business licenses

One of the biggest challenges that municipalities face is evasion of the above payments and integrity of their employees. Most Kenyans on the other hand have lost faith in the city council based on different allegations made in the media .The manual systems that are currently in existence seem to have failed miserably. In line with the Vision 2030 goals it is therefore important and necessary that counties strive to procure automated revenue collection systems whose focus revolves around:

- Increasing efficiency in municipal operations
- Enhancing simplicity in payment of revenues

- Reduction of corruption of municipal employees

1.2 Problem Statement

Currently most of the county governments are heavily still reliant on processing data without making use of stored-program computing equipment and semi-automated that were left behind by the previous government structure. These systems contain several gaps and weaknesses (Office of the Controller of Budget, 2013).

Manual tasks have proven to be inadequate in their efforts to record and disseminate information within the various municipality organs in the absence of automated systems. These tasks currently require huge labour and financial resources for their successful implementation. An automated system can perform all these tasks more efficiently and accurately with just a click of a button hence preventing wastage of resources. Examples of manual tasks that are predominant across municipality business processes include:

- Hardcopy exchange of documentation and subsequent approval processes
- Manual calculations
- Non-automated crosschecking of data for purposes of auditing, reconciliation and verification
- Manual transfer of data from one hardcopy format to another

The need for data entry duplication, validation and reconciliation creates a sluggish implementation of municipality business processes. The time consumed to complete a process is exponentially increased in circumstances where there is no automated intervention. A process that would have been processed in a matter of seconds ends up taking minutes or even hours in some cases. Poor processing times coupled with lack of data integrity, is a major reason for substandard service delivery in the relevant revenue collection points. The primary consequence of this issue is frustrated customers which in turn entices them to part with a bride in order to procure the services they require. This behaviour spawns corruption.

Manual systems where data processing is without making use of stored-program computing equipment have forced individuals to perform manual data analysis to municipal data, so as attain credible information that can be used for decision making purposes. Manual analysis is not only highly inefficient and prone to errors, but also can be easily manipulated to protect the interests of corrupt officials.

Data that is conceived in a municipality set up is meant to traverse the municipal management structure both vertically & horizontally. The need to access data on a real time basis has proven to be an advantageous aspect when dealing with organizations that require high levels of transparency. The limitations of the existing manual systems have excluded constituents and businesses from real time information that would have been useful during most instances.

In conclusion, all the above gaps create conducive conditions for corruption. These gaps cumulatively offer an opportunity for fraudulent and unethical officials to access public funds. Corruption is therefore the most fundamental evil brought about by manual systems.

1.3 Objectives and Purpose

I. To investigate the challenges faced by Kenyan citizens during payment of various county fees.
II. To review the existing mechanisms/tools used to collect revenue at counties.
III. To design and create a mobile based solution that solves the current challenges
IV. To test the validity and effectiveness of the application using a qualitative approach.

1.4 Research Questions

I. What are the common challenge Kenyan citizens face when making county payments?
II. What methods and tools were used to collect revenue at counties?
III. How can a mobile-based application be designed, implemented and tested to solve the challenges faced in revenue collection?
IV. What will be the best way to test the application?

1.5 Significance of the study

This study is fundamentally beneficial to Kenyan citizens and county officials. The proposed system seeks to eradicate the challenges that were previously brought about by manual systems. The weaknesses faced by these manual systems include: fraud, high-cost of collection, unreliability, lengthy processing time and non-comprehensive decision making reports.

It also seeks to set a precedence of governance that revolves around accountability, transparency and efficiency. Its potential impact in service delivery to the public will bring about tremendous benefits for all its user.

Using the proposed system, Kenyan citizens will be able to make remote payment services with the use of electronic money platforms. This will ensure payment efficiency and relieve the citizen of worries such as theft when dealing with physical money.

On the other hand, the relevant county officials will have access to specialized reports that are critical for business intelligence purposes .This functionality will go hand in hand with the integration of inter-departmental processes making them available across different applications and technologies.

1.6 Scope and Limitation

This study decisively discusses the various challenges faced by Kenyan citizens as they make a variety of county payments, current approaches used to eliminate those challenges and creation of a mobile solution that may be used to adequately resolve these challenges. Questionnaires will be used for data collection purposes. Applications that are similar to the proposed mobile application will also be discussed with the aim of creating a holistic mobile solution.

The primary limitation is the lack of access and interaction with to the existent systems. Despite my persistent efforts I have only been able to interact with these systems as a user but as not as an administrator .The relevant municipal authorities claimed that my interaction as an administrator would be considered a “security threat” .Accessing the system as an administrator would have been highly beneficial especially when it comes to designing elements of the proposed system such as the database.

Secondly, although my research was comprehensive I may have potentially missed some relevant studies. This is mainly due to lack of additional partners working on this study. However, the credibility and integrity of this study is not deteriorated by this fact.

1.7 Assumptions of Research

The primary assumption in this research is that the intended target resident of Nairobi County is capable of affording a Smartphone that can effortlessly run the mobile application.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The relatively new Kenyan constitution currently dictates the founding blocks of administration and governance within Kenyan boundaries(Republic of Kenya, 2010). The newly formed territories known as counties create a unique opportunity that can facilitate equitable distribution of Kenya's wealth. Recent studies show that Kenya is ranked as one of the most unequal societies in the world, revealing that 60%of Kenyans live under extremely poor conditions (Juma, 2010).

Before the creation of counties, Kenya's wealth was distributed across the existent 210 constituencies through The Constituency Development Fund (CDF).This fund was conceived in 2003, during The Kibaki Presidency. This distribution scheme propelled Kenya into a new era of consistent economic growth fundamentally facilitating Kenya's 7% growth in 2007(Okombo, Muluka, & Sungura-Nyabuto, 2011).Despite the success of this model, CDF has been riddled with various challenges that mainly revolve around corruption(Auya & Oino, 2013).

The introduction of counties creates an opportunity for Kenya to distribute large chunks of its wealth in a manner that is fair and equal. Figure 2.1, below shows the formula that is currently used to distribute Kenya's wealth across counties (Commission on Revenue Allocation, 2014) .

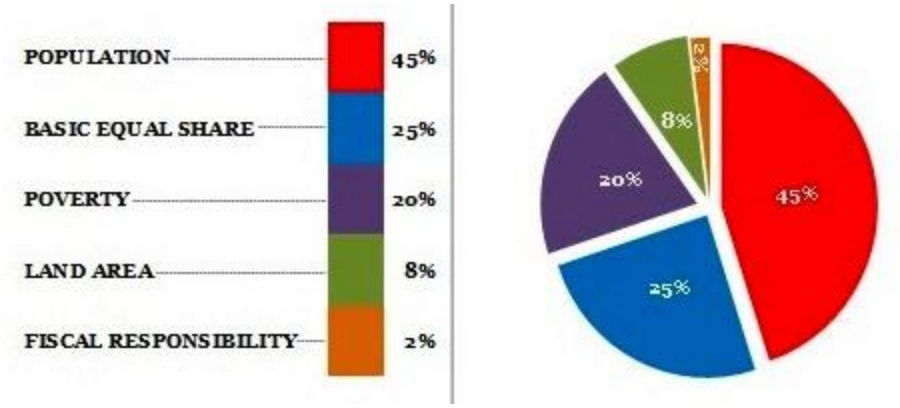

Figure 2.1 Kenya Wealth Distribution Formula (Commission on Revenue Allocation, 2014)

As counties receive their allocations based on the figure above, it is very important that they observe prudent revenue management methods. This will ensure that the funds distributed can impact the community in a positive way that spurs economic development. These allocations should ultimately enable counties to build infrastructure that will in the long run allow them to

rely on revenue collected from their own sources; as opposed to relying on National government allocations. This goal can only be achieved through the use of technology.

”Revenue Management is the art and science of maximizing revenue under variable conditions.”(Adams, Burgess, Kelly, Ringham, & Varini, 2013).This research discusses the challenges faced by citizens when making county payments and collects facts regarding existent structures used in the process of revenue collection that will be helpful during implementation of the proposed solution. Furthermore, this study seeks to elaborate the technological gap that will facilitate more efficient county payments and consequently allow counties to effectively collect revenue.

2.2 Challenges faced by Kenyans during payment of revenue collection

Detailed mappings of the factors that majorly contribute to the challenges faced by citizens as they make their county payments are highlighted in the section below. The main purpose of these findings is to serve as a guide so as to provide a dynamic mobile solution whose impacts ranges from allowing efficient county payments to facilitating economic growth. The challenges mentioned include:

2.2.1.1 Processing Time

Currently, most of the county payments subject Kenyans to very slow processing times. Ordinarily Kenyans have to wait for days for a service they would have easily been delivered within minutes or hours. This circumstance creates a huge challenge for Kenyans as they make their county payments. Kenyans ultimately end up avoiding making these payments due to the implied “wastage of time”. Acquiring a single business permit in Nairobi, which is an essential part of running a business, takes approximately 5 days(The World Bank, 2012).

2.2.1.2 Corruption

Corruption is a major issue that tremendously curbs revenue collection in Kenya. Kenya ranks 4th in the global bribery index(Mathenge, 2013). This translates to 1 in 4 Kenyans who have parted with a bribe while interacting with a government official. This level of corruption encroaches on the process of making county payments .Kenyans have to furnish revenue officials with a bribe in order to receive services that they constitutionally deserve. This makes the payment process unnecessarily expensive for Kenyans and poses a great challenge.

2.2.1.3 Lack of Multiple payment points

The current status quo dictates that Kenyans can make county payments via directly accessing a county office or accessing an authorized local bank. In Nairobi, for instance, there is only 1 county office where Kenyans can make county payments. This directly means that all Kenyan citizens have to travel to the Central Business District in order to make a payment such as a Single Business Permit. If they opt to pay via a local bank, they must still travel to the Central Business District for payment processing at the county offices. This lack of alternative payment options creates a major challenge. Kenyans have to dig deeper into their pocket as a consequence of this challenge.

2.2.1.4 Errors

Due to the lack of automation in the current payment processes, more often than not, errors are encountered .These errors are mainly mathematical errors. Kenyans are often faced with a situation where a service rendered to them may be revoked due to the fact that an error was made by a revenue official. This situation is not only frustrating but may also prove to be costly in circumstances where legal authority to operate a business is revoked.

2.3 Mobile Technology among Kenyan Citizens

The focus of this dissertation is identifying and consequently addressing the challenges faced by Kenyan citizens in their daily pursuit to make payments to the relevant county payments or fees. The core design of the discussed solution shall be determined by the findings in the derived from the following area: existing revenue collection systems available to Kenyans today, penetration of Smartphones among Kenyan citizens, preference between mobile money and other existing payment platforms, choice between mobile applications and web portals.

2.3.1.1 Smartphone Use

According to (Mupaso, 2014)Kenya has 67% smartphone penetration. This figure is much higher than the related continent figures. Fundamentally owning a smartphone has become a way of life. This serves as evidence of how entrenched the use of smartphone devices is among Kenyan citizens. This finding is key as it may be used to benefit Kenyan citizens through the development of functional applications to help bridge the existent revenue collection gap. The graph below shows other projections of smart phones penetration in comparison to other developing countries

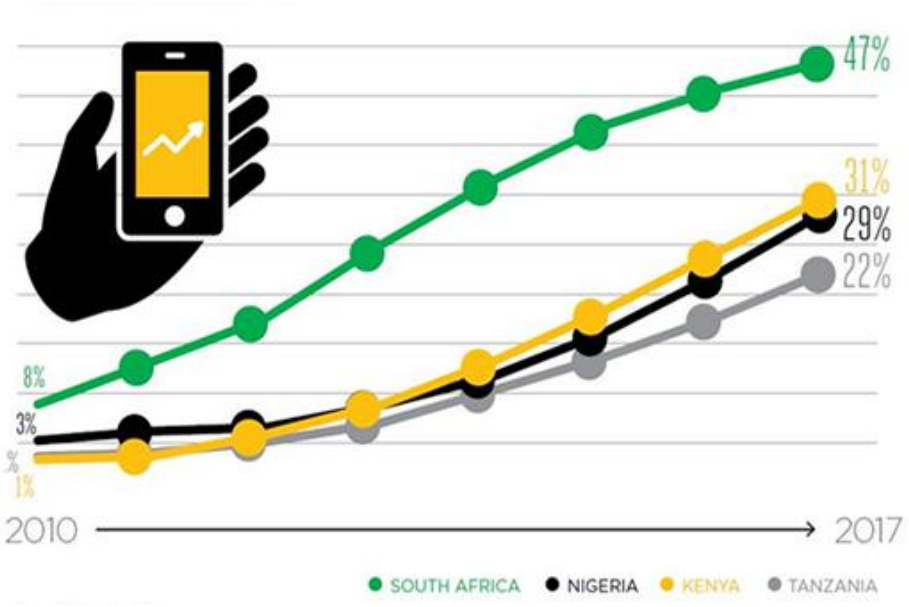

Figure 2.2 Smartphone Penetration in Sub-Saharan Africa (BusinessTech, 2013)

2.3.1.2 Application Type Preference

According to (Sohne, 2003), Mobility is central to the ability to collect additional revenue in the field. It is not necessary to have an expensive laptop or personal computer when automating a series of simple, well defined business processes in as cost-effective a manner as possible.

Over the last decade, the need for more efficient ways of delivering services has increased. This has led to an increase in mobile development .The cost of mobile devices has drastically decreased as well, and smart phones have become ubiquitous. These conditions have created a ripe opportunity to capitalize on the use mobile technology for applications that range from delivery of small services to revenue collection on a large scale.

The scalability of mobile devices is unmatched due to their ability to collect and manage vast volumes of data in environments that have minimal or no infrastructural capacities. The use of mobile phones to deliver services has most notably been seen in the agricultural, banking and education industry.

2.3.1.3 Preference between Mobile Money and Other Existing Payment Platforms

The current success of mobile money in Kenya has been extremely phenomenal. People now have access to financial services as never before, such that the proportion of the population which is completely excluded from financial services is lower in Kenya than any other African country except for South Africa(United States Agency for International Development, 2011).

Currently approximately 16 million Kenyans use mobile money for their day to day activities(United States Agency for International Development, 2011).The figure below shows money transfer behavior before and after M-Pesa.

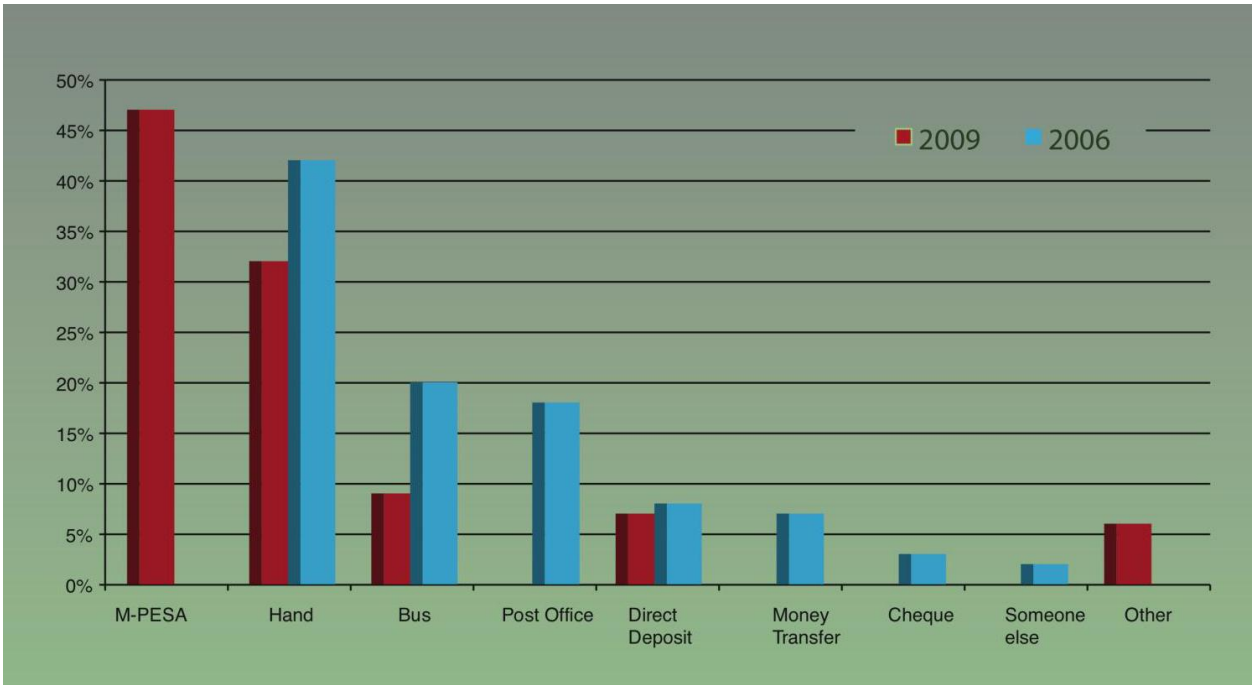

Figure 2.3 Money Transfer Behavior Before and After M-Pesa (United States Agency for International Development, 2011)

2.4 Existing Computerized Revenue Management Systems

2.4.1.1 Local Authorities Integrated Financial Operations Management System (LAIFOMS)

LAIFOMS is an integrated financial management system developed for The Ministry of Local Government comprising for implementation within local authorities(Interact Sytems Limited, 2014). Ordinarily the local authorities are tasked with covering large regions that fall under their jurisdiction .The fundamental purpose for the development of LAIFOMS was to:

- Enhance quality customer service
- Streamline revenue collection.
- Allow revenue clerks in remote area access to the local authorities database through WANs

Figure 2.4 below shows the key stakeholders/actors of LAIFOMS.

Stakeholder	Organization	Department	Designer	User	Interests
Government of Kenya	Office of the President	Directorate of E-Government	+		Service Delivery
	Ministry of Finance		+	+	
	Ministry of Local Government	Kenya National Budget Office	+	+	
			+	+	
		KLGRP IT Accounts Minister (1999) Inspectorate	+	+	
Supra-national / International Institutions	World Bank	KUTIP	+ (until 2001)		Facilitate Good Governance
	EU	DFID	+ (1999-2005)		
	World Bank	Country Office	+ (from 2006)		
	Duke University	DCID	+		
Other Government Arms	Anti-Corruption	KACC		+	
	Auditor General	KNAO		+	
Suppliers	Local Audit Firm	National Practice International Practice	+	+	Profit
	Local ICT Suppliers	Head Office	+		
Public	Citizens	Accounts Clerk		+	Good Service
	Business	Accounts Clerk		+	
Civil Society	ALGAK	Head Office	+	+	Empower Public
	Media			+	

Figure 2.4 Classification by Function of the Key LAIFOMS Stakeholders (Nixon Muganda-Ochara, 2008)

2.4.1.2 Integrated Financial Management Information System (IFMIS)

According to (Bartel, 1996) a financial management information system, or integrated financial management information system (IFMIS), is an information system that tracks financial events and summarizes financial information.

According to (Republic of Kenya National Treasury, 2014)IFMIS currently performs the following task in The Ministry of Finance in Kenya:

- Facilitating a higher degree of quality for data
- Guarantees robust business results through improved workforce performance
- Provision of specialized reporting for budget planning purposes
- It allows automation of the procurement procedures
- It facilitates automated revenue collections in order to improve cash forecasting
- It provide a more precise information regarding the government's financial position

2.4.1.3 Application of Geographic Information System (GIS) in Tenement Rates Collection

According to (Felix Iyiola, 2013) this study intended to use Geographical Information System for efficient collection of land rates and performed in Nigeria. The purpose of enhancing revenue

collection was to boost funding that was available for development in the grassroots of the country. This study finally concluded that benefits such as well-equipped health centers, quality education etc. were achieved through the use of this system. The analytics tool availed in this system also enhanced revenue collection and administration at the municipality level. Figure 2.5 below is a representation of the system.

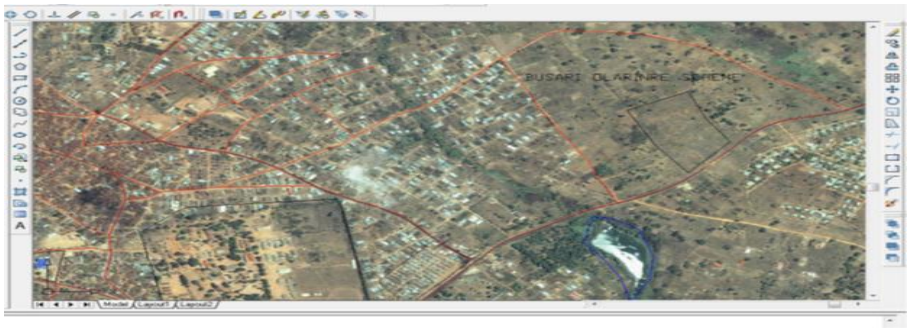

Figure 2.5 GPRS Snap Shot (Felix Iyiola, 2013)

2.4.1.4 An Online Revenue Management System: Case Study-Kampala City Council

The significance of this project was to promote awareness and elaborate the need for automating revenue collection (Naiwumbwe, 2005). The study was supported by an application developed based on The Kampala City Council infrastructure and environment at the time. The software was customizable to suite other management institutions i.e. both government and non-government. The table 2-1 below shows the similarities and differences between the proposed system and this study which was conducted earlier.

SIMILARITIES	DIFFERENCES
• **The use of an online platform for revenue collection**	• Customization to non-government institutions
• **Ability to access reports**	• Availability on a mobile platform
	• Use of GPS technology
	• Lack of real-time capabilities

Table 2.1 Similarities and differences between the proposed system and this study

2.5 Design Methodology Review

Research shows that agile methodology is a perfect fit for mobile application development for many reasons discussed below. The main reason is it is a faster way to develop applications and time is a crucial factor. “Agile software development breaks down the application development

to smaller chunks and incorporates quality testing, documentation and review. Agile software development differs significantly from previous "waterfall" development methods which sought to predefine requirements, and inclined to make analysis and documentation successive steps rather than a fundamental part of development", (Habermas, 2013).

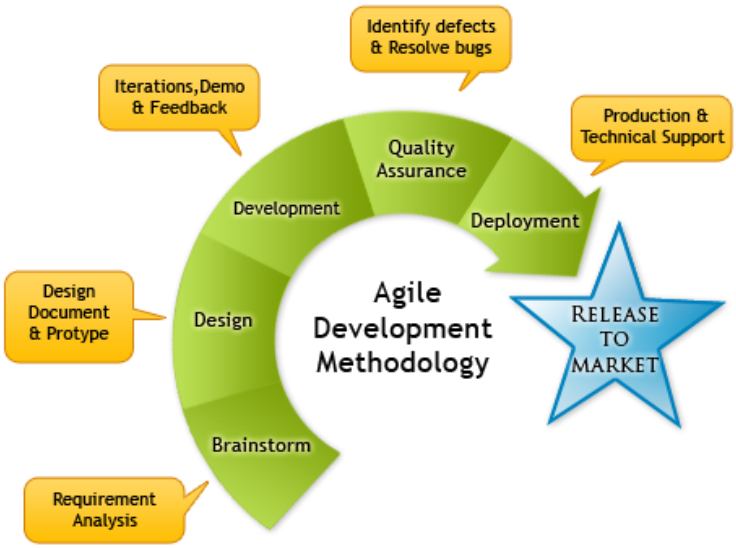

Figure 2.6 Agile Methodology Flow Adopted (Prismetric, 2013)

Figure 2.6 describes the steps followed in software engineering as per the agile methodology. A summary of ways agile methodology enhances mobile development (Kannan, 2011) & (Prismetric, 2013) are:

i. **This methodology fits the experimentation and adaptation nature of mobile apps** - Mobile apps are user specific hence this approach refines what users need and perfectly fits the constituent of iteration.
ii. **Increases reliability and leads to continued use of application** - The quality assurance and testing of this methodology gives reliable output. The mobile app world is intolerant to errors and apps that crash because the app store provides a range of options.

iii. **Agile sprints encompass naturally into mobile app model -** allows for updates and testing of different versions of the app as app store allows installations of app and updates.

iv. **Enables Mobile app to be responsive to technological change -** the technological changes can be updated in the app and released as updates and not reinstalling the app.

v. **Enables Rapid accommodation of customer feedback -** The continuous process of updating and debugging helps improve the app as the users still use the older version.

vi. **Enables thoughtful User Experience**

2.6 Development Platform

Mobile devices have been accepted as an interactive program platform. There are many tools in the market that offer developers to use different technologies. The most common examples are java, Python, Objective c, JavaScript and Ajax that provide implementation of sophisticated mobile applications.

2.6.1.1 The Common Mobile Application Platforms

The platforms available for handheld devices are Symbian, android, iPhone, open C and for the web runtime environments are python, Lazarus, Brew. Numerous development platforms are available for handheld devices, including native environments such as the Symbian, OpenC, iPhone, and Palm operating systems; Web runtimes such as widgets; and runtime environments such as Python, Lazarus, Brew and java ME edition. The Software stacks of common platforms are summarized in figure 2.7.

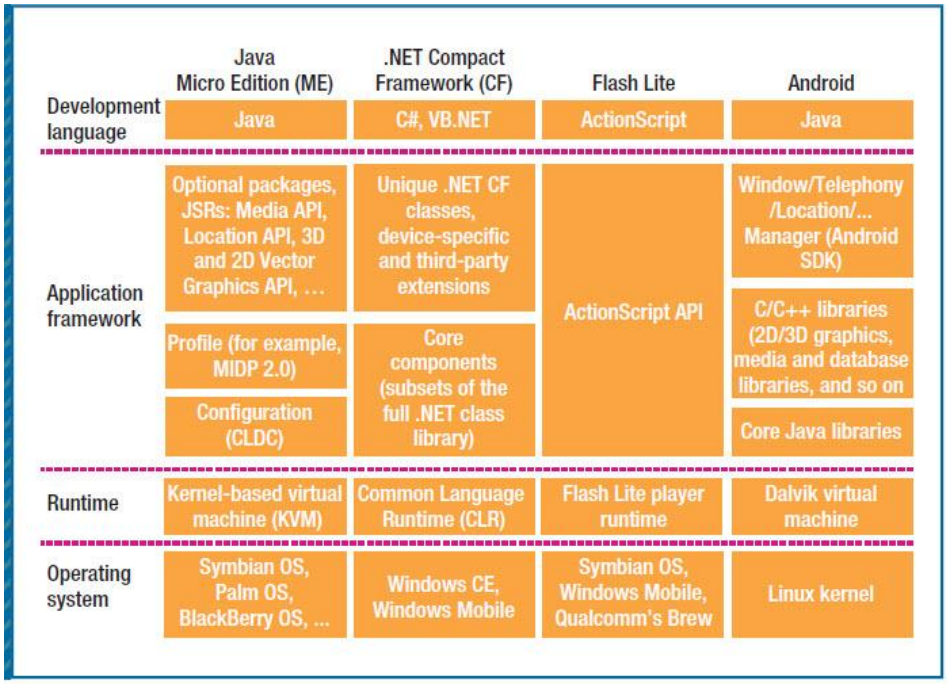

Figure 2.7 Software Stacks for The Reviewed Mobile-Application Development Platforms (infoQ, 2009)

Figure 2.7 gives a comparison between java ME.Net, Flash Lite and Android platforms this gives the developer an insight of how the development language works and the application framework it works on.

2.7 Development Framework

There are many different models and Frameworks that exist in the mobile application development.

2.7.1.1 Oracle Development Application Framework

Oracle Application Development Framework Mobile (ADF Mobile) browser is a framework that was developed to be a standard version to enhance rapid development of mobile applications. It is built on JSF to target mobile browsers. It enables developers to develop applications with same principles and methodologies like developing applications for desktops. It ensures the data can be rendered on different browsers. It Implements HTML, JavaScript, CSS, DOM and XMLHttpRequest. JSF provides an MVC mechanism that streamlines the development of mobile web apps. Below is a detailed diagram showing the architecture of ADF framework(Oracle, 2013).

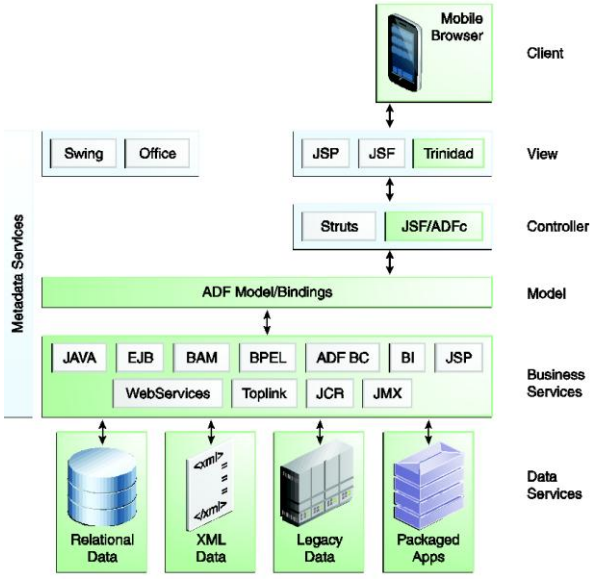

Figure 2.8 ADF Mobile Browser Architecture (Oracle, 2013)

Figure 2.8 give a graphical explanation on the MVC architecture works in the oracle development framework. It shows connections from the mobile device all the way to the data services.

2.8 Architectural Review

Two existing systems which have adopted two different architectural designs are discussed. Some architectural styles and patterns are; Client- Server, data centric, peer to peer, layered and component based. Mobile applications lately have been adopting the MVC architectural design which stands for Model-View –Controller Pattern.

2.8.1.1 Client - Server Architecture- C-Registration System

This provides and architectural overview of the system developed by Wylie College to support online registration and report card viewing.

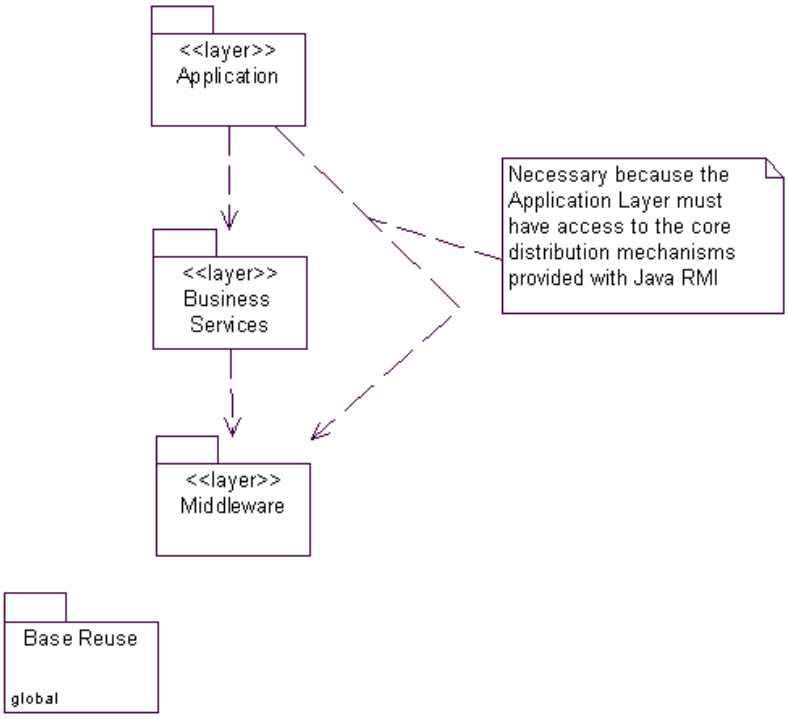

Figure 2.9Architectural Overview of the System (College, 2001)

Figure 2.9 gives the outline of the architecture. Architectural components as described by Wiley College (College, 2001):

I. Application layer

The layer represents the application screens of the user interface. This layer depends on the process object layer that separates the client tier from the middle tier.

II. Business Services layer

This layer represents the use case managers that change the application behavior. This comprises of the client to middle tier border.

III. Middleware layer

This layer supports access to Relational DBMS and OODBMS.

IV. Base Reuse layer

This includes all classes to support the functions and patterns.

2.8.1.2 Client Architecture- Pocket Timetable Windows 8

This is a mobile application that enables a student, teachers and parents to keep track of multiple timetables, subjects and personal comments. It gives reminders and occasionally refreshes to load data from server. It works on a windows 8 framework and has adopted the rich clients-server architecture. The rich client's architecture means the formation of an app that will be saved on the device (the business and data services layers) and the database located on a server and communicate through the internet(Forster, 2009).

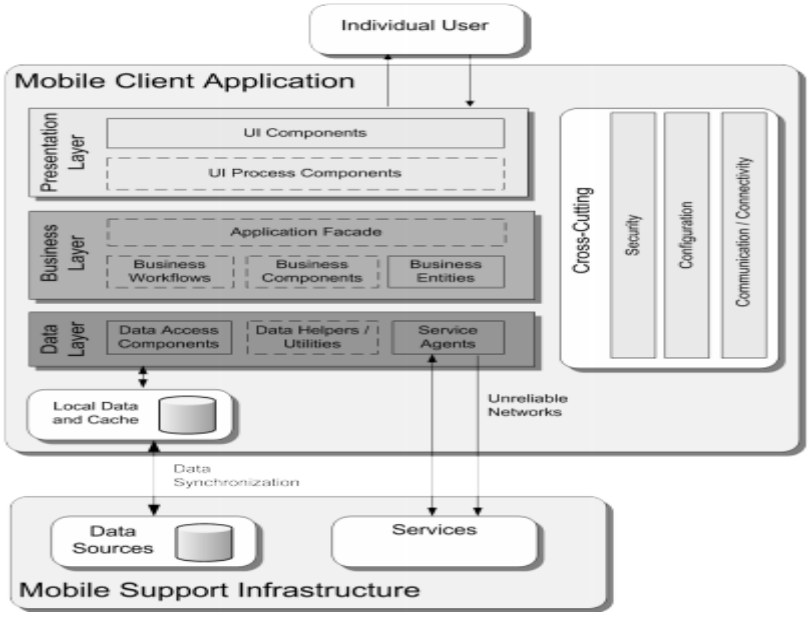

Figure 2.10 Rich Client Architecture of Pocket Timetable App (Jadey, 2005)

Figure 2.10 shows the typical internal components in rich-client architecture as it pertains to mobile applications. A rich client is chosen in this case because the application requires local processing and occasionally connects to the server to save and retrieve records. The key principles used to design the above architecture to minimize cost and maintenance is; separation of concerns: this breaks the application into distinctive features to avoid applications from overlapping.

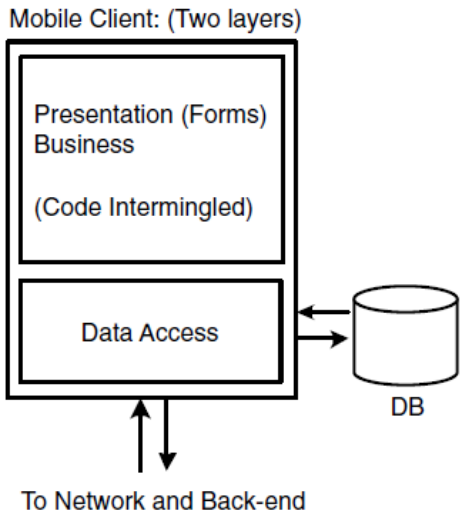

Figure 2.11 Representation of Two Layer Fat Client (Forster, 2009)

Figure 2.11 shows the relationship between the database and a fat client in the mobile platform environment. The advantages of the chosen architecture are it is very convenient because does not entirely depend on internet connections and they are quick to develop and deploy. The disadvantages of this architecture are: less scalable and it's hard to secure.

2.8.1.3 Advantages of Adopting Client –Server Architecture

I. Reduces load on workstation on which applications are running on.
II. It allows for scalability as the data grows increasing database space in a server is easier than in a mobile device or laptop.
III. Reduces load on network only results transmitted not all the data.

Architectural - Operation and Synchronization Modes

The retrieval of data from a mobile application dictates its data connection property and synchronization methods implemented. It is majorly determined by the need of internet access.

2.8.1.4 Data Connection

Data connection is the access of data from a remote server .A mobile device connects to the internet using mobile data or a WIFI connection. (Microsoft, 2014) . In the case of a mobile website a phone requires a connection to access a webpage. On the other hand a native or hybrid mobile application provides three different ways of connection.

There are three connection types to choose from when dealing with mobile applications: Always Connected- Online Mode, Partially Connected and Never Connected – Offline Mode. Online mode indicates that the application cannot be accessed until there is a data connection between the mobile and the internet. The partial connection means the application can work and synchronize data when there is internet connection and at the same time it can work with downloaded data when there isn't an internet connection. Offline mode online requires internet for download of the application. The data of the application will all be saved in the phone memory.

2.8.1.5 Synchronization

The connection type chosen affects the synchronization method chosen. There are two types of synchronization methods; continuously or through the store and forward method.

Continuous Method

The continuous method means the device is always online and retrieves and saves data immediately to the remote server. It is applicable when data connection is guaranteed and always used in mobile websites,(Nussbaum, 2012).

The Store and Forward Method

This method is used when the connection between the client and server is not guaranteed; it is made possible to store data on the local memory. Later when connection is re-established the mobile application will forward the saved data to the server (Schneider, 2010) . The Pocket Timetable application discussed has adopted the partially connected Mode. The user saves events, comments and timelines that save to the local phone memory. When the user is connected to the internet it synchronizes with the data from the database,(Cooperation, 1999).

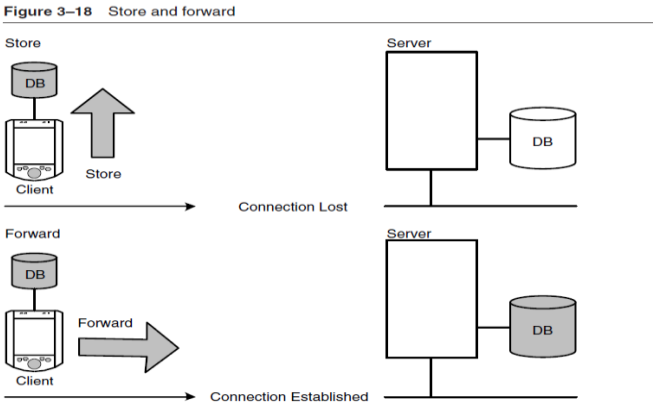

Figure 2.12 Store and Forward Synchronization Adopted From (Schneider, 2010)

2.9 Mobile Application Types

The decision of selecting the right client architecture for a mobile application depends on development cost, TCO multiplatform Support, consumer perception, durability, maintainability and brand impartiality. The design chosen must take into account factors like connectivity, bandwidth and multi-platform support,(Mehta, 2012).

There are three approaches:

a. **Mobile Web Application**: This approach the user access the application from a web browser but the website designed to suit the mobile platform.
b. **Native Application**: This is an application that is built to suit the operating system of the device example android, IOS and windows mobile. This approach promotes user experience and a great feel.
c. **Hybrid Application**: This is a native app with web pages embedded inside the app. The application can access hardware features like Bluetooth and camera and preserves the cross platform support.

Mobile Web Approach

The advantages of this approach are that it supports the multi-platform feature and reduces complexity and cost. It is designed once and runs on any mobile device. The main disadvantage is that it needs full internet access to view. The figure below is a diagram summarizing its operation,(Mehta, 2012).

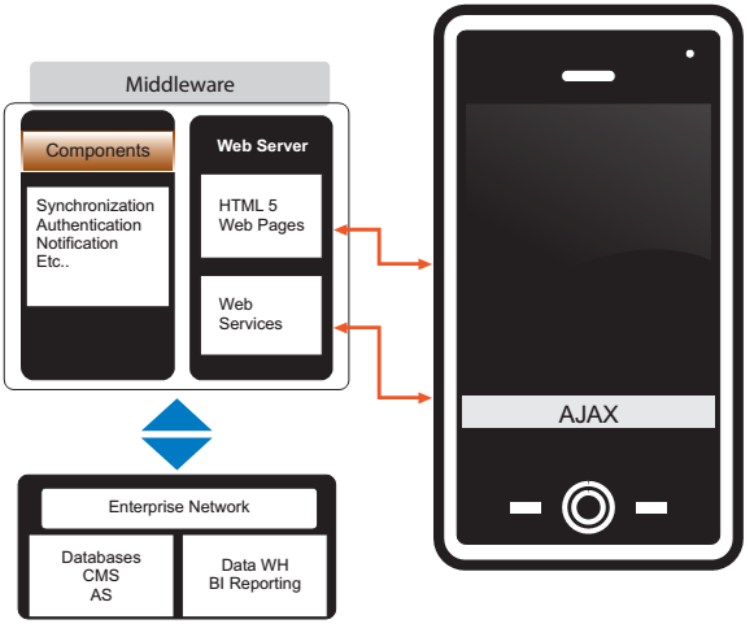

Figure 2.13 Mobile Web Approach (Mehta, 2012)

2.9.1.1 Native Application Approach

Native application approach provides multiple and diverse rich content features. It offers the best user experience and takes full advantage of the devices functionality. Most common applications using this approach include Social networking, games and entertainment applications. . The app can access all hardware features of the phone. The disadvantage is it is time consuming and complex for the developer. It also doesn't support multiple platforms.(Mehta, 2012).The figure 2.14 shows how the native app is embedded in the mobile device and its interactions.

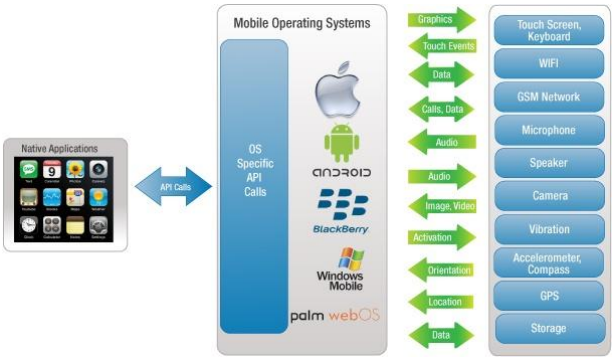

Figure 2.14 Native App Interaction with Mobile Device (XRG, 2014)

The figure 2.15 provides a graphical representation of the development framework which shows how the source code relates to the SDK Tool and distribute to the application packages.

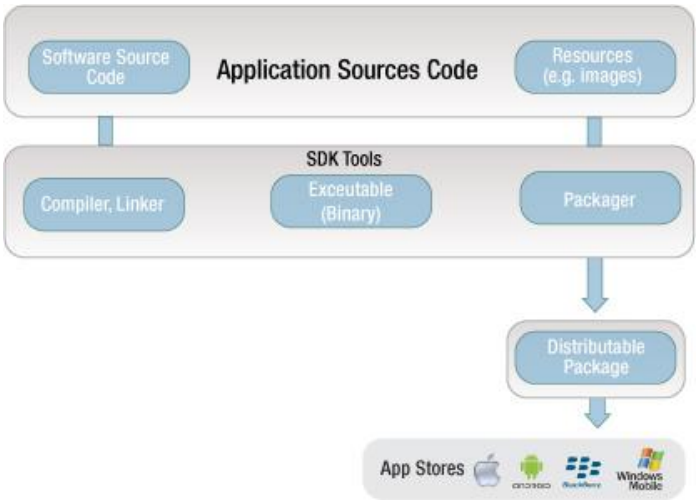

Figure 2.15 Native Development Framework (XRG, 2014)

2.9.1.2 Hybrid Application

Hybrid application combines the best features from the native apps (Touch screen, GSM Network, System Clock, GPS, and Storage) and websites. This approach provides the advantages of both the native app and the web application. It has evolved to work even of offline mode. It uses HTML pages and can be distributed in the app stores.(Mehta, 2012). Figure 2-16 shows how the hybrid app interacts with the mobile device, it's an HTML webpage viewed within a native app and at the same time interacts with the phones hardware.

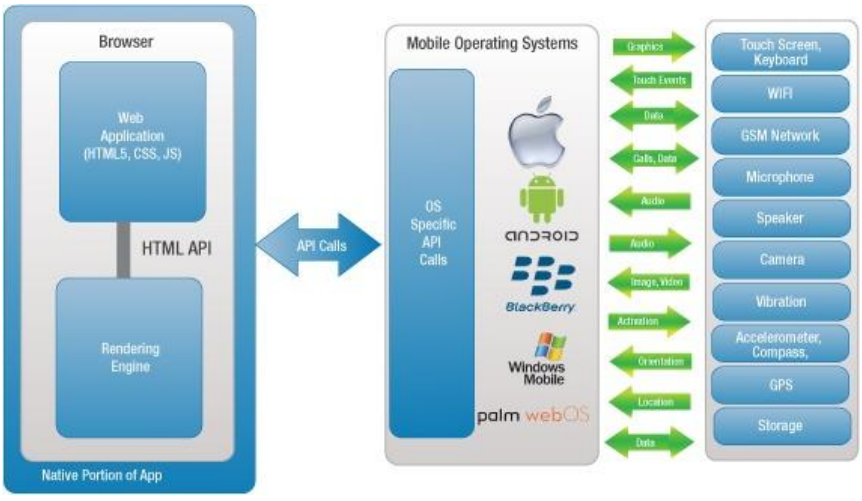

Figure 2.16 Hybrid App Interaction with Mobile Device (XRG, 2014)

The figure 2-17 shows a graphical presentation of the hybrid app development framework.

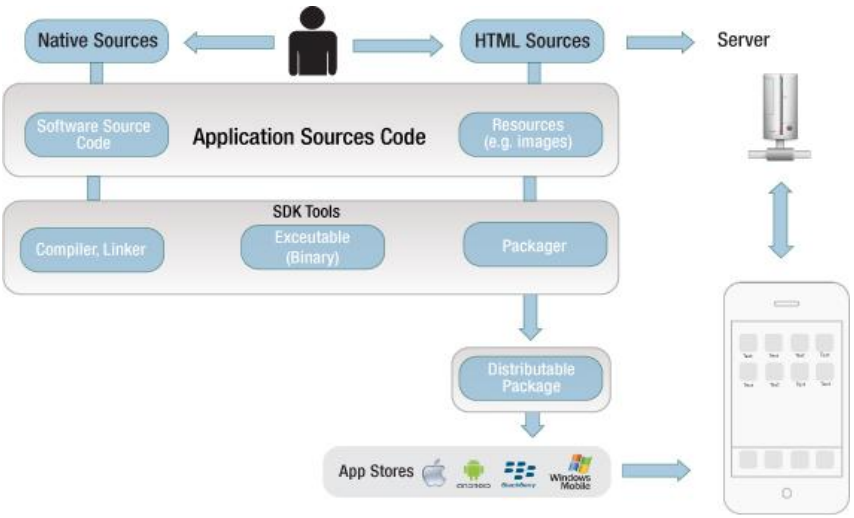

Figure 2.17 Hybrid App Development Framework (XRG, 2014)

2.10 Gap in Design and Solution

The literature review included different models designed on different platforms to solve challenges of slow processing time, high corruption rate, lack of multiple payment points/channels and proneness to errors for Kenyan citizens. Different applications concentrated on one factor, either providing information to students or time tracking or personal planning. The gap that exists is the lack of an integrated mobile solution. A solution to solve the challenges highlighted in chapter one is needed as a central hub to provide all these solutions at ones fingertips. That will enhance the students' performance and provide a suitable situation for learning. The proposed solution will provide information customized per the institution requirements more easily and integrate more features such as time management, frequent events notification, assignment track and personal budget.

2.11 Conceptual Framework of Proposed Solution

The most suitable framework for the proposed solution considering the above discussed architecture, model, and user interface and synchronization type. Initially the agile methodology as summarized in figure 2.6 will be used owing to the advantages discussed. The most suitable architecture for the proposed application is the client- server architecture on android platform as graphically represented figure 2.18.

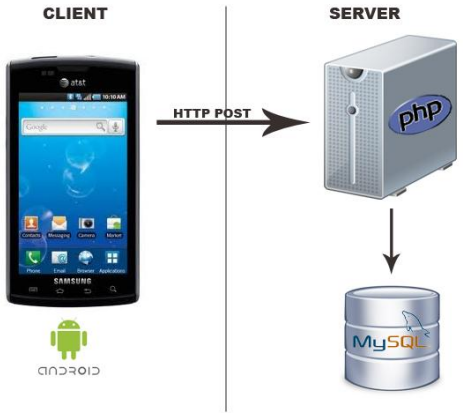

Figure 2.18 Client - Server Architecture in Android Platform (Rahman, 2011)

It adopted the hybrid application type as discussed in section 2.8.3. This will enable the application to access the hardware features on the device and remotely access data. To enable the user to access features and info from the application with or without internet access the store and forward synchronization method will be most suitable.

2.12 Summary

Literature review research has highlighted the challenges faced by Kenyans during payment of relevant county fees, provided facts about Kenyan's habits in relation to smartphones and preference of mobile applications in our day and age as opposed to websites, reviewed features of different solutions that can solve the challenges covered in chapter one, reviewed the a few common applications and in conclusion discussed the gap in the market and the need to design the proposed solution. The literature review justifies the need to have an integrated mobile solution for Kenyan citizens that allows them to efficiently make relevant county payments.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The main purpose of this chapter is describe and elaborate the methods, processes and procedures that were used in order to collect data that is relevant to this study. It is divided into the following sections:: research design, study variables, location of the study, target population, sampling strategies, research instruments, validity, reliability, piloting, data collection procedure, ethical measures, and data analysis procedures.

3.2 Research Design

According to Shields & Rangarajan (2013) Descriptive research, is used to describe characteristics of a population or phenomenon being studied. It does not answer questions about how/when/why the characteristics occurred. Rather it addresses the "what" question (What are the characteristics of the population or situation being studied?).

This study used a descriptive research design to determine whether the use of mobile technology can make revenue collection more efficient and convenient for citizens also provide a deeper understanding on the different techniques used in revenue collection, which influenced the decision on the technology adopted for the application. Questionnaire and interview techniques were used in order to collect holistic data regarding user experience .The data collected may be particularly helpful in circumstances where strategic planning is required for revenue collection optimization. Fundamentally, this exercise entailed involved gathering, organizing and tabulating data that described collection of revenue through mobile technology.

3.3 Study Variable

This study contains both independent and dependent variables. The independent variables in this study are assumed to be affecters of the dependent variables. The independent variables were the challenges of implementing mobile technology for revenue collection in a county setup and the core business processes that currently require automation within the municipal revenue sources. The dependent variable was the design and creation of an automated revenue collection system that will ensure efficiency in revenue collection.

3.4 Location of the study

This study was conducted in Nairobi County. According the Central Intelligence Agency (2013), Nairobi has a population of 44,037,656 inhabitants as of July 2013.The age structure is as follows:

0-14 years	**42.4% (male 9,357,084/female 9,299,586)**
15-24 years	18.8% (male 4,148,153/female 4,147,896)
25-54 years	32.4% (male 7,210,891/female 7,070,217)
55-64 years	3.6% (male 719,374/female 876,458)
65 years and over	2.7% (male 529,873/female 678,124)

Table 3.1 Demographic Segmentation

3.5 Target Population

Based on the nature of a descriptive survey design, the users of the system play a major role as respondents of the study. The researcher randomly selected 21 customers from each of the 17 constituency in Nairobi County. The primary users are citizens of Nairobi County who are considered to be its customers and thus are the most vital source of information for this study. Their input in the study is very rich and valuable based on the knowledge they possess from past and present interactions with the county during the revenue collection process.

3.6 Sampling Strategies

Sampling is a very useful tool that makes it possible to collect and summarize responses from various participants of a study without engaging the entire population of the study. According to Wikipedia (2014), sampling is concerned with the selection of a subset of individuals from within a statistical population to estimate characteristics of the whole population.

Nairobi County was specifically chosen for this study due to its position as the most technologically developed county in Kenya. It also contains the most heterogenic population among all counties. Simple random sampling was used to determine the respondents of the study.

Each element in the population had an equal probability of selection. The researcher randomly selected 21 customers from each of the 17 constituency in Nairobi County. A preliminary survey from city hall data revealed that over 10,000 citizens are involved in payment of revenue on a monthly basis

According to Fitz-Gibbon & Morris (1987), the recommended sample size for the number of citizens stated above is approximately 350.

Population	Sample
50 or less	50 or less
500 or less	approx. 200
1,000 or less	approx. 275
10,000+	approx. 350
Entire country population	2,000 to 4,000

Table 3.2 Sample Size Determination

3.7 Research Instrument

For purposes of gathering information, two questionnaires were created to collect the necessary information regarding the use of mobile technology in revenue collection. The first questionnaire i.e. survey questionnaire was used to collect data for purposes of the application's design. The second questionnaire i.e. user testing questionnaire was used to gauge the usability of the application .The questionnaires had both closed-ended questions and open-ended questions. Some of the closed ended questions required a citizen to answer based on a scale (i.e. excellent, good, average and poor) while the rest of the questions were answered on a yes or no basis. Interviews were also used in the collection of data. This instrument was used alongside the questionnaire so as to ensure holistic collection of data.

3.8 Validity

According to Teijlingen& Hundley (2001), the following pilot study procedures can used be improve validity of a questionnaire:

i. Administer the questionnaire to pilot subjects in exactly the same way as it will be administered in the main study.

ii. Ask the subjects for feedback to identify ambiguities and difficult questions.

iii. Record the time taken to complete the questionnaire and decide whether it is reasonable.

iv. Discard all unnecessary, difficult or ambiguous questions.

v. Assess whether each question gives an adequate range of responses.

vi. Establish that replies can be interpreted in terms of the information that is required.

vii. Check that all questions are answered.

viii. Re-word or re-scale any questions that are not answered as expected.

ix. Shorten, revise and, if possible, pilot again.

3.9 Reliability

The consistency of the questionnaires was tested by asking questions in more than one way during the pilot study. The different responses were juxtaposed so as to identify looming inconsistencies in the questionnaire. The pre-test was conducted in the same geographical location so as ensure all questions were refined in a uniform manner.

3.10 Piloting

5 randomly selected respondents subjected the questionnaire to pretesting during a pilot survey. The pre-test was conducted in the same geographical location so as ensure all questions were refined in a uniform manner.

3.11 Data Collection Procedure

A preliminary survey was first conducted by the researcher so as to examine how citizens ordinarily make their payments at the relevant county offices. This provided the researcher with a better perspective of how revenue is usually collected on a practical level.

The researcher then used the survey questionnaire to collect data regarding the best ways to design the application so as to optimize efficiency. This questionnaire was used before the development of the system. The user testing questionnaire was used to collect data regarding the usability of the application. This questionnaire was used after the application was developed. Informal interviews were used alongside both questionnaires with the aim of capturing data that could not be captured in the questionnaires.

3.12 Ethical Measures

The researcher conducted the research in accordance with the standing Laws in Kenya. All participants of the study were fully aware of the purpose of the study and consequently gave their consent willingly. The confidentiality of the participants was key in this study and was maintained at all times.

3.13 Data Analysis Procedures

After collection and compilation of data, the analysis of the questionnaires was done with the help of a program called Statistical package for Social Sciences (SPSS) along with Microsoft Excel.

3.14 Conclusion

This chapter has conclusively detailed the methods and procedures employed in order to collect data for the study. It includes the following sections: research design, study variables, location of the study, target population, sampling strategies, research instruments, validity, reliability, piloting, data collection procedure, ethical measures, and data analysis procedures.

CHAPTER 4: RESULTS AND FINDINGS

4.1 Introduction

This section presents the results obtained from the findings of this study. Questionnaires were used in this research study to gather data on the use of a mobile application to make relevant local authorities payments and consequently obtain the usage patterns by different users.

The target population was 357 Kenyan citizens from 17 constituencies.147 out of the 357 were unreachable. This was due to limited timing and lack of enough resources. Therefore the response rate was 58.8% responses against 41.2% .According to Baruch (1999), a response rate of 50% and above is acceptable.

4.2 Challenges Faced While Making Council Payments Currently

This section was addressed by citizens who participated in the survey questionnaire. A majority of the respondents cited the lack of efficiency as the major challenge they face during payment of their relevant charges. This represented 55% of the respondents.32% of the respondents cited lack of adequate payment channels as a challenge they faced when making payments.10% of the respondents gave other reasons for their challenges.3% of the participants were non – responsive.

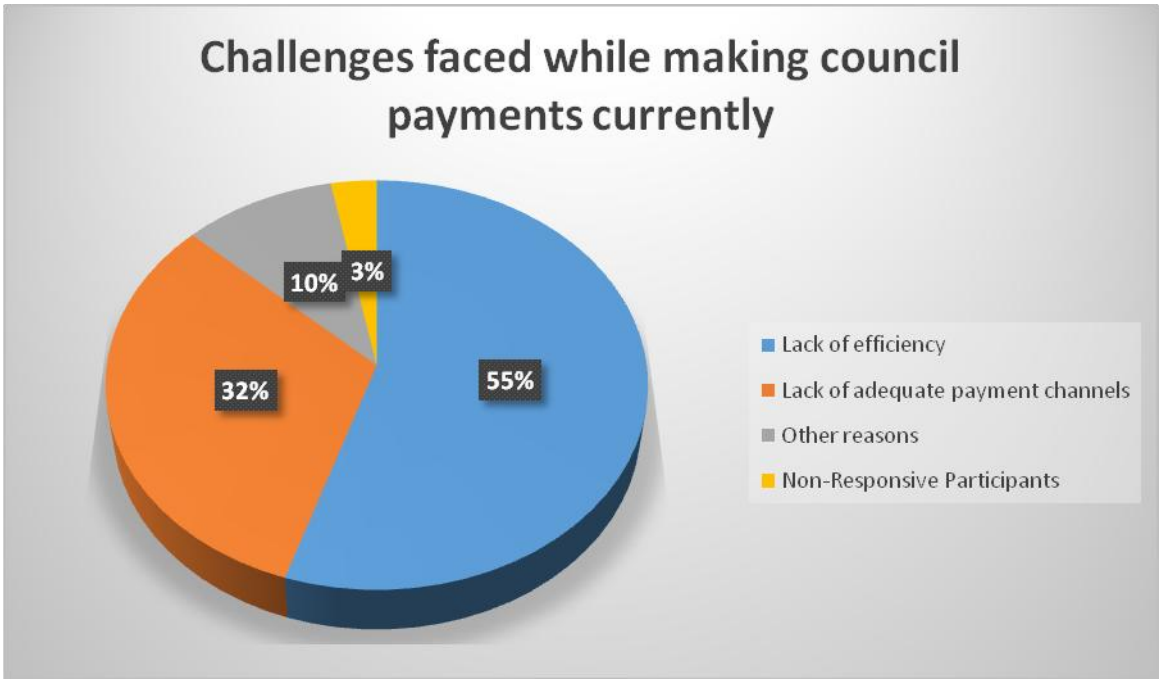

Figure 4.1 Challenges Faced By Citizens While Making Council Payments Currently

The table 4.1 is tabular representation of challenges users currently face when making council payments.

Response	Frequency	Percentage
Lack of efficiency	116	55
Lack of adequate payment channels	67	32
Other reasons	21	10
Non-Responsive Participants	6	3

Table 4.1 Challenges Faced By Citizens While Making Council Payments Currently

4.3 Ways Respondents Preferred To Make Council Payments

This section was addressed by citizens who participated in the survey questionnaire.46% of the respondents preferred to make their council payment with the use of a mobile application.33% of the respondents preferred to use banks to make their council payments. The remaining 21% preferred council offices for their payment.

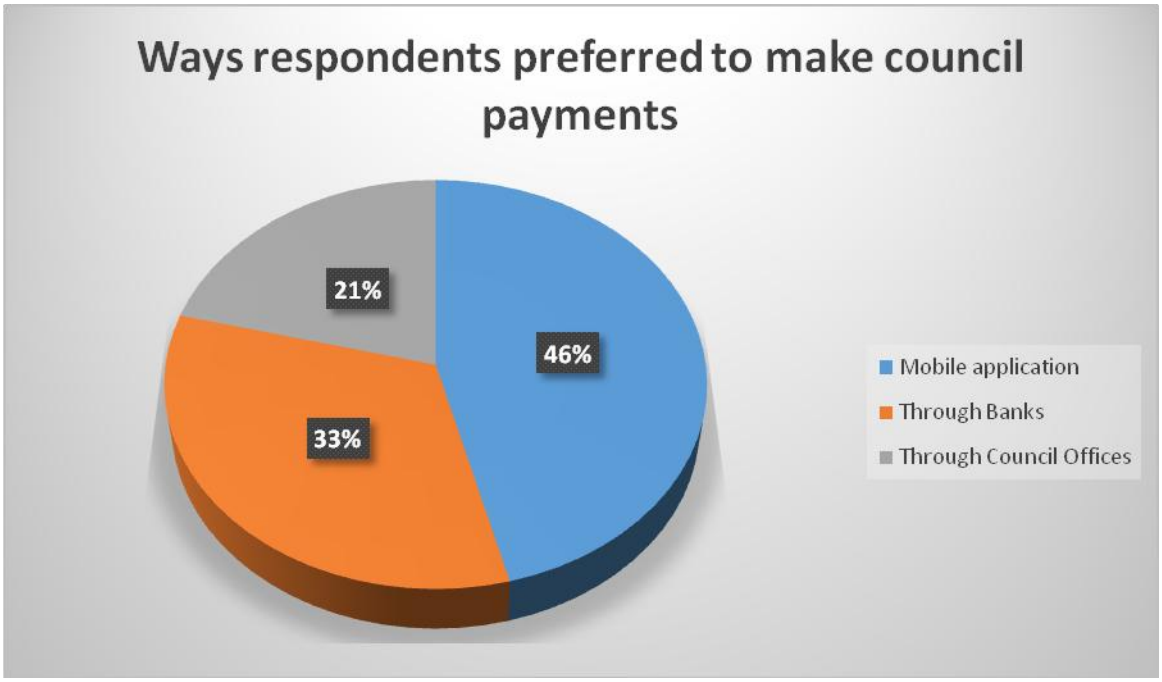

Figure 4.2 Ways Respondents Preferred To Make Council Payments

The table 4.2 is tabular representation of the methods users prefer when it comes to payment of council fees.

Response	Frequency	Percentage
Mobile Application	97	46%
Through Banks	69	33%
Through Council Offices	44	21%

Table 4.2 Ways Respondents Preferred To Make Council Payments

4.4 Queuing Duration at the County Desks

This section was addressed by citizens who participated in the survey questionnaire. Its purpose was to determine the duration citizens queued for before receiving services from county council desks.7% of the respondents queued at council offices for 0 – 15 minutes. 13% of the respondents queued at council offices for 15 – 30 minutes. 10% of the respondents queued at council offices for 30 – 45 minutes.70% of the respondents queued at council offices for over 45 minutes.

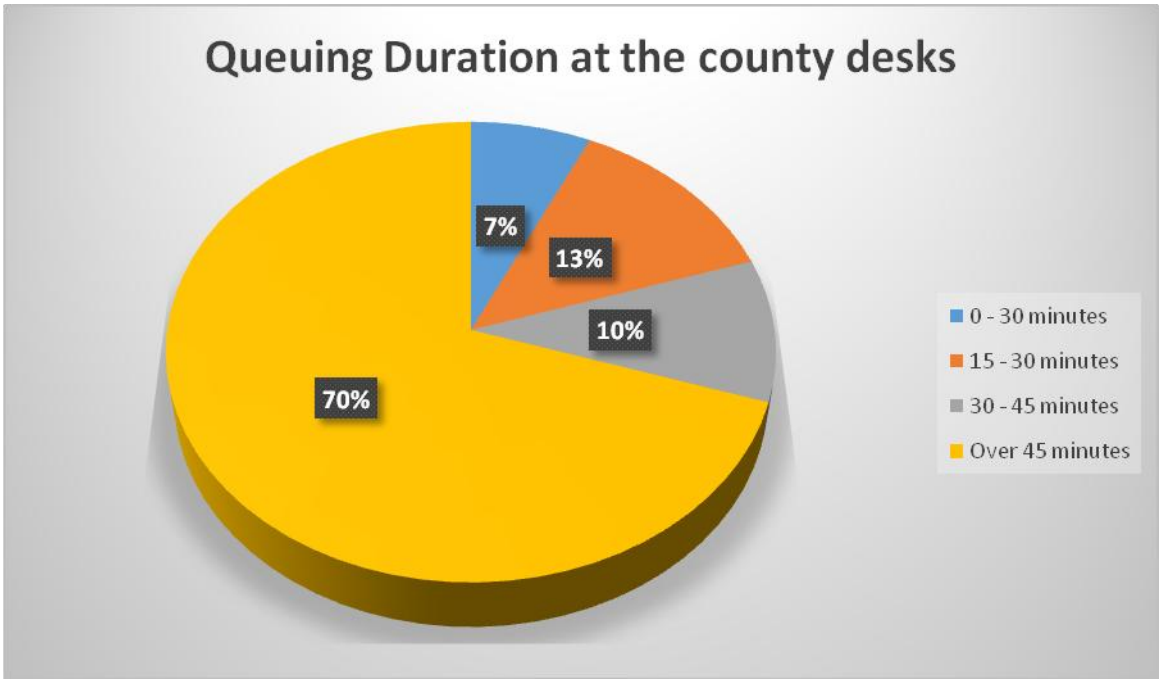

Figure 4.3 Queuing Duration at The County Desks

The table 4.3 is tabular representation of the queuing duration at county desks when it comes to payment of council fees.

Response	Frequency	Percentage
0 – 15 minutes	15	7%
15 – 30 minutes	27	13%
30 – 45 minutes	21	10%
Over 45 minutes	147	70%

Table 4.3 Queuing Duration at the County Desks

4.5 Bribing

This section was addressed by citizens who participated in the survey questionnaire.98% of the respondents had previously given bribes as to ensure their payments were processed faster. Only 2% claimed they had never given bribes in order to procure faster payment processing.

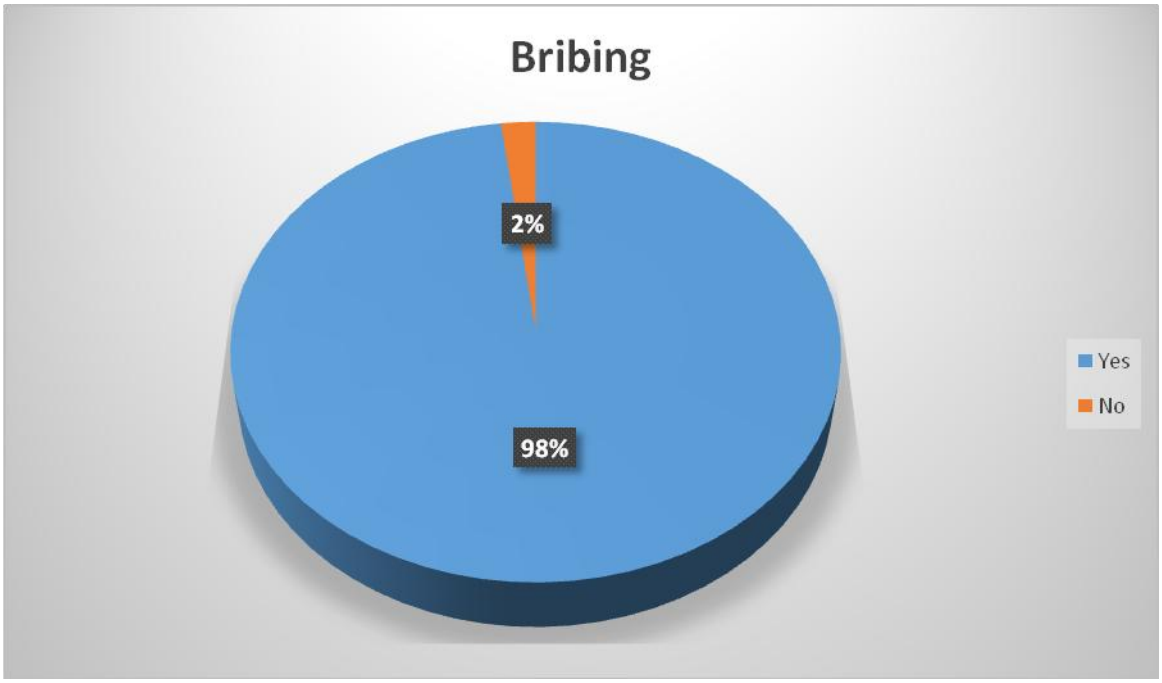

Figure 4.4 Bribing

The table 4.4 is tabular representation of the users prefer bribing when it comes to payment of council fees.

Response	Frequency	Percentage
Yes	206	98%
No	4	2%

Table 4.4 Bribing

4.6 Errors in Council Payment Processing

This section was addressed by citizens who participated in the survey questionnaire.54% of the respondents claimed that previously, errors had been made when their when their payments were being processed by council officials.46% of the respondents claimed that previously, no errors had been made when their payments were being processed by council officials.

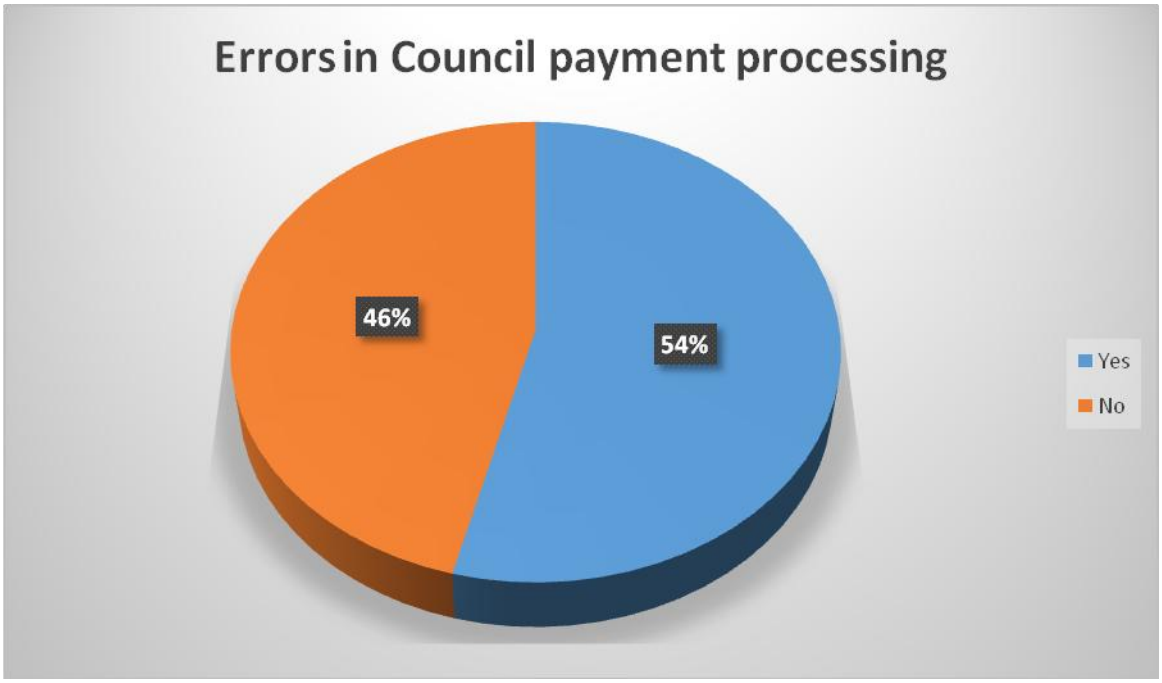

Figure 4.5 Errors in Council Payment Processing

The table 4.5 is tabular representation of the errors in payment processing when it comes to payment of council fees

Response	Frequency	Percentage
Yes	133	54%
No	97	46%

Table 4.5 Errors in Council Payment Processing

4.7 Length of Council Payment Procedures

This section was addressed by citizens who participated in the survey questionnaire.83% of the participants believe the current process of making council payments was too long.17% believed that the process was not too long.

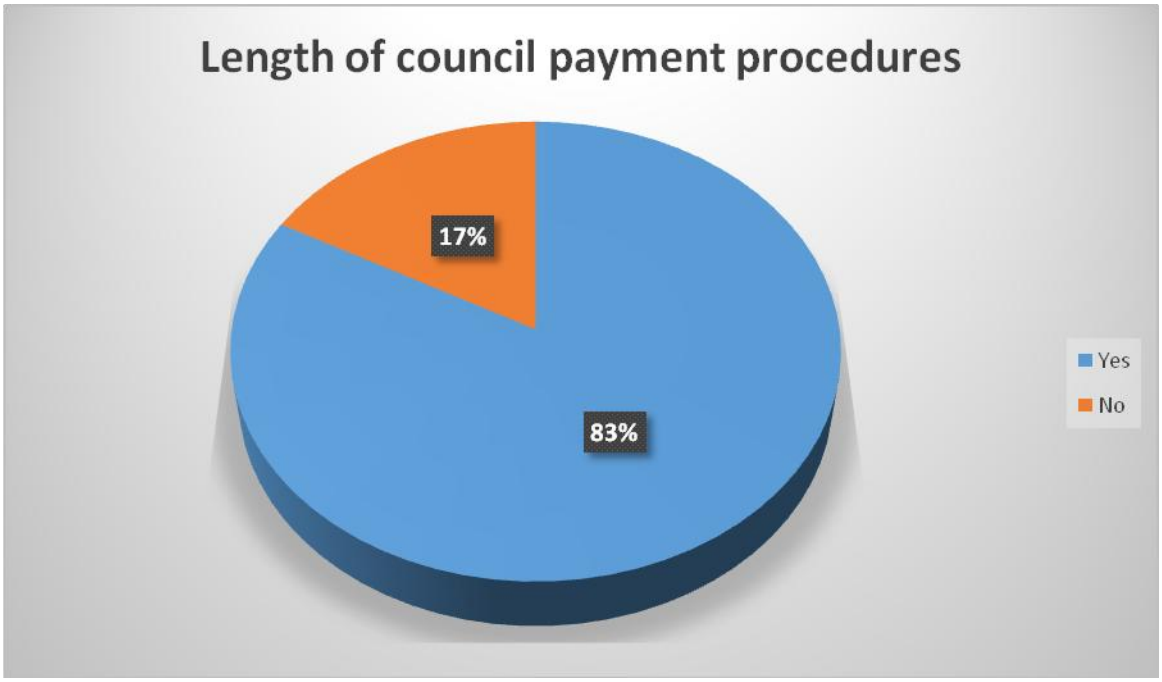

Figure 4.6 Length of Council Payment Procedures

The table 4.6 is tabular representation of the length of council procedures when it comes to payment of council fees.

Response	Frequency	Percentage
Yes	174	83%
No	36	17%

Table 4.6 Length of Council Payment Procedures

4.8 Usage of Mobile Money Platforms

This section was addressed by citizens who participated in the survey questionnaire. Its purpose was to determine the frequency of mobile money platforms by citizens when making different payments for goods and services .37% of the respondents use mobile money platforms on a daily basis. 51% of the respondents use mobile money platforms on a weekly basis. 11% of the respondents use mobile money platforms on a monthly basis. 1% of the respondents had never used mobile money platforms to make any payments.

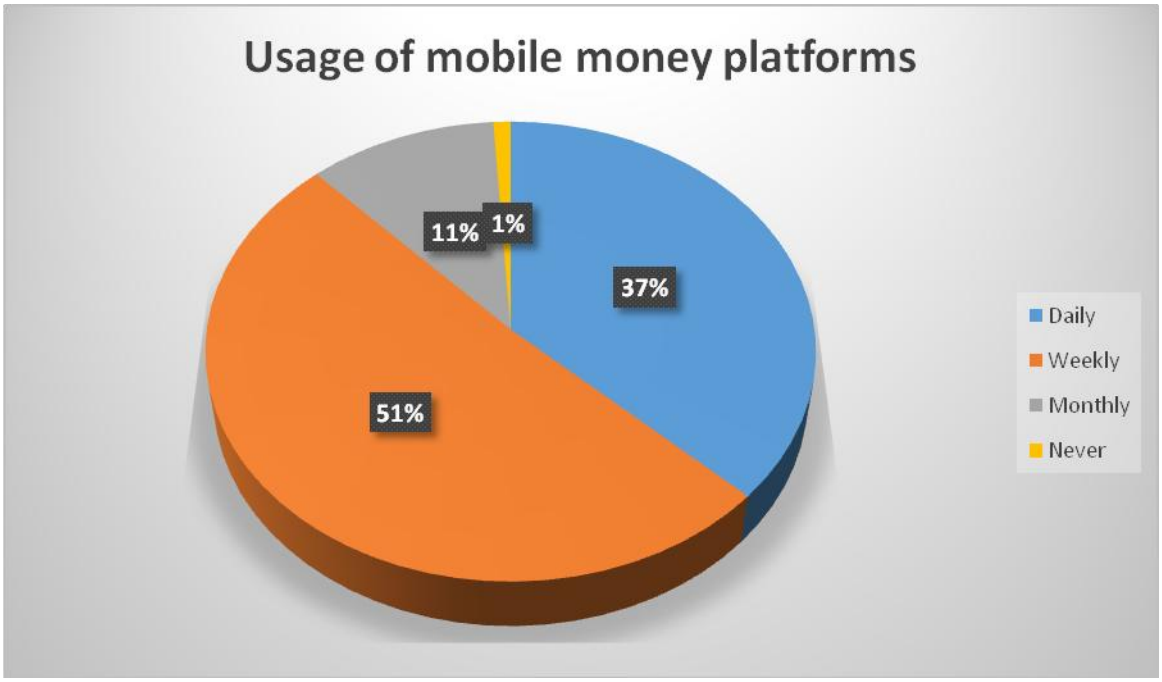

Figure 4.7 Usage of Mobile Money Platforms

The table 4.7 is tabular representation of the methods users prefer when it comes to payment of council fees

Response	**Frequency**	**Percentage**
Daily	78	37%
Weekly	107	51%
Monthly	23	11%
Never	2	1%

Table 4.7 Usage of Mobile Money Platforms

4.9 Presence of Additional Parking Packages

This section was addressed by citizens who participated in the survey questionnaire. Its purpose was to determine whether the addition of an hourly package for parking payments would be suitable for citizens.93% of the respondents said yes.7% of the respondents said no.

Figure 4.8 Presence of Additional Parking Packages

The table 4.8 is tabular representation of the presence of parking packages when it comes to payment of council fees.

Response	Frequency	Percentage
Yes	195	93%
No	15	7%

Table 4.8 Presence of Additional Parking Packages

4.10 Summary

The findings deduced from the data collected suggest that most of the respondents were interested in using a mobile application to make their payments due to the efficiency and ease of use involved. These findings show the willingness of the public to adopt mobile technology and reveal the remarkable potential of this research regarding revenue collection improvement.

CHAPTER 5: SYSTEM DESIGN AND ARCHITECTURE

5.1 System Architecture

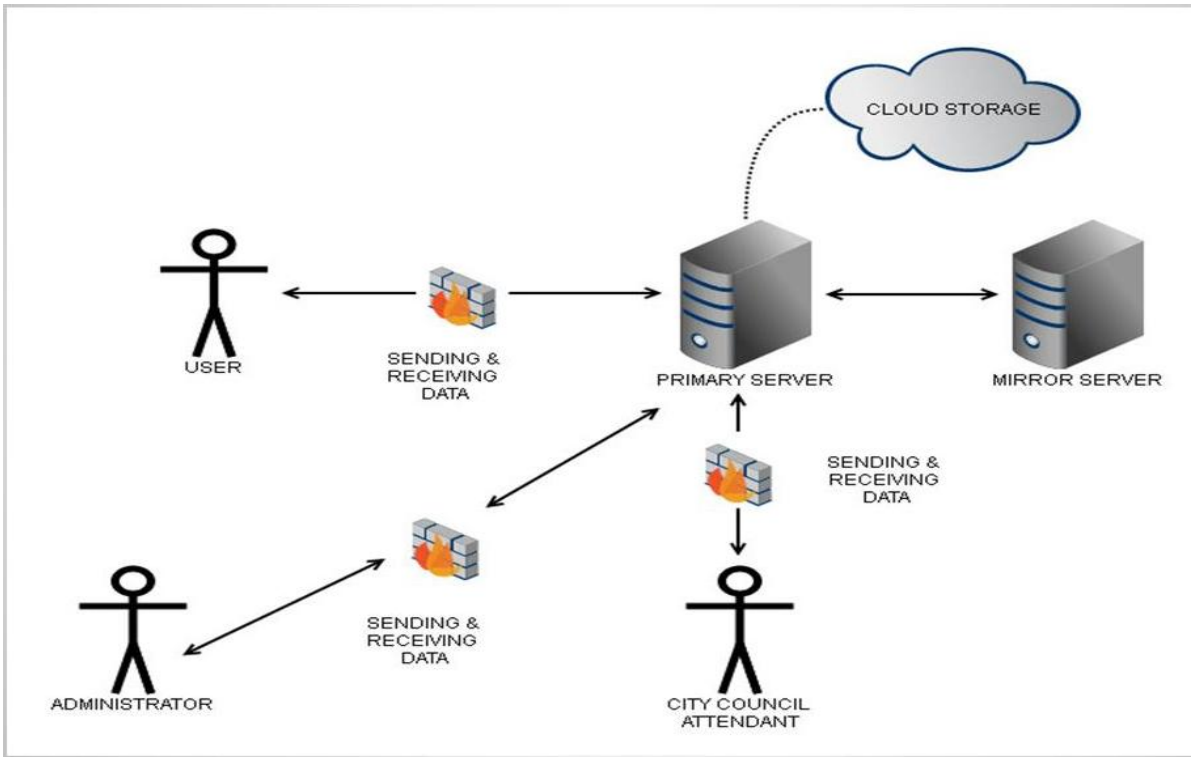

Figure 5.1 System Architecture

Based on the analysis from previous architectures of past applications, the developed m-county application was based on a client server architecture model where the M-county application composed primary of two components. These are client and server components. The client component composed of mobility devises with M-county mobile application accessing the remote server via an API that allows data to be send to and from the remote server. The citizen interacts with mobile application to request and pay for various county services. The client accesses the server via an internet connection to retrieve and post data to the database in the primary server which hosts the backend of the application. The server component comprises of a primary server which runs a web server, database server, mirror server for redundancy storage and cloud storage for backups.

5.2 System Analysis and Design

The system design and Analysis is a step-by-step definition of how the system will operate, meeting the user's requirements.

The phase considers the following:

- Transformation of the functional specifications of the system into a physical structure of the new system.
- To develop a hierarchy of programs within each module and the interface between modules.
- To meet functional and non-functional requirements.

UML refers to unified modelling language and it is a standardized general purpose modelling language in the field of software engineering. It includes a set of graphical notation techniques to create visual models of software intensive systems. The Unified Modelling Language is used to specify, visualize, modify, construct and document the artefacts of an object oriented software intensive system under development. The UML diagrams used to represent this M-County application are:

I. Use Case Diagram
II. System Sequence Diagrams
III. Entity Relationship Diagram

5.3 Use Case Diagram

This is a behavior diagram that shows the functionality provided by a system in terms of actors, their goals as represented as use cases and any dependencies on those use cases.

In this M-county system there are two main actors the citizen and county admin who can further be given different roles in the system .The main processes in the M-county application are

I. Select Services: the primary actor is the citizen who selects the services he/she wants to pay for
II. Request Bill: the primary actor is the citizen who request for a bill using an identifier
III. View Bill: the primary actor is the citizen who is presented with a bill to pay after inputting the identifier
IV. Manage bills: the primary actor here is the county administrator who can make adjustments to the bills and post bills to citizen

Use Case	**Description**
Use case UC1: Select Services	I. Primary actor: Citizen II. Stakeholders • Citizen

	• County III. Preconditions • The citizen must be registered into the system • The citizen must have been logged into the system IV. Main success scenarios • The citizen loges inn and is authenticated and authorized • The citizen selects the service he/she wants • The citizen is presented with service options V. Frequency of occurrence :this occurs frequently
Use case UC2: Input an Identifier	I. Primary actor: Citizen II. Stakeholders • Citizen • County revenue department III. Preconditions • The Citizen must have been logged inn into the system • The citizen must have selected a service VI. Main success scenarios • The citizen selects a service • The citizen inputs the identifier • The citizen selects service option if any IV. Frequency of occurrence: this process occurs very often
Use case UC3: Request Bill	I. Primary actor: Citizen II. Stakeholders • Citizen

	III. Preconditions • Citizen must have been authenticated and authorized • The citizen must have selected a service • The citizen must inputted an identifier and selected a service option if any IV. Main success scenarios • The citizen inputs an identifier • The citizen presses request bill button • The bill is presented to the citizen V. Frequency of occurrence: this occurs frequently
Use case UC4: View Bill	I. Primary actor: Citizen II. Stakeholders • Citizen III. Preconditions • Citizen must have been authenticated and authorized • The citizen must have selected a service • The citizen must inputted an identifier and selected a service option if any IV. Main success scenarios • The citizen inputs an identifier • The citizen presses request

	bill button • The bill is presented to the citizen V. Frequency of occurrence: this occurs frequently
Use case UC5: Pay bill	I. Primary actor: citizen II. Stakeholders • citizen III. Preconditions • The citizen must have been presented with a bill • The citizen must have confirmed that the bill is okay IV. Main Success scenarios • The citizen inputs an identifier • The citizen presses request bill button • The bill is presented to the citizen • The citizen presses pay button • The citizen is presented with payment options • The citizen pays V. Frequency of occurrence: process occurs often
Use case UC6: Manage customers	I. Primary actor: County admin II. Stakeholders • Citizen • County admin III. Preconditions • The user must have been

	authenticated and authorized • The administrator must have selected administer customers menu IV. Main success scenarios • The county administrator selects administer customers • The county admin is presented with a list of all active customers • The county admin chooses which customer to administer V. Frequency of occurrence: process does not happen often
Use case UC7: Manage Services	I. Primary actor: County admin II. Stakeholders • County • County admin III. Preconditions • The user must have been authenticated and authorized • The administrator must have selected administer servises menu IV. Main success scenarios • The county administrator selects administer service • The county admin is presented with a list of all services • The county admin chooses which service to administer V. Frequency of occurrence: process does not happen often
Use case UC8:Manage Bills	I. Primary actor: County admin II. Stakeholders

	• Citizen • County admin III. Preconditions • The user must have been authenticated and authorized • The administrator must have selected administer bills menu IV. Main success scenarios • The county administrator selects administer customers • The county admin is presented with a list of all bills • The county admin chooses which bills to administer V. Frequency of occurrence: process does not happen often

Table 5.1 Use Case Description of The M-County Application

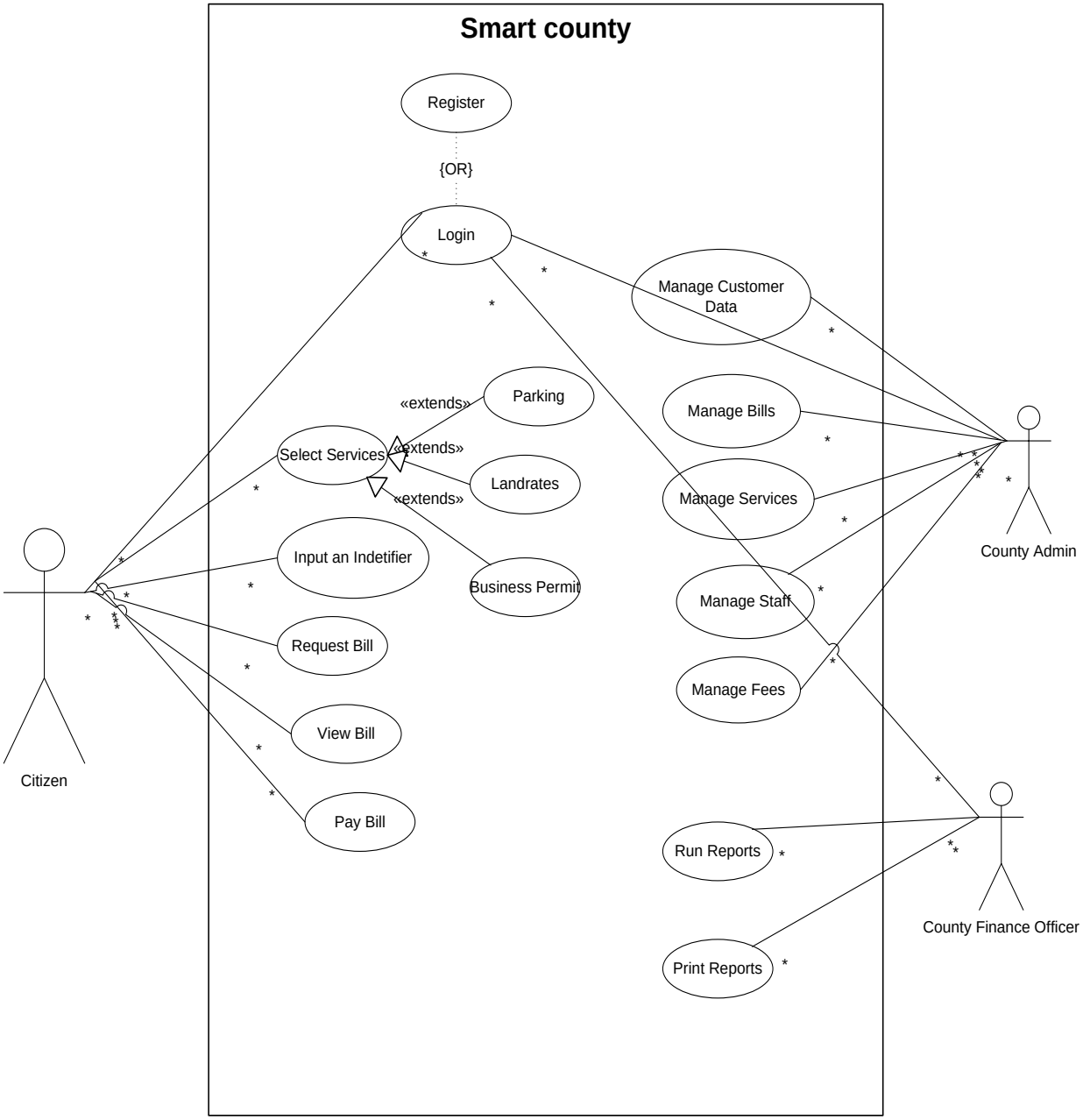

Figure 5.2 Main Use Case Diagram.

5.4 Sequence Diagram

It shows how objects communicate with each other in terms of sequence of messages. In this system the sequence diagram shows the interaction between the different methods within the system and the users.

The sequence diagram shows how clients request for services messages to the system. It also shows the entire request of service process together with the expected feedback from the system. The major entities of this system are:

I. **The citizen**: the citizen registers to the system to access various county services. The citizen selects which services he /she wants and views various options and request for a bill which he/she makes payment using various payment option.

II. **The M-county mobile app**: the m-county mobile application provides the citizen an interface to make the request illustrated in the sequence diagrams hence forms a point of interaction for the citizen with the system.

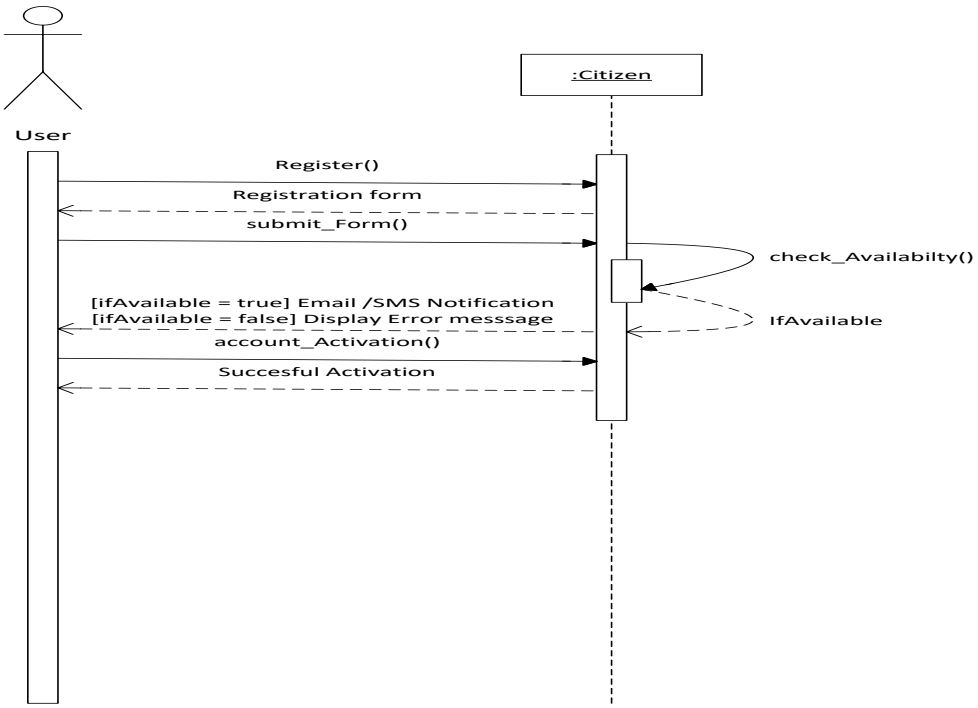

Figure 5.3 Sequence Diagram for the User Registration

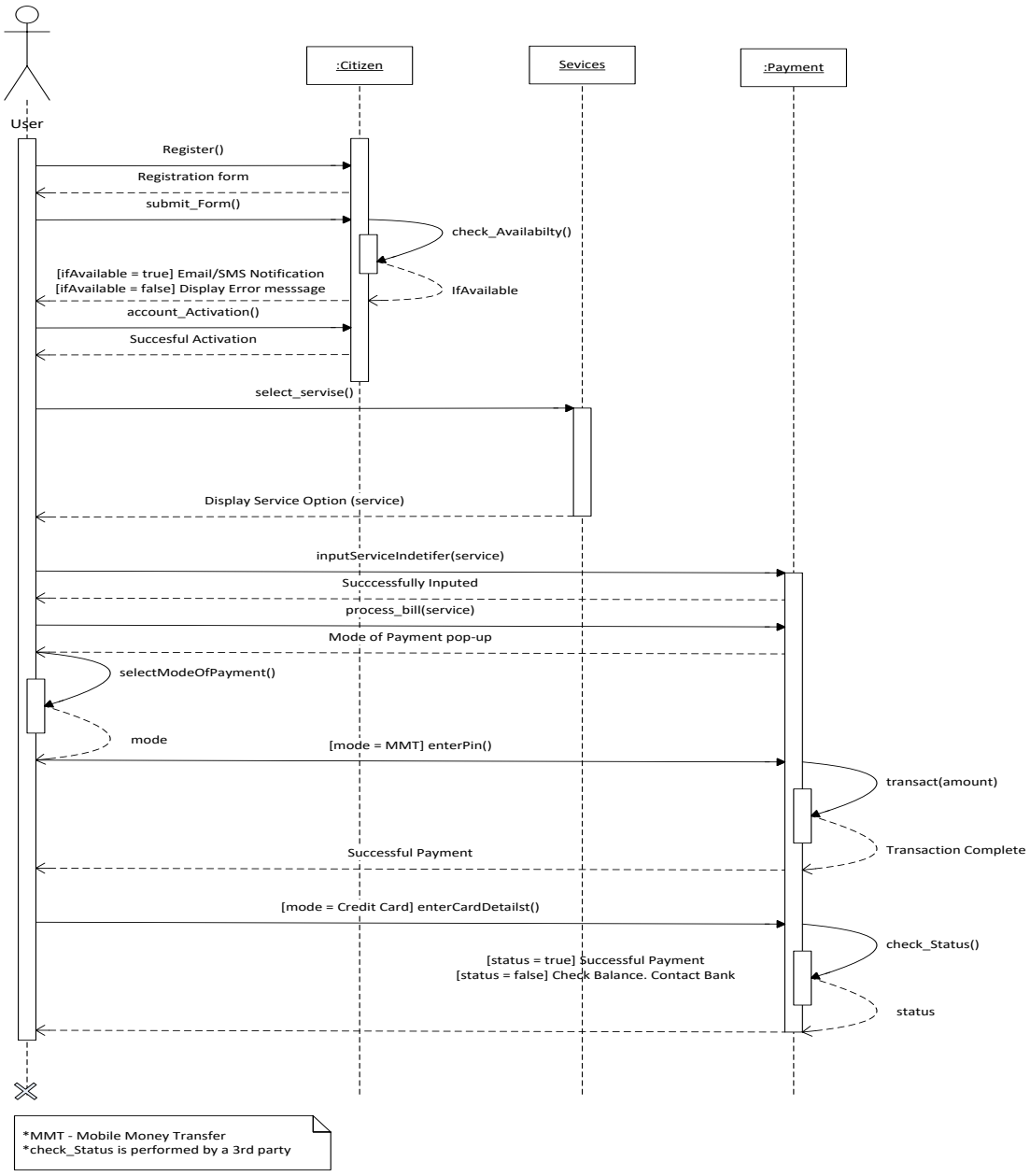

Figure 5.4 Sequence Diagram for Service Request And Payment

5.5 Class Diagram

A class diagram is a structure diagram and it describes the structure of a system by showing the system's classes, their attribute and the relationships among the classes or methods.

In this M-county the class diagram shows the interaction between the different entities of the system and their relationships. The class diagram is as shown below.

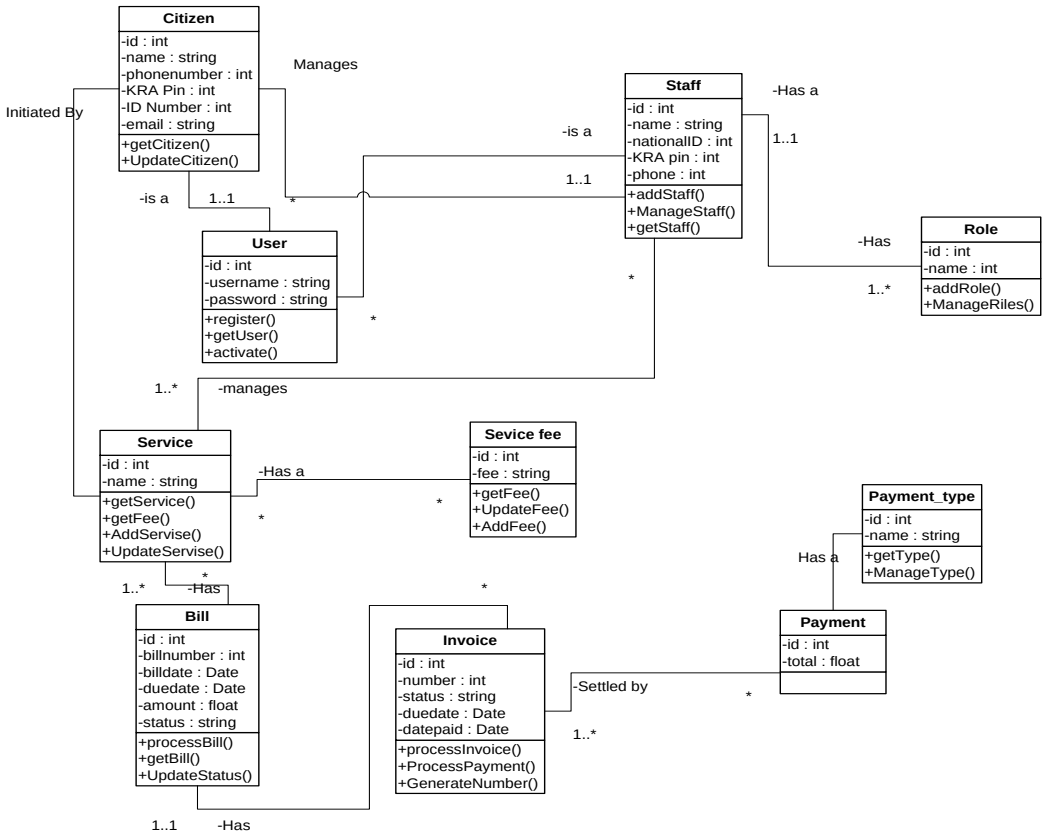

Figure 5.5 Class Diagram

5.6 Database Design

Logical Design

Citizens, who wish to appear in the system, must be registered members. However new citizens are allowed to complete the registration form and submit their details for processing. All this information is stored in the system database. The database is available to store this information in

a consistent manner ensuring easy retrieval of information when required. The database tables are created using My SQL.

Entity Relationship Diagram

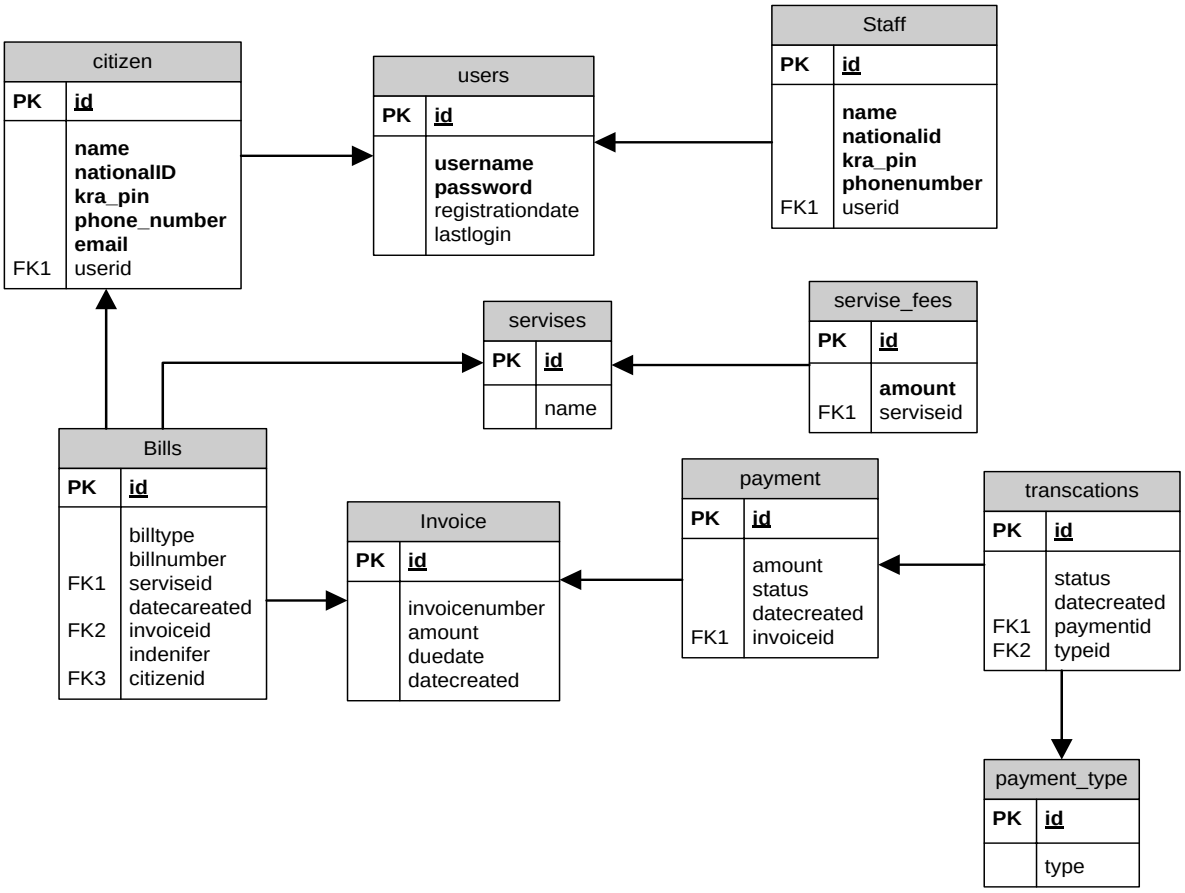

Figure 5.6 Entity Relationship Diagram

5.7 Screen Design

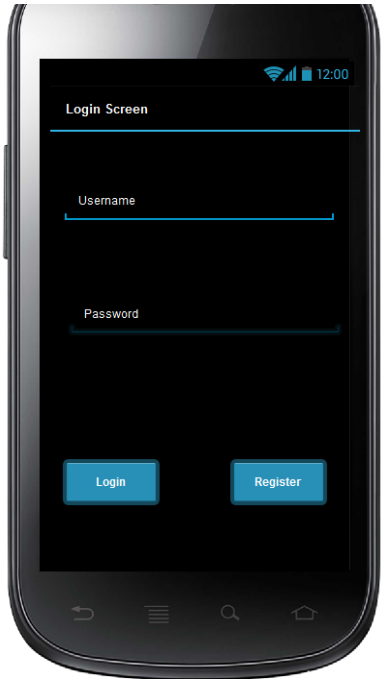

Figure 5.7:Home screen

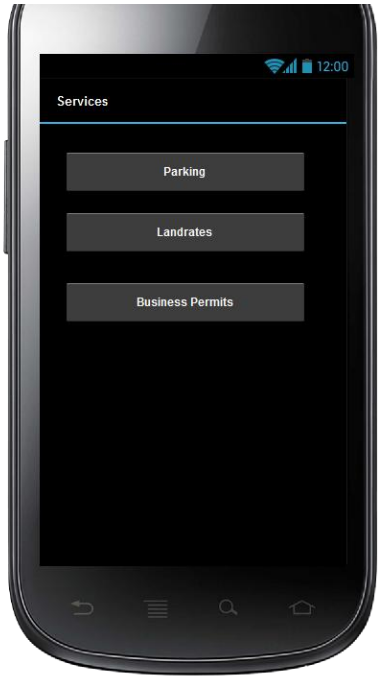

Figure 5.8:Services screen

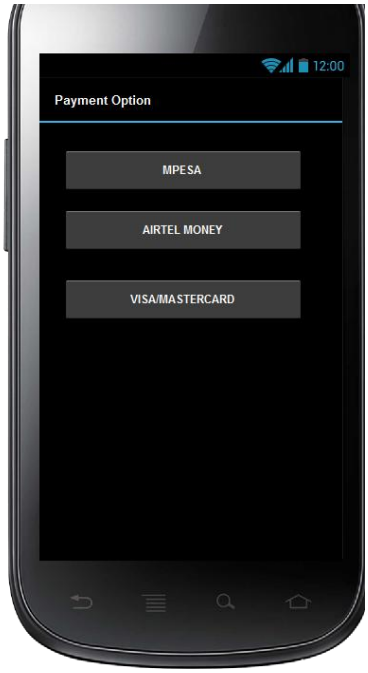

Figure 5.9:Payment options

5.8 Security Design

The data transmitted between the mobile application and the web end must be secured in such a way information cannot be intercepted and modified. Several measures have been put in place to ensure maximum security of the data.

5.8.1.1 Data Security

Any sensitive information such as exam results and timetable that is transmitted from web end to the various mobile applications installed is encrypted. For example, the passwords of all the students and system administrator were encrypted using the MD5 algorithm.

5.8.1.2 Database Security

At the database level, the database management system requires the creation of user and various roles assigned to them. Password expires regularly and users are expected to renew them. Passwords are saved in encrypted form. Finally the webpages are secured to avoid hackers from messing with the information.

5.9 Development

The system was developed to work on mobile and web platforms. The citizen mobile application is currently designed on the android platform which enables installing in a wide variety of android handheld devices. The citizen mobile application provides 2 core modules namely the services and payment module. It is built on the principle of a hybrid application where records are retrieved directly from the application and displayed on a application. PHP and HTML5 technology has been used. While the web end uses PHP and HTML pages. The prototype system is using a MySQL database management system

CHAPTER 6: SYSTEM IMPLEMENTATION AND TESTING

6.1 Introduction

This section describes the implementation of the proposed applications and tests performed on both the mobile and web application. During testing the mobile and web applications were handled as one system because none of them work in isolation.

6.2 Implementation Environment

6.2.1.1 Mobile Application Prototype

The mobile application was implemented on the Android operating system. The source code was written in Java, utilizing Android classes. The application was compiled and tested using the Android Software Development Kit (SDK) emulator and Huawei ideos U8150. The application is optimized for Android version 4.3(API 18) that allows compatibility with higher versions. JSON was used as the web service that provides the interface between the Android application and the database.

6.2.1.2 Web Application

The web application was developed using the Yii framework based on PHP. The website is hosted on an online Apache HTTP server.

6.2.1.3 System Components

The main system components of the mobile revenue collection application are:

6.2.1.3.1 Application Login

To gain access to the application users have to login using a username and password. In order to get login credentials the administrator needs to register a user and provide the login credentials. Registration of users is done using the web application. For each login, the username and password are validated to ensure security and prevent unauthorized access. Figure 6.1 shows the login screen for the mobile application.

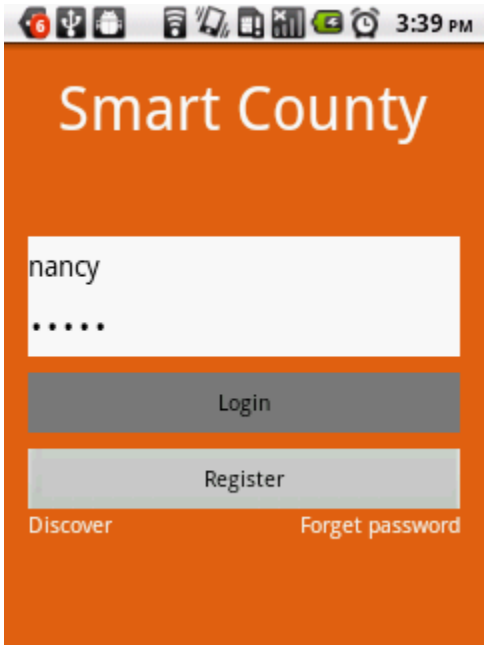

Figure 6.1: Mobile login

6.2.1.3.2 Main Menu

This screen as shown in Figure 6.2 contains six items: parking, landrates, market fees, single business permit, cess and municipal owned housing. When a menu options is clicked, it redirects a user to a screen to pay for a particular county service using a certain unique reference to the user.

Figure 6.2:Mobile main menu

Payment options

To make payment one is presented with various payment options that a county accepts. In order to make payment a user selects payment he or she wishes to use and is prompted for their security pin and money is deducted automatically from their account.

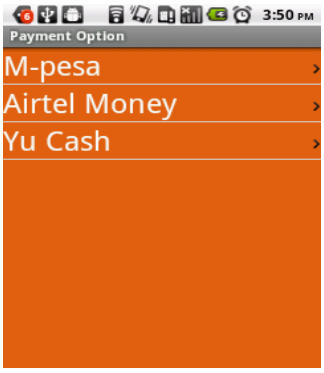

Figure 6.3:Payment Options

6.2.1.4 Web Application

The web application receives and retrieves information sent by the revenue management mobile application to the database. It resides in the HTTP web server and linked to the revenue management database. Due to screen size and memory limitations of mobile phones, the web application is largely used to generate and view reports. It is also used for graphical data representation.. To enhance usability search and sorting functionality are provided for each report.

6.2.1.4.1 System Components

The main system components of the solution web application are:

6.2.1.4.2 Login

To gain access to the web application users have to login using a username and password. The username and password is authenticated and verified then access is granted or denied. This prevents against unauthorized access.

6.2.1.4.3 User Management

This system component is used to ensure secure access for both the mobile and web application. It offers used management by providing interfaces for adding a new user, managing user roles and levels, managing resources and also activating or deactivating a user. The screen shot for user management is provided in Figure 6.4

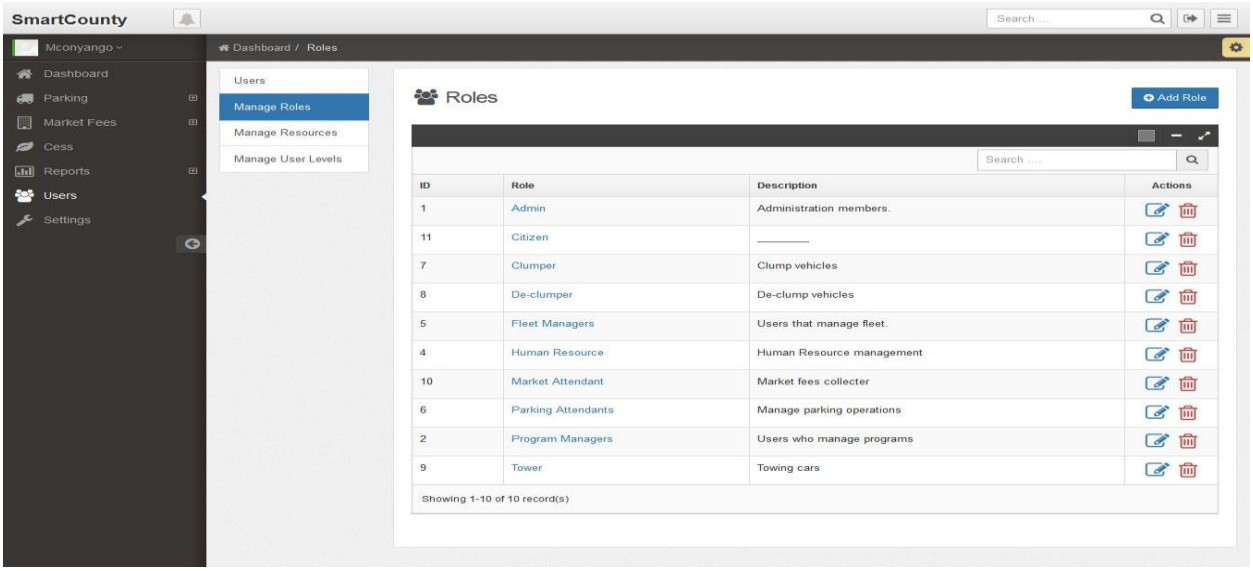

Figure 6.4: User management

6.2.1.4.4 Graphical Representation

This system component generates graphs based on revenue collection information. The graphs are very helpful in decision making as they offer clear visualization of data. Sample graphs are shown below in Figure 6.5

Figure 6.5: Graphical representation

6.3 System testing

6.3.1.1 Compatibility Testing

This test was done to ensure that the mobile and web applications are compatible with the available platforms. The mobile application was tested against the available Android versions while the web application was tested against the available web browsers commonly used.

6.3.1.2 Android Platform Compatibility Testing

Compatibility test conducted for each of the available Android platforms is shown in Table 6-1 below.

Android Platform	**Compatible**
Android 8(2.2)	Yes
Android 9 (2.3.1)	Yes
Android 10 (2.3.3)	Yes
Android 11 (3.0)	Yes
Android 12 (3.1)	Yes
Android 13 (3.2)	Yes
Android 14 (3.3)	Yes
Android 15 (4.0.3)	Yes
Android 16 (4.1.2)	Yes
Android 17 (4.2)	Yes

Table 6.1:Android Platform Compatibility Test

6.3.1.3 Web Browser Testing

Web application testing on commonly used browsers is shown below in Table 6-2

Browser types	**Compatibility**
Firefox (version 8.0 and above)	Yes
Chrome (All versions)	Yes
Internet Explorer (versions 4 and above)	Yes

Table 6.2: Web Browser Test

6.3.1.4 User testing

This section was addressed by citizens who participated in the user testing questionnaire

6.3.1.4.1 Age Bracket

This section was addressed by citizens who participated in the user testing questionnaire. 68% of the participants in the research fell in the 20 – 30 years age bracket and hence represented the highest age bracket.15 % of the participants fell in the 31 – 40 years age bracket.11% of the participants fell in the over 40 years age bracket.6% fell in the below 20 years age bracket. The age results are represented diagrammatically in the pie chart below:

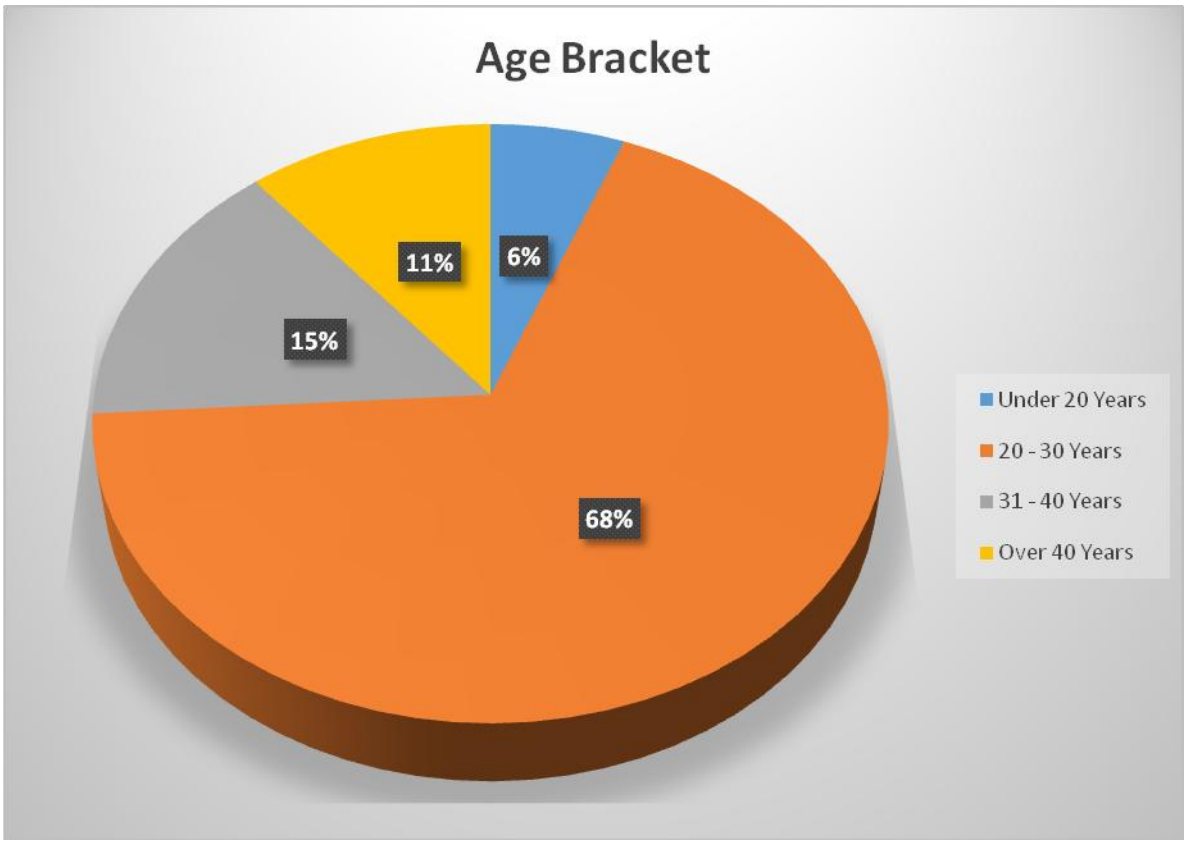

Figure 6.6 Age Brackets of The Participants

The table 6.3 is tabular representation of the age bracket data

Response	Frequency	Percentage
>20 years	13	6
20 – 30 years	143	68
31 – 40 years	32	15
> 40 years	23	11

Table 6.3 Age brackets of the participants

6.3.1.4.2 Occupation of the Respondents

This section was addressed by citizens who participated in the user testing questionnaire .61% of the respondents of this study were students.22% of the respondents and 24% of the respondents were self-employed and employed individuals respectively. Individuals categorized as others represented 8% of the users. The pie chart below, graphically represents the occupation of the application users.

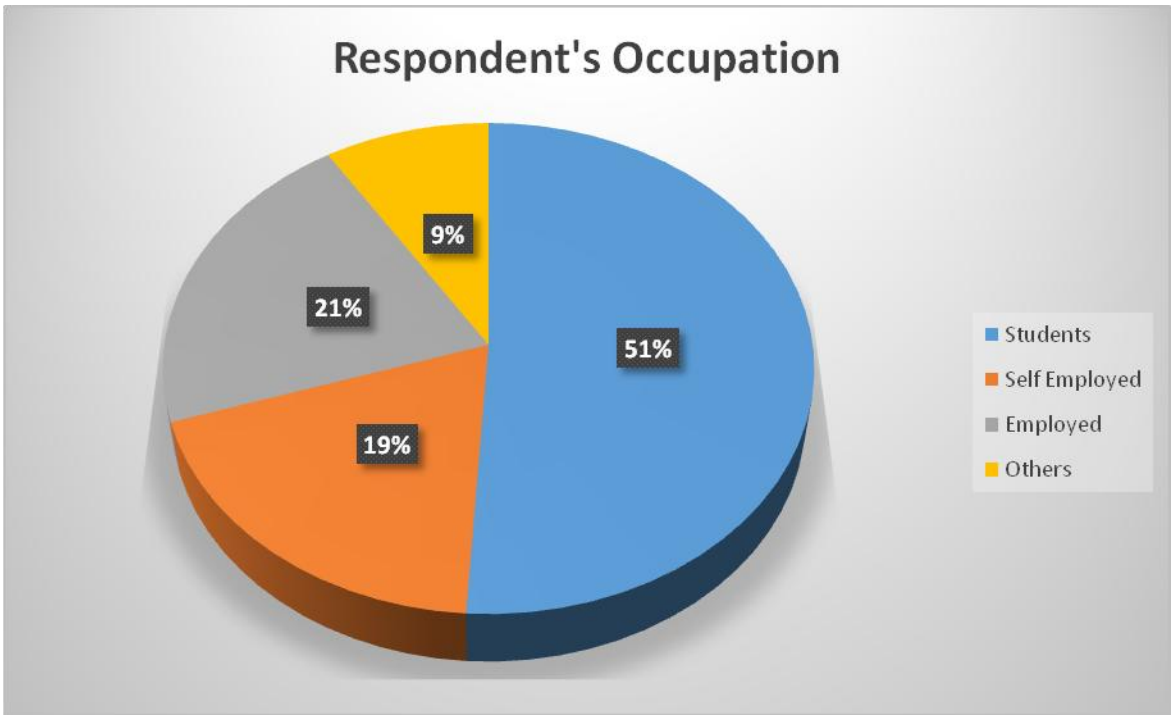

Figure 6.7 Occupation of The Respondents

The table 6.4 is tabular representation of the respondent's occupation data.

Response	Frequency	Percentage
Students	107	51
Employed	44	21
Self Employed	40	19
Others	19	9

Table 6.4 Occupation of The Respondents

6.3.1.4.3 Difficulty in Using the Application

This section was addressed by citizens who participated in the user testing questionnaire .28% of the respondents encountered problems during their first time use of the application. This translates to 59 users. The problems the respondents cited ranged from challenges in mobile application installation to difficulties in application naviagation.72% of the respondents did not encounter any problems during their first time use of the system. This represented 151 users. This data is represented graphically in the pie chart below.

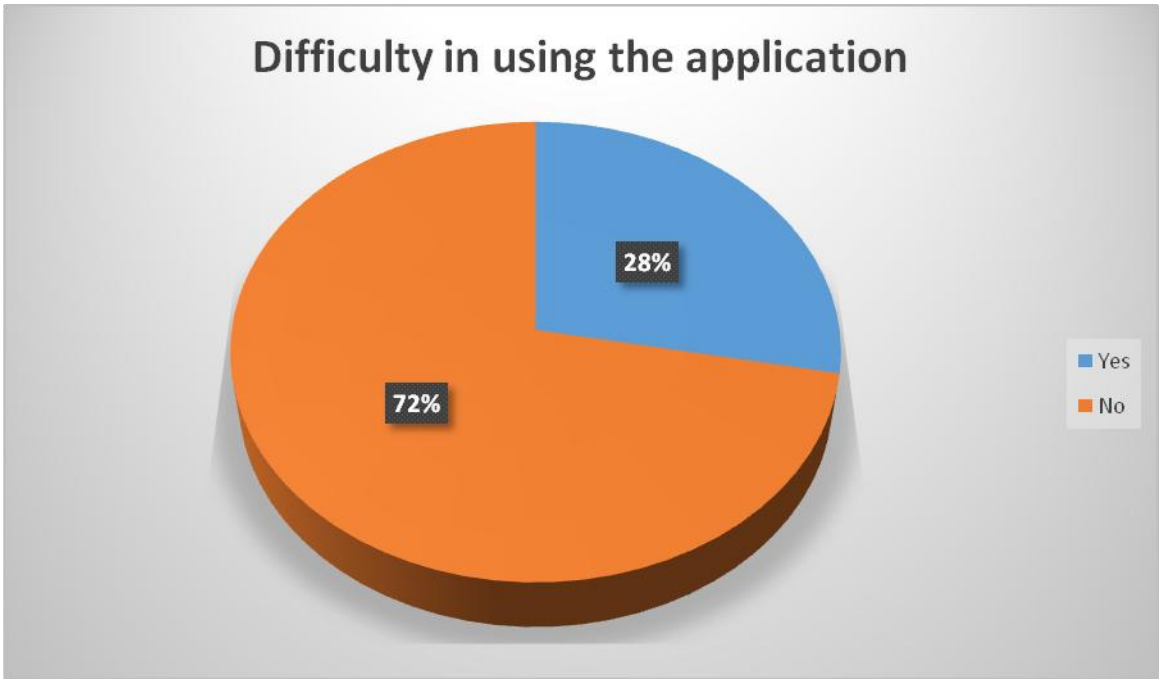

Figure 6.8 Difficulty in Using The Application

The table 6.3 is tabular representation of the users who encountered difficulties during the usage of the system.

Response	Frequency	Percentage
No	59	28%
Yes	151	72%

Table 6.5 Difficulty in Using The Application

6.3.1.5 User's Awareness of Application Status

This section was addressed by citizens who participated in the user testing questionnaire The figure below describes that 71% of the users, i.e. 149 individuals, were aware of the status of the application throughout their interaction with it.19% of the users were unaware of the status of the

application during their interaction.10% of the users were unsure of the application's status during their interaction

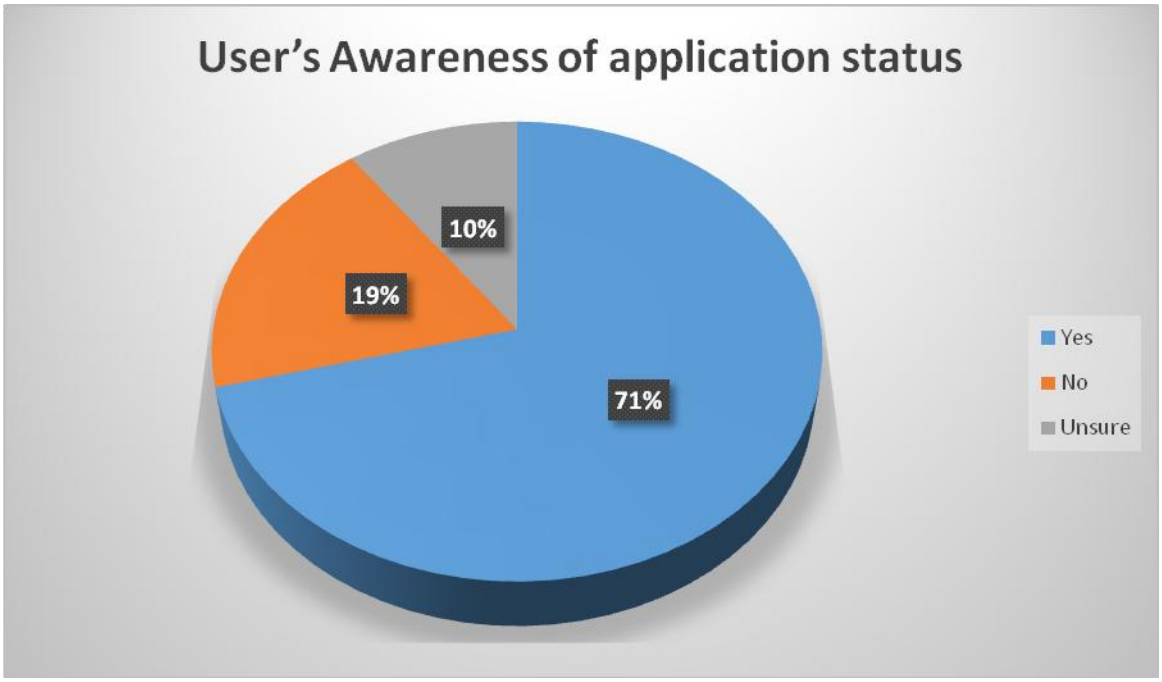

Figure 6.9 User's Awareness of Application Status

The table 6.4 is tabular representation of the users who encountered difficulties during the usage of the system.

Response	Frequency	Percentage
Yes	149	71%
No	40	19%
Unsure	21	10%

Table 6.6 User's Awareness of Application Status

6.3.1.5.1 The Application's Appearance and Feel

This section was addressed by citizens who participated in the user testing questionnaire .54% of the respondents gave the mobile application an excellent rating.31% of the respondents gave the application a rating of good.7% of the respondents gave the application a rating of average.5% of the respondents and 2 % of the respondents gave the application a rating of below average and poor respectively.1% of the participants were non-responsive.

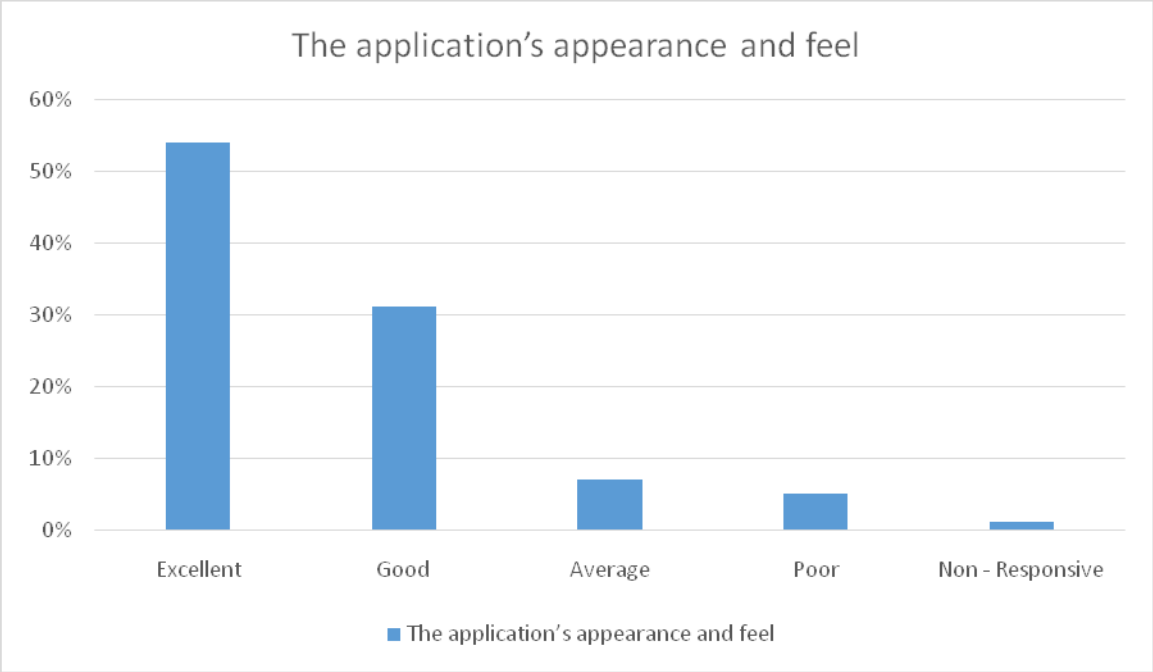

Figure 6.10 The Application's Appearance and Feel

The table 6.5 is tabular representation of user's response to the appearance and feel of the application.

Response	Frequency	Percentage
Excellent	113	54
Good	65	31
Average	15	7
Below Average	11	5
Poor	4	2
Non Responsive	2	1

Table 6.7 The Application's Appearance and Feel

6.3.1.5.2 User Satisfaction Based on the Application's Major Functionalities

This section was addressed by citizens who participated in the user testing questionnaire .On the questionnaire, users were instructed to rate the system based on the following functionalities: The ability to make payments using mobile money platforms, ability to view a user's entire transaction history from the application, ability of the user to choose various payment packages, the system's ability to automatically notify users of charges due based on a set time constraint and the ability of the users to query the amount one is required to pay.

The Table 6.6 summarizes the user's satisfaction based on the application's functionalities

Functionality		5	4	3	2	1	Weighted Average
ability to make payments using mobile money platforms	Frequency	128	53	21	9	0	4.43
	Percentage (%)	61	25	10	4	0	
ability to view a user's entire transaction history from the application	Frequency	103	78	8	19	2	4.24
	Percentage (%)	49	37	4	9	1	
ability of the user to choose various payment packages	Frequency	101	84	15	8	2	4.3
	Percentage (%)	48	40	7	4	1	
the system's ability to automatically notify users of charges due based on a set time constraint	Frequency	90	67	36	11	6	4.07
	Percentage (%)	43	32	17	5	3	
the ability of the users to query the amount one is required to pay	Frequency	36	55	86	19	14	3.37
	Percentage (%)	17	26	41	9	7	

Table 6.8 User Satisfaction Based on The Application's Major Functionalities

The chart below displays the average weighted mean based on the user's assessment of the major functionalities of the application. The functionality that obtained the highest score is the ability to make payments using mobile money with a score of 4.43. The ability of the user to choose various payment packages was second with a score of 4.3. The ability to view a user's entire transaction history from the application was third with a weighted mean score of 4.24.The system's ability to automatically notify users of charges due based on a set time constraint scored 4.07. The ability of the users to query the amount one is required to pay scored 3.37.

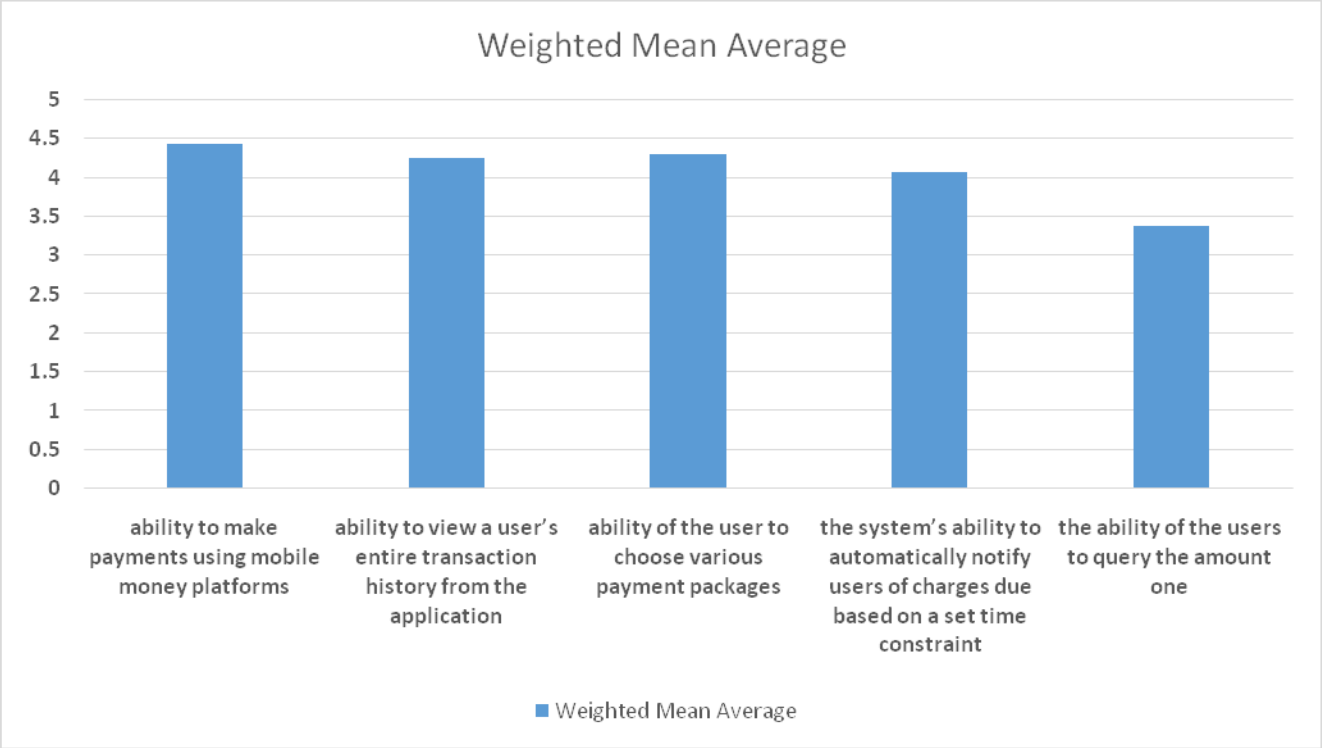

Figure 6.11 User Satisfaction Based on The Application's Major Functionalities

6.3.1.5.3 Application's Usability

This section was addressed by citizens who participated in the user testing questionnaire .52 % of the respondents rated the system as excellent in terms of its usability.25% of the respondents believe the application's usability was good.16% of the respondents rated the application's usability as average.7% of the respondents rated the application's usability as fair.

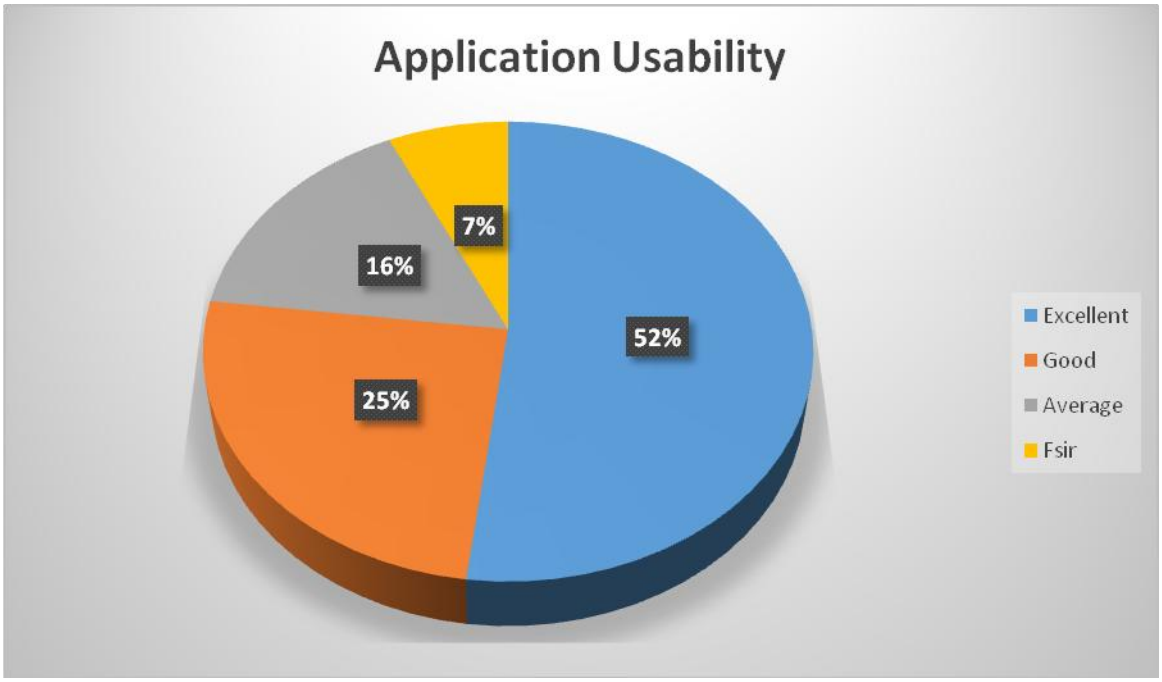

Figure 6.12 Application's Usability

The table 6.7 is tabular representation of the application's usability

Response	Frequency	Percentage
Excellent	109	52
Good	53	25
Average	37	16
Fair	15	7

Table 6.9 Application's Usability

6.3.1.6 Ease of Payment

This section was addressed by citizens who participated in the user testing questionnaire .55% of the respondents believed it was easy to pay for council charges using the application.24% of the respondents rate the ease of payment as average.8% of the respondents felt the payment process was difficult.13% of the respondents were unable to make a payment using the application.

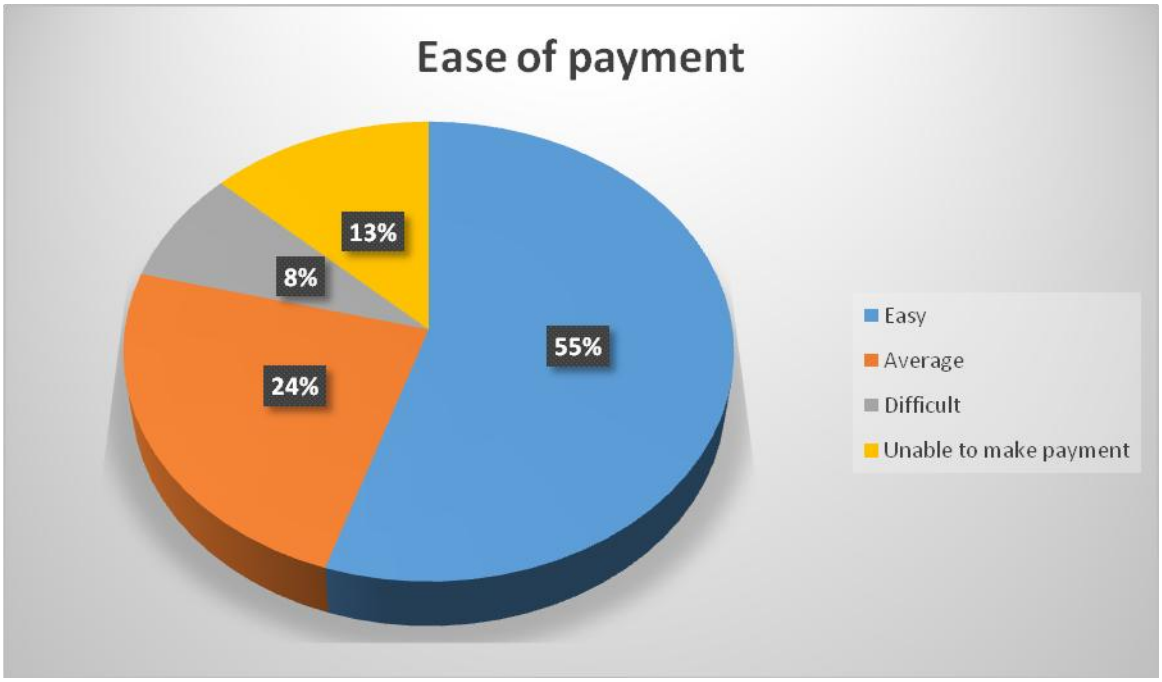

Figure 6.13 Ease of Payment

The table 6.8 is tabular representation of user responses regarding the ease of payment using the mobile application.

Response	Frequency	Percentage
Easy	109	52
Average	53	25
Difficult	37	16
Unable to make payments	15	7

Table 6.10 Ease of Payment

6.3.1.6.1 Overall User Satisfaction

This section was addressed by citizens who participated in the user testing questionnaire .91% of the respondents were satisfied by the application generally. The data collected indicated that only 9% were unsatisfied with the application generally. This indicates that the users sampled generally appreciated the application's functionalities, its appears and feel and its simplistic navigation abilities

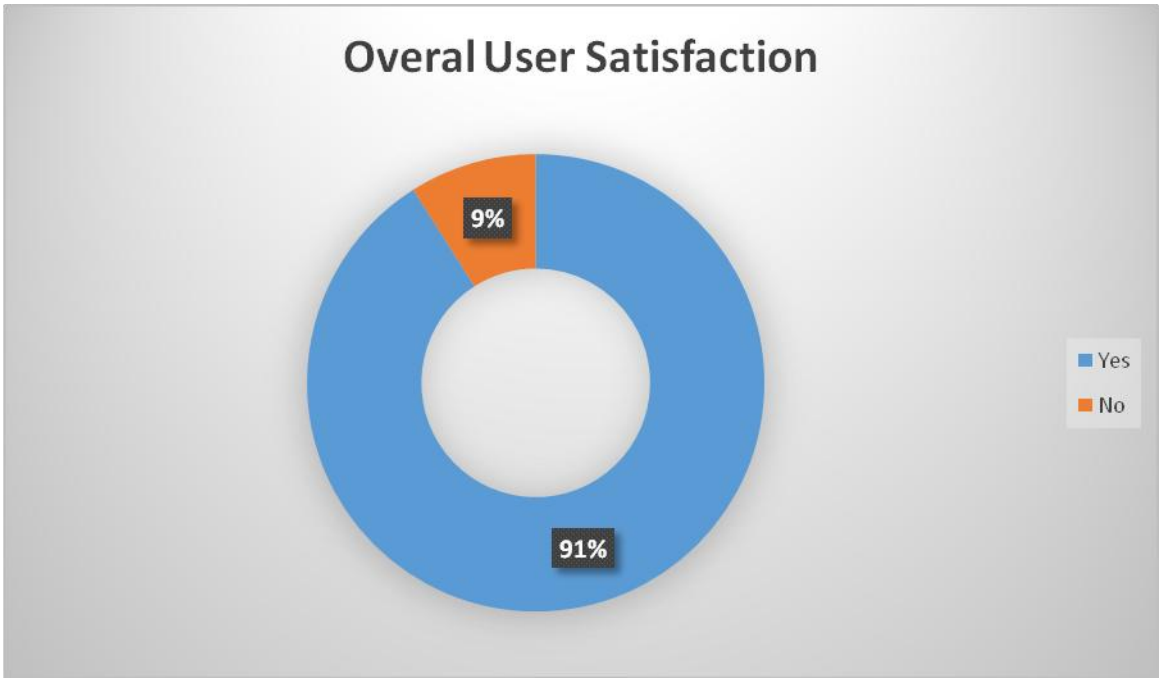

Figure 6.14 Overall User Satisfaction

The table 6.11 is tabular representation of the overall satisfaction experienced by users during their interaction with the system.

Response	Frequency	Percentage
Yes	191	91
No	19	9

Table 6.11 Overall User Satisfaction

6.4 Summary

The findings deduced from the data collected suggest that most of the respondents were ultimately satisfied by the application generally. The respondents expressed joy while interacting with the application. The application's functionalities proved to be adequate enough to serve the needs of the respondents. It was important to note that most of the respondents were interested in using a mobile application to make their payments due to the efficiency and ease of use involved. These findings show the willingness of the public to adopt mobile technology and reveal the remarkable potential of this research regarding revenue collection improvement

CHAPTER 7: DISCUSSIONS

7.1 Introduction

The purpose of the research was to investigate the challenges faced by Kenyan citizens during payment of various county fees in order to identify a suitable technique that will be adopted in an organization facing major challenges in revenue collection and management leading to major losses in revenue in the counties. The research finding helps to identify an appropriate revenue collection technique that was adopted, the challenges faced in payment, collection of revenue and management in order to develop an application that solves these challenges. By providing a mobile and web application for revenue collection and management, revenue collection and management was made easier, accurate and efficient.

Simple random sampling was used in this research targeting a population based in Nairobi. The sample size comprised of 210 respondents. The age group being sampled was between the ages of 18 – 45.Both primary and secondary data collection tools were utilized in the collection of data for purposes of user testing the mobile application. Questionnaires and interviews were essentially used in collection of primary data. The analysis of the findings was done using Microsoft Excel and Statistical Package for Social Sciences.

7.2 Findings and achievements

A review of the literature indicated that the techniques used in revenue collection were a manual where information was stored in files.

The research was conducted at Nairobi County. 68% of the participants in the research fell in the 20 – 30 years age bracket.15 % of the participants fell in the 31 – 40 years age bracket.11% of the participants fell in the over 40 years age bracket.6% fell in the below 20 years age bracket. This suggests that the majority of the respondents who participated in the study are the youth. This group showed great reception of the application mainly due to their willingness to digress into automation. The 31 – 40 years age group showed great promise in adoption of this mobile technology but will need further understanding of the application to facilitate this adoption. The participants who were over 40 years generally showed little enthusiasm towards the application and hence represented the second lowest recording. Individuals who were below 20 years are generally tasked with making council payments and consequently recorded the lowest participation.

61% of the respondents of this study were students.22% of the respondents and 24% of the respondents were self-employed and employed individuals respectively. Individuals categorized as others represented 8% of the users. These findings were expected based on the fact that students are mainly aware of such innovations through the use of social media platforms. They also have adequate information on how access the application based on the same platforms.

A majority of the respondents cited the lack of efficiency as the major challenge they face during payment of their relevant charges. This represented 55% of the respondents.32% of the respondents cited lack of adequate payment channels as a challenge they faced when making payments.10% of the respondents gave other reasons for their challenges.3% of the participants were non – responsive.

The main concern faced by participants is according to the findings of the study is lack of efficiency in the current payment process.

7% of the respondents representing queued at council offices for 0 – 15 minutes. 13% of the respondents queued at council offices for 15 – 30 minutes. 10% of the respondents queued at council offices for 30 – 45 minutes.70% of the respondents queued at council offices for over 45 minutes. These findings show the high level of inefficiency that is currently troubling the council payment processes. These findings indicate that citizens waste a lot of time in queues as they wait for processing off their payments.

54% of the respondents claimed that previously, errors had been made when their when their payments were being processed by council officials. This represented 118 participants.43 out of 118 participants reported errors during registration of their vehicles as were making parking payments. They claimed some parking attendants often entered the wrong number plate as they were issuing them with a parking ticket.56 out of the 118 participants reported errors during the registration of their single business permit.22 out of the 118 participants claimed that they had encountered errors when it came their land rates billing. 46% of the respondents claimed that previously, no errors had been made when their payments were being processed by council officials. These findings were helpful during the designing of the application which aimed at reducing errors encountered through reduction of instances of data entry.

83% of the participants believe the current process of making council payments was too long. This represented 174 of the patricipants.103 out of the 174 participants claimed the land rates payment procedure was too long.53 out of the 174 participants claimed the single business permit registration procedure was too long.15 out of the 174 participants claimed that the parking payment procedure was too long.3 participants believed the market fees payment procedure was too long.17% believed that the process was not too long.These findings were instrumental in determining the how the design of the application can be engineered to make the council payment procedure shorter.

Based on the above mentioned findings a mobile based county revenue collection and management application was designed and developed. It comprises of an Android application and a web application.

91% of the respondents were satisfied by the application generally. The data collected indicated that only 9% were unsatisfied with the application generally and 55% of the respondents believed it was easy to pay for council charges using the application. 24% of the respondents rate the ease of payment as average.8% of the respondents felt the payment process was difficult.13% of the respondents were unable to make a payment using the application.

7.3 Review of Research Objectives in Relation to the Mobile Application

This dissertation identifies the revenue collection techniques and the challenges faced in revenue collection and management from research based on books, journals, websites and user feedback. A mobile and web application was designed and developed with a selected technique from the literature review and results from system analysis. The research objectives acted as a guideline to develop the mobile and web application.

The first objective was to investigate the challenges faced by Kenyan citizens during payment of various county fees. This information was useful as it enabled the researcher to gain an understanding of the challenges that exists hence providing best way to solve this challenges. This objective was achieved use of interviews and a questionnaire provided in Appendix A and B respectively.

The second objective was to review the existing mechanisms used to collect revenue in the counties. This information was useful as it enabled the researcher to gain an understanding of the techniques used and identify the strengths and weaknesses of each technique hence choosing the

best technique to be adopted. This objective was achieved by the review of literature based on the current revenue collection techniques and systems used globally.

The third objective was to design and develop a mobile based solution that collects revenue at counties. This objective was achieved through the design, implementation and testing of the mobile and web application. The mobile application was developed for the Android platform while the web application was developed using the Yii Framework.

The last objective was to test the validity and effectiveness of the application using a qualitative approach. This objective was achieved through testing of the mobile and web application. Compatibility testing where the mobile application was tested against different Android versions and the web application was tested against different web browsers and finally user testing where the aesthetics, user friendliness, application functionality and user acceptance were tested.

7.4 Summary

The findings of this study were able to shed light on numerous key aspects. The most crucial finding was the user's overall satisfaction which is an indication that a majority of the respondents were pleased with the application. Based on the findings, Kenyans lack an efficient platform which can guarantee them easy and efficient ways to pay their council fees. The general feedback of the respondents was that they eager to see such an application rolled out holistically.

In summary the major benefits of the application are:

I. **Easy payment of council payments**: Users can easily make payments using mobile money platforms from the comfort of their phone. This capability is particularly crucial based on the increased use pf platforms such as M-Pesa and Airtel Money.

II. **Payment History**: Users consistency require means to facilitate their financial prudence. More often than not, Kenyans have been forced to rely on annual record keeping in order to manage their expenses. The application consequently allows users to shift from primitive methods of record keeping

III. **Application's appearance**: The application contains appealing color schemes. This is consistent throughout the system. This feature drastically enhances user experience from the get go.

IV. **Difficulty of use**: Based on the research findings, the system can easily be adopted and taught to new users. This aspect is brought about by the ability to easily navigate across the system. Users greatly enjoy the efficiency brought about by this capability.

CHAPTER 8: CONCLUSION, RECOMENDATIONS AND FUTURE WORK

8.1 Conclusions

Information about county revenue collection, tools used and the method used was reviewed. From analysis carried out, the results pointed out that there are major problems in revenue collection and management in the counties.

The result was the development of a mobile based county revenue collection and management both mobile and web application. The key features of the application include: adding new records, revenue management, debt management, payment and reconciliation management and generate reports.

The application was aimed at: increasing revenue collection, easy retrieval of information, improve accuracy in revenue information, creating an easy way of payment for county fees , creating a sense of responsibility and eliminating loopholes in the whole revenue collection cycle.

System testing was performed, look and feel, ease of used, system compatibility and acceptance was done.

8.2 Recommendations

Based on the findings from the research the following recommendations were made:

I. The application should cater for payment of other council other than the ones described in this research. This will increase the user's payment options and make the application more holistic.

II. The application should be upgraded so as to be able to accept other forms of payment such as credit cards. This upgrade will allow the application to facilitate larger payments that are outside the mobile money platform capabilities

III. Based on the feedback received, the application should have a multi-lingual capability that can different users to use the application as effectively as possible. Kiswahili was the most request language alternative by users.

IV. The application can be used to generate further if used as an advertising tool .Different businesses may be required a fee that would allow them to use the application for advertisement. This business model would add on to the revenue generated by the application.

8.3 Suggestions for Future Research

The fundamental aim of this application is to enhance revenue collection. Hence its future goal would to be its implementation not only within Kenyan borders but across Africa as a whole. In order to increase its reach to the citizens, it is important for the application to run on multiple platforms such as Windows, Java and iOS. Aggressive advertising should be implemented in order to increase public awareness on the application. Finally, future research should venture into how the application can be manipulated and optimized for use in other public service delivery initiatives.

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APPENDICES

Appendix A: Survey Questionnaire

This questionnaire is aimed at collecting information on *"use of mobile technology for revenue collection"* The information you give will be of benefit to the researcher in accomplishing an academic goal. You are kindly requested to answer the questions according to the instructions given. Note that there is no right or wrong answer.

(Please Tick √ where appropriate)

1. Name (optional) _____
2. Kindly indicate which age bracket you fall in:
   a) Under 20 years { }
   b) 20 – 30 years { }
   c) 31 – 40 years { }
   d) Over 40 years { }

3. Kindly specify your occupation
   a) Employed { }
   b) Student { }
   c) Self – employed { }
   d) Other

   _____

   _____

4. What challenges do you currently face when making your council payments?
   a) Lack of efficiency { }
   b) Lack of adequate payment channels { }
   c) Other reasons

   _____

   _____

5. Kindly choose the method you would prefer the most when making your council payments:
   a) Through a mobile application { }

b) Through a banks { }

c) Through council offices { }

Kindly specify which payment if you selected (a)

_____

_____

6. How long do you usually queue for on average when making council payments at the relevant council offices?

   a) 0 – 15 minutes { }

   b) 15 – 30 minutes { }

   c) 30 – 45 minutes { }

   d) Over 45 minutes { }

7. Have you ever given a council official a bribe so as to ensure your council payments are processed faster?

   a) Yes { }
   b) No { }

8. Have any errors ever been made as your council payments were being processed?

   a) Yes { }

   b) No { }

   If yes please specify

   _____

   _____

9. Do you believe the process of making council payments is currently too long?

   c) Yes { }

   d) No { }

   If yes please specify which one

   _____

   _____

10. How often do you use mobile money platforms such as M – Pesa or Airtel Money to make payments for goods and services
    a) Daily { }
    b) Weekly { }
    c) Monthly { }
    d) Never { }

11. Would you like an hourly package to be included as one of your package options for parking payments?
    a) Yes { }
    b) No { }

Appendix B: User Testing Questionnaire

This questionnaire is aimed at collecting information on *"use of mobile technology for revenue collection"*The information you give will be of benefit to the researcher in accomplishing an academic goal. You are kindly requested to answer the questions according to the instructions given. Note that there is no right or wrong answer.

SECTION A: PERSONAL INFROMATION

(Please Tick √ where appropriate)

1. Name (optional) _____
2. Kindly indicate which age bracket you fall in:
   e) Under 20 years { }
   f) 20 – 30 years { }
   g) 31 – 40 years { }
   h) Over 40 years { }
3. Kindly specify your occupation
   a) Employed { }
   b) Student { }
   c) Self – employed { }
   d) Other

   _____

   _____

SECTION B: USABILITY TESTING

(Please Tick √ where appropriate)

4. During your interaction with the application, did you encounter any problems:
   e) Yes { }
   f) No { }

   If no please specify

   _____

   _____

5. Kindly rate the application's feel and appearance

   c) Excellent { }
   d) Good { }
   e) Average { }
   f) Below average { }
   g) Poor { }

   (Kindly give your reason)

   _____

   _____

6. How would you rate the application's navigation ability and ease of use i.e. the application's usability

   a) Excellent { }
   b) Good { }
   c) Average { }
   d) Below average { }
   e) Poor { }

7. Were you able to easily accomplish the application's tasks easily

   e) Yes { }
   f) No { }

   If no please specify one

   _____

   _____

8. Kindly rate your level of satisfaction based on the list functionalities

	Statement	**1 Poor**	**2 Fair**	**3 Good**	**4 Very Good**	**5 Excellent**
1	Ability to make payments using mobile money platforms					

2	Ability to view a user's entire transaction history from the application					
3	Ability of the user to choose various payment packages					
4	The system's ability to automatically notify users of charges due based on a set time constrain					
5	The ability of the users to query the amount one is required to pay					

9. How would you rate the application's ease of payment
    e) Very easy { }
    f) Average { }
    g) Difficult { }
    h) Could not complete/perform payment { }

    Kindly give reason if you selected (d)

    _____

    _____

10. Were you generally satisfied with this mobile application
    c) Yes { }
    d) No { }

Appendix C: Software and Hardware Resources

Software Resources

SOFTWARE	USE
MS Office Word (2010)	Documentation.
MS Visio (2007)	UML diagrams and Gantt chart.
Mozilla Firefox web browser	Test web pages.
WampServer MySQL	Establishment of database.
SPSS 12.0 and MS Excel	Data analysis and charts.
Net Beans IDE 6.8	Programming and testing.

Hardware Resources

HARDWARE	USE
Core2Duo Laptop, HDD 250GB, Processor 2.0 Ghz	Programming, documentation and running the Mobile emulator.
Ideos Huawei	An android enabled phone for testing the application