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A Mobile financial management system for investment groups

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Master of Science in Mobile Telecommunication and Innovation

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Nairobi, Kenya

April 2018

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 dissertation itself.

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Approval

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ABSTRACT

Investment groups have become a sure path to financial freedom not only because of their simplistic nature, but also due to the substantial gains that members of such groups accrue. They have been recognised as the driving force of the non-formal economy helping members to invest in various industries like real estate and transport. However, many of them fizzle out without making any substantial gains due to poor financial management practices and lack of financial management tools. Majority of investment groups are unable to accurately document, manage and track their financial transactions leading to lack of transparency and accountability.

The study establishes that majority of investment groups are not able to effectively manage their finances due to various factors like limited financial resources to take up credible tools for financial management and limited access to information on financial management. To fill this gap, the study came up with a mobile financial management system. The system comprised of an Android mobile phone, an Android application and a backend web application for authentication, transactions monitoring and generation of reports. The application was implemented using a combination of mobile money technologies to allow group members to contribute directly to a group's bank account. The application allowed group members to view financial statements for the group e.g. group balance sheets and trial balances hence enhancing transparency. The functionality and usability of the system was tested to establish whether the system and user needs were adequately realised. Results of the tests established the system is efficient, fast and user friendly, hence, a conclusion was made that the system can therefore be used in Investment Groups to accurately document, manage and track financial transactions in real time. Additionally, supporting MFIs can now accurately monitor these groups due to improved financial reporting brought about by the solution.

Keywords: Investment Groups, Financial Management Systems, Android Application, Micro-finance

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LIST OF ABBREVIATIONS/ACRONYMS

API   - Application Programming Interface

ERD   - Entity Relationship Diagram

JEE   - Java Enterprise Edition

SACCOs - Savings and Credit Cooperative Societies

SHG   - Self Help Group

SASRA   - Sacco Societies Regulatory Authority

UI   - User Interface

UML   -   Unified Modelling Language

SMS   - Short Messaging Service

OTP   -   One Time Pin

PIN   -   Personal Identification Number

GL   -   General Ledger

PLC   - Publicly Listed Company

STK   - Subscriber Identity Module Toolkit

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DEDICATION

I dedicate this dissertation first to Jesus Christ my Lord and savior, family, friends, to all my future children, mentors for their encouragement that I could make it, my classmates for the support granted throughout the masters' period and finally to all the lecturers for their guidance and the entire Strathmore University Fraternity

CHAPTER ONE: INTRODUCTION

1.1 Background

Investment Groups, Savings, and Credit Co-operative Societies (SACCOs) are the primary source of financing for small to medium enterprises in Kenya (Bwana K, 2013). In 2005, Kenya had 2700 SACCOs with a membership of 2.5 million people with close to 1.66 billion dollars in share capital and close to 1.24 billion dollars in loans outstanding, making it by far the largest SACCO sector in Africa (Owen G, 2007). By definition, SACCO's are voluntary associations where members pool in their savings in turn giving them access to loans, which they pay back to the group at an interest rate, which in most cases is lower than bank rates (Owen G, 2007; Walubengo N, 2012). In recent times, SACCOs like the Mwalimu National Sacco and Unaitas have tried making moves into the banking sector, with the former trying to buy majority stake in Equatorial Commercial Bank and the latter trying to restructure into micro finance banking institutions, moves which were halted by the governing body SASRA (Sacco Societies Regulatory Authority) (Okoth J, 2014). This growth has led to almost 35% of the country's national savings being held in SACCOs and investment groups.

In recent times, there has been a rise in the number of unregistered investment, savings and credit groups in Kenya, most of whom are not big enough to be called a SACCO. This segment of investors and savers remain unreached and this has created a niche market that remains untouched and accessible. These groups operate as investment vehicles whereby after a long period, the funds are re-invested for the members' benefits. According to (Walubengo N, 2012), they work by charging members a minimum monthly fee, which helps reinforce the saving culture and ensure consistency from members.

The massive growth has opened the sector up to issues that were previously only seen in the banking sector, chief of which falls under record keeping and accountability. Investment groups are struggling with lack of qualified personnel and financial management tools which negatively affects the quality of reporting in the sector (Mathuva D, 2015) leading to a lack of transparency, financial losses and consequently shorter lifespans of these groups.

1.2 Micro-finance

According to (Tapan P, 2013), Micro-finance is defined as the provision of financial services, including credit, loans, savings and insurance, to poor, disadvantaged and otherwise under-

privileged members of society (particularly in developing countries) who would otherwise not have access to such facilities. Over the last 10 years, micro-finance has emerged as one of the most effective methods of financial development and poverty alleviation in these communities. Much of micro-finance in Kenya is built upon the grassroots infrastructure of a self-help group (SHG). SHGs are small community-based groups, consisting of between 10 to 20 members, within which most micro-finance transactions are conducted.

Micro-finance Transactions (including payments, loans, withdrawals, deposits, etc.) usually occur during monthly meetings of the group. During these meetings, individual members deposit money into a common fund, which is in turn lent to other members at a mutually agreed interest rate, usually for some productive purpose, such as making an investment in their farm or business. Sometimes groups also access larger loans from banks and other micro-finance institutions (MFI), which is then lent as smaller loans to each member. No collateral is usually required, as the community liability among members is enough to enforce repayment.

Documenting each level of micro-finance transactions is important to track the financial performance and credit of individual members and groups. This allows organisations to better manage their funds hence lending to individuals and groups for purposes, which will maximize repayment and overall benefit to the community. Moreover, according to strict interpretation of Kenyan laws, every transaction must be documented and audited at the end of each fiscal year. It often falls to the supporting MFI to carry out these time-consuming tasks. This proves a huge burden for a number of reasons. First, the raw volume of small transactions that occur in a typical SHG is so high, that data management and reporting becomes a serious issue. This is one of the major overhead costs involved with conducting micro-finance activities and a major reason for its perceived unsustainability.

1.3 Problem Statement

The main problem is that majority of investment groups are unable to accurately document, record and report financial transactions in real time. This is mainly due to the lack of appropriate finance management tools that cater for this niche market. Majority of investment groups acknowledge the need for financial systems but full featured finance management systems e.g. SACCO Management Systems are financially beyond the reach of such small groups and are a reserve of well-established finance institutions. Additionally, existing financial management applications are complex and fail to meet critical financial management requirements for such

groups. These groups opt to perform their tasks manually greatly exposing themselves to risks. These risks include fraud, endless disputes between members due to accountability issues and lack of funding from supporting MFIs due to inaccurate finance records.

1.4 Research Aim

The aim of this research is to develop and test a mobile-based financial management system for investment groups

1.5 Research Objectives

i. To investigate factors that hinder financial management of investment groups.
ii. To analyse current techniques and technologies for managing the finances of investment groups.
iii. To develop and test a mobile based financial management system for investment groups.
iv. To validate the developed financial management system to confirm that it provides the relevant financial management capabilities to investment groups.

1.6 Research Questions

The study seeks to provide answers for the following questions:

i. Which are the factors hindering the effective financial management of investment groups?
ii. What are the current techniques and technologies used for managing the finances of investment groups?
iii. How can a mobile-based financial management system for investment groups be designed, developed and tested?
iv. Does the developed application effectively provide financial management services relevant to investment groups?

1.7 Justification

In order to ensure that there are effective financial management and accounting systems for small-unregistered groups of people looking to save and invest their money while monitoring progress on their mobile devices, there is need for the creation of lighter, small scale, mobile based financial management system. Providing these financial management systems to the average person and groups ensures that there can be accountability and transparency even at the lowest levels of finance in the country. This ensures that more people are able to comfortably

invest and save their money in groups with the aim of working on projects together, knowing that they have some piece of mind when it comes to accountability and transparency at every turn.

Using a mobile application to deliver effective financial and accounting services to small groups of people will mean better cash flow, accounting for tax, accessibility and transparency for the billions of shillings that go untraced in the lower financial circles in Kenya. This will open up previously inaccessible markets and opportunities to groups of people who have the potential to drive economic growth within the informal sectors and bring basic accountability to the smallest of unregistered groups. This study aims to come up with a mobile-based financial management system for investment groups in Kenya.

1.8 Scope of the Research

This study offers a prototype and not a complete application with the data being used being test data, with the aim of launching and registering groups to the platform later. The final application allows users to create groups, contribute using mobile money, create member accounts, manage and account for their finances on their mobile phones.

1.9 Limitations of the research

There are certain limitations associated with building a mobile-based financial management and accounting system for small, unregistered savings and investment groups. These include the fact that all users are required to have a smart phone capable of installing a mobile application on them. The supported devices in this case are smart phones running Android version 4.0 and above.

CHAPTER TWO: LITERATURE REVIEW

2.1 Overview

This chapter provides an overview of finance on a micro level with a primary focus on informal groups. It also looks at some of the factors that hinder the effective financial management of investment groups and analysis some of the current techniques and technologies for managing the finances investment groups. It discusses the features and limitations of some of the systems currently available on the market. Finally, based on the literature review, it gives a conclusion highlighting the research gap needed for an effective informal group financial management system.

2.2 Factors Hindering Financial Management of Investment Groups

This section dives deeper into some of the factors that directly contribute to the poor financial management of small, unregistered groups. These groups include people who run small businesses and partnerships, friends and family as well as households, subsets that have historically not been considered as financial groups (Tapan P, 2013). With the ever-expanding technology sector, it has become easier to open up such niche sectors, giving rise to the ability to manage finances across all sectors to the micro level. These factors include limited financial resources to take up credible tools for financial management, lack of appreciation of structured financial management, limited skills to implement basic financial management and limited access to information on financial management (Bwana K, 2013).

2.2.1 Limited Financial Resources to Take Up Credible Tools for Financial Management

One of the biggest challenges faced by small, informal and unregistered groups in financial management is the general lack of finances either to hire an accountant or to be able to purchase effective financial management systems. In Kenya, a full featured Sacco management system will cost an average of 350,000 Kenyan Shillings (Kshs) excluding maintenance fees and upgrades with others going as high as 1,000,000 Kshs (MovTech, 2012; Sun Afric Group, 2012). This also does not include the cost of hiring a person technically capable of running the management system, which could mean a recurring cost per month of around 30,000 Kshs. Having in mind that the average Kenyan is said to earn a between 20,000 Kshs and 49,000 Kshs (Njoroge K, 2015), sustaining the cost of a financial management system at this micro level is not feasible.

According to (Njoroge K, 2015), only 2.89% of the people in the formal employment sector earn more than 100,000 Kshs, with a staggering 97% of the working population earning less than this. This coupled with the every rising cost of living in the country (Otuki N, 2016), means that a large chunk of the population is not able to access proper financial and accounting systems. This lack of access means that groups suffer from poor practices, lacking paper trails, fraud and malpractice every step of the way, dissuading a vast majority from the investment world.

It is reported that close to 65% of the financial transactions in Kenya remain cash based and on mobile money meaning that there is still the potential to tap into the informal sectors vast resources and bring effective management into the lower financial sectors in the country (Kimani M, 2016). With these kinds of figures, it is easy to assume that the average small group might have enough money to purchase and successfully run a Financial Management System, but that is not the case. To successfully run and maintain such a system, a group would have to be comprised of anything from 100 members upwards, something that is in many ways inaccessible to the average Kenyan. The small groups we are focusing on are comprised of between two-fifty members.

2.2.2 Lack of Appreciation for Structured Financial Management

Cultural norms and mind-sets are a major factor that directly affects how finances are managed on the micro-micro level. By definition, cultural norms are guidelines that regulate actions within specific frameworks (Nugent, P., 2013). Putting this into context, these are the principles that formally or informally guide how people behave in various scenarios and circumstances. Small groups like friends, family and households have historically not been considered in the financial sector as being viable financial instructions due to their informal nature and erratic spending pattern. This is however changing with the rise of technology, which is bridging the gaps between these informal groups and financial knowledge and investment opportunities.

For the average person to start a small investment in Bitcoin on Zebpay Bitcoin exchange for example, they require a minimum of 7 US Dollars (700ksh) (Patel S. , 2016), an amount easily accessible by the average Kenyan. This means that people or groups of people even on the most basic levels can be able to engage with and make investments on various online platforms with relative ease. With the rise of accessibility on these levels, financial management has become something of a necessity. From a research done by (Akunga B., 2012) on the financial success of households in Nairobi, it is found that without proper financial management within

households, families were found to be less likely to save, were in some kind of debt and were likely to overspend in one area or another. The same research underscores the importance of accountability, prioritization and generally knowing what expenses there were relative to the income (Akunga B. , 2012).

Coming to 2018, successful households still abide by the very same principles and focus on the same kinds of goals, depending on their social standing. What differs is the access to information for all the members of the family. Internet access in Kenya is now at a staggering 89.4% of the entire population with 99% of these users being mobile users (Omulo C. , 2017). With more than 40 million of the 48 million Kenyans being online in one way or another, information access is present in almost every household in the country. This means that households can do so much more as a unit than just save money and set static targets. They can actively engage in and track online investments as a unit or as individuals. This gives rise to a new cluster of micro-investment and savings groups that are still unaccounted. The cultural norm that has revolved around the family is slowly being eroded and expanded to include previously inaccessible roles. These norms have been a large player in the poor financial management practices in households across the region.

2.2.3 Limited Skills to Implement Basic Financial Management

Outside of cultural norm and financial constraints involved in successful and efficient financial management, there is the aspect of skills required in managing finances at any level. Financial management, like most other skills is acquired through some kind of training which most households might not have. With the exception of households with members who have some kind of financial management training, most other households will have basic financial management skills (Akunga B. , 2012).

Beyond this, even basic book keeping for the home is not a normal practice for most households. (Akunga B., 2012) notes that most households in Nairobi have a very informal system of managing finances for the house, with little or no management on spending or use of resources. This leaves room for overspending which could in some cases lead to debt within the household. A prime example of what happens to Kenyan households is overspending during the festive season which leads to a resource strain at the beginning of every year, a phenomenon commonly referred to as Njaa-nuary (Njaa is Swahili for hunger) (Kitundu C., 2018). With the general lack

of proper financial management in the household, it becomes difficult for most households to keep up with the ever-rising cost of living.

Outside the household, small groups of people coming together to raise finances for investment or savings have the same problem. Not only do they not have the relevant software for financial management but also they very rarely have the required skills to perform effective financial management even at the most basic levels. The very basic skills that are required for financial management are accounting skills, analytical thought, technological expertise and written and verbal communication

Accounting skills, which make up the backbone of financial management (Doyle A., 2017) is a skill that is well out of the reach of the average person. (Half, 2017) describes accounting skills as having subsets which include general business knowledge, Information Technology skills, Communication, Leadership and Customer service orientation. Learning to use applications like MS. Excel, SAP, IBM Cognos, Data modelling tools and others is at the very heart of accounting knowledge (Half , 2017).

Such skills are beyond the capabilities of more than 95% of the world's population, with the vast majority only being able to perform mundane tasks on computers at best (Nielsen J., 2016). In an article published on the NN Group website, (Nielsen J., 2016) highlights just how little the world's population can do on a computer, noting that only 5% of the human population can perform complex tasks on a computer. Having this in kind and considering that applications like SAP are extremely technical and available to niche groups, we can conclude that very few people are technically capable to do financial management.

2.2.4 Limited Access to Information on Financial Management

Despite the increasing number of smartphones and internet access points in Kenya (Omulo C. , 2017), access to information on financial management is still out of the reach of the common Kenyan. This is partially down to the fact that most of this information is found in sources easily accessible on desktop computers, but not as easily on mobile devices. According to Gicheru (2014), 64% of the phones sold in Kenya are smartphones with the rest being feature phones with limited internet capabilities. This means that a sizeable chunk of the population still does not have access to smartphone features (Gicheru M. , 2014). Out of the population that can, a small number actually visit websites that are academic oriented, with the vast majority visiting betting sites, news sites, social media sites and adult websites (Similar Web, 2017).

This information is put further out of the reach of people due to the still high cost of data in the country. On the country's biggest network, Safaricom, 1mb of data goes for an average of 1 shilling, accessible to very few people in the smartphone population (Wainaina E. , 2015). Out of this, most of the data is used for communication and entertainment through social networks like WhatsApp and Instagram. This reduces the likelihood of people going out of their way to find material on financial management. Another angle one could look at is with respect to education levels in the country. With more than 50% of the population falling short of the required literacy standards (Kiplagat S. , 2015), it is difficult to pass learning material on financial management to a vast majority of the population.

Things look even grimmer when you consider the fact that a little less than 3 years ago, only 1 million, of the close to 50 million Kenyans were graduates (Ogeto A. , 2015). This means that there are very few people in Kenya right now have the capability and training to comb through volumes of books on finance and financial related material. (Ogeto A. 2015) points out the knowledge gap that exists in Kenya, despite the prevalence of mobile devices and information sources.

2.3 Technologies for Managing Group Finances at a Micro Level

This section touches on some of the technologies used in the management of financial resources for micro finance institutions. It looks at the various means through which people have over the years employed to help them account for their financial resources. We will look at some of the ways that technology has changed the financial sector and how the industry has adapted to this.

2.3.1 Adoption of Technology in Finance

With the rise of the age of technology, it was just a matter of time until the financial sector would completely evolve from the old manual processes to more technology driven solutions. 'Disruption' is a new term coined for change that happens on a large scale in various industries and which is driven by technology (IBM, 2017). The internet, smartphones, social media and education and many others have all changed so dramatically over the past few years to the point that industrial advancement to towards technology has become almost inevitable (Arnold M. , 2017). PayPal, founded in 1998, revolutionised the financial sector by adding online payments, transactions and banking, making life easier in the online space. This had far-reaching effects for various stakeholders in the sector including banking, investments, lending and insurance, most of whom are now heavily technology driven (IBM, 2017; Mastrocola, 2016).

The financial sector was once a closed sector, with very little information exchange and manual data collection, with offices filled with stacks and stacks of records on paper. In 2018, finance is a completely different ball game all together all thanks to technology. Finance is now a global affair (Mastrocola, 2016), with information flowing freely and access to it unlimited all thanks to the internet. People who have never met in person with relative ease now all thanks to international standardized laws governing the financial sector can do financial transactions. Figure 2.1 shows how money moves from country to country.
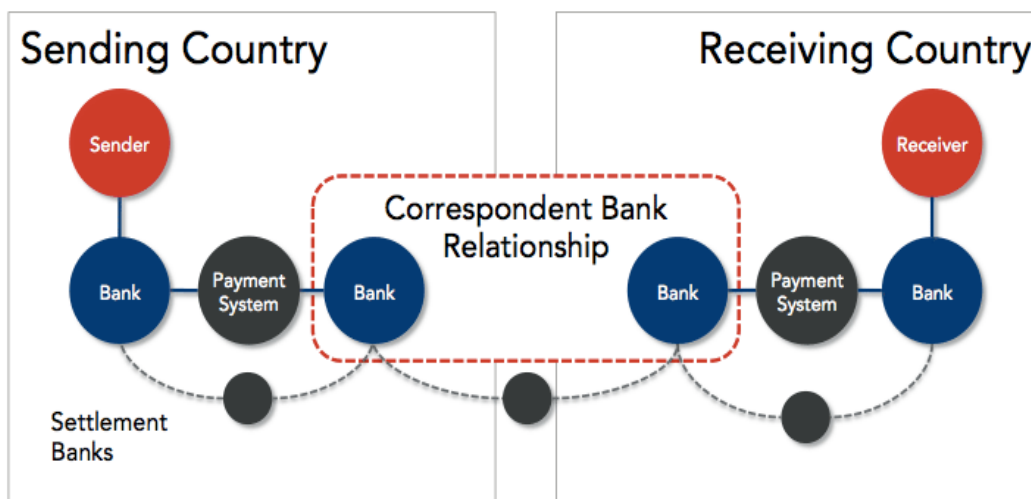
Figure 2.1: Sending money across borders. Adapted from "Wikishare" 2015, Retrieved from https://www.wikishare.us. Copyright 2015 by Rumayor

Figure 2.1 illustrates how money moves from a sender in one country to a receiver in another, all without any of the two having to meet. It demonstrated just how technology has been employed to make life much easier for people in the financial sector. Technology has also changed the financial sector in the following ways.

Financial technologies for a very long time have been beyond the reach of the average person due to a number of factors like financial constraints and applicability these systems considering that most do not work on a small scale. IBM (2017) wrote in an article on how technology has changed the financial sector and that this sudden shift was pushed in part by the 2008 financial crisis. This crisis, whose ripples were felt across the world, caused people to lose faith in large financial institutions (IBM, 2017; Dauer, 2016). This caused the small-scale saver and investor to look for smaller institutions to put their faith in, splitting the market and opening the sector to even smaller players (Klein M. , 2017).

Everything from buying stocks to investments can be done outside the traditional financial institutions and their large overheads. This means that most people have the ability to access these services with very little restriction from the traditional banking sector. In the case of Kenya, mobile money platforms have transformed how people transact (Mutua R. , 2010). Mobile money has helped bank the people who have historically been unbanked, provided means for people to invest and save their money by giving people a safe and secure way to transfer money, even from the diaspora. This increase in banking has also given rise to new businesses, which have taken advantage of this newly found space. Companies like SportPesa have made billions of shillings off Kenyans investing in football and betting (Kasami D. , 2016).

With the rise of technology, there came the rise of readily available information for people who are looking to invest and to make investments. Not too long ago, if an entrepreneur wanted capital to invest in their idea, they only had two options, family or the bank (IBM, 2017). Thanks to technology however, these options have changed across the world, giving rise to platforms like Indiegogo and GoFundMe, crowd-sourcing platforms. With crowd funding platforms, users get a chance to pitch an idea to millions of people across the world, make an offering to them in return for their investments and receive funding not just from one source (Tice C. , 2014).

These platforms and the general free nature of information flow have reduced the number of people going to banks to get loans for businesses. (Dunkley E., 2015) claims that banks risk losing close to 22 billion euros to big technology groups looking to disrupt the retail payment sector with efficient software and applications. This has made big banks to evolve their businesses to keep up with the technological rise by incorporating technology driven services to their packages (Dunkley E. , 2015). This kind of competition is a huge part of why the rise of technology has been effective in the financial sector.

2.4 Review of Current Systems

This section reviews the systems currently in the market in Kenya and the gaps that the proposed solution will fill.

2.4.1 My Budget Book

Developed on the Android platform, this application helps users to do budgets and track expenditures on a micro level, it features personal accounting and household accounting. It has various categories including a revenue tracker, expenditures tracker, a section for standing orders and the ability to track categorized and uncategorized expenditures. It gives you access to your

bank accounts and gives you the ability to move money from account to account (Elmblad S., 2017). Its major shortcoming is the lack of mobile money integration, which is vital for cash movement. It also does not give users the ability to start group activities. This is important because group members should have the ability to follow up on their savings and investments with the group without necessarily having to meet face to face. Lastly, this application does not give users the ability to generate group financial statements and lacks a group calendar for scheduling important meetings. Figure 2.2 shows a screen shot of My Budget Book.

Figure 2.2: My Budget Book. Adapted from "Android Pit" 2015, Retrieved from https://www.androidpit.com/my-budget-book-keep-an-eye-on-your-budget. By Jay O.

2.4.2 MoneyWise

Moneywise is a home budgeting application that helps users take control of their home incomes and expenditures. Its greatest power is in taking incomes and putting them against expenditures and giving reports. It also excels at alerts and notifications for pending bills and due dates as well as at memorizing transactions, essentially making life easier for the user (Elmblad S., 2017). Its shortcomings include the lack of connectivity to banks, which forces users to keep track of their expenditures and incomes by manually typing them in. It lacks features for mobile money transfers and accounting features, which disqualifies it for investment groups. Figure 2.3 shows the MoneyWise UI.

Figure 2.3: Moneywise UI. Adapted from "LifeHacker" 2016, Retrieved from https://lifehacker.com/5873325/the-best-budget-tracking-app-for-android. By Alan Henry

2.4.3 ChamaSoft

ChamaSoft is a bookkeeping tool for Investment Groups, commonly known as "Chamas" in Kenya (About ChamaSoft, 2018). It automates the operations of these groups, eliminating the need for complex Excel sheets and bulky write up, thereby making the work of financial book keeping within the group easier. It achieves this in the following way: It automates member invoicing, keeps an updated statement for each member, members can login to view their financial position within the group, reminds members to make payments, stores group data on the cloud and a cash book module for use by the Treasurer (About ChamaSoft, 2018). Its shortcomings include, lack of real-time connectivity to banks making it a human-dependent process to obtain bank statements. It is also not possible for members to contribute directly via mobile money from the application. Another drawback of ChamaSoft is that it lacks automation on some critical processes. For example, capturing of member fines and other financial transactions. This creates a financial loophole since group administrators can forget to enter transactions or make erroneous entries. Figure 2.4 and Figure 2.5 show the ChamaSoft UI.

Figure 2.4: ChamaSoft Login Screen. Adapted from "Google Play" 2018, Retrieved from https://play.google.com. Copyright by ChamaSoft Limited

Figure 2.5: ChamaSoft Contribution Screen. Adapted from "Google Play" 2018, Retrieved from https://play.google.com. Copyright by ChamaSoft Limited

2.4.4 M-Changa

M-Changa is an online and mobile fundraising platform. It provides the tools to create awareness and receive funds for your fundraiser – for individuals, organisations and businesses (M-Changa, 2018). M-Changa's mobile platform is SMS/USSD based making it useable to those in marginalised areas. M-Changa's online web portal allows individuals to start fundraisers and share their stories. It allows for secure payments via all major online payment platforms like Visa, PayPal etc. (M-Changa, 2018) . Biggest shortcoming with this application is the fact that it does not have modules for group activities such as investment tracking, savings, and direct connection to bank accounts. Another reason why M-Changa is not suitable for investment groups is that it does not allow for generation of financial statements making it hard to evaluate group performance. Figure 2.6 shows the M-Changa's online web portal.

Figure 2.6: M-Changa Online Portal. Adapted from "Mchanga" 2018, Retrieved from http://changa.co.ke/. Copyright by Mchanga

2.4.5 Stash Invest

The Stash Invest application specialises in helping mobile users get started investing (PCMag, 2018). From the application, you can buy, sell, and monitor investment funds, with as little as $5 to start. It is a rather simple application that would benefit from additional features and notification options, but it does succeed in helping you get started investing quickly. For users with less than $5,000 in investments, the first three months are free; you pay $1 per month thereafter. Account holders with $5,000 or more invested pay 0.25 percent of their account balance per year (PCMag, 2018). One major drawback for this application is that it is only available for iPhone users. With majority of users on the Android platform, this means lesser majority users have no access to it. The application is also not tailor-made for the Kenyan market and has a strong focus on foreign markets i.e. (US and Canada). The application also lacks group investment functionality since mostly focused on individual investments. Figure 2.7 shows the Stash application UI.

Figure 2.7: Stash UI. Adapted from "PCMag" 2016, Retrieved from https://www.pcmag.com/. Copyright by PCMag

2.4.6 JStock

JStock is a stocks investment mobile application. It supports 34 different stock markets, features to analyse your stocks, and even a charted history dating back 10 years so you can check stock histories (Android Authority, 2018). If you go premium, you will get cloud storage integration, unlocked features, and unlimited amounts of some features from the free version. There is also a news section if you want to keep up on the latest news (Android Authority, 2018). One obvious drawback is that it only allows users to invest in the stock market hence not suitable for investment groups who want to invest in other ventures. Additionally, the application does not have group finance management features. Figure 2.8 shows the JStock application user interface.
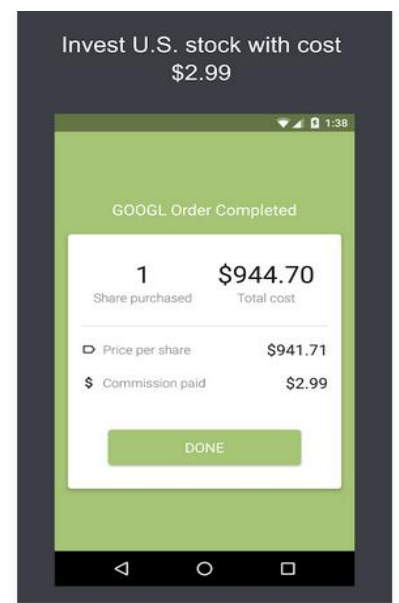
Figure 2.8: JStock User Interface. Adapted from "Android Authority", 2018 Retrieved from play.google.com. Copyright by JStock

2.4.7 EazzyChama

Owned by Equity Bank, EazzyChama is a simple to use web application that enables investment groups to manage all their group activities and communications. The cloud-based solution enables group administrators to track all contribution accounts within the group. The application has the following features: Financial management, allowing groups to record group payments and view transaction reports. Membership management, allowing group administrators to add members with ease, bank account management, allowing group administrators record withdrawals and deposits performed on the group's bank account. Expenses management allows users to track group expenses. Project management, allowing users to track group investment projects. Loans management, for groups that do internal lending, the application provides a

platform for recording these loans. Finally, financial reports which enables the group to generate member statements, cash flow, balance sheets and profit and loss statements (EazzyChama, 2018). One obvious EazzyChama drawback is that the application is only available for Equity Bank customers. Additionally, the application transaction recording process is manual. For a group with many members, the process of recording each transaction becomes a daunting task and highly prone to human error. The application also lacks a mobile money component, which is key for cash movement. Figure 2.9 and Figure 2.10 show the EazzyChama Web UI and Mobile UI respectively.
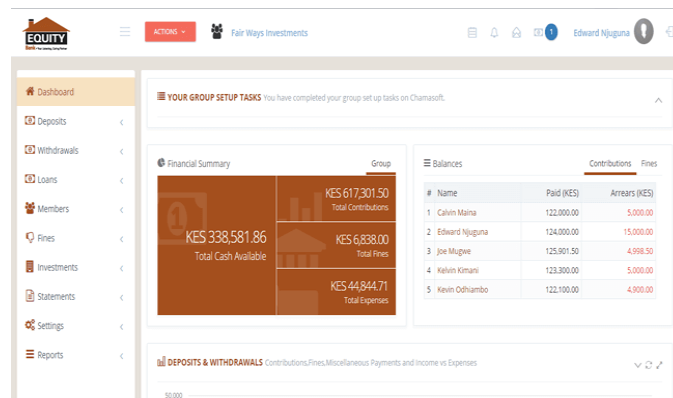
Figure 2.9: EazzyChama Web UI. Adapted from "EazzyChama" 2018, Retrieved from https://eazzychama.co.ke. Copyright by Equity Bank
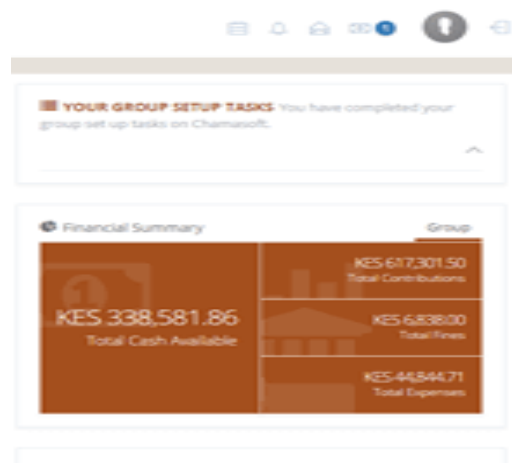
Figure 2.10: EazzyChama Mobile UI. Adapted from "EazzyChama" 2018, Retrieved from https://eazzychama.co.ke. Copyright by Equity Bank

2.5 Research Gap

Despite operating from a micro-level, investment groups transact billions of shillings. This review has analysed and shown that there are existing applications for managing investment group finances. However, most of these systems lack the financial management features that any investment group would require in order to run efficiently. Analysis of the *My Budget Book* application for example, has shown that the application lacks a mobile money integration component, which is vital for cash movement (Elmblad S., 2017). A review of the *MoneyWise* application has shown that it not only lacks the mobile money component, but also it lacks a group dashboard (Elmblad S., 2017). This is vital for any investment group in that group members should be able to view account balances without having to walk into a bank. *ChamaSoft* on the other hand accurately automates group activities but lacks important features like mobile money integration and ability for group members to view their group's financial status in real-time. This leaves the daunting task of capturing member transactions to group administrators. The *M-Changa* application does not have modules for group activities such as investment tracking and savings. *M-Changa* does not allow for generation of financial statements hence making it hard to evaluate group performance (Mchanga, 2018).

It is clear from the review that existing applications and systems are not able to meet critical financial management requirements of investment groups. A common gap identified in all applications is the lack of mobile money integration, which is vital for cash movement. Other gaps identified is lack financial reporting features, which is vital for MFI evaluations, group dashboard for all members to view their group's financial status which is vital for transparency and automated payments processing from group members. This study seeks to address the gaps identified by providing a viable alternative solution by developing, testing and validating a mobile financial management system for investment groups.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Overview

This study's aim is to find out the challenges faced in financial management for informal, unregistered investment and savings groups with the aim of coming up with a mobile financial management system for such groups. This section discribes the methodology to be used to come up with the system. It gives a brief overview of the system development methodology used and the various phases of the development cycle.

3.2 System Development Methodology

The application was built using Agile Development Methodology. It offerred the ability to assess the direction of the reseach throughout the development cycle. Agile allows for release schedule and user feedback opportunities while allowing for faster and more controlled improvements (CPrime, 2014). It was used in the development of this application for the following reasons: Agile methodology can accommodate ever growing and changing user requirements, the methodology welcomes changes in requirements even late in development, unlike its competition, it allows development teams to remain competitive especially during long projects and finally, Agile methodology provides for a faster to market strategy with a greater guarantee of user acceptance due to constant user engagement through out the development process. Agile methodology has five main phases ranging from planning, requirements analysis, design, development to testing (CPrime, 2014). Figure 3.1 shows the steps to be taken during the implementation of the mobile application using Agile development methodology.
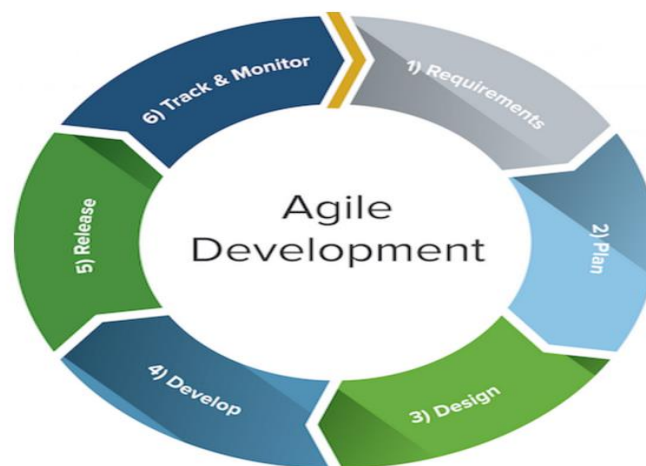

Figure 3.1: Agile Development Methodology Adapted from "Smartsheet" 2016, Retrieved from https://www.smartsheet.com/. Copyright by SmartSheet

Figure 3.1 shows the steps taken during the implementation of the mobile application using Agile development methodology. The first step, the requirements study, looked into the relevance, requirements and feasibility of the application that is to be developed and the value that it will add to what is currently available. This was achieved by researching systems that have been implemented across the world, how they use existing technologies to improve financial management and the effects that these systems have on groups and how best to implement their models in a local scenario.

The second phase, planning, involved looking into the steps to undertake and outlining them clearly to ensure that the research objectives are met. Step three, design, involved designing the relevant architectures based on the data collected and analysed. Steps four and five, development and release show how the application will be developed according to specifications and released to the market for users to interact with. The last phase, which is tracking and monitoring involved observing how the system reacted to use by the relevant people and recording the results to determine how effective the system was. The sections below elaborate the phases in detail.

3.2.1 Planning Phase

This was the very first step in the software development life cycle and was kept at a very high level, facilitating for the planning of how the entire development and research process will be conducted (Agile Movement, 2011; Highsmith, 2012). This helped identify the resources required for the successful completion of the development.

3.2.2 Requirements Analysis Phase

This section allowed the researcher to look at some of the key requirements for the project from the perspective of what the system was expected to accomplish. It identified key information about processes such as user requirements, development requirements like environments and parameters required for the successful completion of the project. The researcher went out to collect user requirements and development requirements. The research was conducted in Nairobi using a sample small investment group called the Kibbutz Residence. It involved all the members of the small group with each individually having a copy of the application. Google docs and forms was used as the primary means of data collection, with the data being interview results and a usability questionnaire focusing on user interactions with the application and whether or not it met the user defined requirements.

Object oriented analysis was used to analyse and model user requirements, identifying all the objects in the system and mapping their relationships. System functionality was modelled using a use case diagram and corresponding descriptions. The system flow was modelled using a sequence diagram with the database being modelled using an entity relationship diagram showing all the tables within the database with their corresponding relationships and attributes.

3.2.3 Design Phase

After identification and verification of system requirements, the system design phase began. This phase involved the use of system design methods to represent the architecture of the system. Unified Modelling Language (UML) was used as the primary modelling language to diagrammatically represent system requirements and the relationships between various components (Bell, 2003; Lynda, 2012). The functionality of the application was modelled using a Use Case diagram, an Activity Diagram, a Design Class diagram, an Entity Relationship Diagram (ERD), a Sequence Diagram and Mock-ups.

Use cases were used to visually represent the various interactions between the key stakeholders in the system and the system itself (UML-Diagrams, 2009; Bell, 2003; Lynda, 2012). In this phase, a use case diagram and a corresponding use case description was used to detail the various users, their interactions with the system and other possible use cases that might arise. From these use case diagrams, an activity diagram was developed detailing the sequence of activities happening in the system and even interactions between various entities. A design class diagram was used to represent all the classes used in the system. It showed the relationships between various objects, their cardinality values, with the classes being defined using attributes and methods (Larman, 2009). An ERD diagrammatically represented the relationships between entity sets stored within a database. It not only helped in the normalization of tables in the database but also to eliminate redundancies (Larman, 2009). A sequence diagram was used to model the flow of logic within the mobile application, visualizing how various users of the mobile application interact with the features (Larman, 2009). Finally, system mock-ups were designed using Adobe Illustrator, helping the researcher visualize how the finished application would look like. Adobe Illustrator was the preferred mock-up tool due to its vast array of design tools.

3.2.4 Development Phase

This phase involved the use of the architectures and models created in the design phase to come up with a mobile application and a web based back end, both of which connect to a central

database. The mobile application was built on the Android platform using the Java programming language. The Android platform was chosen due to its robust SDK, the Android developer tools, support from online developer communities and ease of access by users and development (Rishabh, 2014).

The web backend was developed using Java Enterprise Edition, an enterprise platform built on the Java programming language providing APIs and runtime environments for developing and running large-scale applications (Theedom, 2016; Versrynge, 2013). It was chosen because of its extensive collection of tools and resources, portability and its ability to handle with ease heavier applications and their demands. Finally, MySQL was used as the primary database management system for the web backend application. It was chosen due to its open source nature and its compatibility with the JEE platform. It was used to handle user data and financial data (Wallen, 2016; Zetcode, 2017). Glassfish application server was used to deploy the web back-end system. It was chosen mainly due to its inbuilt persistence architecture that allows one to create and manage database entities. It is also lightweight and open source.

3.2.5 Prototype Evaluation, Testing and Validation

As soon as development was complete, the application underwent a number of tests to ensure that all the objectives that set were achieved. The tests reviewed the user interface and how user friendly the application was and if the designs set out were met. Usability Testing was conducted to determine the application's usability. Functional testing was done to test the system's functional and non-functional requirements and finally validation was conducted to validate that the system solves the financial management issues raised at the small-scale level using a sample group.

3.3 Ethical Considerations

Ethical considerations in research make up a very important part of research work that helps researchers in varying field decide if their work is ethically acceptable (Behi, 2005). The conclusions drawn from such consideration will determine whether the research gets the approval, moral support and green light of professionals, the scientific community and the society (Behi, 2005). Most ethical guidelines for research involving human subjects require that anonymity and or confidentiality is guaranteed, consent is informed, dignity is maintained and, on balance, the individual and society receive more benefit than harm (Couchman, 1990). This section will look at some factors contributing to ethical considerations in an effort to ensure that

all the work done falls under relevant moral codes and is acceptable to the scientific community and society.

3.3.1 Anonymity and Confidentiality

Every human being has a right to privacy and therefore research subjects might not want information about themselves, their motivations and attitudes to be identified and made available in the public domain (Behi, 2005). The data collected needs to be presented in a manner that would ensure no one but the individual concerned is aware of the source. This research will ensure the anonymity of all the parties involved without exception.

3.3.2 Informed Consent

Informed consent is a right of every participant in a research (Couchman, 1990). This means that all the subject in a research experiment must be given true and sufficient information about what they are about to undergo so that they can get a chance to opt in or out of it should they not agree with some of the methods being used (Behi, 2005). This research informed all the participants of the reasons for the research, the importance of their participation and the parameters and extents to which the research will use their data. No information was withheld from the participants and in the case where a participant is unable to comprehend or make informed decisions, then informed consent by proxy was be used.

3.3.3 Benefit to risk ratio

It is highly unlikely that a sample group of people will agree to take part in a research if the risks i.e., the potential harmful effects, are judged to be greater than the benefits (Behi, 2005). In other cases, there might be no immediate benefits to the participant, but they might come in the long term or be beneficial to the greater society. All participants were informed of any potential harmful effects or benefits that might arise because of their participation.

CHAPTER FOUR: SYSTEM DESIGN AND ARCHITECTURE

4.1 Overview

This chapter details the design and structure of the proposed solution by incorporating the user requirements collected in the previous chapter. This was realised through system Use-Case Diagrams with detailed use-case descriptions, Sequence Diagram, Design Class Diagram and an Entity Relationship Diagram.

4.2 Requirement Analysis

Detailed descriptions of services, features and constrains that should be addressed by the System were broken into functional and non-functional requirements.

4.2.1 Functional Requirements

Functional requirements are the functions, basic processes and capabilities that the implemented system should be able to execute. They include group registration, member addition to groups, member contributions via mobile money, generation of financial statements (balance sheets, trial balance and profit and loss statements), member's dashboard, administration dashboard and user management.

4.2.2 Non-Functional Requirements

These are qualities that a system can do without but are desired in order to make the system interactive, user friendly and easy to use. These qualities include feedback (adequate feedback should be implemented to facilitate knowledge on working of the application), error reporting (send error logs to the loggers to aid in in resolving issues) and data security (encryption of sensitive data like passwords). System availability (the system should be available at all times), usability (the system should have an intuitive user interface), scalability (the system should allow for future upgrades and improvements in technology in a cost-effective manner) and reliability.

4.3 System Design

The collection of user requirements from potential users were merged with the ideas that the researcher had in mind to come up with an application design. The following design diagrams and corresponding information was used to guide the actual implementation of the system. StarUML modelling tool was used to create the UML diagrams. It was preferred due to its open source nature and ease of use.

4.4.1 Use-Case Diagram

Figure 4.2 illustrates the major interactions that will take place between the various sub -systems and actors in the mobile financial management system.

Figure 4.2: System Use-Case Diagram

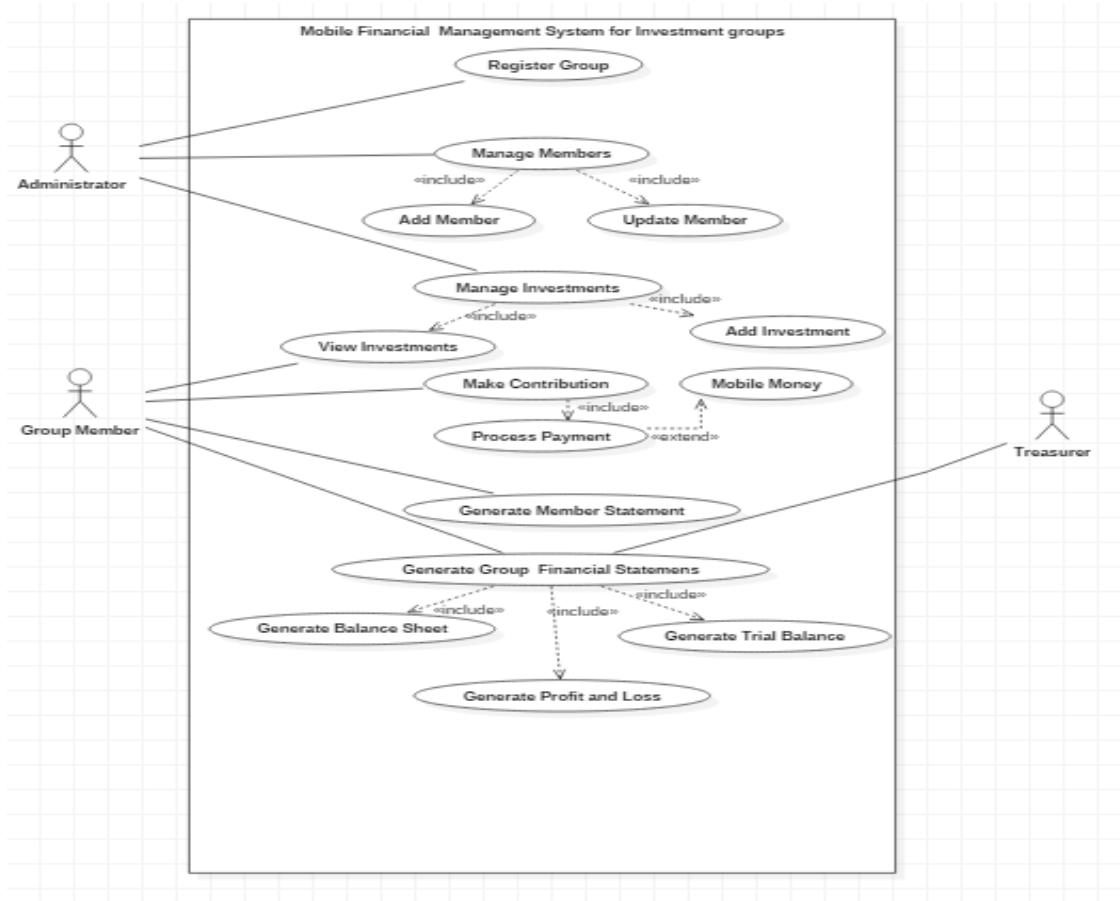The below sections further explain the various use-cases.

4.4.1.1 Use-Case: Register Group

This Use-Case reports registration of a new Investment group.

Pre-conditions:

Administrator has not registered group with similar name.

Post conditions:

Group is registered and ready for members' registration.

Main success scenario:

1. Administrator opens the mobile application.

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2. Selects add new group.

3. Administrator enters mandatory group information details.

4. Administrator configures group payment methods.

5. System verifies if the administrator has a group with similar name.

6. System records details and presents results.

Alternative Flow: Duplication error

At step 5, system finds that the administrator has registered group with similar name.

- Cancels operation.
- Administrator updates details.

Alternative Flow: Registration failure

At step 6, system fails to register member.

- Replicate process.
- Check internet connectivity.

All the remaining system use-cases are described on Appendix E.

4.4.2 Activity Diagram

The researcher used and activity diagram below to model the business processes and to describe the various use-case steps discussed in the previous section. To demonstrate the dynamic aspects of the system, various activity objects are instantiated for specific user actions as illustrated on Figure 4.3.
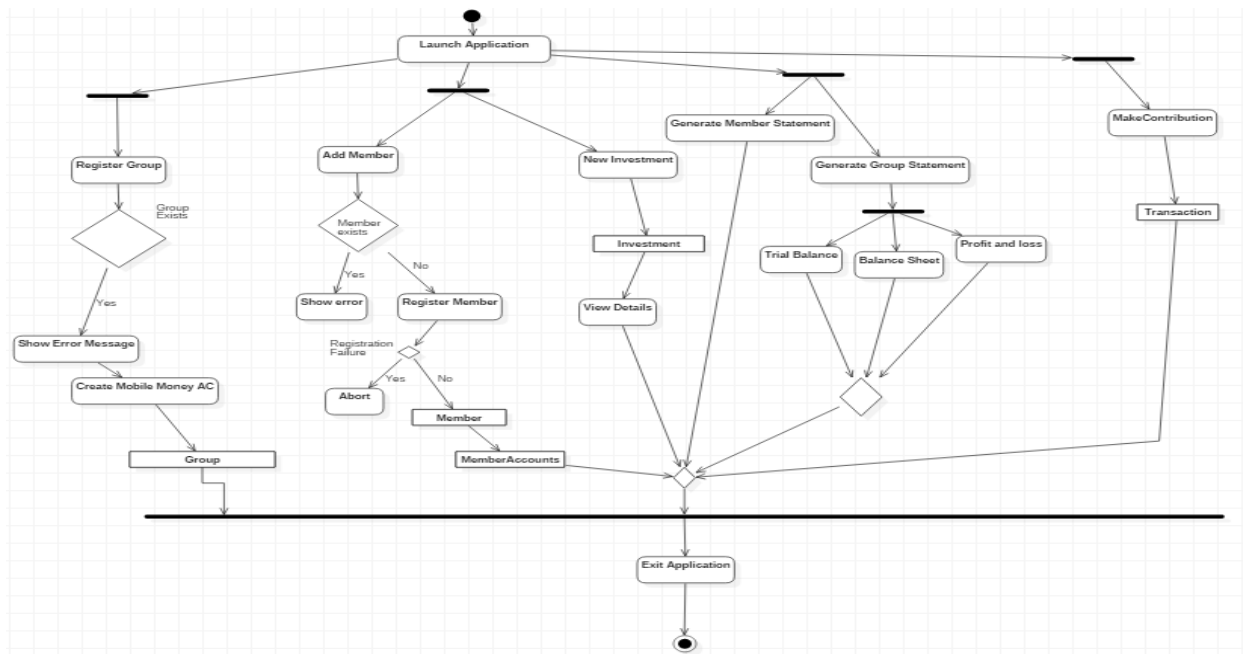
Figure 4.3: System Activity Diagram

4.4.3 Design Class Diagram

The class diagram in Figure 4.4 depicts the interaction of all the classes in the system, their corresponding attributes and methods.
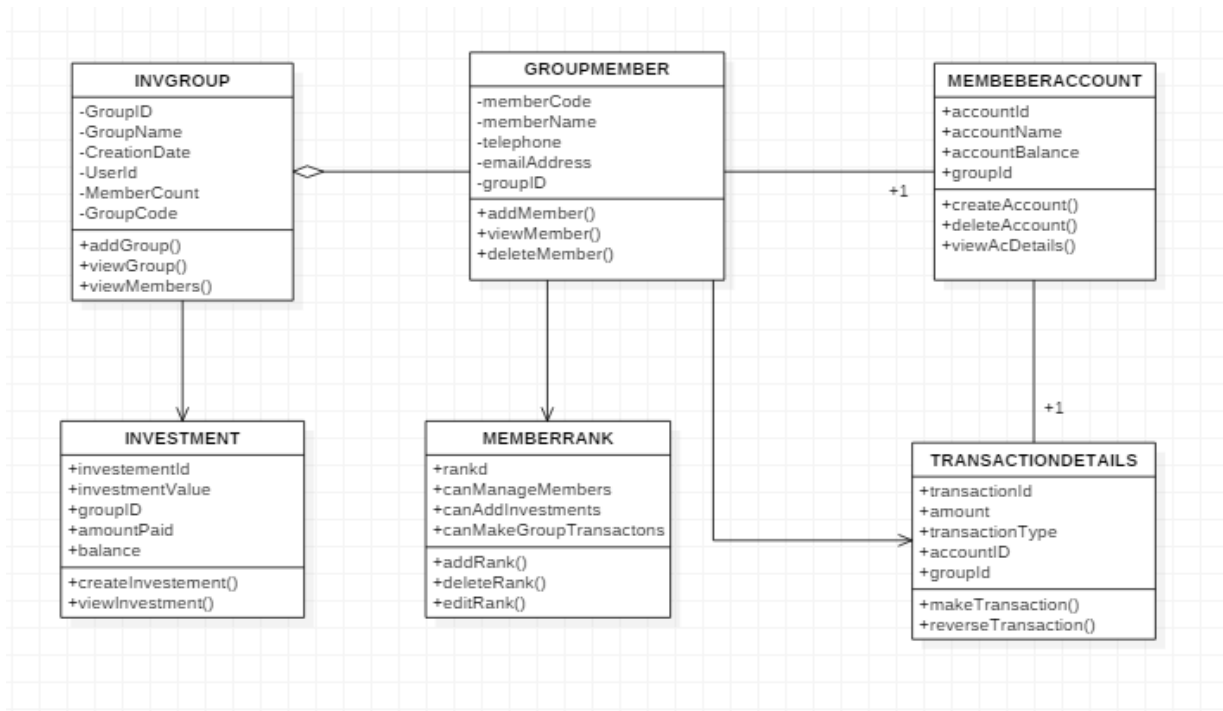

Figure 4.4: System Class Diagram

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4.4.4 Sequence Diagram

The sequence diagram in Figure 4.5 puts on show how the main actors interact with the system. It illustrates the sequential flow of information as it passes through the main entities in the system.
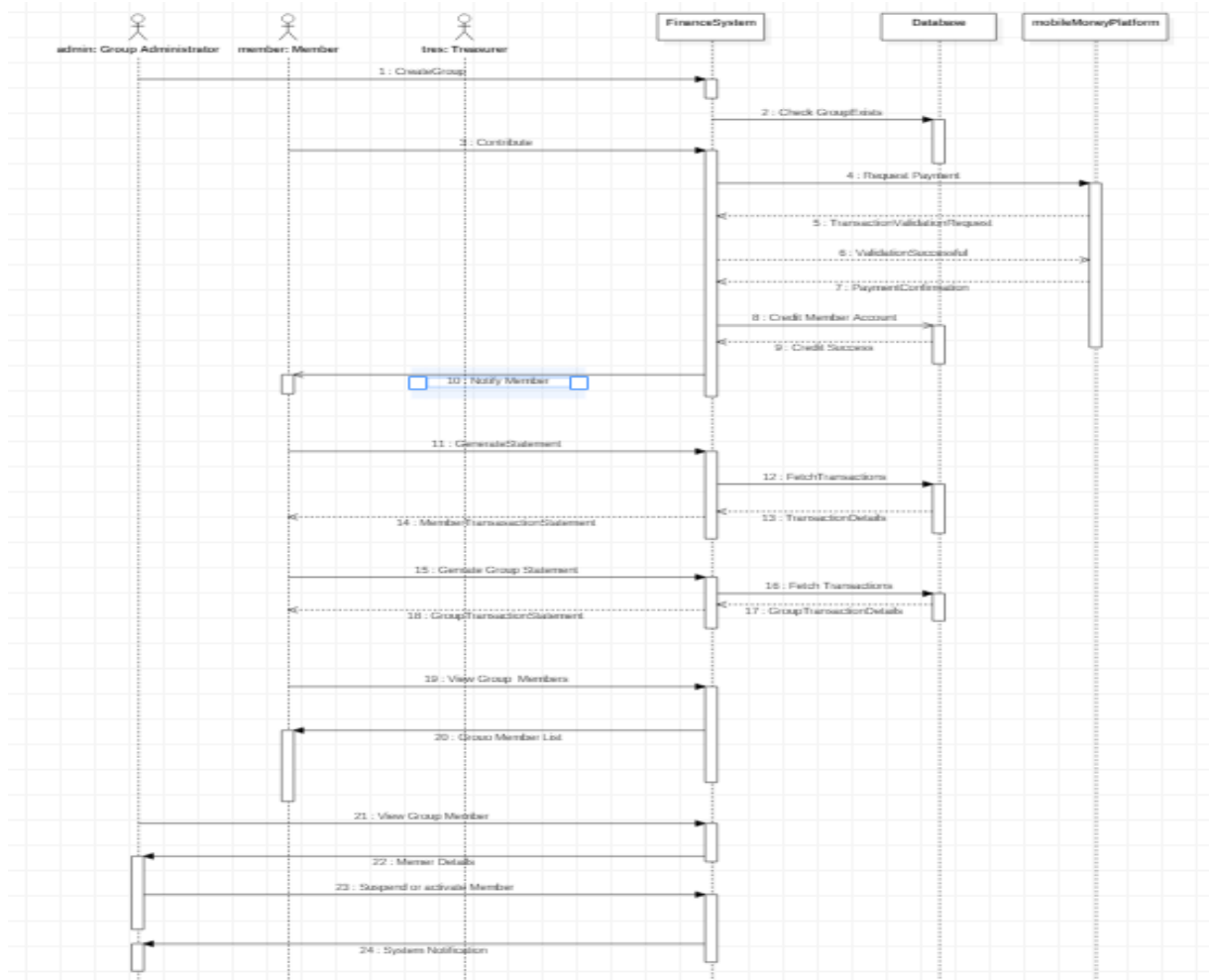
Figure 4.5: System Sequence Diagram

4.4.5 Entity Relationship Diagram

All the entities represented in Figure 4.6 below are used in the database to store data. They can be accessed from both the mobile application and the web back-end system. The InvGroup entity is used to store group details while the GroupMember entity stores member details. Secondly, the MemberAccount entity stores member account details while the the TransactionDetails entity records financial transactions from members. Thirdly, the Investment entity holds all group investment details while the MemberRank entity records a member's rank in the group. Lastly, the InvGroup_GroupMember is a join table that facilitates the many-many relationship between InvGroup and GroupMember entities.
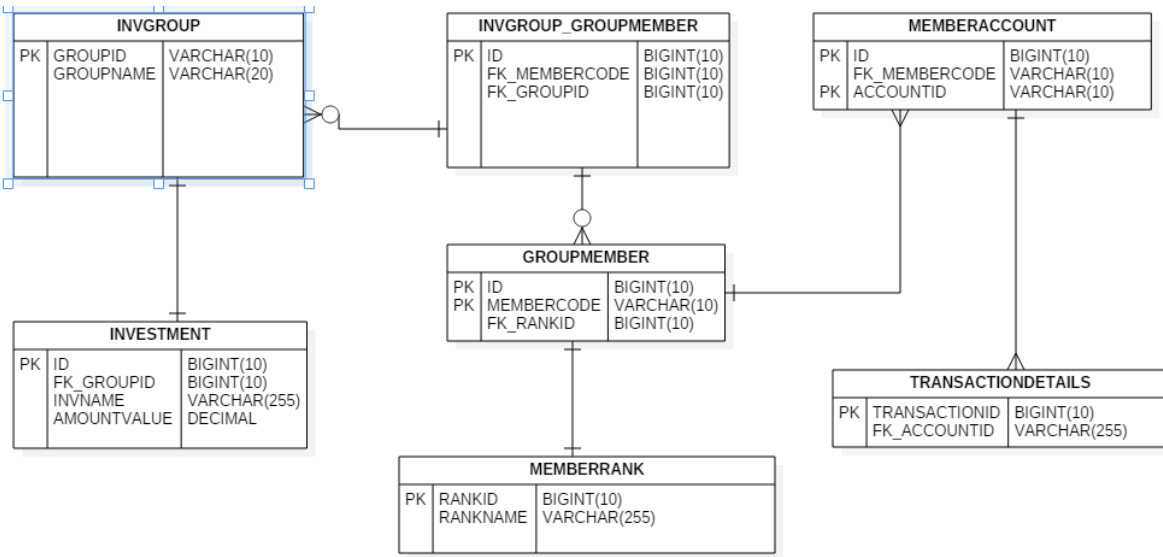
Figure 4.6: Entity Relationship Diagram

4.4.6 Database Schema

Figure 4.7 illustrates the database schema. It puts on show all the database tables realised from the entity relationship diagram in Figure 4.6.
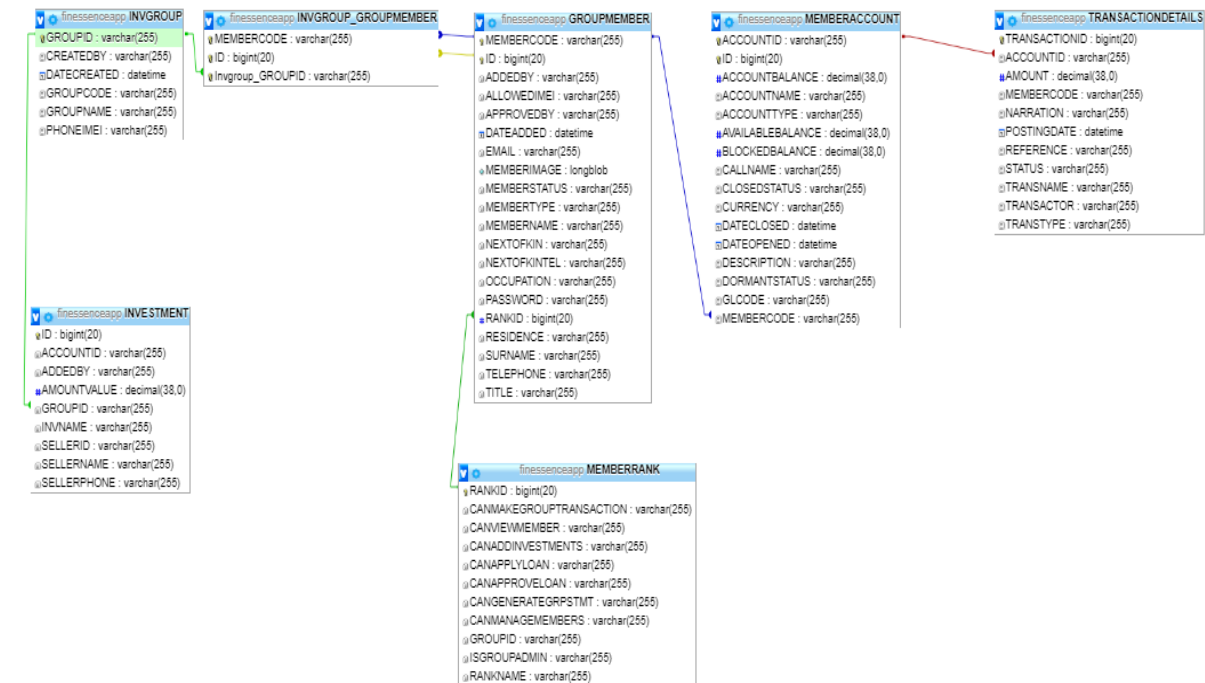
Figure 4.7: Database Schema

4.4 System Architecture

The developed solution has the following main actors: A group administrator (registers new group and assigns roles to group members), group member (makes financial transactions, views group financial status and generates member statements) and finally the Treasurer (generates member and group statements). Figure 4.1 illustrates the system architecture.
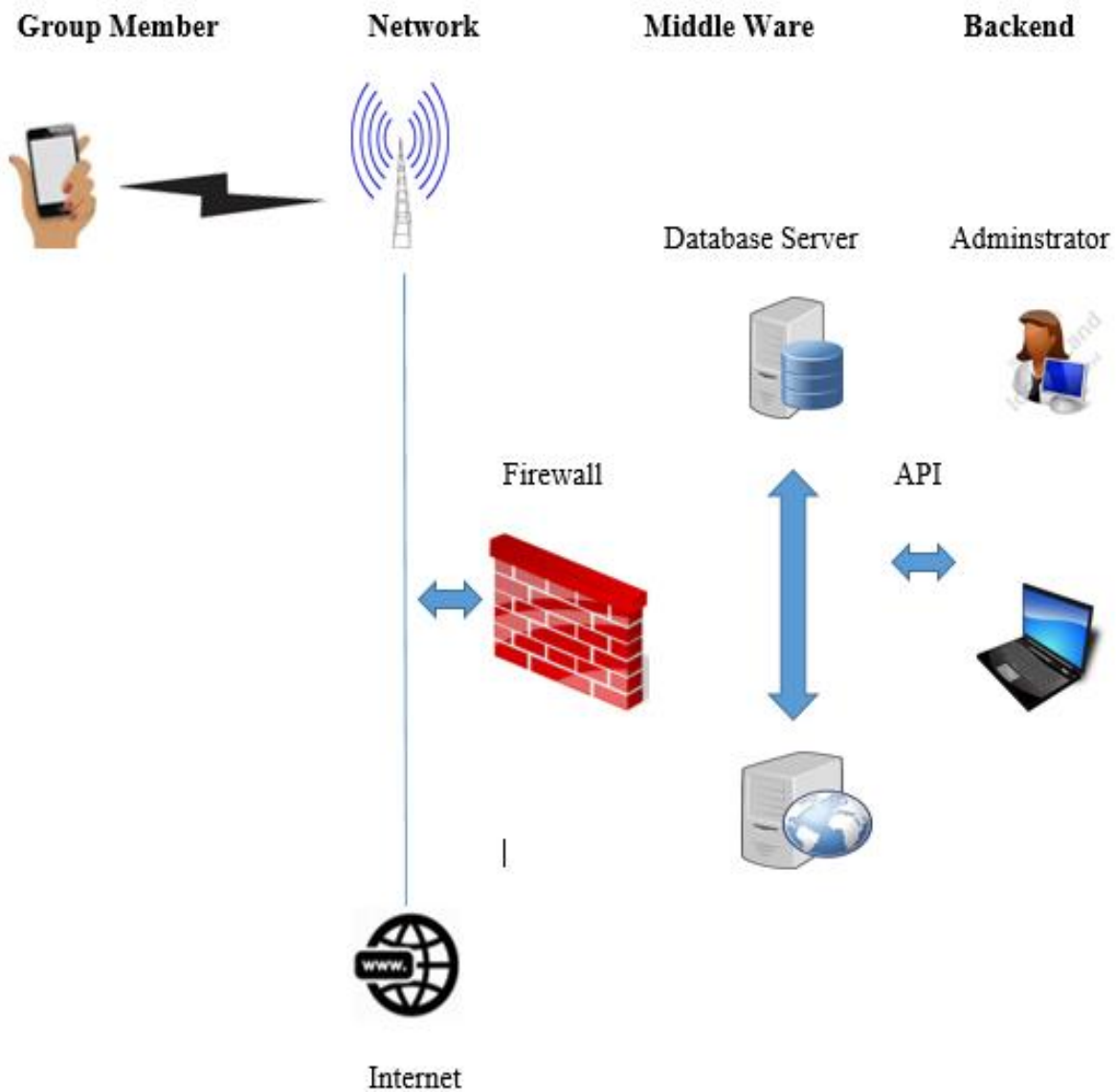
Figure 4.1: System Architecture

4.5 System Mock-ups

The user interface was modelled using mock-ups. A mock-up is a low-fidelity representation of a system design. The researcher preferred to use Mock-ups over wireframes in order to come up with a near look alike prototype. This greatly reduced the design time. The mock-ups were designed using Adobe Illustrator, a vector graphics editor developed and marketed by Adobe Systems. Figure 4.8 shows the first screen when the users starts the application. The screen provides options to sign up or login. If the user opts to sign up, they are redirected to the sign up screen as shown in Figure 4.8.

Figure 4.8: Welcome Screen and Signup mock-ups

Once the user successively signs up, the user is redirected to a login screen that is similar to what is shown in Figure 4.8. On successful login, the user can access various functionalities from the left menu as shown on the screen in Figure 4.9.

Figure 4.9: Login Screen and Menu Screen mock-ups

Figure 4.10 shows the Members screen mock-up. It is a listing of all members in the group. It gives the user the option to add members to the group.
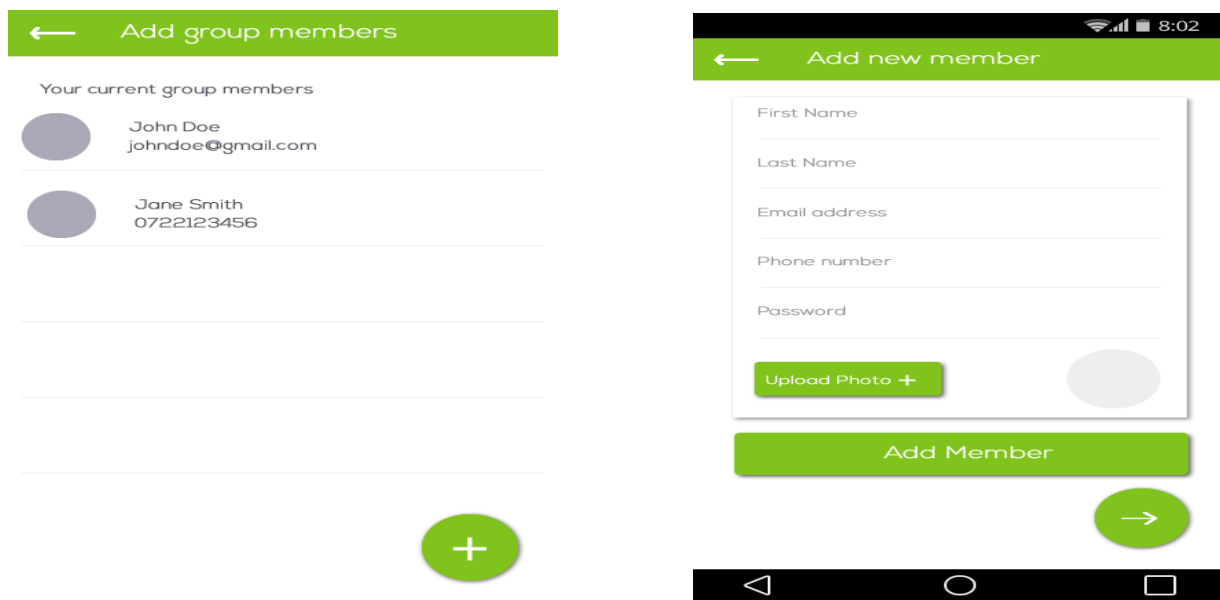
Figure 4.10: Members Screen and Add Member mock-ups

Figure 4.11 shows the members' contribution screen mock-up and the members' dashboard. The user captures contribution details. Once done they are redirected to their dashboard as shown in the figure below.
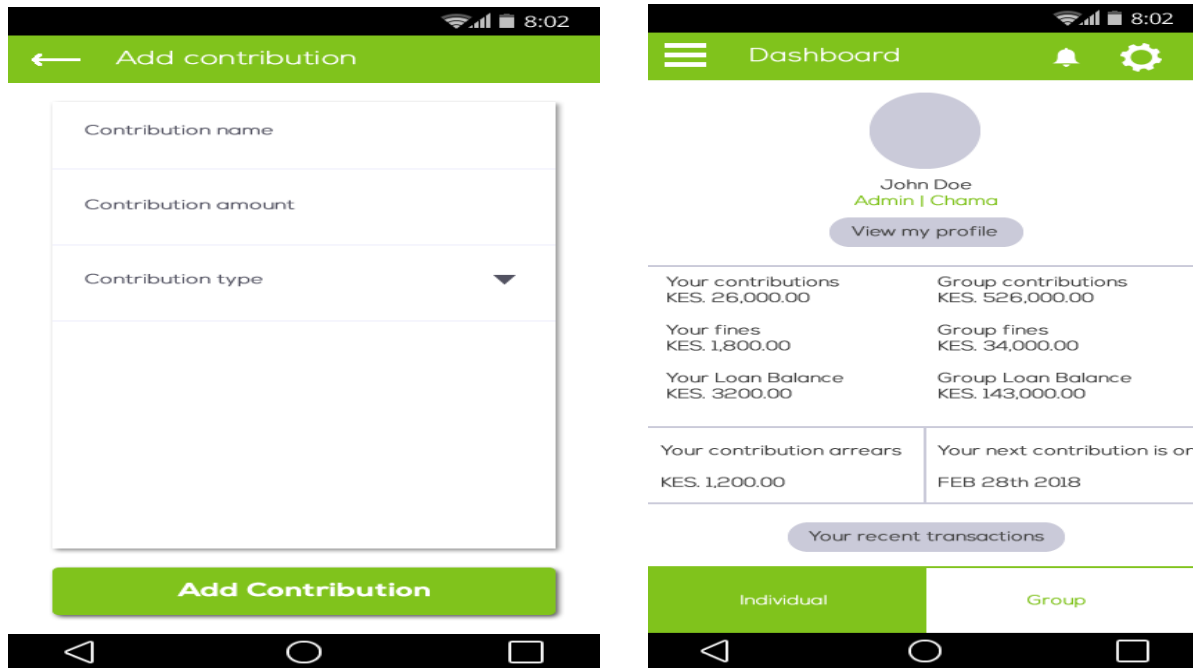
Figure 4.11: Member Contribution and Members dashboard mock-ups

Figure 4.12 shows member view mock-up with options to suspend or delete the member.

Figure 4.12: Member view screen mock-up

Figure 4.13 shows the balance sheet and trial balance financial statements mockup screens.
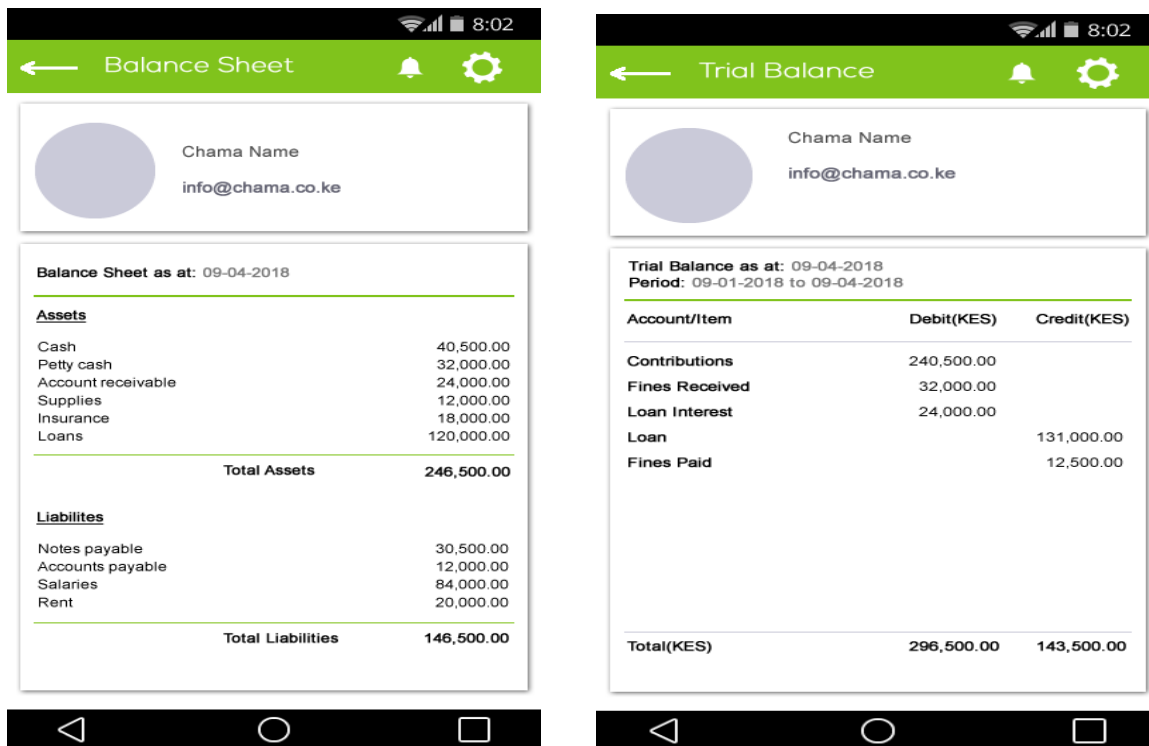
Figure 4.13: Balance sheet and Trial Balance Mock-up Screens

Figure 4.14 shows the Profit and Loss Mockup Screen.
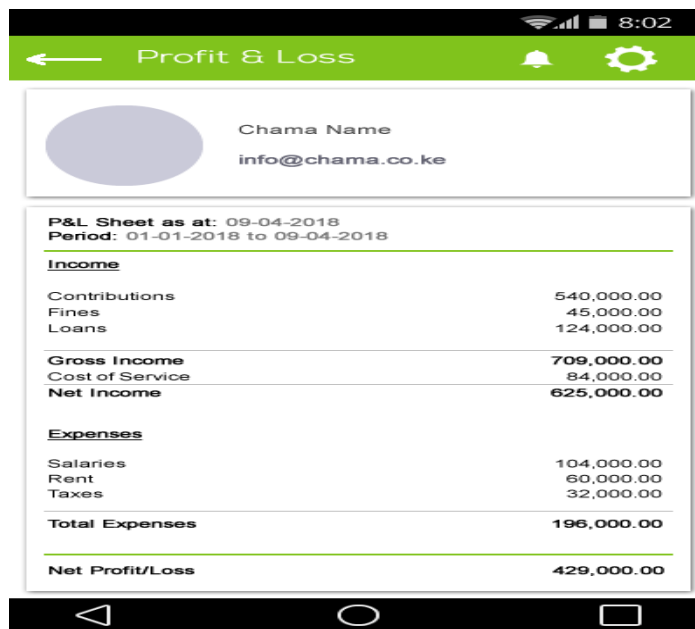
Figure 4.14: Profit and Loss Mock-up Screen

4.6 Security Design

To enforce maximum data security, the researcher undertook various measures. First, all passwords were encrypted using Base64 encoding scheme. Secondly, two-level factor authentication mechanism using one time pins was used to authenticate all users before logging in to the mobile application and making financial transactions.

CHAPTER FIVE: SYSTEM IMPLEMENTATION AND TESTING

5.1 Introduction

The chapter focuses on the implementation and testing of the proposed system. The implementation part, explores different parts of the system, how they were implemented and how they function. The testing section of this chapter focuses on usability testing and functional testing to verify if the application attains the objectives of the proposed solution.

5.2 System Implementation

The system developed is FinEssence and consists of an Android mobile application and a web backend. The web backend enables group administrators to view reports, manage member ranks, manage member accounts, manage mobile money and transactions monitoring.

5.2.1 Mobile Application

The FinEssence mobile application allows investment group administrators: to create investment groups and to add members to a group, allows group administrators to view and manage member profiles. The application allows group members to contribute to the group securely via mobile money and allows for group members to generate their contribution statements. The mobile application enhances transparency in a group by allowing all members to view a group's financial statements, view fellow group members, view their group and individual member information. After downloading and installing the application, the user will be taken through a splash screen Figure 5.1. After the splash, they will be redirected to a welcome screen, Figure 5.2 from where they can opt to login or sign up.

Figure 5.1: Splash Screen
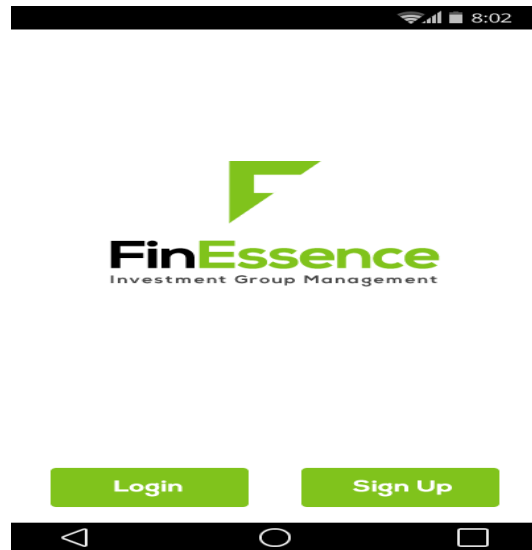
Figure 5.2: Welcome Screen

If the user selects to Sign up, the application redirects to Figure 5.3 where they enter their basic profile details and the group name they wish to register. On completion, the website back-end registers the group, creates the member and group accounts. The system creates the following member accounts: a savings account for capturing member savings, current account for user transactions and a shares account for capturing member shares. The group accounts created consists of an internal revenue account for capturing member fines and other incomes and an internal mobile money account for capturing mobile money transfers. The user receives a short message service (SMS) text to confirm their registration. The SMS text contains a member code that they use in combination with their password to log into the application. The user is then redirected to the login screen Figure 5.3.
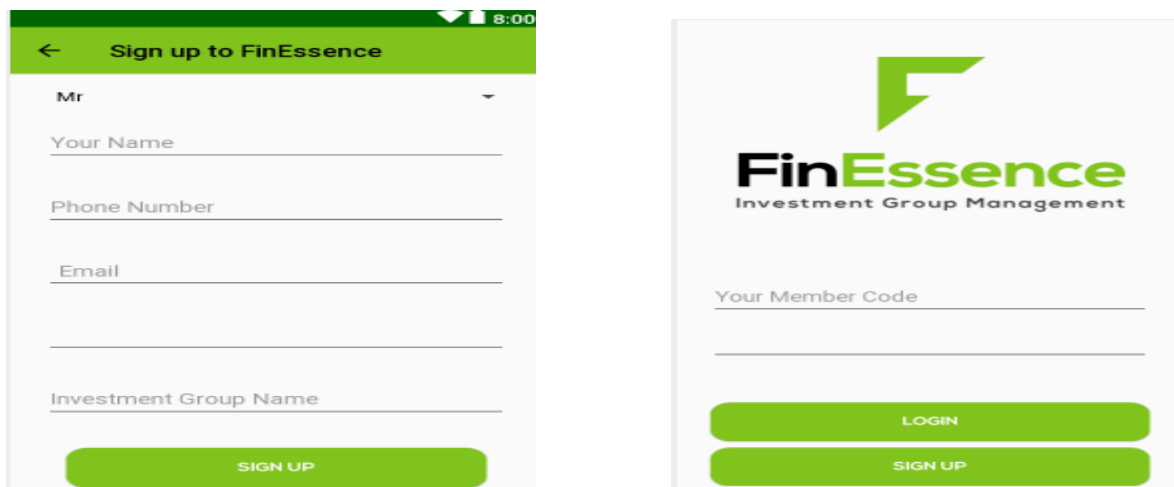
Figure 5.3: Sign Up and Login Screen

On successful login, the system sends a One-Time Personal Identification Number (OTP) via SMS to the user. The application then redirects the user to a one-time pin (OTP) screen Figure 5.4. This usually happens if the user is logging in for the first time. The purpose of the OTP is to enhance security by providing a second layer of authentication. Once the user is authenticated using the OTP, they are redirected to the member dashboard Figure 5.4. The member dashboard shows a member's total net worth, which is a summation of their shares, savings, investments and current account balance.
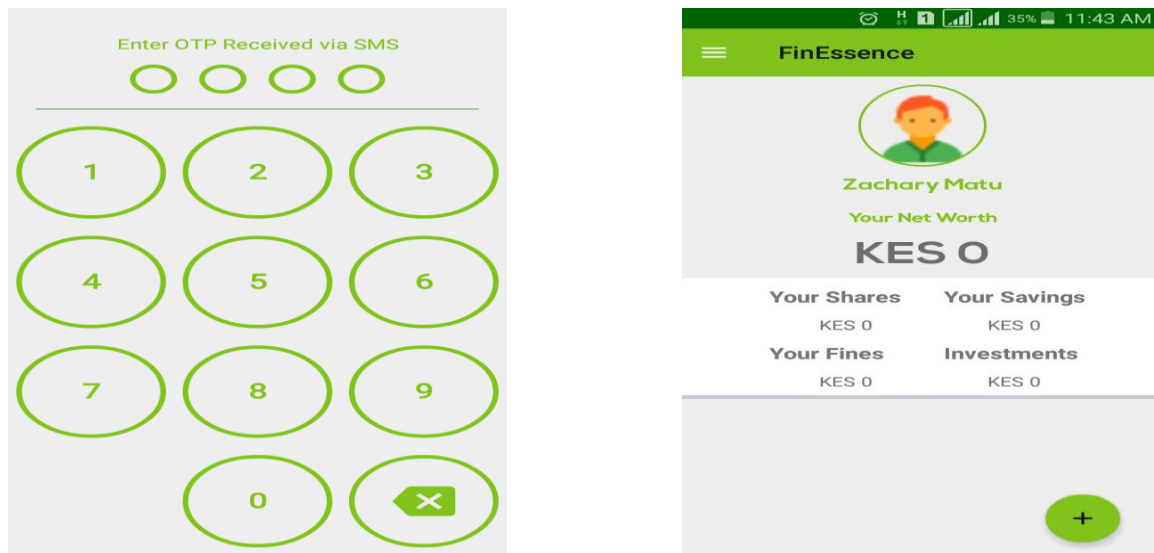
Figure 5.4: OTP Screen and Member Dashboard

The plus button on the member's dashboard provides the user with the option to contribute to the group or generate their contribution statement. On selecting the plus button, a menu appears Figure 5.5 with the options. Once the user selects 'Contribute', the application redirects the user to a contribution screen Figure 5.5.
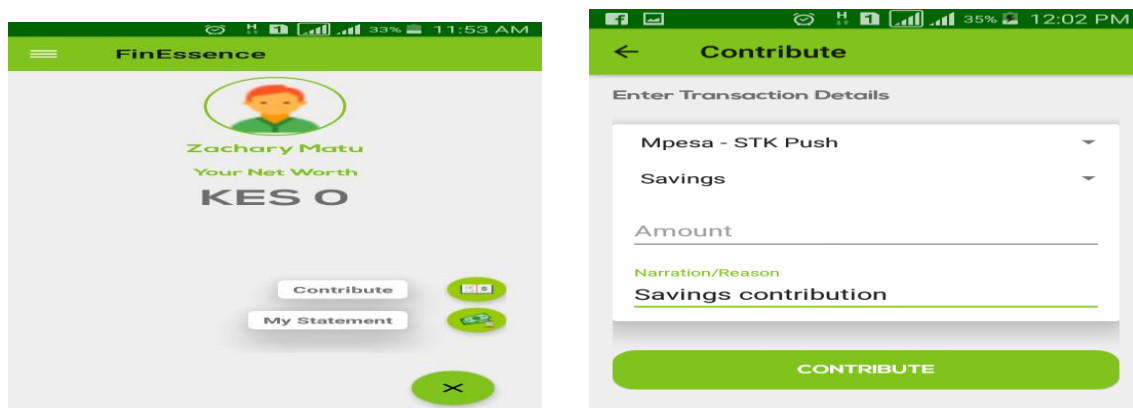
Figure 5.5: Dashboard Menu and Contribution Screen

The contribution screen comprises of a Payment Mode drop down. This allows the user to select a payment mode. There are two payment modes. Wallet payment mode and a mobile money payment mode. The Wallet payment mode enables a group member to contribute from their group's current account while the mobile money payment mode enables a member to contribute from their mobile money account. The mobile money platform used is MPESA, a mobile money platform provided by Safaricom PLC that allows customers to send and receive money from their mobile phones. The mobile money payment mode is listed as 'Mpesa – STK Push' on the Payment Mode drop-down. The screen also comprises of a Transaction Type drop down and has four options. The Savings option allows a group member to make a savings contribution while the Shares option allows the member to make a shares contribution. The Fines option allows the member to make a fine payment while the Wallet option allows the member to fund their group's current account. The amount field enables the user to enter the transaction amount while the narration field allows the member to enter the reason for the transaction. Once the member selects the contribute button, a confirmation dialog appears Figure 5.6. This allows the member to confirm transaction details before submitting the transaction.
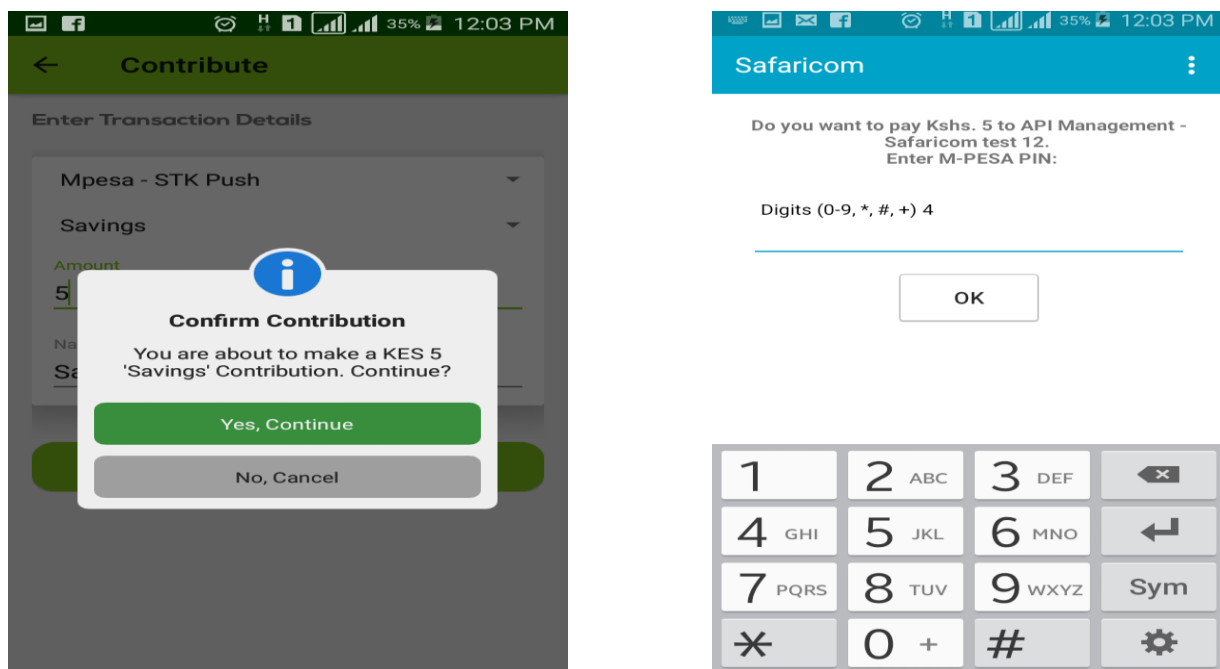
Figure 5.6: Confirmation Dialog and Mpesa PIN Input

Once the user confirms the transaction and the Payment Mode selected is 'Mpesa – STK Push'. The system sends the transaction to the mobile money platform (MPESA) which in turn presents the user with PIN input Figure 5.6. Once the user enters their mobile money PIN, the application

presents the user with a payment confirmation dialog Figure 5.7 and an SMS receipt as shown in Figure 5.7.
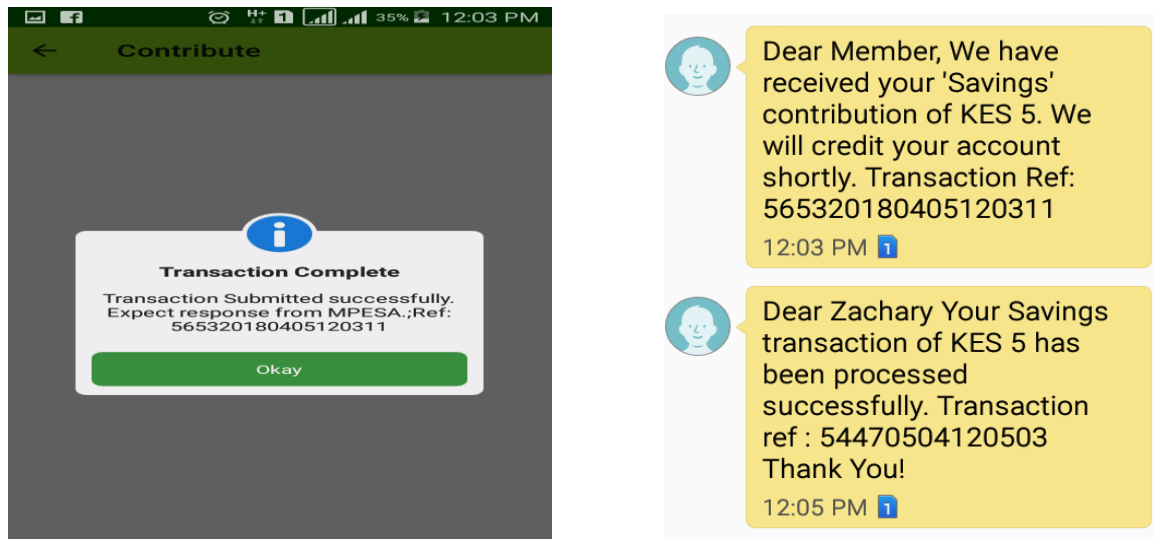
Figure 5.7: Payment Confirmation Screen and SMS Receipt

To generate a contribution statement, the user selects 'My Statement' from the dashboard menu. This causes the mobile application to redirect the user to the Member Statement Screen Figure 5.8 A list of all member transactions is shown. Red arrows depict a debit from the current account while the green arrow depicts a credit into the member's current account.
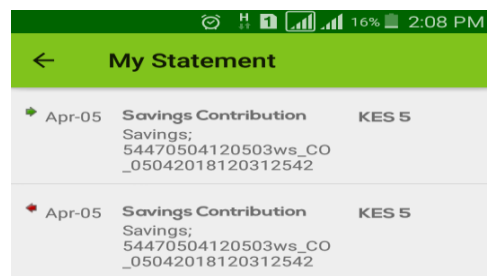
Figure 5.8: Member Statement

To view a group's dashboard, the user selects 'Group Status' from the navigation menu Figure 5.9. The application redirects the user to the group's dashboard Figure 5.9. The dashboard shows the group's net worth which is a summation of the total shares account balances , revenue account and assets account balances. The plus menu Figure 5.10 on the group dashboard exposes a menu that allows the Treasurer to collect funds from members and record group expenses. Once the

Treasurer selects 'Collect From Member', the application takes them to the Collect From Member Screen Figure 5.10. The screen is similar to the Member Contribution Screen in Figure 5.5. The only difference here is that the Group Administrator or Treasurer must input a member code of the member they are collecting funds from.
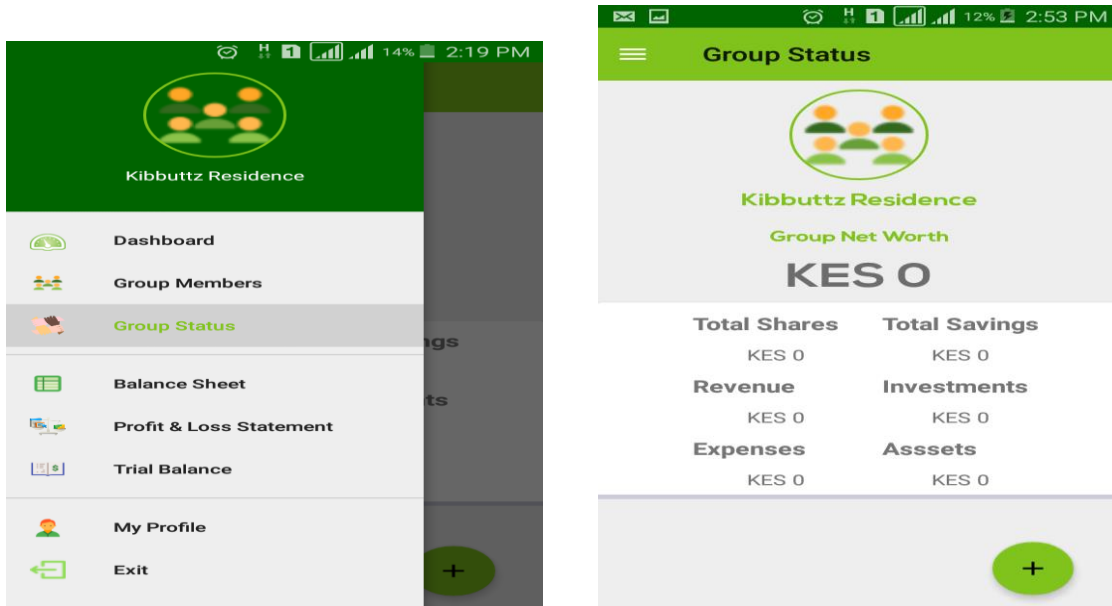
Figure 5.9: Navigation Menu and Group Dashboard
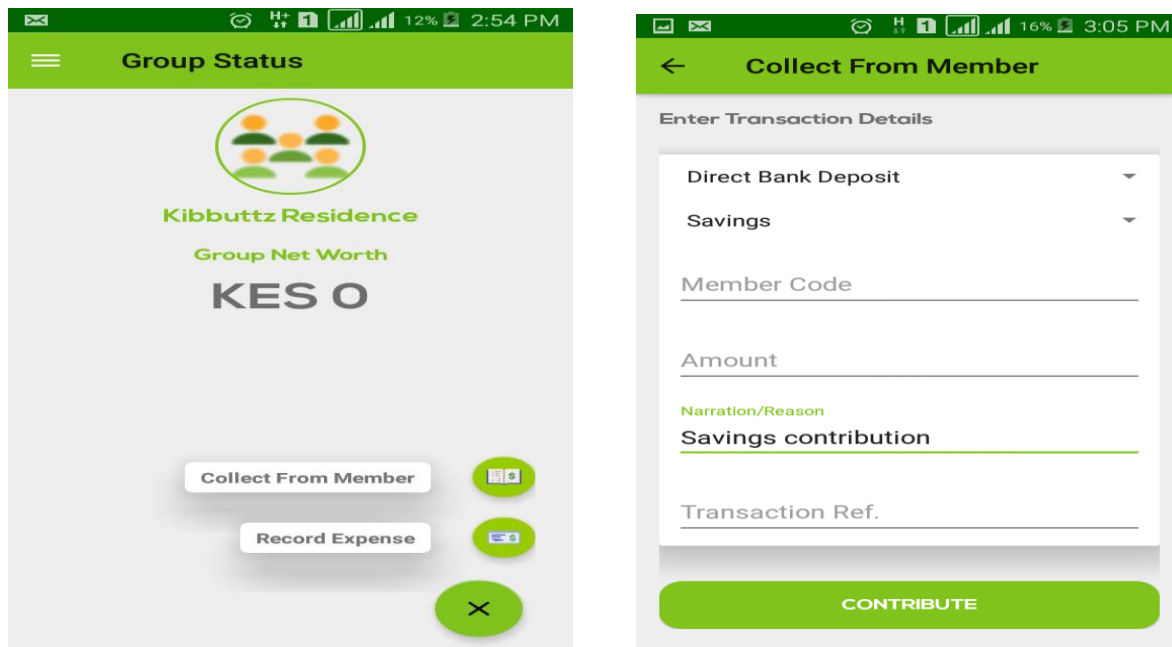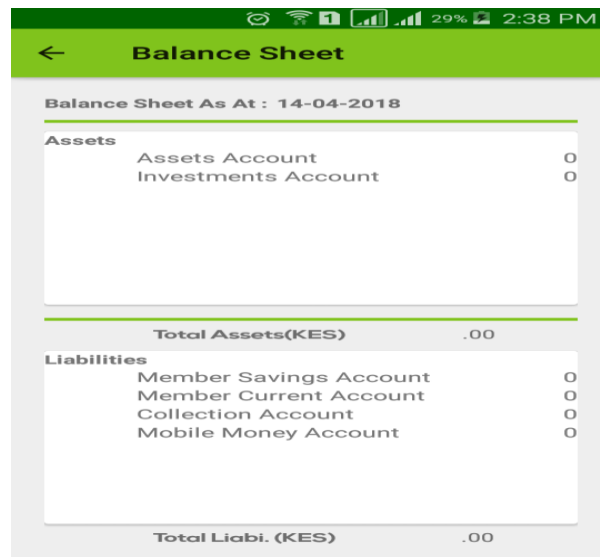
Figure 5.10: Dashboard Menu and Collect from Member Screen
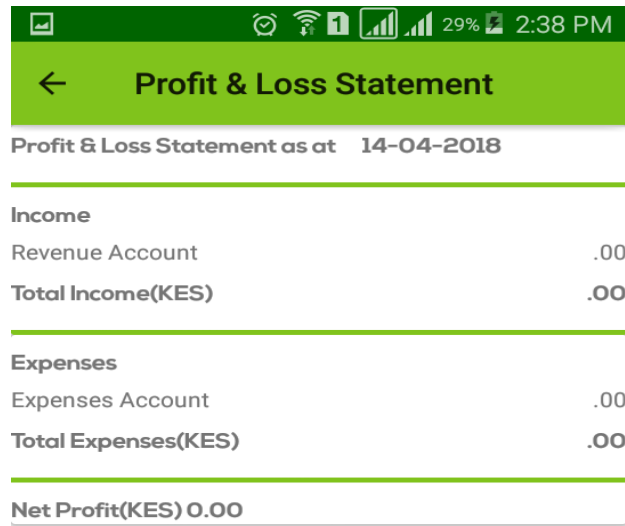
To generate group financial statements, the user selects the appropriate financial statement menu from the Navigation Menu Figure 5.9. To generate the Group Balance sheet, the user selects 'Balance Sheet' from the menu while selecting 'Profit & Loss Statement' prompts the application to generate the Profit and Loss Statement. Selecting 'Trial Balance' prompts the application to generate the group's Trial balance.

To facilitate generation of financial statements, the researcher mapped every account in the system with a General Ledger Code that classifies an account according to its ledger type. For instance, member savings accounts are liability accounts. Therefore, generating a balance sheet is simply a listing of all group's assets and liabilities i.e. displaying the total sum of all liability accounts, and comparing with total sum of assets accounts. Generating a Profit and Loss statement is a listing of all income account balances and expense account balances. Generating a Trial Balance is a listing of all account balances clearly showing debits and credits which must tally. Figure 5.11, Figure 5.12 and Figure 5.13 show the Balance Sheet, Profit and Loss Statement and Trial Balance screens respectively.
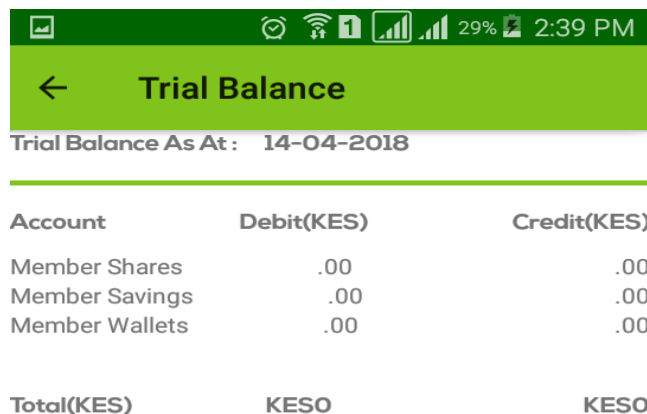
Figure 5.11: Balance Sheet Statement

Figure 5.12: Profit and Loss Statement

Figure 5.13: Trial Balance Statement

Figure 5.14 puts on show how a group administrator adds a new member to a group. The user starts by selecting 'Group Members' on the left Navigation Menu, the application responds by displaying a list of all group members as shown in Figure 5.14. The user then selects the plus sign which displays a menu listing as shown in Figure 5.14. When the user selects the 'Add Member' menu, they are redirected to the add member screen as depicted in Figure 5.15. From there, they fill in the member details before submitting. An SMS registration alert sent to the new member is shown in Figure 5.15. It contains the login credentials for the new member.
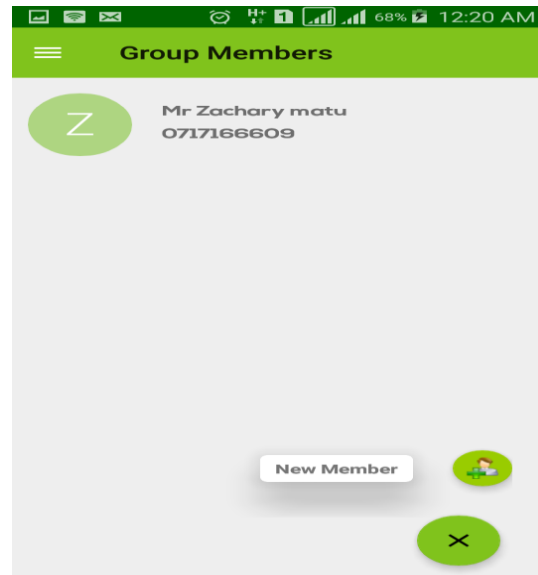
Figure 5.14 Members List and Add Member Menu
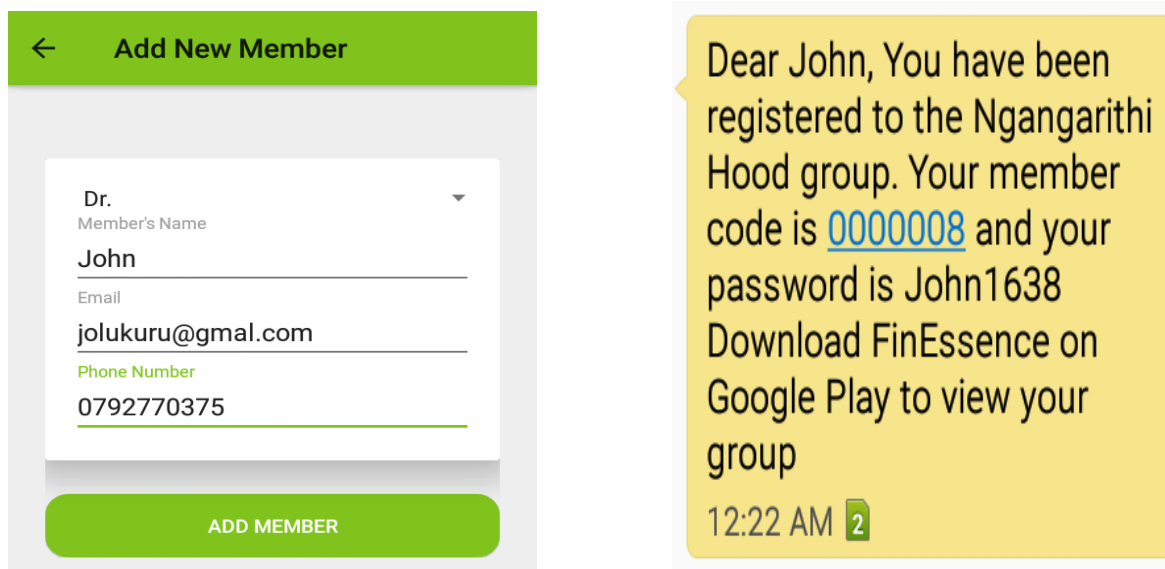
Figure 5.15: Add Member Screen and Registration SMS

To add a new investment to the group, a group administrator starts by selecting 'New Investment' from the left Navigation Menu. After that, they are redirected to the 'Add Investment' screen shown in Figure 5.16. From there, they enter the investment details before clicking on 'Add Investment'.

Figure 5.16: The Add Investment Screen

To record a group expense, a group administrator starts by selecting 'Record Expense' from the group dashboard menu as shown in Figure 5.17. This causes the application to redirect to the 'Record Expense' screen depicted in Figure 5.17. From there, the group administrator selects the expense type and enters the expense amount before clicking on 'Record Expense'.

Figure 5.17: Recording Group Expenses

5.2.2 Web-backend

The FinEssence Web back-end is the main administration panel for the whole system. Its functionalities are: generation of reports, manage member ranks, manage member accounts and transactions monitoring. After successful login, the main dashboard Figure 5.18 is visible. Other modules can be accessed from the dashboard or from the left navigation menu as illustrated in Figure 5.19. The manage member ranks module helps the administrator create different roles for assigning group members as depicted in Figure 5.20 and Figure 5.21 respectively. Further manage member accounts, and transactions monitoring modules are used to manage individual member accounts, and viewing of transactions history respectively whereas, the administrator uses the reports module to generate reports that are useful for decision making as shown in Figure 5.22, Figure 5.23, Figure 5.24 and Figure 5.25 respectively.
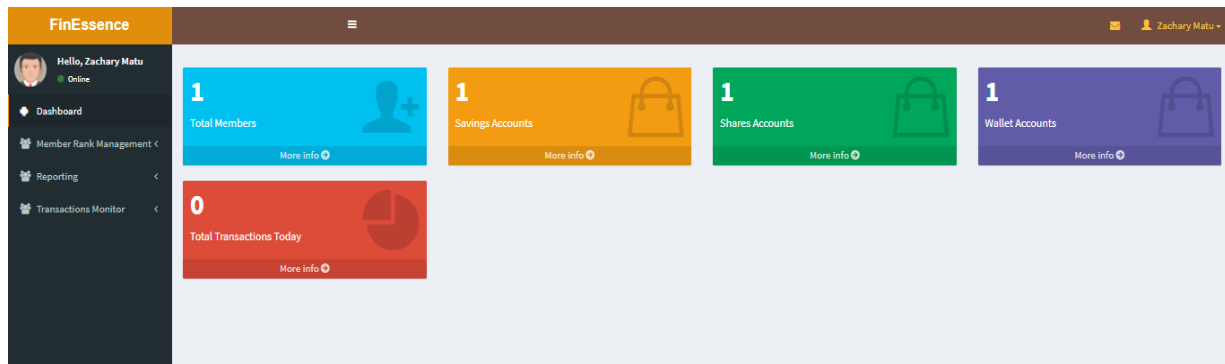
Figure 5.18: Web back-end dashboard

Figure 5.19: FinEssence Web back-end Navigation Menu

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Figure 5.20: FinEssence Member Ranks Management

Figure 5.21: FinEssence Web back-end adding member ranks

Figure 5.22: FinEssence Web Members Report

Figure 5.23: FinEssence Members Savings Accounts Report

Figure 5.24: FinEssence Members Shares Accounts Report

Figure 5.25: FinEssence Member Wallet Accounts Report

The Transaction Monitor module allows for monitoring of member transactions and generation of daily transactions report as illustrated in Figure 5.26.

Figure 5.26: FinEssence Transactions Monitor for monitoring transactions

5.3 System Testing

Usability and functionality tests were performed on the system. Functionality testing focused on the functional parts of the system which are: adding of new groups, member registration, member contributions via mobile money, viewing of group members, authentication in the mobile application; generation of reports, manage member ranks, manage member accounts and transactions monitoring in the FinEssence Web back-end system. Usability testing looked at the following attributes for the various system modules: consistency, efficiency, navigability, ease of learning and use, easy to find content, user interface, user friendliness, predictability, usefulness and responsiveness.

The study selected 20 respondents of the Kibbutz Residence group to carry out tests using the Usability testing questionnaire in Appendix B. The tables below show the various tests that were conducted by the researcher and the respondents to verify that the functional requirements were met.

Table 5.1 illustrates activities carried out by the respondents to test the mobile application.

Table 5.1 Mobile Application Test Cases

Module Name	Test Plan	Expected Behaviour
Group Registration	Group Administrator fills in their personal details, group name on the Sign Up Screen and submits. Tries to register without connecting to the internet.	Validates Empty Fields. Error message indicating no internet shown to the user. Group registered successfully User registered successfully as group administrator SMS alert is sent to the administrator
Authentication	Member enters their member code and password and clicks Login button.	A one-time pin generated and sent to the member. System authenticates the one time pin Fails when invalid credentials input. Fails when no data is input

Table 5.2 Mobile Application Test Cases

Member contributions	Member Contributes to group via mobile money without leaving the application.	System makes call to mobile money platform. Mobile money platform responds by requesting member to authenticate. On success, system sends alert to member. Mobile money platform debits member's mobile money account. Member's accounts is credited and debited successfully. System sends confirmation to member.
Generation of financial statements	Member selects appropriate financial statement from the left navigation menu.	Balance Sheet - Application displays the group balance sheet showing Assets and Liabilities Trial balance – Application displays the group's Trial Balance listing total debits and credits of all accounts. Profit and loss statements – Application displays the groups' profit and loss statement listing income and revenue account balances accurately.
Member Statements Generation	Member selects to view their contributions statement from their dashboard	Application displays member statement accurately depicting debits and credits from their wallet account.
Viewing of group members	Member selects 'Group Members' from Navigation menu	Application displays all group members.

Figure 5.27 depicts the validation messages shown during group registration when the user attempts to sign up without filling all the form fields and the error message shown when the device is not connected to the Internet.
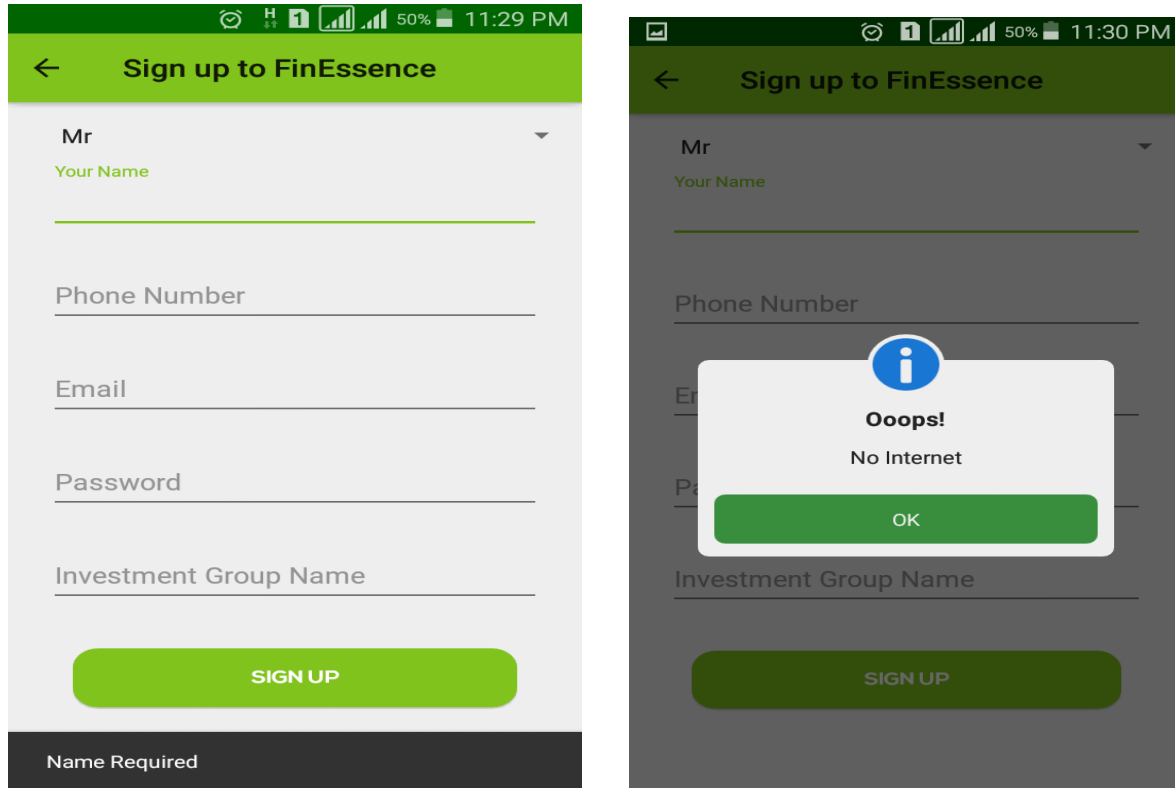
Figure 5.27: Form Validation error message and device connectivity error

Figure 5.28 depicts the error message that is displayed once the user attempts to login without entering their credentials and when they attempt to log in with invalid credentials.
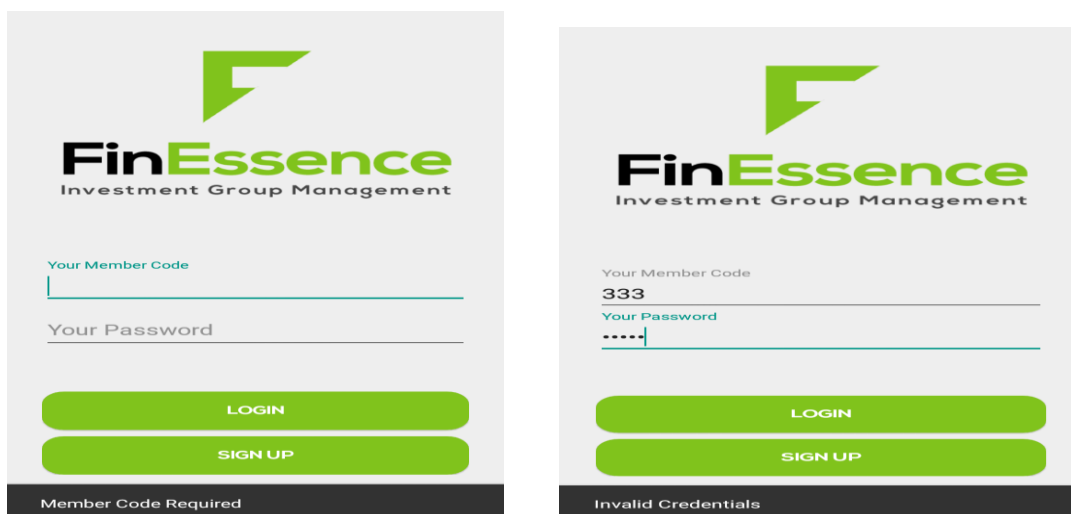
Figure 5.28: Application Error when user fails to enter credentials

Figure 5.29 illustrates the member registration form and the confirmation SMS that is sent to the newly registered member.

Figure 5.29: Member Registration and Confirmation SMS

Figure 5.30 puts on show the PIN input screen from the mobile money platform once a member contributes to a group via mobile money and an SMS confirmation from the system once input to the mobile money platform is complete. Figure 5.28 shows the confirmation SMS from the mobile money platform.

Figure 5.30: Mpesa PIN Input and System Confirmation message
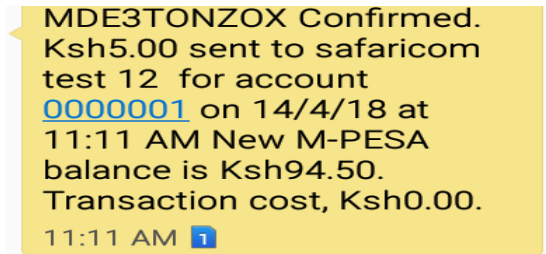
Figure 5.31: Mpesa Payment confirmation SMS

Table 5.3 illustrates activities carried out by the respondents to test the web back-end.

Table 5.3 Web-Backend Test Cases

Module	Test Plan	Expected Behaviour
Authentication	Attempt to login with invalid credentials. Attempt to login without supplying credentials.	System displays 'Invalid Credentials' error message. System validates input and displays error message when no credentials are supplied.
Reports	User is able to retrieve reports from the system	System navigates to the required report page and displays data to the user.
Member Ranks Management	Attempt to add member rank that already exists.	System displays 'Rank Exists' error message.
Transactions Monitoring	Retrieve transaction logs by entering transaction reference	System displays transaction details.

Figure 5.29 depicts the error message displayed to the user when they attempt to login with invalid credentials and when no credentials are supplied.
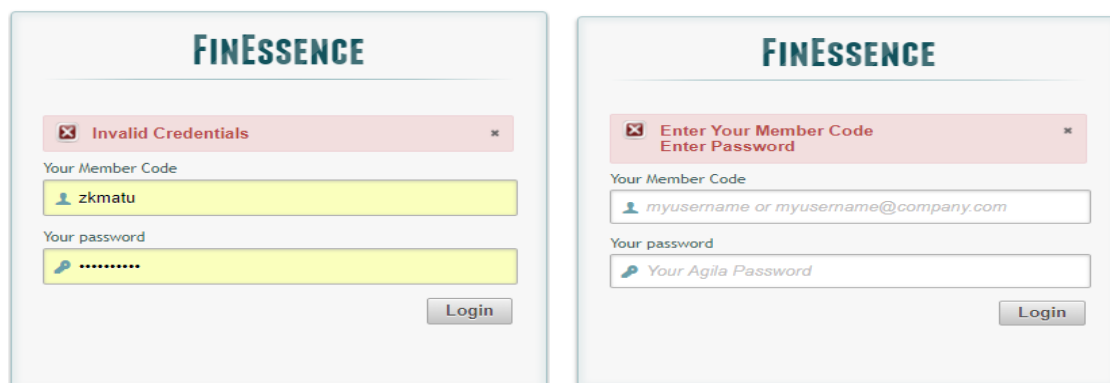
Figure 5.32: Credentials validation error messages

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Figure 5.30 illustrates the error message displayed to the user when an attempt to add an already existing member rank.

Figure 5.33: Member Ranks validation message

CHAPTER SIX: DISCUSSION OF RESULTS

6.1 Introduction

Findings obtained during the research formed the basis on which the mobile finance system was developed. The application was tested to ascertain its features and how usable it was. The chapter entails a detailed discussion of the research findings of the dissertation. This covers analysis of results from the interviews, system usability and functionality tests. Finally, the chapter also analyses the findings in relation to the research objectives.

6.2 Results from Interview Questions
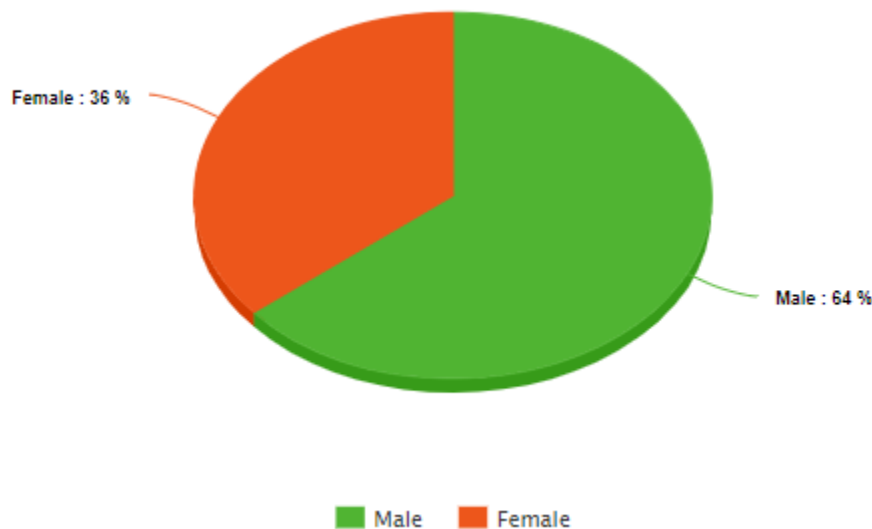
Figure 6.1: Analysis of Respondents' data

Table C.1 on Appendix C, contains biographical data of the respondents interviewed. An analysis of the respondent's gender is represented in Figure 6.1. 64% of the interviewees were male while 36% were female. This is attributable to the men being the majority in most investment groups where the interview was carried out. Figure 6.2 depicts a chart representing the respondents' age variety. 76% of the responders were aged between 18 and 39 years old. This was the largest age group represented. 24% of the remaining respondents were aged above 40 years. This established that the youth were the most receptive to the mobile finance technology.
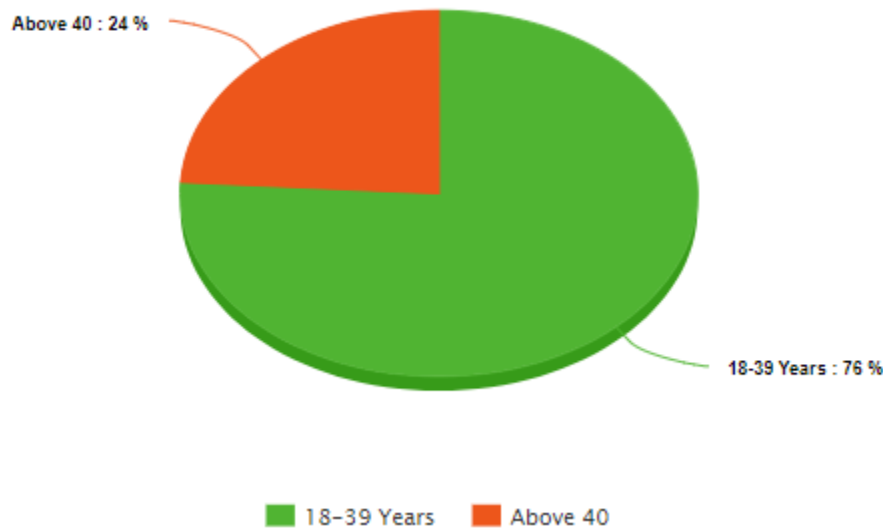
Figure 6.2: Age Variation of the Interviewees

Analysis of the level of education of the responders indicated that majority had reached Secondary. The second largest group had attended College for their education with the least number of the interviewees having attended University. This is depicted in the chart, Figure 6.3
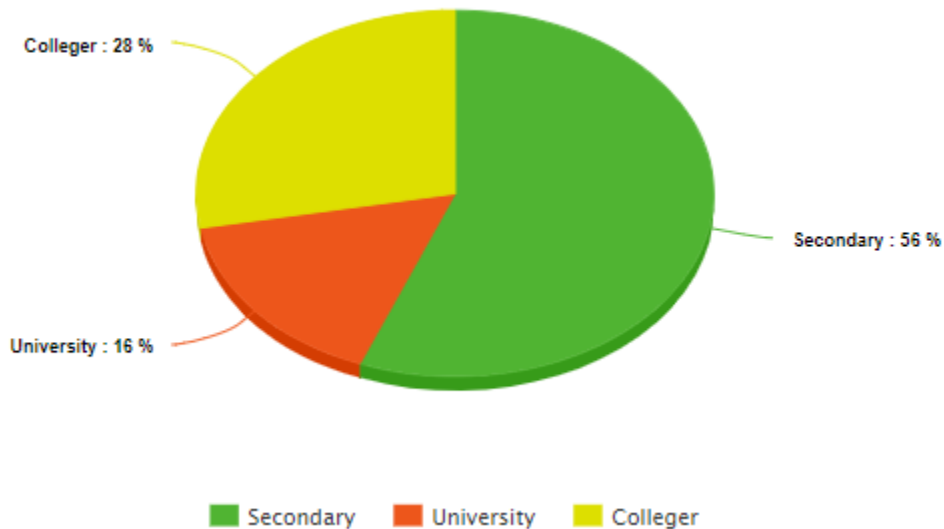
Figure 6.3: Level of Education of Respondents

Data on (Appendix C, Table C.2), was used to establish familiarity of the respondents with mobile applications. All those interviewed owned a cell phone. 88% of the responders had phones which were android enabled and thus android was selected as the platform to realise the solution.

The iOS and windows were gaining acceptance and were represented by 2% and 10% respectively as illustrated in the chart, Figure 6.4.
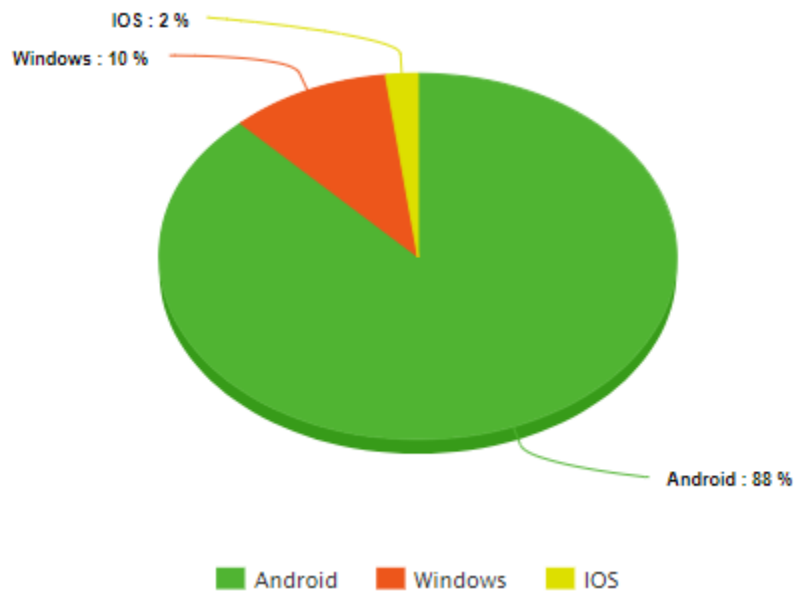
Figure 6.4: Operating System Statistics

Table C.3 on Appendix C, represents data used to establish system and user requirements. Figure 6.5 shows the finance challenges witnessed in investment groups. 42% of the responders faced the problem of real time contributions and transactions monitoring. This was the main problem that the study aimed to address. 34% of the interviewees faced the problem of generating member contributions statements. The dissertation addresses this concern by integrating the system with a mobile money platform for real time transactions as the primary mode of contribution capturing and accounts settlement.
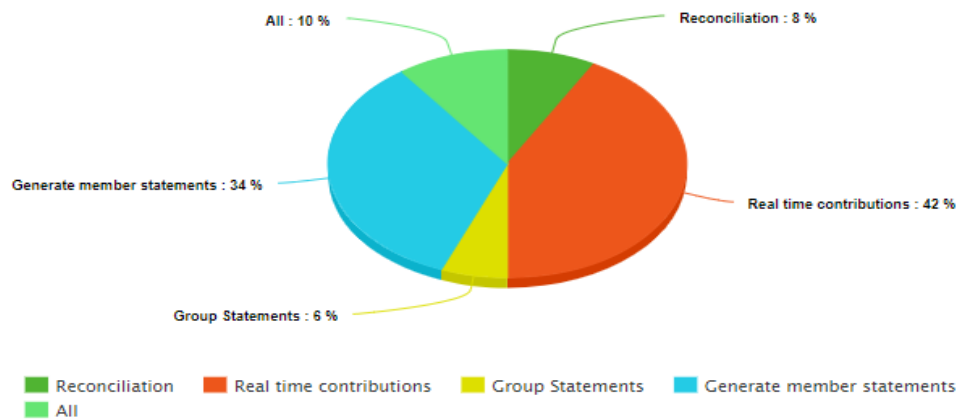
Figure 6.5: Challenges in Investment Groups

Figure 6.6 analyses the preferred modes of contribution for the mobile finance system. 42 % of those interviewed preferred to contribute using cash during meetings. The study therefore adopted the rest (58%): Direct Bank Deposits and mobile money.
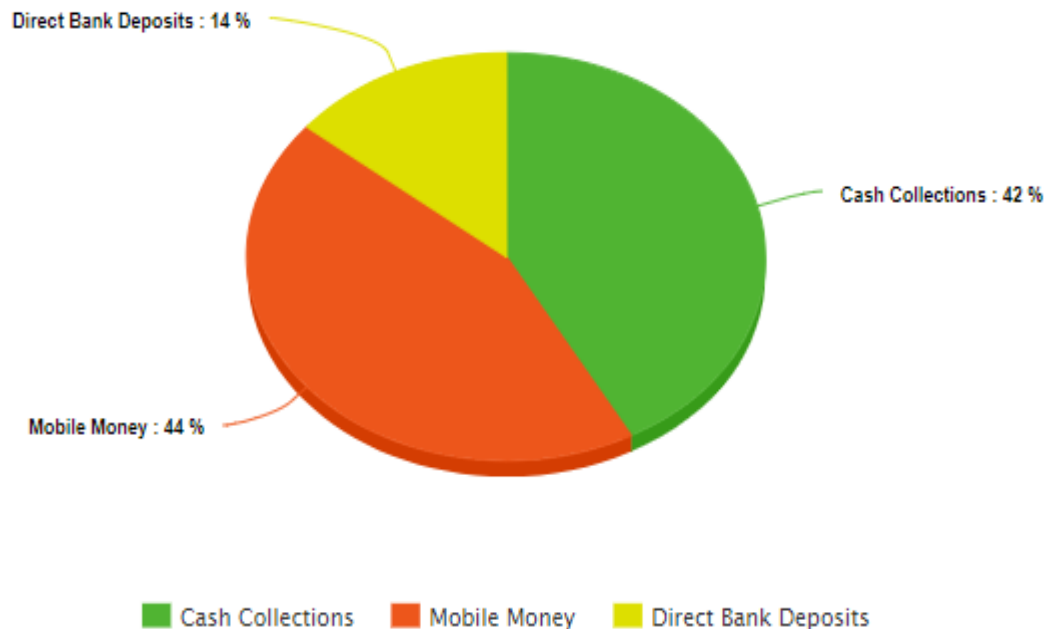
Figure 6.6: Member Contribution Methods

40% of those interviewed stated that the main reason as to why they do not own a Finance Management system was due to lack of a suitable system in the market. 20% stated that existing systems were too expensive while 16% stated that lack of skilled personnel to run and maintain a finance system in the group was the main reason as to why they have not procured one. 24% of

those interviewed stated that they were not aware of existing systems. The analysis is shown in Figure 6.7.
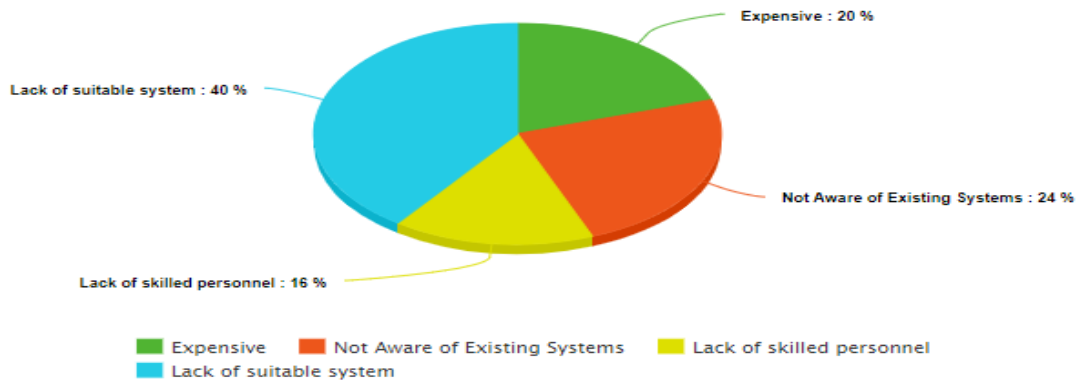
Figure 6.7: Analysis of why investment groups do not own finance systems

Majority of the respondents interviewed were familiar with mobile money technology (66%) as compared with those who were not (34%) as established in Figure 6.8. The most frequently used mobile money platform was MPESA (64%) as compared to Airtel Money (20%), Telkom T-Kash (6%) and Equitel (10%) as illustrated in Figure 6.9. Lastly, analysis of the responses found that the benefits investment groups would gain from a mobile finance management system was better cash flow (72%), ability to transact faster (10%), accountability and openness (18%) as established in Figure 6.10.

Figure 6.8: Users Familiarity with mobile money Technology
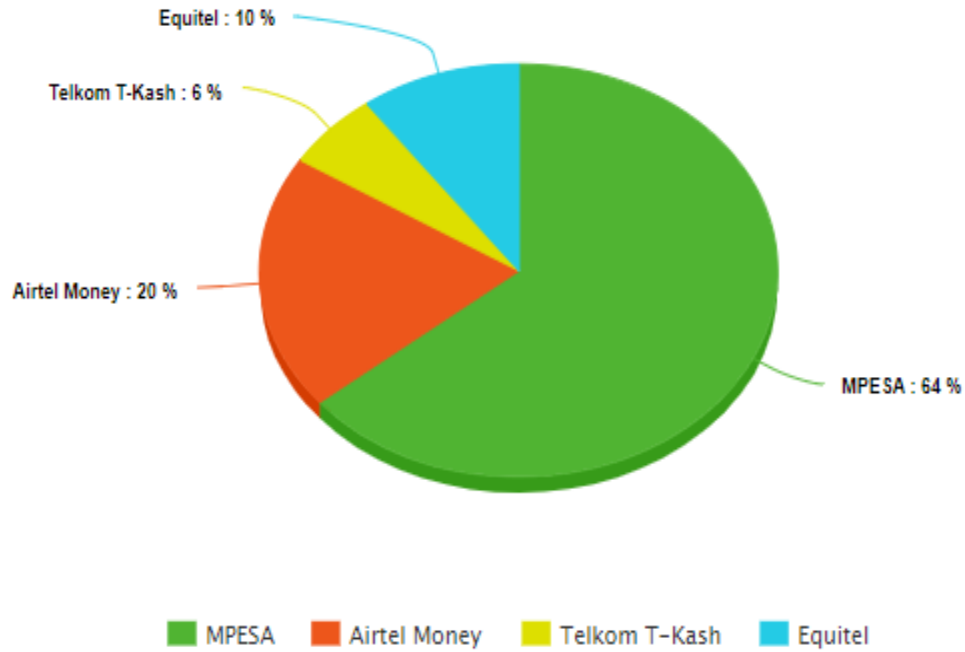
Figure 6.9: Frequently used mobile money platforms
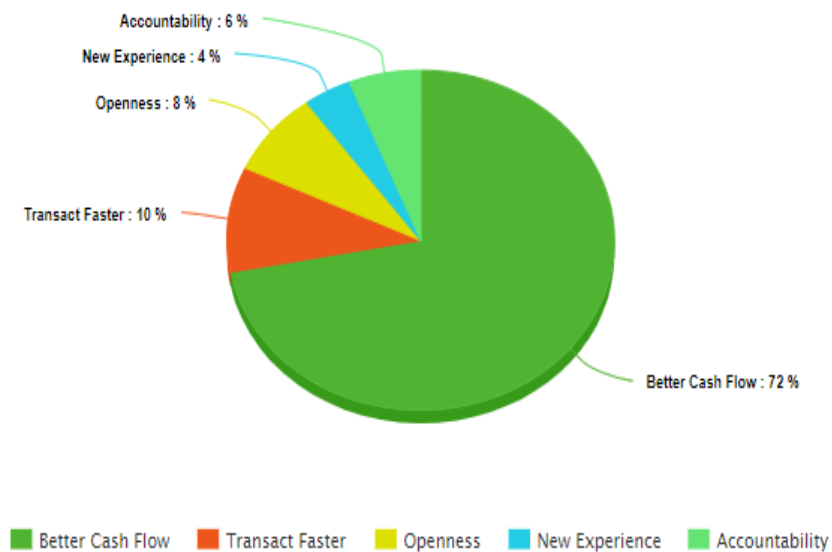
Figure 6.10: Benefits of the proposed solution

6.3 Usability Testing Results

Usability refers to a quality attribute that assesses how easy user interfaces are to use and can be defined by five quality components: Learnability (How easy is it for users to accomplish basic tasks the first time they encounter the design?), Efficiency (How quickly can users perform tasks?), Memorability (Can application users remember how to carry out tasks after a period of time?), Errors (How error prone is the system and how easily can the users recover from the errors?) and Satisfaction (Is the software design pleasant to use?); (Nielsen, 2018).

Feedback on the usability of the application is shown in Figure 6.11. The bar chart indicates that those interviewed found the system good in terms of consistency, efficiency, navigability, predictability, responsiveness and usability. Twenty respondents as visible on (Appendix D, Table D.1), confirmed that the efficiency of the solution was good. In Figure 6.11 and 6.12 the labels 1 to 5, represent the scale of responses for the questionnaire. 1 being the lowest and 5 the highest: 1 - Poor, 2 - Fair, 3 - Good, 4 - Very good, 5 - Excellent.
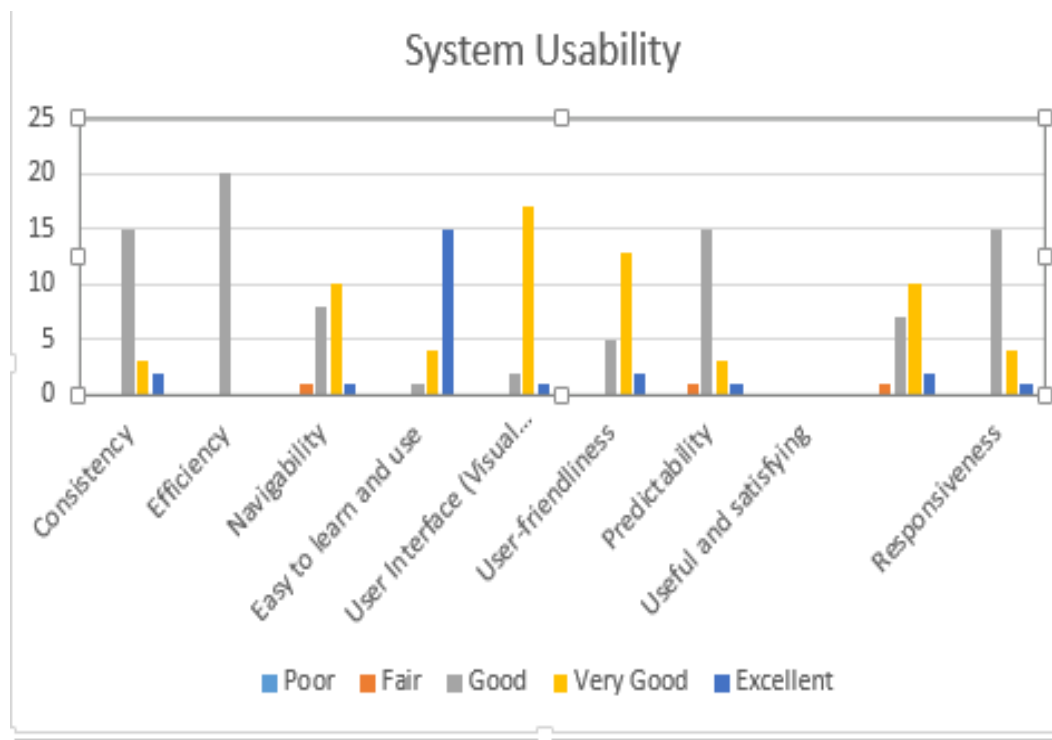
Figure 6.11: Feedback on Application Usability

Each module was also tested individually and as seen on Figure 6.12, the Integration with Mobile Money functionality for contributions capturing had excellent feedback with majority of the respondents in support of the same. The member registration module had poor reception from most of the interviewees. Ten respondents on (Appendix D, Table D.2), found that member registration module performed poorly since a member had to be registered by the group administrator manually. The concern was addressed by the implementation of the member invite feature, which makes adding of members simple.

The performance of each module was also enquired. How fast the modules were in completing their respective tasks. From Figure 6.13, most modules were fast except for the member registration part of the system which was slow due to the manual group administrator registration process. Member contributions via Mobile Money and Reporting were the fastest to execute. On Figure 6.13, the labels 1 to 5 represent the scale of responses for the questionnaire. One is the lowest and five is the highest: 1 - Slow, 2 - Fair, 3 - Fast, 4 - Very fast, 5 - Extremely fast.

Figure 6.12: Response about the Performance of Each Module
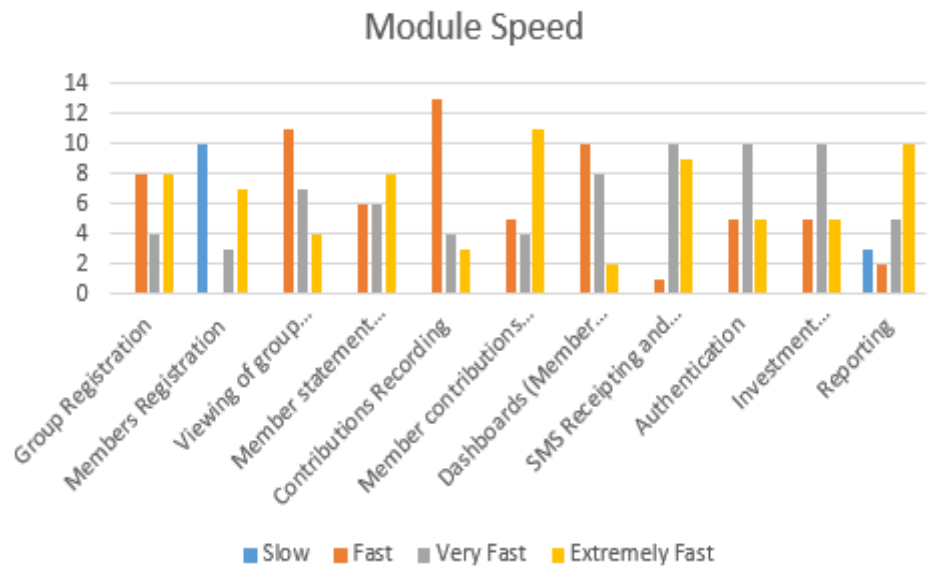
Figure 6.13: Reaction about the Speed of each Module

Figure 6.14 shows the usability of each module. Reporting, Authentication i.e. login / logout and Member contributions via Mobile Money or via Group dashboard were the easiest tasks to learn and get used to perform. On Figure 6.14, the labels 1 to 5 represent the scale of responses for the questionnaire. 1 is the lowest and 5 is the highest: 1 - Not easy, 2 -Fair, 3 - Easy, 4 - Very easy and 5 - Extremely easy
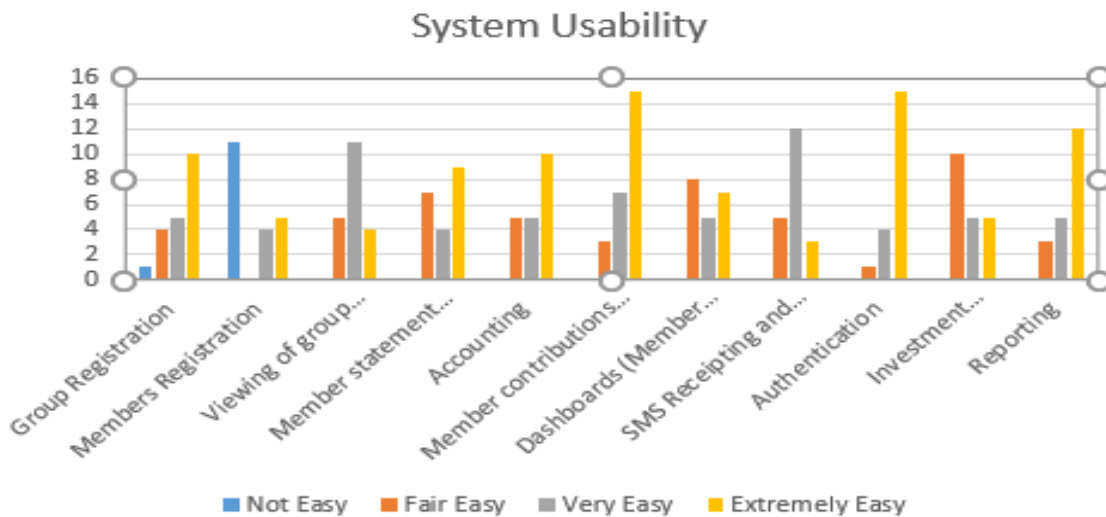
Figure 6.14: Usability of Each Module

6.4 Discussion of Research Findings According to Research Objectives

The study settled for android phones to run the finance management application. In addition, direct integration to a mobile money platform from the application was used for capturing member contributions in real-time.

The mobile finance management system was developed to provide relevant financial management solutions to small-scale investment groups. A comparison between existing systems and the developed system showed that the developed system was better suited for investment groups because of its unique capabilities. These capabilities include real-time transaction capturing and monitoring via mobile money, generation on group financial statements and member contribution statements in real time, expenses capturing, reporting and investment management. The system consisted of an android mobile application for use by members in a particular group and a web-backend for transaction monitoring and reporting. Usability tests were carried out on the application to help ensure its various features were friendly and easy to use to the intended recipients while functionality tests were done to verify that its features are working as expected.

CHAPTER SEVEN: CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The researcher reviewed various literatures so as to identify the components suitable for realizing a mobile finance management system and the appropriate technologies for implementing the mobile application. The literature review pointed out that a combination of android enabled mobile phones and web technologies were the most appropriate tools to use in the realization of the system. Research was carried out to ascertain the information obtained. Findings from the research revealed that mobile phones using the android operating system were the preferred component for use in the mobile finance management system with 88% of those interviewed in support. Secondly, mobile money technology was the most suitable technology for making contributions with 44% of the interviewees agreeing.

A mobile finance management system that can allow investment group members to transact in real time, generate member contributions statements while keeping in tabs with their group's financial position, without the need to undergo tedious processes, can be realized through the use of the FinEssence mobile application. Finally, usability and functionality tests were carried out on the system to help ensure system and user requirements were captured. Results obtained are in Appendix D. The Integration with Mobile Money functionality for contributions capturing had excellent feedback while Reporting, Authentication i.e. login / logout and Member contributions via Mobile Money or via Group dashboard were the easiest tasks to learn and use.

7.2 Recommendations

From the findings of the dissertation, the researcher recommends the following.

i. In order to increase early adoption of the system, mobile money providers should work towards reducing their tariffs especially for small transaction amounts.

ii. A security module that incorporates biometrics needs to be integrated into the mobile finance system to reduce reliance on the member code/password authentication mechanisms.

7.3 Suggestions for Future Research

Given that the system is hugely transaction based, it can be advanced by collaborating with commercial banks to allow for inter-bank transfers. This will not only allow members to transact from their bank accounts in real time but also improve a group's reputation due to increased member deposits. This can be realised by interlinking a member's wallet account with their existing bank accounts allowing for direct credits to their group wallet accounts and vice versa. Secondly, the system can be further developed to issue and sell loan products to group members. This will increase revenue for the groups through interests accrued from loans and other charges. Thirdly, the system can be improved by incorporating an online checkout feature that allows group members to make purchases from online stores using their wallet accounts. Fourthly, there is need for banks to have open APIs for integration with external finance systems to avoid over-reliance on mobile money platforms. Finally, the mobile application runs on Android phones only. It should further be developed to run on IOS and Windows platforms to widen the reach and serve more people

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APPENDICES

Appendix A: Interview Questions

The questions were used to obtain biographical data from the respondents, to establish familiarity of the respondents with mobile applications and to gather system and user requirements.

Introduction

I am a graduate student at Strathmore University undertaking a Master's degree in Mobile Telecommunication and Innovation. I am currently conducting a study on the use of a mobile-based financial management system for investment groups. This interview is aimed at collecting information on system and user requirements. Your response will be treated with confidentiality and used for academic purposes only.

1. What is Your Gender?

   a) Female

   b) Male

2. Age Group?

   a) 18-39 Years

   b) Above 40 Years

3. Highest Level of Education?

   a) University

   b) College

   c) Secondary

   d) Primary

4. Do you own a smart phone?

   a) Yes

   b) No

5. If Yes above What operating system does your smart phone run on?

   a) Android
   b) IOS
   c) Windows

6. How best would you describe your accounting skills?

    a) Basic Advanced

    b) Intermediate

7. What Financial Management challenges do you face in your group?

    a) Real-time transaction monitoring Reconciliation

    b) Generating Group Financial Statements

    c) Generating Member Financial Statements

    d) Other: _____

8. How do members contribute?

    ☐ Direct Bank Deposits

    ☐ Manual cash collections from members during

    ☐ meetings.

    ☐

    We have not started contributing yet

    Via Mobile Money

9. Do you know of any mobile money platforms?

    a) Yes

    b) No

10. Which Mobile Money Platform do you frequently Use?

    a) Mpesa

    b) Airtel Money

    c) Telkom T-Kash

    d) Equitel

    e) Other:

11. How does your group currently record and manage group finances?

    a) Spreadsheet

    b) Manual register

    c) We have finance system

12 Does your group currently own a finance management system?

  a) Yes

  b) No

13 If yes, above what is the name of the system? Briefly, describe how it works

14 If No Above? Why?
  a) Too expensive for my group obtain one not aware of any existing systems

  b) No skilled personnel to run or   use

  c)   Prefer manual process

  d) We are a new group and do not have plans to

      procure one.

  e) We are a new group and we plan to procure one

  f) Other:

14 If your group has a finance system is it Mobile-Based?
  a) Yes

  b) No

16. What benefits would you get if your group owned a mobile-based financial management system?

☐ Accountability
☐ Openness
☐ New Experience
☐ Transact faster
☐ Better Cash Flow

Appendix B: Usability Testing Questionnaire

This questionnaire was used to gather information about the experience that the responders had when using the system and the performance of each application module.

1. Have you in the past used a system or mobile application?

   a) Yes

   b) No

2. If the answer is yes, for what purpose did you use the system or mobile application?

3. Did the application fail or crash unexpectedly, during testing?

   a) Yes

   b) No

4. If the answer is yes, expound on what happened

5. What feature interested you the most?

   a) Ability to register a group and add members
   b) Generation of group financial statements
   c) Generation of Member Statements
   d) Contributions
   e) Viewing group members
   f) Dashboards (Member and Group)
   g) Accounting
   h) Integration with Mobile Money platforms.
   i) SMS Receipting

6. How would you rate the whole application? Select where appropriate for each attribute*

	Poor	Fair	Good	Very Good	Excellent
Consistency					
Efficiency					
Navigability					
Easy to learn and use					
User Interface (Visual Appeal)					
User-friendliness					
Predictability					
Useful and satisfying					
Responsiveness					

7. How good is the system in carrying out the following functionalities? Tick where appropriate

Task	Poor	Fair	Good	Very Good	Excellent
Group Registration					
Members Registration					
Viewing of group members					
Member statement generation					
Accounting					
Member contributions via Mobile Money and Via Group Console					
Dashboards (Member and Group)					
SMS Receipting and alerts					

8. How fast is the software in performing the following tasks?

Task	Slow	Fair	Fast	Very Fast	Extremely Fast
Group Registration					
Members Registration					
Viewing of group members					
Member statement generation					
Accounting					
Member contributions via Mobile Money and Via Group Console					
Dashboards (Member and Group)					
SMS Receipting and alerts					
Authentication					

9. How easy was it for you to learn how use the application to perform the following tasks?

Task	Not Easy	Fair	Easy	Very Easy	Extremely Easy
Group Registration					
Members Registration					
Viewing of group members					
Member statement generation					
Accounting					
Member contributions via Mobile Money and Via Group Console					
Dashboards (Member and Group)					
SMS Receipting and alerts					
Authentication					

10. Anything else you would like to add / comment about the usability of the system?

Appendix C: Interview Questions Responses

This appendix depicts responses to the interview questions. Table C.1 shows the results obtained after gathering personal details from the test population

Table C.1: Biographical Data

Personal Attribute	Response	Total Number
Gender	Male	32
	Female	18
Age Group	Below 18 Years	38
	18-39 Years	12
Level of Education	University	28
	College	8
	Secondary	14
	Primary	0

Table C.2 presents data about the interviewees' Smart Phone ownership and operating system.

Concern	Response	Total Number
Do You own a smart phone?	Yes	50
	No	0
If Yes above What operating system does your smart phone run on?	Android	44
	IOS	1
	Windows	5

Table C.3 represents data used to establish system and user needs.

Table C.3: System and User Requirements

Concern	Response	Total Number
Finance Management Challenges in groups	Reconciliation	4
	Real time contributions and transaction Monitoring	21
	Generating group financial statements	3
	Generating member financial statements	17
	All of the above	5
Accounting Skills	Basic	40
	Advanced	7
	Intermediate	3
Member Contribution Methods	Direct Bank Deposits	7
	Manual Cash collections	21
	Via mobile money	22
Contributions and Transactions recording in groups	Spreadsheets	20
	Manual Register	12
	Finance System	8
	Not Sure	10
Familiarity With Mobile money platforms	Yes	33
	No	17
Frequently Used Mobile Money Platform	Mpesa	32
	Airtel Money	10
	Telkom T-Kash	3
	Equitel	5
Why Groups do not own a finance management system	Expensive	10
	Not aware	12
	Lack of skilled personnel to run a finance system	8
	Lack of a suitable one in the market	20
Benefits of a mobile finance management system	Accountability	3
	Openness	4
	New Experience	2
	Transact Faster	5
	Better cash flow	36

Appendix D: Usability Testing Questionnaire Responses

This appendix illustrates the responses from the usability-testing questionnaire. Table D.1 displays feedback about general feel of the responders towards the system

Table D.1: Feedback about the System

	Poor	Fair	Good	Very Good	Excellent
Consistency	0	0	15	3	2
Efficiency	0	0	20	0	0
Navigability	0	1	8	10	1
Easy to learn and use	0	0	1	4	15
User Interface (Visual Appeal)	0	0	2	17	1
User-friendliness	0	0	5	13	2
Predictability	0	1	15	3	1
Useful and satisfying	0	1	7	10	2
Responsiveness	0	0	15	4	1

Table D.2 exhibits the responses obtained about the performance of each module.

Table D.2: Performance of System Module

	Poor	Fair	Good	Very Good	Excellent
Group Registration	0	0	4	15	1
Members Registration	10	0	3	7	0
Viewing of group members	0	0	0	15	5
Member statement generation	0	1	8	10	1
Accounting	0	0	5	5	10
Capturing member contributions via Mobile Money	0	0	0	0	20
Dashboards (Member and Group)	0	7	10	3	0
SMS Receipting and alerts	0	0	0	1	19
Authentication	0	0	0	18	2
Investment Management	0	0	18	1	1
Reporting	0	15	3	1	1

Table D.3 tabulates how fast the various modules were in executing their tasks.

Table D.3: Speed of Application Modules

	Slow	Fast	Very Fast	Extremely Fast
Group Registration	0	8	4	8
Members Registration	10	0	3	7
Viewing of group members	0	11	7	4
Member statement generation	0	6	6	8
Accounting	0	13	4	3
Member contributions via Mobile Money and Via Group Console	0	5	4	11
Dashboards (Member and Group)	0	10	8	2
SMS Receipting and alerts	0	1	10	9
Authentication	0	5	10	5
Investment Management	0	5	10	5
Reporting	3	2	5	10

Table D.4 reveals how easy to learn and accomplish their tasks the system parts were.

Table D.4: Usability of Software Modules

	Not Easy	Fair Easy	Very Easy	Extremely Easy
Group Registration	1	4	5	10
Members Registration	11	0	4	5
Viewing of group members	0	5	11	4
Member statement generation	0	7	4	9
Accounting	0	5	5	10
Member contributions via Mobile Money and Via Group Console	0	3	7	15
Dashboards (Member and Group)	0	8	5	7
SMS Receipting and alerts	0	5	12	3
Authentication	0	1	4	15
Investment Management	0	10	5	5
Reporting	0	3	5	12

Appendix E: Use Cases

This section illustrates the system use cases that the researcher used to come up with the final system.

E.1 Use-Case: Add Member

This Use-Case reports registration of a new member to a group.

Pre-conditions:

Member not yet registered to the group.

Post conditions:

Member registered to an investment group and is ready to transact.

Main success scenario:

1. Administrator opens the mobile application.
2. Selects add members.
3. Administrator enters mandatory member information details
4. System verifies if the member is already registered.
5. System records details and presents results.

Alternative Flow: Registration failure

At step 5, system fails to register customer.

- Repeat process.
- Check internet connectivity.
- Member not registered.

Alternative Flow: Duplication error

At step 4, system finds that the member is already registered.

- Cancels operation.
- Administrator updates member details and repeats process.

E.2 Use-Case: Suspend Member

This Use-Case reports registration of a new member to a group.

Pre-conditions:

Member already exists in the system.

Post conditions:

Member details updated successfully.

Main success scenario:

1. Administrator opens the mobile application.
2. Selects Group members.
3. Administrator selects member.
4. System retrieves member details and presents to user.
5. Administrator suspends and activates member accordingly.

E.3 Use-Case: Add Investment

This Use-Case reports addition of a new group investment.

Pre-conditions:

User has rights to add investments in the system.

Post conditions:

Investment added successfully and a notification sent to members.

Main success scenario:

1. Administrator opens the mobile application.
2. Selects add investment.
3. Administrator enters relevant investment details.
4. System validates information/details entered.
5. System records investment details and notifies all members

Alternative Flow: Validation error

At step 4, system finds errors in information entered.

- Cancels operation and presents relevant error message.

E.4 Use-Case: View Investment

This Use-Case reports viewing of a new group investment.

Pre-conditions:

User must be a member of the group.

Post conditions:

System presents investment details to user.

Main success scenario:

1. Member opens the mobile application.
2. Selects view investment.
3. Member searches investment by name.
4. System validates information/details entered.
5. System retrieves investment details and presents the information to member.

Alternative Flow: No data error

At step 4, system finds that no investment exists that matches name provided in search.

- Cancels operation and presents relevant error message.
- Presents search input for the user to repeat the search process.

E.5 Use-Case: Make Contribution

This Use-Case reports recording of a new contribution from group members.

Pre-conditions:

User must be a member of the group.

Post conditions:

System successfully records payment details and sends alert to group members.

Main success scenario:

1. Member opens the mobile application.
2. Selects contribute.
3. System presents payment options.
4. User selects mobile money.
5. System presents mobile money options to user.
6. User selects preferred and system presents interface to enter mobile money pin.

7. User enter pin and confirms transaction.

8. System records transaction and a sends notification to the member.

Alternative Flow: Communication Error

At step 6, system is unable to connect to mobile money provider.

- Check internet connectivity.

- Repeats process.

Alternative Flow: Insufficient funds error

At step 7, system finds that member has insufficient funds to complete the transaction.

- Cancels operation and presents relevant error message.

- Navigates to home screen.

E.6 Use-Case: Generate Member Statement

This Use-Case reports statement generation by members.

Pre-conditions:

User must be a member of the group and can only generate their statements.

Post conditions:

System presents member's contribution statement.

Main success scenario:

1. Member opens the mobile application.

2. Selects my statements.

3. System retrieves transaction records and presents to the user.

Alternative Flow: No Records Found Error

At step 5, system finds that no transaction records exist for the dates specified.

- System reports that no transaction records found.

E.7 Use-Case: Generate Group Financial Statements

This Use-Case reports statement generation by members.

Pre-conditions:

User must be a member of the group.

Post conditions:

System presents groups financial statement options.

Main success scenario:

1. Member opens the mobile application.
2. Member selects relevant group financial statement.
3. System retrieves the appropriate financial statement.

Alternative Flow: No Records Found Error

At step 5, system finds that no transaction records

- System reports that no transaction records found.

The next section describes activity diagrams for the use-case steps discussed in this section.

Appendix F: Turnitin Report

Figure E.1 shows the originality results of the dissertation obtained from the Turnitin software.

Figure E.1: Turnitin Report