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**A Mobile Application to Promote Neighbourhood Relationships and Provide
Residential Records: Case of Nairobi County**

Onduko Larvinia Nyanchama

**Submitted in partial fulfilment of the requirements for the Degree of Master
of science in Mobile Telecommunications and Innovation at Strathmore**

University

Faculty of Information Technology

Strathmore University

Nairobi, Kenya

VT OMNES VNVM SINT

June, 2016

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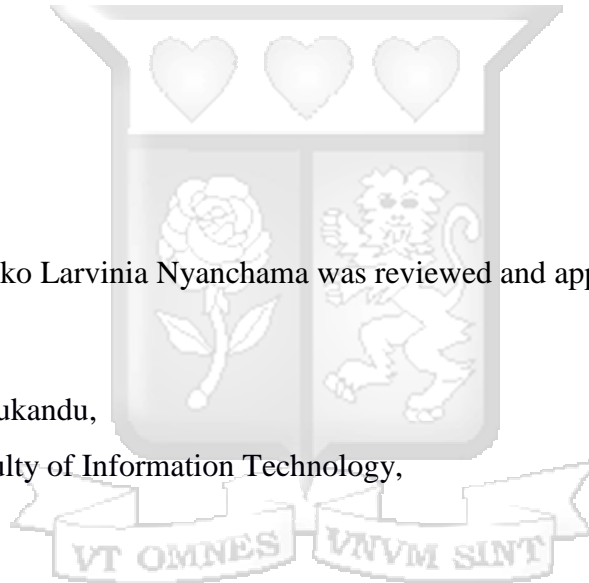
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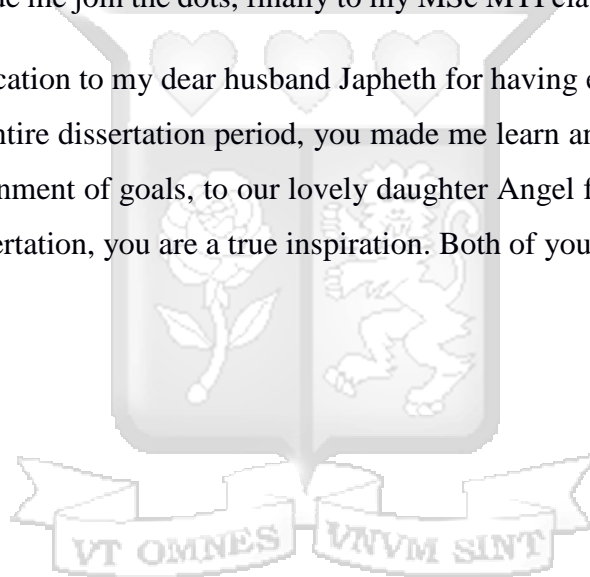


Dedication

I dedicate this dissertation work to my family and friends. A special feeling of gratitude to my wonderful parents Nelson and Rose whose words full of wisdom and motivation have brought me this far. My brothers Douglas, Lewis and Michael for believing and instilling confidence in me. My sister Sandra who has never left my side and is very special I appreciate all you have done.

I also dedicate this work to my many friends whose support has been key in this accomplishment. I appreciate every effort, especially Fred and Zeffah, for making sure all the technology resources were available to complete the work, Anne for her invaluable critiques that have always made me join the dots, finally to my MSc MTI classmates for the year 2014.

Special dedication to my dear husband Japheth for having encouraged and supported me throughout the entire dissertation period, you made me learn and appreciate the virtue of perseverance in attainment of goals, to our lovely daughter Angel for her constant reminders to finish up this dissertation, you are a true inspiration. Both of you have been my best.



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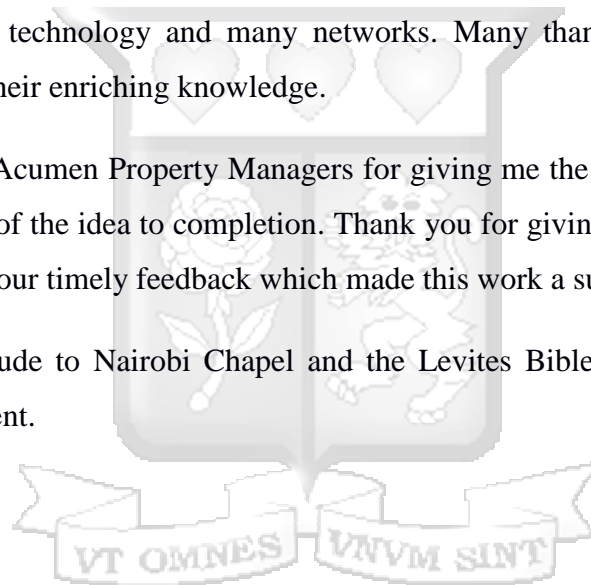
I would like to express my deep gratitude to my supervisor Professor Ismail Ateya Lukandu for his patient guidance, enthusiastic encouragement, and useful critiques, valuable and constructive suggestions throughout this dissertation. His willingness to give his time so generously has been very much appreciated.

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I would also like to extend my thanks to Safaricom Academy, @iLabAfrica and Strathmore University for the golden opportunity to partake my masters in their program which has exposed me greatly to emerging technology and many networks. Many thanks to all the Strathmore University lecturers for their enriching knowledge.

I am thankful to Acumen Property Managers for giving me the opportunity to work with them from the inception of the idea to completion. Thank you for giving your time to go through several surveys and for your timely feedback which made this work a success.

Finally my gratitude to Nairobi Chapel and the Levites Bible Study for their constant prayers and encouragement.



Abstract

The purpose of this dissertation is to review the neighbourhood networking literature, most of from other countries, to identify the trends and issues that can best be applied in the Kenyan context. It focuses on networks and neighbouring techniques and their challenges. Studies have shown that the most common crime after carjacking in Kenya's major cities, and in particular Nairobi is violent home invasions. This is mainly because people who stay in a certain neighbourhood do not know their neighbours well in terms of their names, professions and largely origin. In Kenya several initiatives have been brought up to help bring people together to create informed neighbourhoods, for instance Nyumba Kumi initiative. This initiative has faced challenges and slow adoption due to the dynamic nature of lifestyles in the urban regions. Tenants and landlords do not have an efficient communication mechanism especially in escalating complains and any updates. Social Networking Services (SNS) and Computer Mediated communication (CMC) have been adapted in other countries but still do not connect the tenants and their landlords. This study has sought to understand the challenges of the neighbouring networking methods and come up with a solution that will enable and maintain connected neighbourhoods. This dissertation focuses on a selected neighbourhood within the city of Nairobi to undertake an in depth analysis, using the System Development Life Cycle (SDLC). The objective is to develop a solution that will facilitate networked neighbourhoods enabling exchange of information and services and give people a sense of belonging even with the dynamic nature of lifestyles. The mobile and web system was developed and tested which enables neighbourhood interactions, channelling of issues, updates and recommendations and also providing tenant reviews.

Keywords: Neighbourhood Networking, Communication Mechanism, Tenant, Landlord, Social Networking Services (SNS), Computer Mediated Communication (CMC), System Development Life Cycle (SDLC).

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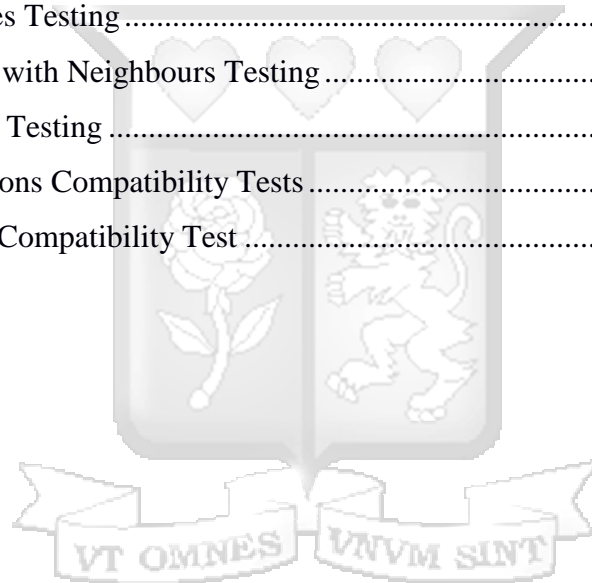
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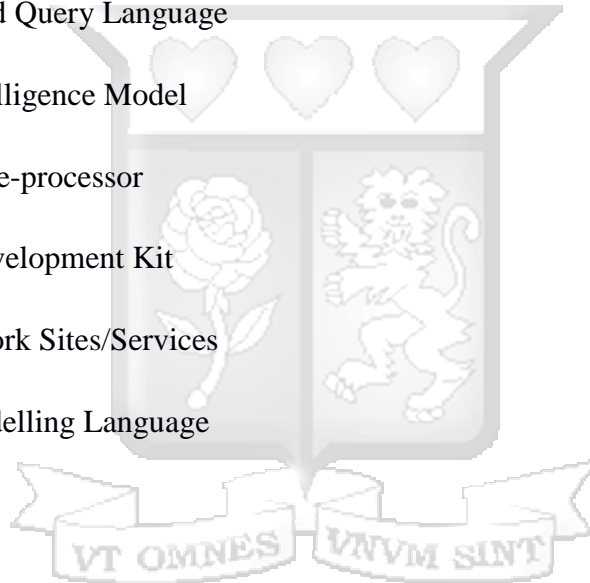
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List of Abbreviations/Acronyms

- ADT - Android Development Tools
- CMC - Computer Mediated Communication
- DFD - Data Flow Diagram
- JSON - JavaScript Object Notation
- ERD - Entity Relation Diagram
- HTTP - Hyper Text Transfer Protocol
- MYSQL - My Structured Query Language
- NIM - National Intelligence Model
- PHP - Hypertext Pre-processor
- SDK - Software Development Kit
- SNS - Social Network Sites/Services
- UML - Unified Modelling Language



Chapter 1: Introduction

1.1 Background of the Study

Neighbourhoods can be defined as physical places and a social community, having some discrete feature by which it can be noticed from the rest. They are a limited territory within a larger urban area where people inhabit dwellings and interact socially (Olima, 2013). According to Jenkins (2013), neighbourhood groups were a representative of their regions and they seemed to be active in decreasing minor theft and vulgarity in the society. Thus, such groups can enhance the standards of life if they cultivate their own goals, locating crime in a hierarchy of activities and priorities. These groups were indeed fruitful because they were not designated to a police agenda of information exchange and crime control. However, these groups are subject to the problems of any other informal policing group.

According to Ndung'u (2008), community based policing is both a way of thinking and a way of carrying out the thought, that allows the police and the community to collaborate in many different ways so as to fix misconduct, disorder and security issues to better the quality of life for each individual in that community. It is argued that community policing is a modern day approach being implemented due to the decline in trust the public have towards the police, in fighting crime (Nyaura & Ngugi, 2014). According to Bessette (1996), he argues that policing requires the involvement of a community at an individual, organizational level and the public. Involving the community in community policing is crucial in identifying community issues, addressing public fear of crime and increasing police visibility thus encouraging confidence in police (Joyce, 2013). Community policing according to Gannoni (2011), is of importance to rural, regional and metropolitan settings alike, prioritizing communalism leads to effective collaboration and partnership building. Under such an approach the community and police become a collective entity that can effectively address crime. According to Coquilhat (2008), community policing leads to warm relationships between the police and the community. This enables the police to meet the needs of the people and makes the public accountable over the police by participation. Citizens who abide to the laws need to take a major role in contributing towards community policing (Trojanowicz, 1998).

Community policing not only involves the community members but more so incorporates the police receptiveness to community concerns towards ensuring full gain of policing (Skogan, 2004). The most important aspect of community policing is that the police should not be disconnected from community policing, thus highlighting that community policing is aimed at creating cooperation between them and the public at large.

Recently in Kenya, an initiative termed as Nyumba Kumi was introduced which involves ten households who make a cluster with neighbours living in one area. The clusters form a security administrative unit, this is meant to make people aware of their neighbours. In turn it enhances a sincere relationship between the police and the citizens that makes execution of security easier as the lawbreakers are among the subjects. Nyumba Kumi works best in rural areas where most of people have permanent residents. This makes it easier for one to get to know their neighbours better easily. On the other hand, in urban areas, people keep on changing houses quite often, and it becomes cumbersome for one to get to interact with their neighbours. The developed world has been experiencing for over a century a shift away from communities based on small-group-like villages and neighbourhoods and towards flexible partial communities based on networked households and individuals. The rich set of interactions between individuals in the society results in complex community structure, capturing highly connected circles of friends, families, or professional cliques in social network. New communication technologies are driving out the traditional belief that community can only be found locally. Cyberspace has enabled people to find each other through electronic mail, group distribution lists, role-playing games, and Web chat rooms.

The remarkable growth of Social Network Sites/Services (SNS) such as Facebook, Myspace, Orkut and their many relatives across the world, is one of the clearest indications that digital technologies are changing radically the communications landscape. Many active users spend hours on the Internet working and socializing using SNS and they are perceived by some of these active users as a virtually indispensable form of communication (Cranston & Davies, 2009).

1.2 Problem Statement

According to Overseas Security Advisory Council (2014), the most common crime after carjacking in Kenya's major cities, and in particular Nairobi is violent home invasions. This is due to the fact that people who stay in a certain neighbourhood do not know their neighbours well in terms of their names, professions and largely origin. The main reason why several initiatives set up by the Kenyan Government in aim to create a safer connected community do not work is due to the nature of open and cosmopolitan nature of Kenyan cities where it is normal for people to go about their businesses without taking notice of others (Atta-Asamoah, 2015). There is therefore a need for a convenient mechanism to help people interact and know each other better in an urban neighbourhood. When people move to new neighbourhoods for instance they find difficulties in finding fixers due to lack of interactions and information sharing in neighbourhoods. A networked neighbourhood will facilitate exchange of information and services and give people a sense of belonging.

According to White (2015), many tenants disrupt peace in a neighbourhood with inappropriate behaviours such as a lot of noise-making, poor grass upkeep and abandoning scrap cars and garbage on the property. The landlords lack backgrounds of the possible renters and therefore face a challenge choosing the right tenant due to absence of tenant reviews. On the other hand the landlords lack an efficient channel to directly communicate any updates to their tenants. They normally use caretakers who sometimes do not deliver information to all the tenants. The tenants as well cannot channel their concerns directly to their respective landlords. There needs to be a system therefore that can be used to record all relevant information of a new tenant. There also needs to be a communication mechanism in a neighbourhood to alert and update one another on security issues and also help them find fixers for example plumbers and electricians.

1.3 Research Objectives

- i. To identify information used to promote relationships in neighbourhoods.
- ii. To identify shortcomings in the existing neighbourhood interaction methods.
- iii. To review the techniques used in promoting neighbourhood interactions.
- iv. To design and develop a neighbourhood networking platform.
- v. To test and validate if the system promotes neighbourhood interactions.

1.4 Research Questions

- i. What information is used to promote relationships in neighbourhoods?
- ii. What are the shortcomings of the existing neighbourhood interaction methods?
- iii. What techniques are currently being used to interact in neighbourhoods?
- iv. How will the proposed neighbourhood network system create and maintain good relationships in neighbourhoods?
- v. Does the system promote neighbourhood interactions?

1.5 Justification of the Research

The main purpose of this research is to understand well community policing and its role in promoting neighbourhood interactions. It narrows down on how landlords and tenants can communicate effectively so as to enhance accountability at an individual level. It looks at how mobile technologies can be used to enhance this initiative in the urban regions. Community policing faces a challenge in urban regions due to the dynamic nature of lifestyles and frequent shifts from town to town, therefore a mobile application will effectively and conveniently maintain a strong communication network in a neighbourhood. On the other hand people's residential records will be recorded and also services will be easily referred to one another creating a society where information flow is practiced.

1.6 Scope of the Research

The neighbourhood networking system will use web technology and a mobile based solution developed on Android platform to improve information flow and promote relations between neighbours. This research is limited to the urban regions, particularly estates in Nairobi. It will later on expand to other regions in the country. The selected regions will assist in data collection and will be used to run the pilot of the proposed system.

1.7 Limitations of the Research

Developing an Android mobile application to promote neighbourhood interactions comes with limitations, the people in a neighbourhood need to have Android phones and Internet connection to access the services. This will affect those who cannot afford the gadgets. Some other people may have the fear of having to share their profiles with their neighbours due to privacy issues.



Chapter 2: Literature Review

2.1 Introduction

Social communication networks have undergone a dramatic growth in recent years. Such networks provide an extremely suitable space to instantly share multimedia information between individuals and their neighbours in the social graph. Social networks provide a powerful reflection of the structure and dynamics of the society of the 21st century and the interaction of the Internet generation with both technology and other people (European Commission Information Society and Media, 2010). This study seeks to discuss the way communication networks have evolved from, physical interactions in neighbourhoods and gatherings to social networks. Study the commonly used social media channels and the existing community based communication networks and their underlying platforms. Finally state the mobile technology that can be used to promote neighbourhood interactions, and how to build and test it.

2.2 Techniques used in Promoting Neighbourhood Interactions

2.2.1 Community Policing

According to Ndung'u (2008), community based policing is both a way of thinking and a way of carrying out the thought, that allows the police and the community to collaborate in many different ways so as to fix misconduct, disorder and security issues to better the quality of life for each individual in that community.

i. Community Policing in Kenya

Nyumba Kumi is a Kiswahili phrase meaning ten households. It is a security initiative that aims at anchoring community policing at the household level by bringing Kenyans together in clusters defined by physical location. It proposes new ways of the public partnering with the police. The initiative promotes the social, economic and security sectors of the economy by organizing people in small units to help keep security amongst them. This means being watchful on your neighbour's way of life and generally alert to help government curb down increasing insecurity trends in the country (Adeya, 2014). This initiative works best in rural areas where most of people have permanent residents. This makes it easier for one to get to know their neighbours better easily.

On the other hand, in urban areas, people keep on changing houses quite often, this therefore makes it cumbersome for one to get to interact with their neighbours. The figure below represents the confidence cycle in a neighbourhood that comes with interactions.

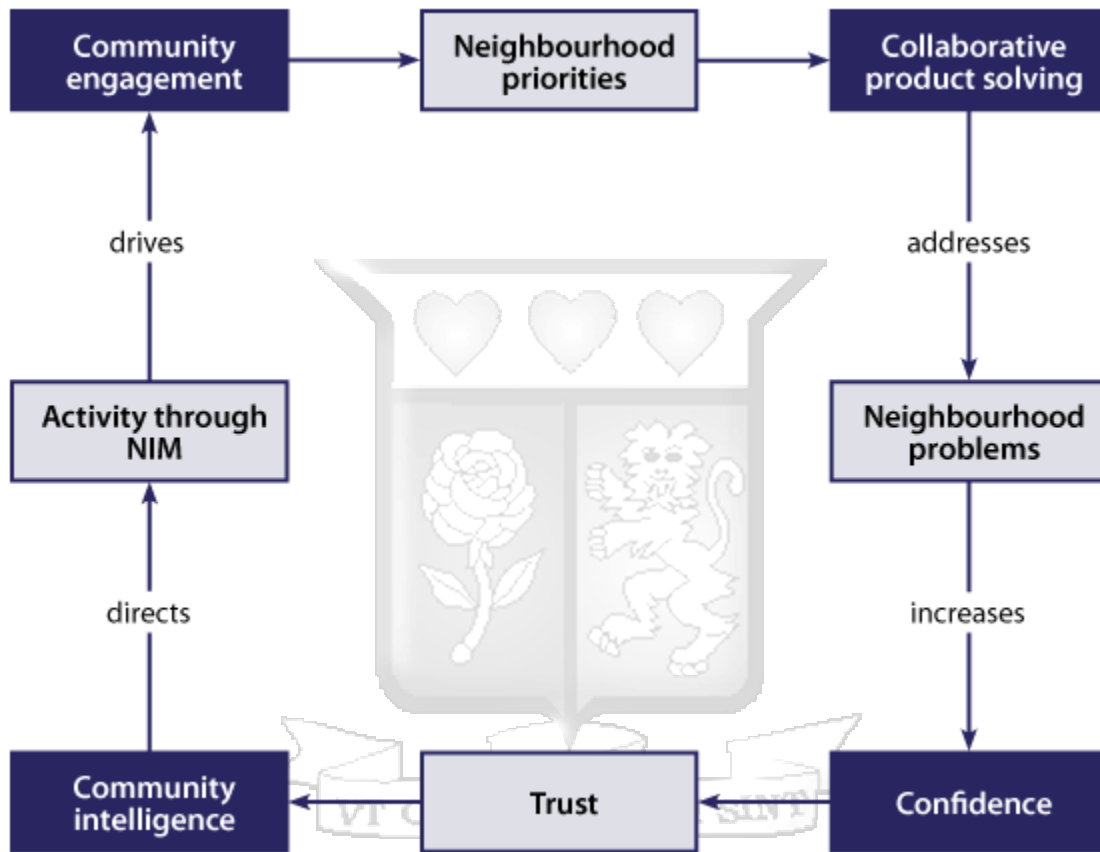


Figure 2:1: Confidence Cycle in a Neighbourhood (College of Policing, 2013)

ii. Community Policing in South Africa

According to Baker (2002), in 1970s and 1980 there were cumulative security hitches, and the South Africa police therefore focused on community policing. This affected the white and black vicinities and resulted to increased dependency on non-state policing for crime avoidance and discovery.

Both the white and black came up with a practice of looking for own procedures of policing in a setting where the state offered very little and what was offered was seen as at best as the groups knew how to deal with the culprits and maintaining order.

iii. Community Policing in Mongolia

Mongolia is one of the countries that has successfully deployed community policing. It therefore has received appreciation internationally and led to impressive transformation of the Mongolian police. This has shown genuine interrelations between the police and the public. The new police reforms have seen remarkable achievement in averting and solving crime (Brogden & Nijhar, 2005).

iv. Community Policing in USA

In the United States, community policing as a concept was first introduced in the 1960's to intensify the police community contact and reduce the fear of crime among the citizens (Cordner, 1999). According to other authors, they have noted that the concept became a dominant policing strategy in the United States during the 1990's with the introduction of 100,000 new community police officers (Nyaura & Ngugi, 2014). The introduced concept of community policing presented the transformation that encouraged problem solving and community engagement with the police as opposed to reactive policing (Innes, 2003).

v. Community Policing in New Zealand

According to Coquilhat (2008), community based policing began in New Zealand in the late 1980's with the introduction of the New Zealand Police New Model of Policing Strategy. The policy was grounded on the knowledge that resident police should have local obligation to reduce the effects of alien to alien policing.

This initiative promoted working in collaboration with the community to explain native difficulties. As a result, community officers were introduced throughout the country in the late 1980's. The opening of dispersed community policing centres and the introduction of formal community consultative committees in the early 1990's followed this. It was quickly discovered that the community policing model supplemented the work of Neighbourhood Support Groups.

Neighbourhood Support encouraged misconduct avoidance methods such as public investigation, property marking and home safety. These techniques were also an important constituent of the work of community officers.

2.2.2 Challenges of Community Policing

Research has shown that community policing has not always worked well. Despite efforts to develop a more comprehensive and prevention-based policing strategy, community policing as a practice requires certain conditions and at times fundamental changes. While every urban setting has its own context, the following are some examples of circumstances that have been experienced across cities and regions according to a report by (United Nations Office on Drugs and Crime, 2013).

- i. Legacies of authoritarianism use of force and vertical institutional structures led to mistrust of the police and repressive policing strategies.
- ii. Pressure from high rates of urban crimes has reduced the focus on community-based policing and prevention strategies.
- iii. High incidence of violence has led to the militarization of urban spaces and prevented close collaboration.
- iv. Consultations or meetings with community members were infrequent and information was not transferred to police departments.
- v. Community policing remained a token concept used by government.
- vi. Police-community structures were not sustainable.
- vii. Change of government or head of police interrupted or dismantled existing promising initiatives.
- viii. High turnover of police officers in community police stations.
- ix. Lack of recognition of community policing as real police work.
- x. Community policing is rarely a career choice among young officers.

- xi. Difficult to measure accomplishments in crime prevention and community safety.
- xii. Lack of training or on going guidance to help the police adapt or effectively implement new strategies.
- xiii. Lack of development of a formal community policing unit with goals, objectives, strategic plan or only a few officers were assigned to community policing.
- xiv. Prevention does not play a role in the institutional framework or strategic plans of the police.
- xv. The implementation of such a strategy is not advertised to the community.

2.3 Personalised Networking

Advances in personal computer technology, and the rise of computer-mediated communication (CMC), have ignited a debate into the nature of community and the effects of cyberspace on social relations. Computer mediated communications are developing towards personalization, with more control over the sources people want to get messages from, when, and about what. This form of communication and the ensuing interactions are more tailored to individual preferences and needs, furthering a more individualized way of interacting and a way of mobilizing as fluid networks of partial commitment. This can easily fragment communities and facilitate coalition building between communities (Wellman, The Social Affordances of the Internet for networked Individualism, 2003). A research by iHub has shown the various activities individuals engage in with their mobile phones.



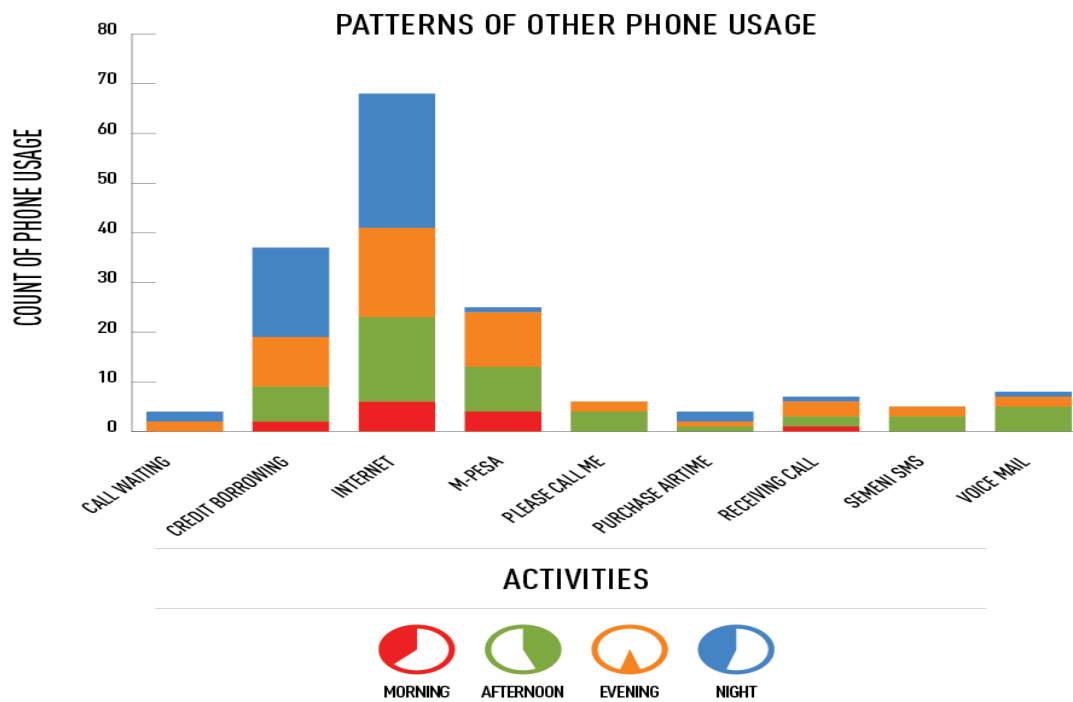


Figure 2:2: Activities Engaged in with Mobile Phones (iHub Research/RSA, 2012)

2.3.1 The Domestication of the Internet

According to Hampton and Wellman (1999), new communication technology is changing the way that neighbourhood residents interact. To better understand how such interactions occur, Hampton and Wellman studied a new residential development suburban in Toronto that they named Netville. They found out that wired residents recognized almost three times as many neighbours, talked with nearly twice as many and were invited or had invited one and a half as many neighbours into their homes. A high rate of online activity resulted in increased local awareness and high rates of in-person activity. Use of ICTs to facilitate the exchange of information, communication, and other resources at the neighbourhood level encourages place-based community. At the same time the location of the technology in the home facilitates access to local relationships, suggesting that domestic relations may flourish. A report by Communications Authority of Kenya (CAK) explains that by the end of September 2014, 57.1% of the Kenyan population had Internet access (CAK, 2014).

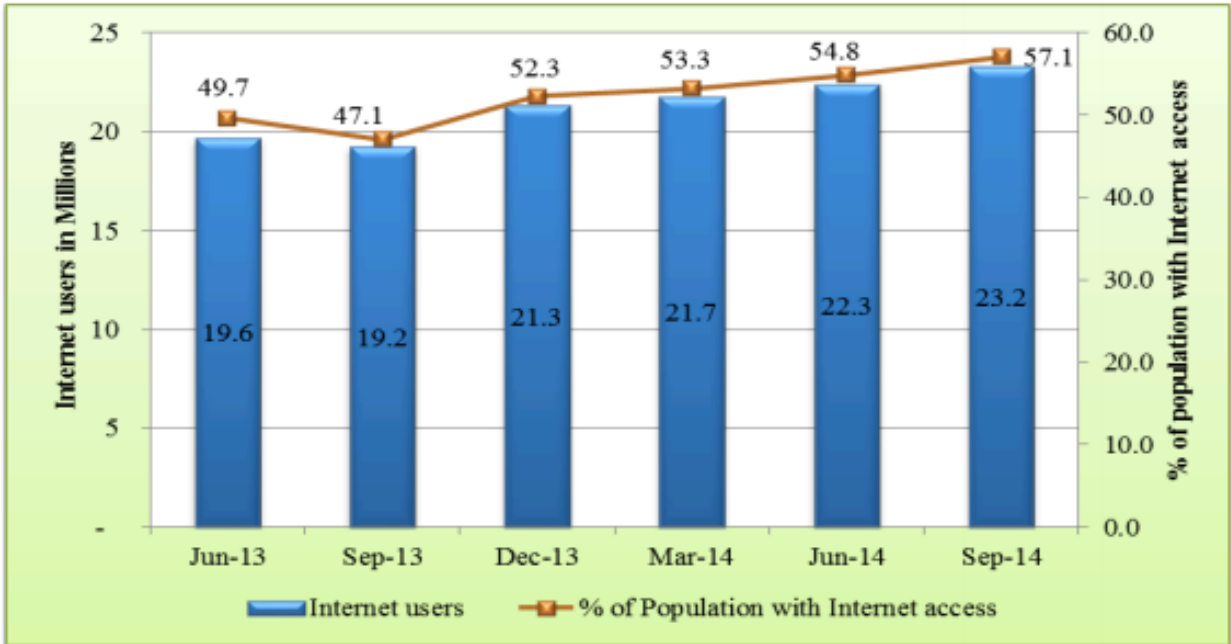
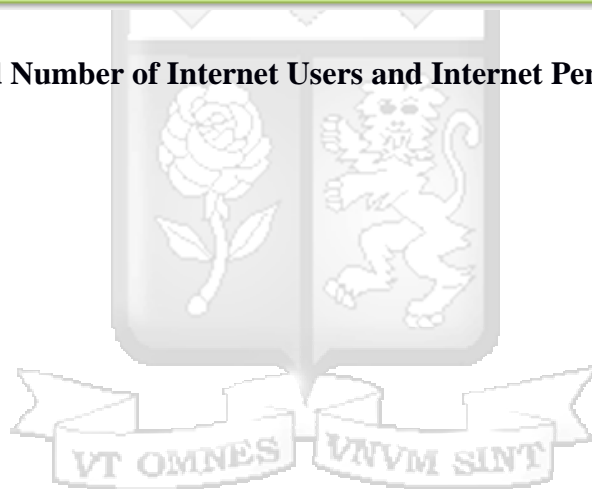


Figure 2:3: Estimated Number of Internet Users and Internet Penetration (CAK, 2014)



2.4 Types of Social Networking Services

2.4.1 Definition and Framework

Social networking services refers to web or mobile based services that allow individuals to construct a public or semi-public profile within a bounded system, articulate a list of other users with whom they share a connection, and view and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site (Boyd & Ellison, 2008). Figure 2.4 below represents the social media framework that entails web browsers, webservers, a social data pool and clients' authentications. A report by Childnet International (2008) presented the following types of social networking services.

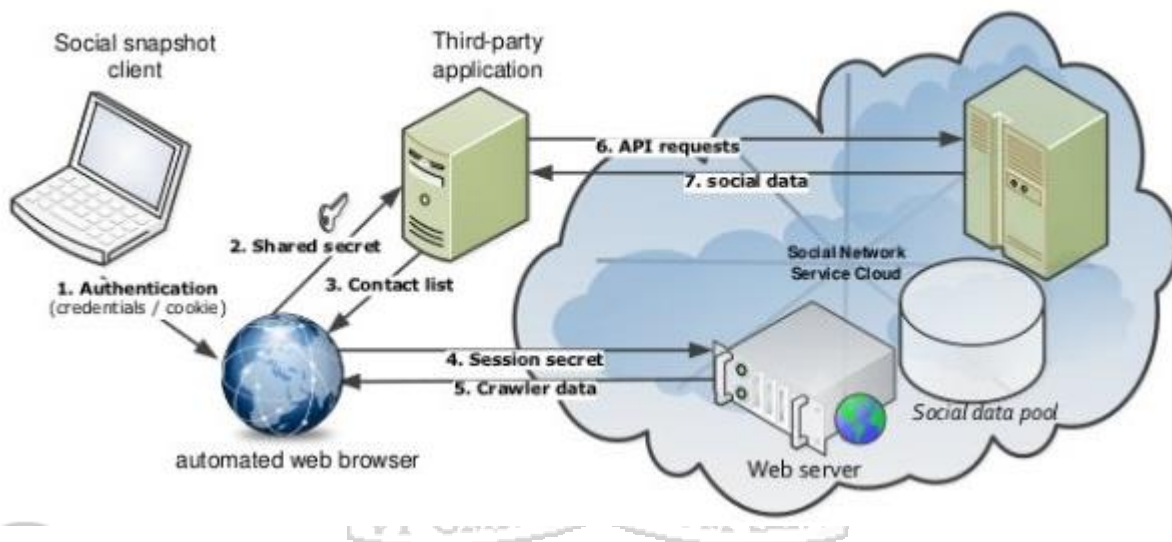


Figure 2:4: Social Network Framework (Agnihotri, 2015)

2.4.2 Profile Based Social Networking Services

Profile-based services are primarily organized around members' profile pages that mainly consist of information about an individual member, including the person's picture and details of interests, likes and dislikes. Bebo, Facebook and MySpace are examples of profile-based services. Users develop their spaces in various ways, and can often contribute to each other's spaces, typically leaving text, embedded content or links to external content through message walls, comment or evaluation tools.

Users often include third-party content in the form of widgets to enhance their profiles or as a way of including information from other web services and social networking services (Childnet International, 2008).

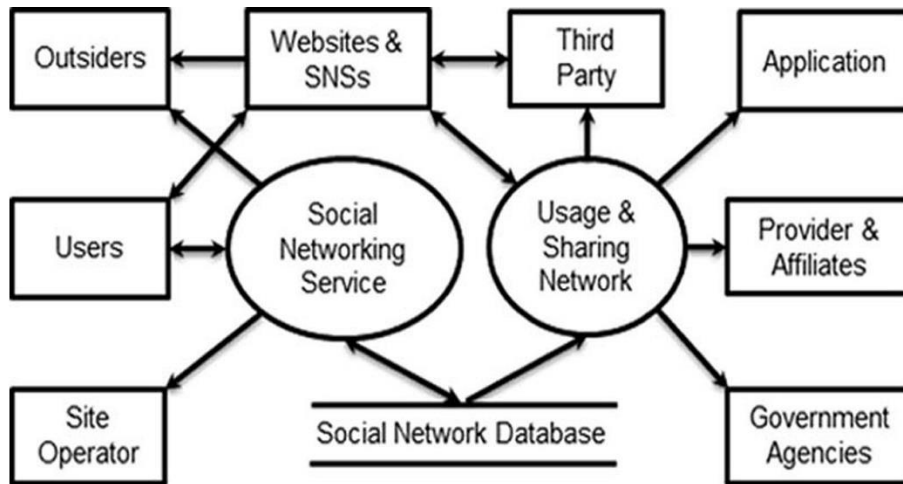


Figure 2:5: Social Networking Service Architecture (Li, 2015)

2.4.3 Content-Based Social Networking Services

In these services, the user's profile remains an important way of organizing connections, but plays a secondary role to the posting of content. Photo-sharing site Flickr is an example of this type of service, one in which groups and comments are based around pictures. Other examples of content-based communities include YouTube for video sharing and last.fm, in which the content is arranged by software that monitors and represents the music that users listen to. Blogs and micro-blogging services are also the examples of content-based social networking services. Micro-blogging services such as twitter allow one to publish short 140 characters messages publicly or within contact groups (Childnet International, 2008).

2.4.4 White-Label Social Networking Services

Most social networking services offer some group-building functionality, which allows users to form mini-communities within sites. Platforms such as People Aggregator and Ning, offer members the opportunity to create and join communities.

Users can create their own mini-Myspace which are small-scale social networking sites that support specific interests, events or activities (Childnet International, 2008).

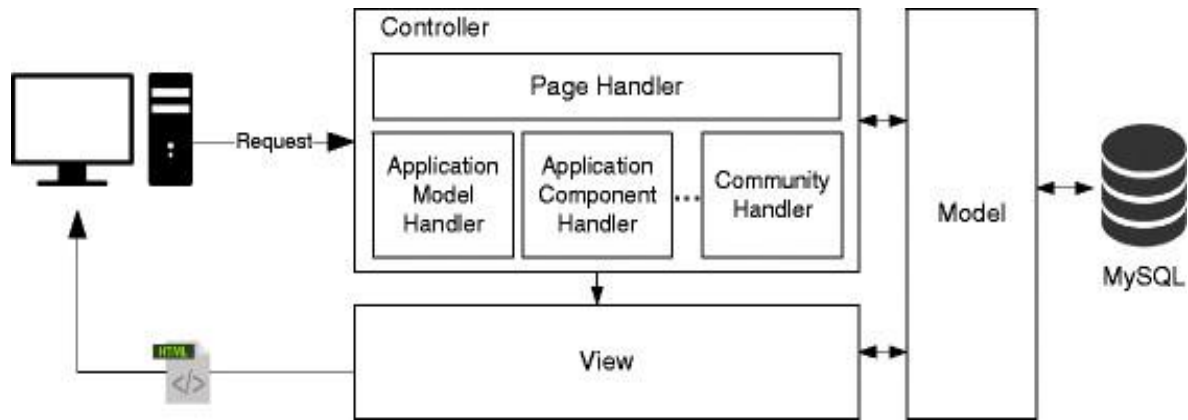


Figure 2:6: Architecture of the Elgg Social Networking Engine (Geier, 2010)

2.4.5 Mobile Social Networking Services

Many social networking sites, for example MySpace and Twitter, offer mobile phone versions of their services, allowing members to interact with their friends via their phones. Increasingly, too, there are mobile-led and mobile-only communities, which include profiles and media sharing just as with web-based social networking services. Myubo and WhatsApp allows users to share and view video over mobile networks (Childnet International, 2008)

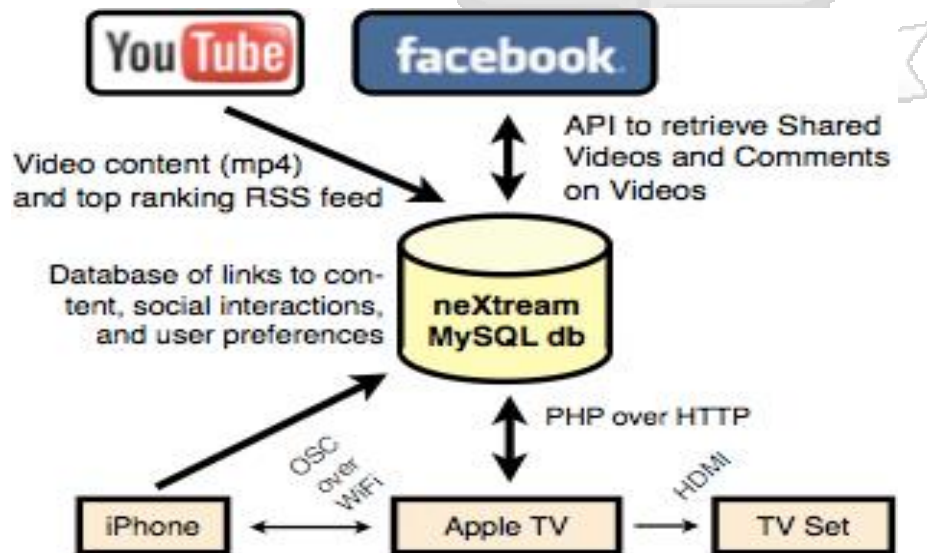


Figure 2:7: Social Network Systems Architecture (Martin, Santos, Shafran, Holtzman, & Montpetit, 2010)

2.5 Existing Systems

2.5.1 Web-based Community Applications

i. **Uniiverse** (<http://uniiverse.appappeal.com>)

Uniiverse is a community of users that offer or need services. The website helps users locate the people, items or services they need in their local community. Individuals can set up a new business offering a service through Uniiverse. Others can browse services to find good deals, more options or a unique service that might be difficult to locate otherwise. Services vary from item sharing and space saving to specialized skills offered by people. Users can also find activities, such as sports, dining opportunities, social events and learning opportunities. The user can begin by searching a specific location by time and maximum distance (Nubera eBusiness, 2008).

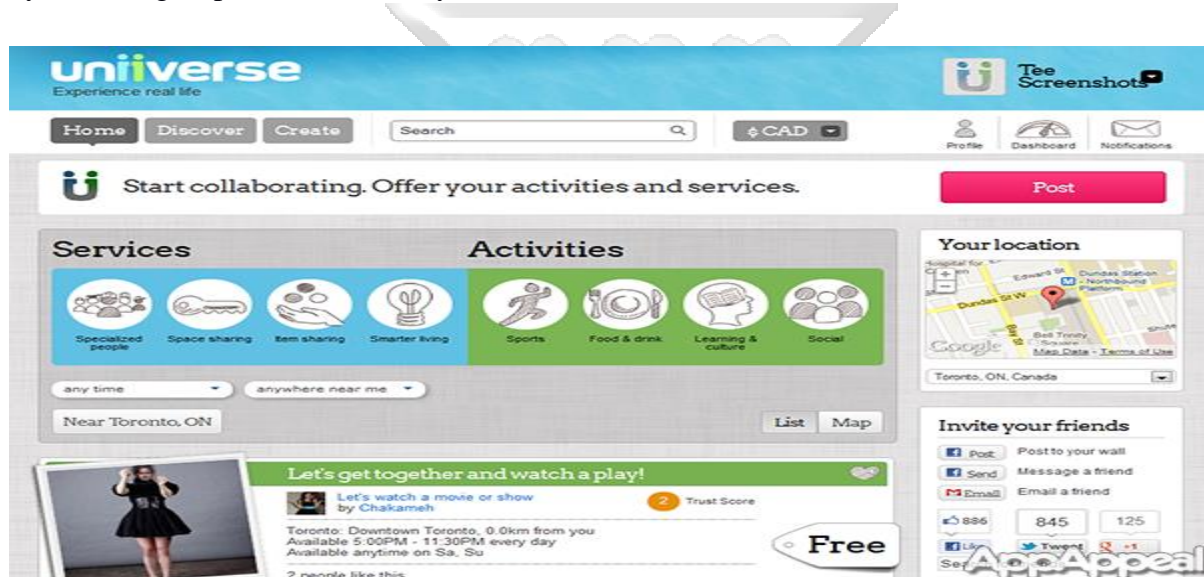


Figure 2:8: Uniiverse Application Screen

ii. **Neighborland** (<http://neighborland.appappeal.com>)

Neighborland is an application that makes it easy for neighbours to connect with one another and to discuss their local issues and opinions with each other online. Essentially it can help bring a community together in a really easy, modern and effective way.

Users can logon to their city's Neighborland page, share their ideas about their town, comment on other's opinions, and connect with the people in their local community. Some issues discussed include the types of businesses that people would like to see open in their community or what local crime issues are people concerned about (Neighborland Inc., 2016).

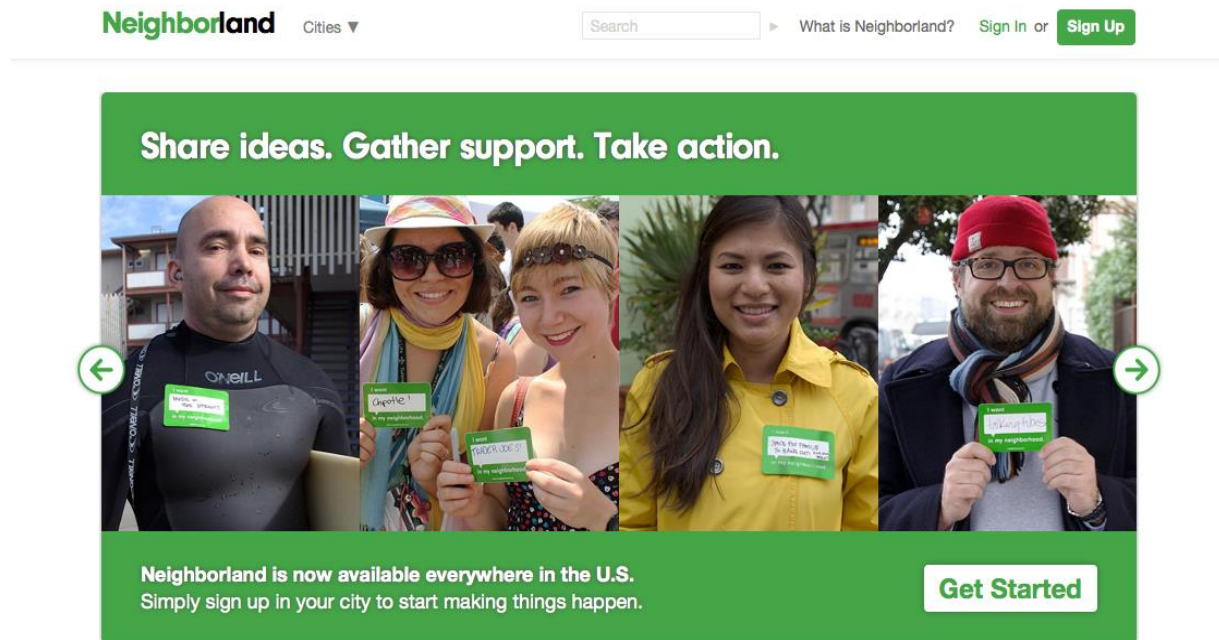


Figure 2:9: Neighborland Screen

iii. **EveryBlock** (<http://Everyblock.appappeal.com>)

EveryBlock is an online service and mobile application that aggregates and curates content on the neighbourhood. EveryBlock gives users an easy to use resource to discover local news stories, discussions and more. The site helps users get in touch with what is going on within their local neighbourhood. Users can enter an address and read stories related to local news, crime and neighbour discussions. Users can also browse content by topic. EveryBlock provides more insight into recent hot topics in the user's local area through trend tracking features (Nubera eBusiness, 2008).

EveryBlock Software Architecture

The core process controls every function and process of the system.

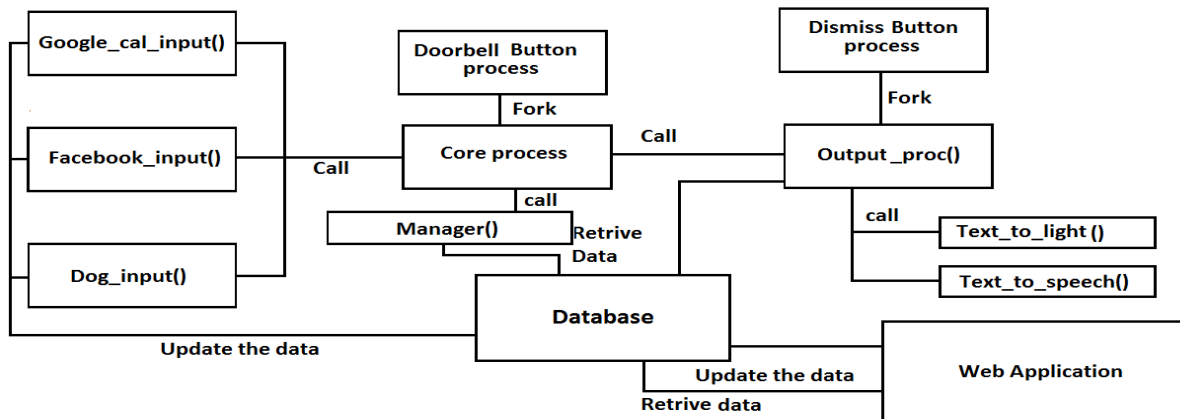


Figure 2:10: Everyblock Software Architecture (*Smart Notifications, 2014*)

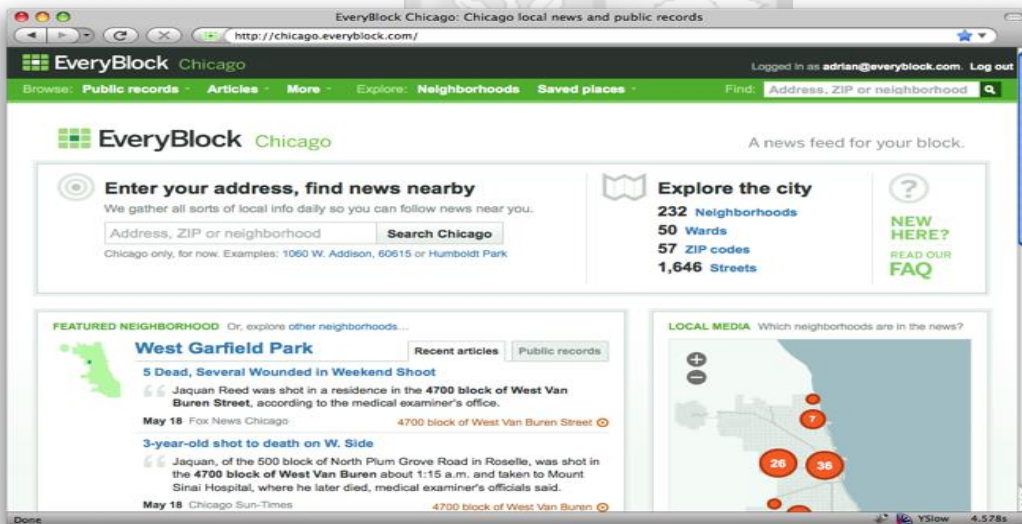


Figure 2:11: Everyblock Application Screen

iv. **SeeClickFix** (<http://seeclickfix.appappeal.com>)

SeeClickFix is an interactive website that enables users to report non-emergency issues in their communities, such as broken street lights, needed crosswalks, potholes, graffiti, and trees that need trimming. The site notifies local officials and plots of issues to be discussed on Google maps. Community and local government responses are reported and tracked by users (Barkat, Jaeggli, & Dorsaz, nd).

SeeClickFix plays an integral role in public services by routing neighbourhood concerns like for instance potholes and light outages to the right official with the right information. Users are able to search for a specific geographical location read all existing and fixed issues for a specific region, vote on issues you feel are important to provide support, create a new issue to share with your community and view issues on a built in Google map (SeeClickFix Inc., 2008).

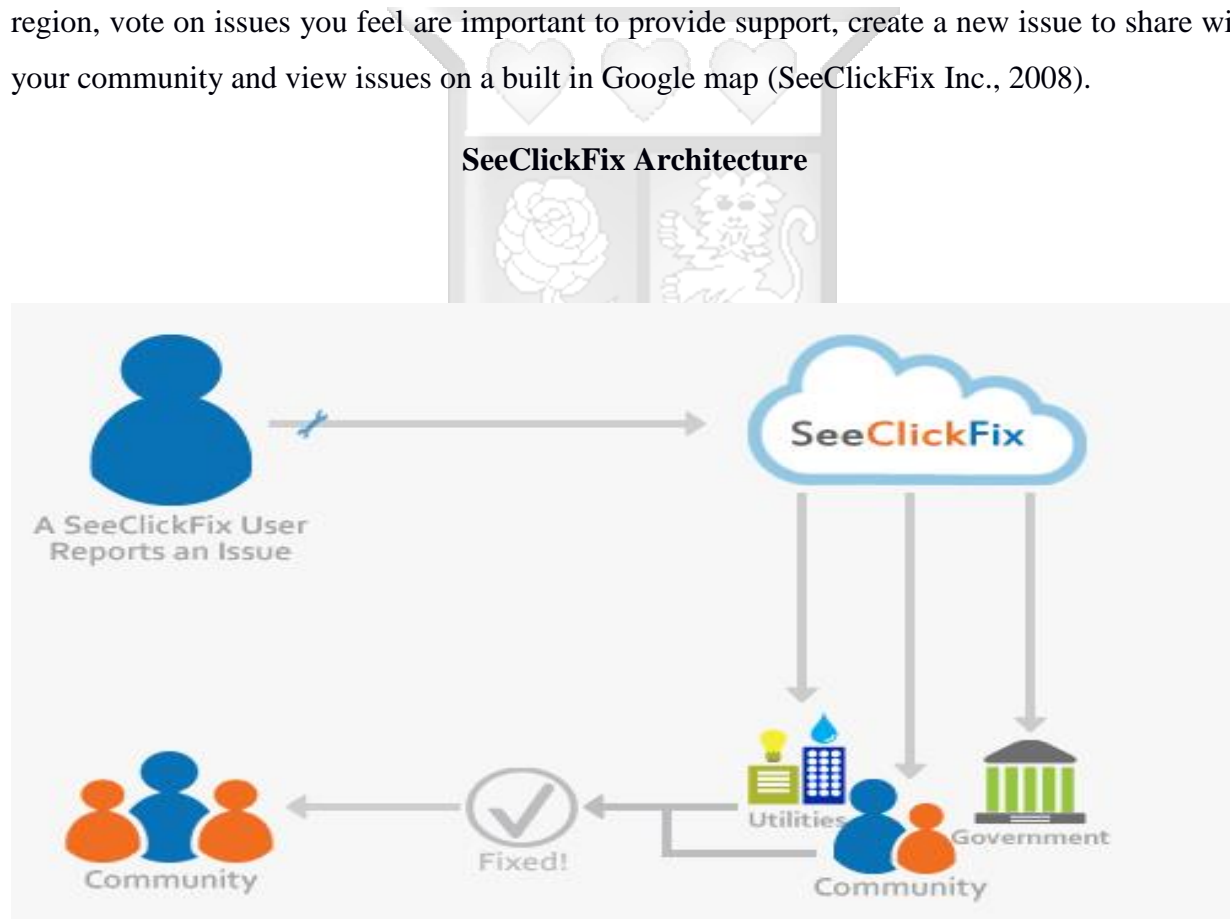


Figure 2:12: SeeClickFix Architecture

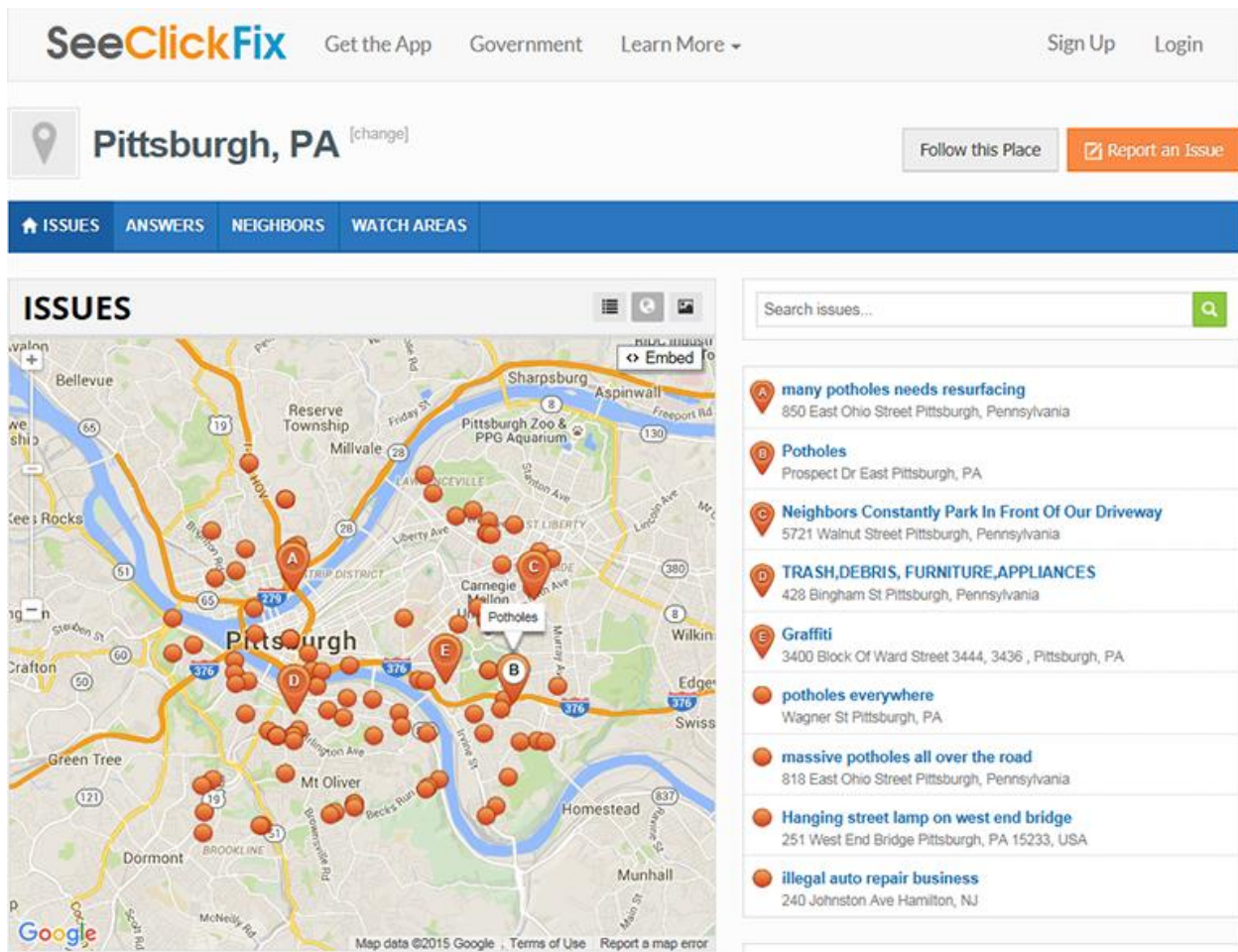


Figure 2:13: SeeClickFix Application Screenshot (Mosure, 2015)

v. **NextDoor** (<https://nextdoor.com>)

NextDoor is a private social network for individuals, their neighbours and community. It connects and enables people talk with their neighbours about the things that matter in their neighbourhood. People use NextDoor to quickly get the word out about a break-in, organize a neighbourhood crime watch, recommend a trustworthy babysitter, find out who does the best paint job in town, ask for help finding a lost dog, find a new home for an outgrown bike and also to remember neighbours' names (NextDoor, 2016).

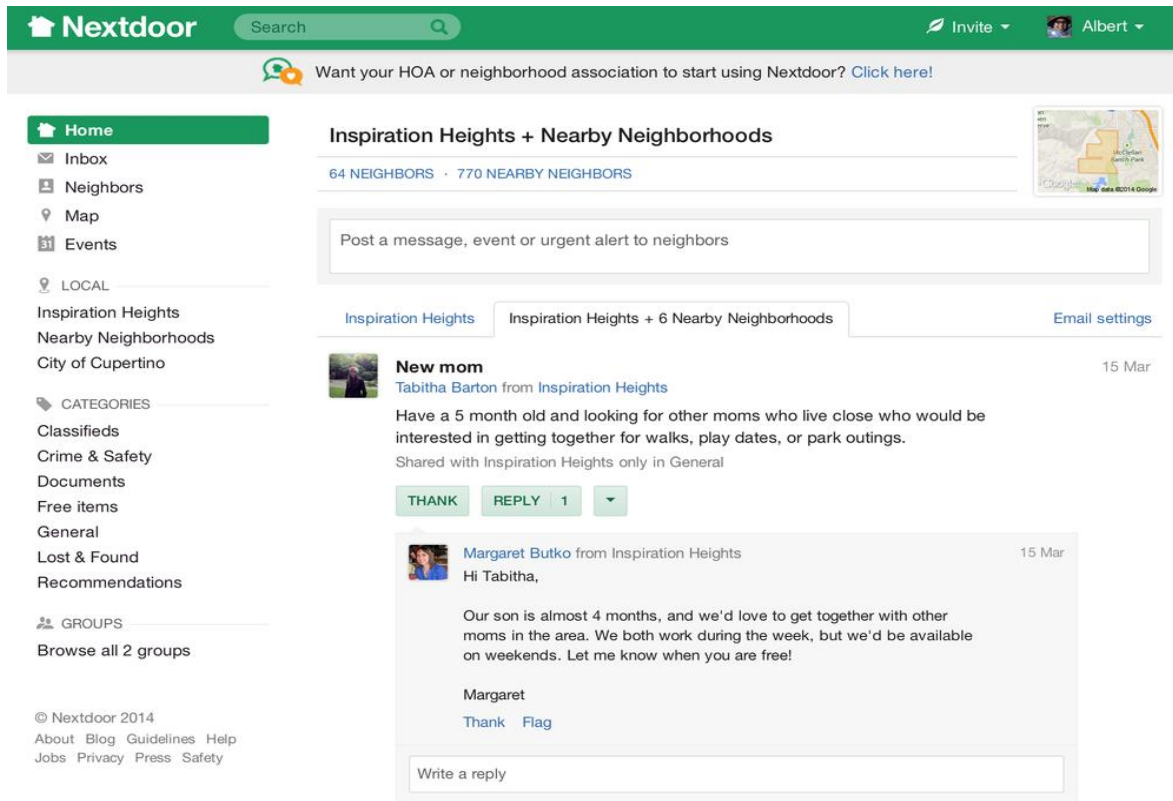


Figure 2:14: NextDoor Application Screen

vi. Nabo (<https://www.nabo.com.au>)

Nabo is an online social network platform that enables people recommend and discover the best things around them, from local events and attractions, a trusted service, to the best coffee in town. Creates a support network of local people who can keep an eye on your home or pet while you're away and grow a stronger, friendlier neighbourhood together. People can easily sell unwanted items from around their homes or borrow from their neighbours (Nabo Community, 2015).

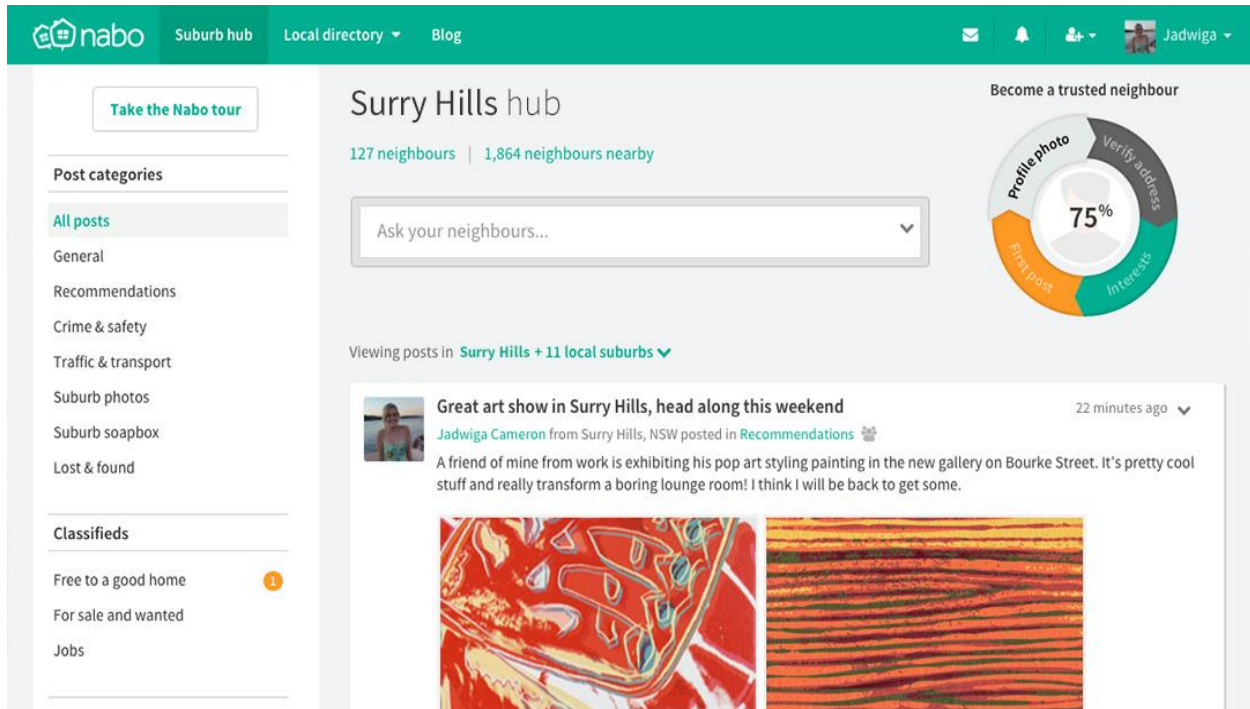


Figure 2:15: Nabo Application Screen

vii. Communr (<http://communr.appapeal.com>)

Communr is an application that helps users connect to and interact with the people and places in their local community. Communr is a social network designed to connect people, places, groups, and events in local communities around the United States. Communr connects users to what's around them, and does this intelligently based on a user's location, interests, likes and dislikes, and other traits. It helps get the word out about local churches, schools, parks, shops and restaurants. Individuals can use Communr to learn about their community from the comfort of their home. This should ultimately lead to more connected neighbours, people and places. Additionally people can connect with one another in their community based on their shared interests in hobbies, opinions or lifestyles. Communr makes it easy for its users to create and join groups online that can range in interest from the local gyms to the nearby neighbourhood associations to a city-wide team (Nubera eBusiness, 2008).

2.5.2 Other Software

Early software developers such as Murray Turoff and Jacques Vallee developed software that met what is considered the four minimum technical conditions for effective online community which include Bounding: Forming closed online groups, Tracking: Listing how far each participant has read in community discussions, Archiving: Maintaining accessible records of community discussions, Warranting: Ensuring stable and most of the time genuine participant identities (Feenberg & Barney, 2004).

2.6 Gaps, Limitations and Conclusions

Following the reviews on the transition of neighbourhood networking, from community policing, to the emergence of personalized networking and social networking services and finally web based systems, we can notice that that all do not create a connected neighbourhood that encompasses landlord-tenant relationships. Community policing has been seen to work best in rural regions because people have permanent residents. Unfortunately this has been replicated in urban regions and failed to achieve the objectives because of the dynamic nature of lifestyles where people frequently shift their residents. Web-based networking systems have seen to work best in developed countries where people update each other on various services in the neighbourhood and get connected as well. A mobile and web based application will best work in Kenya considering the large number of people who have access to the Internet and own smartphones. This will bridge the limitation of community policing in urban regions and also for web systems by enabling the tenants communicate real time information via the mobile application.

In addition to this, reports will be generated that will represent the nature of the houses and this will help the landlords in planning and decision making. The nature of the neighbourhood for instance security can also be determined from the reports. This is a feature that is currently not available in the existing platforms and will bridge the accountability, trust and transparency gap.

The proposal to come up with a mobile-based neighbourhood networking technique is more justified given ineffective mode of communication in urban neighbourhoods. It helps neighbours interact and keep one another updated. Agents can efficiently communicate with the tenants and provide timely services. The reports generated are an invaluable asset in making major decisions about the houses and their locations.

Chapter 3: Research Methodology

3.1 Introduction

Research methodology is a way to systematically solve a research problem (Kothari, 2004). This research is looking into the various steps followed when studying a research problem. It involves finding out the communication challenges neighbourhoods face and how a mobile based solution can improve the neighbourhood relationships, and more specifically uphold landlord tenant interactions. The chapter highlights the methodology, location of study, research purpose, data collection, and data analysis tools and techniques. Finally be able to come up with a mobile based solution to solve the problem based on the responses.

3.2 Software Methodology

The system development lifecycle (SDLC) will be used. SDLC is the overall process of developing, implementing, and retiring information systems through a multistep process from initiation, analysis, design, implementation, and maintenance to disposal. SDLC is the most effective methodology to secure information and information systems because it integrates security into every step of the system development process, from the beginning of a project to develop a system to its disposition. This is to guarantee suitable protection for the information that the system will transmit, process, and store (Radack, 2009). The phases are represented in Figure 3:1 below.

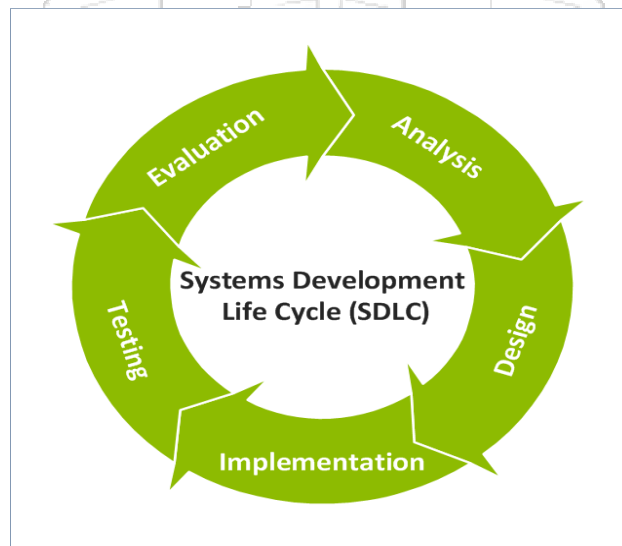


Figure 3:1: SDLC Development Steps

Source: http://qiriskiju.blogspot.co.ke/2014/09/sdlc-systems-development-life-cycle_15.html

- i. **System Analysis:** This phase entails determining the location of study, target population and the sample size. All possible user and system requirements are also identified through data collection methods for instance questionnaires, interview questions and observation.
- ii. **System Design:** The requirement specification from the first phase creates a road map for the system design phase. The design phase involves translating the identified requirements into a logical structure that can be implemented in programming logic. The software specifications are defined and the overall system architecture.
- iii. **System Implementation:** With inputs from system design, implementation involves developing small programs for each unit. Each unit is then developed and tested for its functionality referred to as Unit Testing.
- iv. **System Testing:** All the units developed in the implementation phase are integrated into a system after testing of each unit. The users test post integration of the entire system for any faults and failures.
- v. **System Evaluation:** Once the functional and non-functional testing is done, the system as well as the entire process, is evaluated. Some of the questions that need to be answered include: does the newly implemented system meet the initial user requirements and objectives? Is the system reliable and fault-tolerant? Is the system valid?

3.3 System Analysis

This phase clearly seeks to identify, understand and analyse the user requirements. The requirements are recorded in a requirement specification document and used to answer the research questions and provide insights in designing and developing the proposed system.

3.3.1 Feasibility Study

Feasibility study will be done through reviews of literature on methods used to create and maintain connected neighbourhoods and challenges facing existing neighbourhood interaction methods in Kenya as stated in the research objectives in section 1.3. This study will be performed to analyse and evaluate the impending solution of the proposed system.

3.3.2 Research Design

Descriptive and Quantitative research designs were used in order to capture the full perspective of this research study.

i. Descriptive Research Design

This research type will give a deeper understanding on the different methods used to enhance neighbourhood interactions in Kenya, thus influencing the conclusion on the technology to be adopted for the mobile application. It included fact-finding enquiries of the existing methods. The main purpose of this research was to understand the present state of communication networks in neighbourhoods. This will form the foundation of the functional requirements for the application.

ii. Quantitative Research Design

This research type comes in to help in explaining the magnitude of the challenges of networking models by collecting numerical data that will be analysed using Google analysis tools. It best communicates on the number of people who feel they do not have a good communication channel in their neighbourhoods and any other challenges they face in the process. It also plays a key role in granting user satisfaction of the non-functional and functional requirements of the application.

3.3.3 Location of Study

This research is limited to the urban regions, particularly a few estates in Nairobi. This location is convenient because, being an urban region, it will clearly reflect the problems faced by the large percentage of tenants in quest to communicate with their landlords and vice versa. It also depicts a dynamic lifestyle where people shift residential locations frequently hence need for a connected community. The selected regions will assist in data collection and will be used to run the pilot of the proposed system.

3.3.4 Target Population

The target population will comprise of two groups of people namely landlords, property agents and tenants. Each group will further be split to population prior to system development and the population after system development. The first group will help in system needs identification. The second group will verify that the system meets all the specified requirements.

3.3.5 Sampling Strategy

The sampling strategy for this study will be stratified random sampling. It involves separating the population into homogeneous groups or segments and a sample is taken from each (Landreneau, 2010). This method is preferred since the research involves collecting data from different groups of people geographically distributed in Nairobi. Stratified random sampling will therefore be used to select 100 respondents who will be willing and available to participate in the research. This technique aids in ensuring that people from the subgroups are represented in the sample space. It ensures that all aspect of the research is completely covered.

3.3.6 Sample Size

A total of 100 respondents will be involved in the study. They include the tenants, their respective property agents and landlords. This sample size is appropriate as they will be directly involved in the neighbourhood interaction and connection process. The respondents will comprise of 90 tenants, 8 Property Managers and 2 landlords.

3.3.7 Research Instruments

The target population constitute 3 categories of people classified per region. Two data collection methods will be used to gather data from the respondents, they include interviews on the landlords and house management agents, and questionnaires on the tenants. The data collected will be an invaluable asset in determining the current mode of communication in neighbourhoods, identify the user needs and understood the core functionalities of the proposed application.

i. Questionnaires

Questionnaires will be distributed to tenants in the chosen sample population. This mode was chosen because of the nature of the sample being geographically distributed. Refer to Appendix A (i) for the Tenant Questionnaire. It will give a clear perception about the neighbourhood networking models. They will also be used to gain more information on the nature of communication amongst people in a neighbourhood and the challenges they face. The information collected will be used to come up with the requirements specification. Questions (questions on Appendix A (ii)) will later be used to get the user feedback and the results be used to refine the system.

ii. Interviews

The research entailed meeting the Landlords and the property agents and conducting face to face interviews to understand exactly their current processes in terms of relating with their tenants, challenges they face and what they would want improved or changed. Refer to appendix B for the landlord interview questions.

iii. Document Review

A review of both primary and secondary sources will be conducted. This will be aimed at gaining a broader look on various aspects of implementation and understanding the operations involved in neighbourhood networking. The documents to be reviewed include; journals, books, texts, academic articles and previously done research neighbourhood networking.

3.4 System Design

The design phase decides how the system will operate in terms of the hardware, software, and network infrastructure that will be in place; the user interface, forms, and reports that will be used; and the specific programs, databases, and files that will be needed. The design phase determines exactly how the system will operate (Roth, 2012).

Object oriented analysis will be used to ensure all requirements are analysed and modelled. Objects will be used to represent the real objects and their relationships established. The system development involves coming up with the system wireframes of both mobile and web applications. The applications are then connected to the database for full development.

Unified Modelling Language (UML) is a visual modelling language that is used to specify, visualize, construct and document the artefacts of a software system (Rumbaugh, Jacobson, & Booch, 2005). The system processes were modelled using various UML notations that include Use case, System Sequence, Data Flow and Class Diagrams. The database will be modelled using the Entity Relationship Diagram (ERD) showing the tables, its attributes and their relationship.

3.4.1 Use Case Diagram

The use case diagram models the functionality of the system and how the users interact with the system. The purpose of the use case is to list the actors and the use cases and show which actors participate in each use case.

3.4.2 System Sequence Diagram

A sequence diagram shows a set of messages arranged in time sequence. Each role is shown as a lifeline that is a vertical line that represents the role over time through the entire interaction.

3.4.3 Class Diagram

The class diagram shows how the different entities of a system relate to each other. They contain the class names, attributes and methods.

3.4.4 Data Flow Diagram

A DFD illustrates those functions that must be performed in a program as well as the data that the functions will need. DFDs reveal relationships among and between the various components in a program or system. They are an important technique for modelling a system's high-level detail by showing how input data is transformed to output results through a sequence of functional transformations (Jr, nd).

3.4.5 Database Schema

The Entity Relationship Diagram (ERD) will enable the researcher to create a database schema. Relationships and attributes are created for the different entities. The table structure was modelled using the database schema showing the fields, data type and its description.

3.5 System Implementation

This phase entails the actual development of the system from the designs in the previous phase. The database was created from the ERD bringing out all the attributes and relationships. The mobile and web application will also be developed by translating the diagrams and wireframes to the actual system.

i. Mobile Application

The mobile application will be developed under the Android operating system. The source code will be written in Java, utilizing the Android classes. JavaScript Object Notation (JSON) will be used as the web service that provides the interface between the Android application and the database. The reasons for choosing Android as the client application include: flexible SDK, Android Development Tools (ADT) availability and support from online developer communities.

ii. Web Application

The web application will be developed using Hypertext Pre-processor (PHP). The website will be hosted on an online Apache HTTP server. The main reasons for using PHP include; it is an open source and independent platform, supports all major web servers and databases, it has multiple layers of security to prevent threats and malicious attacks.

iii. Database

The database will be developed using MySQL database. Reasons for using MySQL are: it is an open platform, it is fully compatible with PHP and other platforms and it is secure in that all passwords are encrypted before storage restricting unauthorized access to the database.

3.6 System Testing

The system will go through the following tests to check if the research objectives have been achieved.

- i. **Functional Tests** – The system functional and non-functional requirements will be tested against the system.
- ii. **Compatibility Tests** – The mobile and web applications will be tested for compatibility with different Android based platforms and web browsers respectively.
- iii. **Users Tests** – The end users of the application will perform a test to measure user satisfaction and will give their feedback that will later be used to refine the system. This feedback will help in validating the system if it promotes neighbourhood interactions. Users' response is discussed in Chapter 6.

3.7 System Evaluation

The developers and the system users evaluate the validity of the system. This is essential as it proves whether the system attains the users' requirement as proposed earlier and shows if the research objectives were attained. To validate if the developed mobile and web application solves the challenges faced in neighbourhood networking, a total of 30 respondents were selected from the sample population of 100 respondents who participated in the survey for collecting user requirements and also participated in the usability testing of the mobile application. An Online questionnaire were designed Refer to Appendix A (iii) and sent to all the respondents to collect data from them. Users' response is discussed in Chapter 6.

Chapter 4: System Analysis

4.1 Introduction

This chapter gives an in depth discussion of the data and system analysis. Data Analysis is primarily focusing on the collected data from the sample population. Breaking it down into understandable data and representing it in various formats. Analysis of the questionnaires was done using Google analysis tools. Charts were used to offer clear visualization of the responses and understanding of results. The results were used to answer research questions stated in section 1.4 of this dissertation. The overall results contributed to the system design of the application through integration of various functionalities.

4.2 Data Analysis

The data was collected using both questionnaires and interviews. The questions on the questionnaires were prepared on Google Forms to facilitate data analysis. Interviews were conducted face to face targeting the landlords and house agents. Firstly, the researcher started off by reading through all the data from the respondents in the interviews. Secondly, organized similar comments into one category, for instance, concern, suggestions, strengths, weaknesses, similar experiences, recommendations, outputs, outcome indicators, etc. and labelled them. Thirdly, identified patterns and causal relationships in the categories and made conclusions that influenced the system development.

4.2.1 Degree of Response

The target population included the tenants, their respective landlords and house agents. The response was 82.3% for the whole target population.

4.2.2 Demographic

Due to time constraint and respondents availability the researcher ended up with 83.3% response on the tenants' feedback and 70% response from the landlords and house agents. This amounted to 82.3% for the whole target population.

4.3 Users Response on Current System

The questionnaires sent to tenants gave the following feedback on various topics.

4.3.1 Familiarity of Individual Neighbours

The question was meant to deduce the degree of familiarity amongst neighbours in terms of their names, occupation and origin. 95.6% of the sampled population did not know their neighbours. This shows that there needs to be a better way of helping neighbours interact rather than the physical mode of meeting face to face.

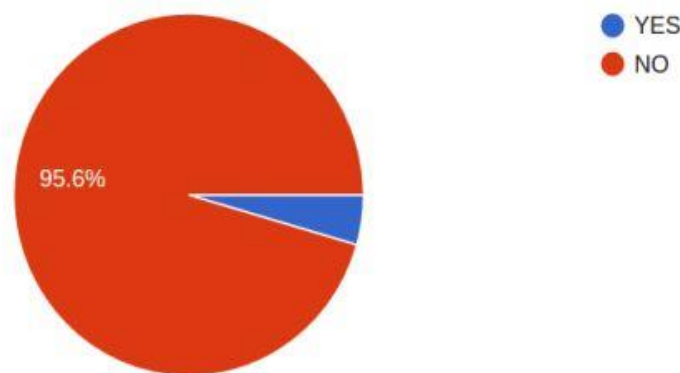


Figure 4:1: Familiarity in Neighbourhoods

4.3.2 Current Mode of Communication

This question was meant to find out the commonly used mode of communication between the landlords and their respective tenants. 59.2% of the sampled population said they used the available caretakers who were inefficient in delivering information while 42.9% used the house agents. 9.2 % of the population used other means, which included making phone calls.

This shows that it will be effective if they could communicating to their house agents/landlords directly as they act in time. Figure 4:2 shows the current mode of communication.

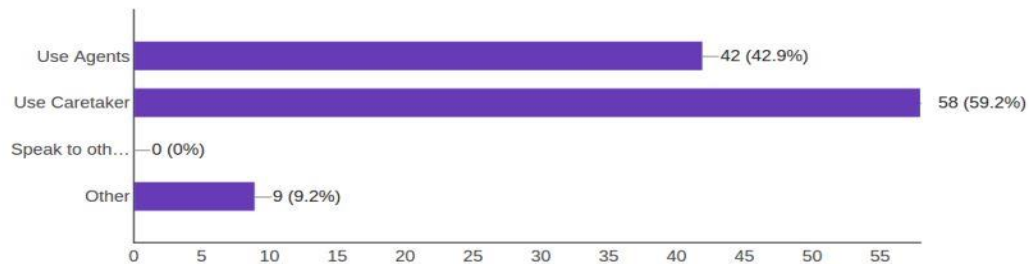


Figure 4:2: Current Mode of Communication with Agents/Landlords

4.3.3 Reporting Crime and Suspicious Behaviour in the Neighbourhood

This question aimed at understanding the most preferred people to report any suspicious behaviour in a neighbourhood. 69.7% said they would report to the landlords then followed by 20.2% who would report to the house agents, 7.9 % would report to their respective caretakers while 14% would use other means, which include the police. This shows that a neighbourhood communication platform would be necessary to link all these groups of people and facilitate information sharing.

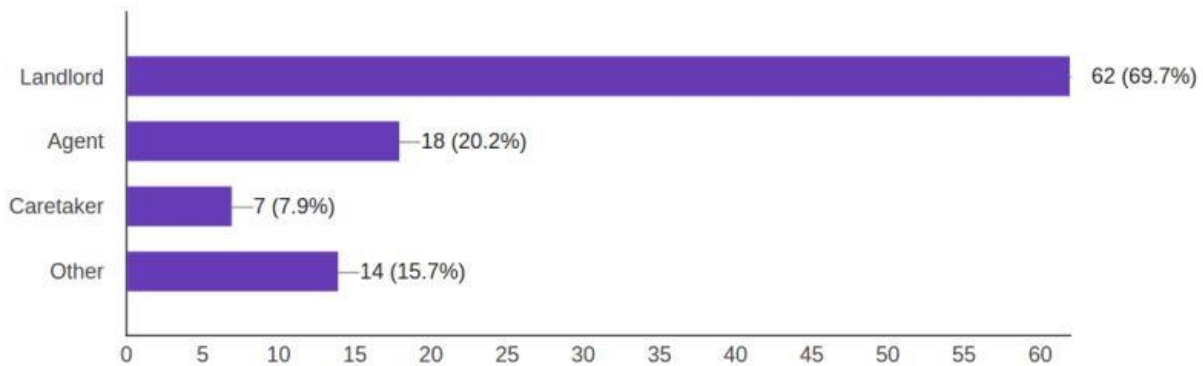


Figure 4:3: Reporting Suspicious Behaviour in Neighbourhoods

4.3.4 Communication in Neighbourhoods

This question having understood that the existing communication modes had challenges, aimed at finding out the most preferred mode of communication by the respondents. 92% of the sample size said they would use a mobile-based chatting platform. 7% considered community days to be set for purposes of interaction, while 1% said they would use their phones to make calls. Figure 4.4 below shows the respondents' response on the suitability of a mobile application in promoting neighbourhood communications.

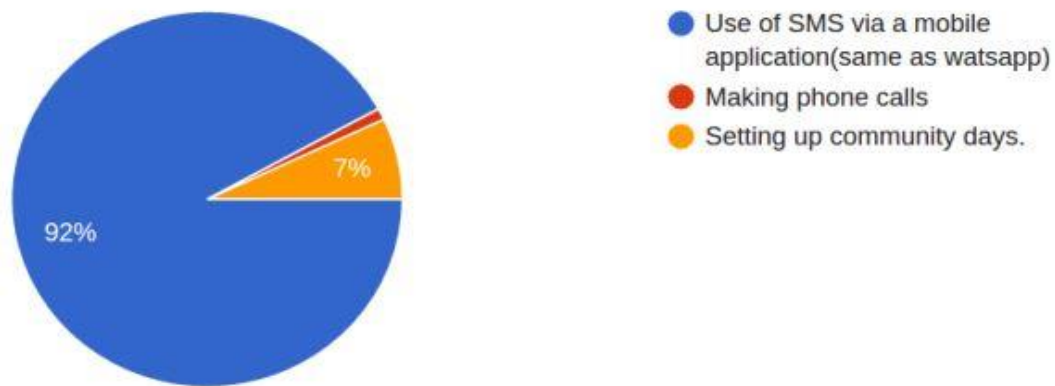


Figure 4:4: Preferred Communication Mode in Neighbourhoods

4.3.5 Impact of Neighbourhood Communication on Privacy

Respondents were asked to indicate whether they thought a mobile-based communication application would be an infringement on their personal privacy. 95% of the population considered the communication not an infringement to their personal privacy, while 5% considered it an infringement to privacy. Refer to Figure 4:5.

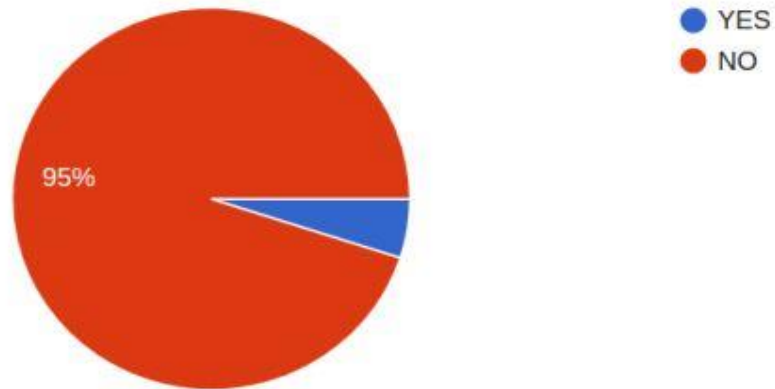


Figure 4:5: Communication as an Infringement of Privacy

4.3.6 Suitability of a Mobile Application in Facilitating Neighbourhood Interactions

All the respondents said they were willing to use a mobile application to facilitate networking and service delivery in their neighbourhoods. Refer to Figure C.1 for the kind of information shared in neighbourhoods.

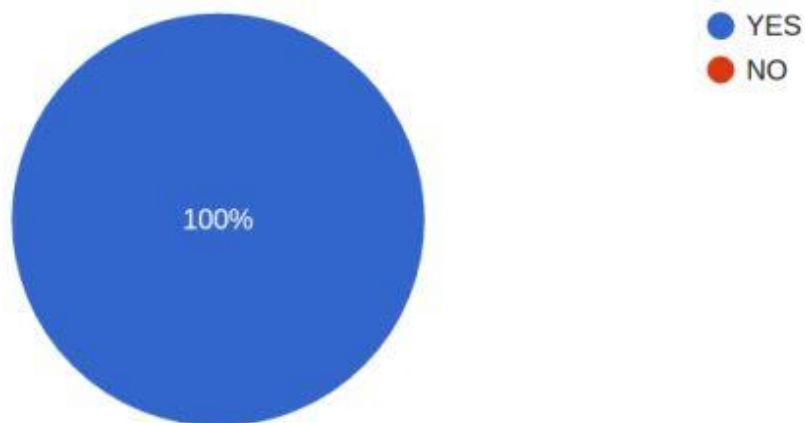


Figure 4:6: Suitability of a Mobile Application to Facilitate Neighbourhood Interactions

4.3.7 Analysis of Interviews

Interviews were conducted on 2 property agents and 8 Landlords. Refer to Appendix B the Interview Questions. The Agencies were; Acumen Properties Limited and Halifax Estate Agency Limited. Firstly, the results revealed that 80% of the population had challenges choosing the right tenants for their premises. This is majorly because they could not validate the prospective tenants' behaviours from the documents they provide. Secondly, 75% of the landlords said they would prefer to use agents for communication purposes as opposed to directly communicating with them. 25% preferred to communicate directly so as to get to know and interact with their tenants better. Thirdly, 80% of the population admitted that they had experienced challenges at some point communicating physically or using the notices, which they drop at the tenants' doorsteps. Refer to appendix B for the interview questions and Figure C.2 and C.3 which shows a letter addressed to ACUMEN Property Managers and the tenants' signatures which the tenants, agents and landlords considered inefficient, expensive, unreliable and time consuming.

Finally 100% said they have dealt with unruly tenants and would like to get tenant reviews before letting them houses and also a reliable and efficient mode of communication amongst them.

4.3.8 Proposed Features for the Neighbourhood Networking System

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

- i. The application should enable the users share information regarding service delivery.
- ii. The application should enable the users directly channel the issues in their houses to the property agents rather than passing through the caretakers.
- iii. The agents and landlords should be able to customize messages and send to specific or all tenants.
- iv. The application should enable exchange of real time information in the neighbourhood so as people can be on the know about what is going on.
- v. Enable neighbours connect easily as there are many ways they can help each other.

4.3.9 Validity

As a process, validation involves collecting and analysing data to assess the accuracy of an instrument. Validity aims at finding out how truthful the results are, and if they really measure what was initially intended. Validity in this research design has been achieved through the different designs that have been used involving understanding the problem first, then analysing the existing platforms used to solve this problem and why they are not efficient, identifying the number of people affected through quantitative research and finally coming up with a solid solution to the same. Validity in data collection has been achieved as the findings through interviews and questionnaires truly represent the magnitude of the problem.

4.4 Conclusions

Positive feedback was received from the respondents which gave a go ahead to build the neighbourhood networking system. Based on the data provided by the respondents, the results were used to come up with the below conclusions:

- i. Majority of people do not know their neighbours, they would therefore want to use a neighbourhood networking system to help them interact with their neighbours, agents and landlords.
- ii. The application could be used to share insecurity issues hence curbing and reducing crime.
- iii. The current mode of communication had major challenges and quite costly for both the landlords and tenants.
- iv. The system should provide comprehensive reports about houses and their surroundings and also help communicate easily for instance making updates to various resources in the neighbourhood.
- v. A connected neighbourhood was essential due to the dynamic lifestyles in the urban regions.
- vi. A mobile-based application was the most preferred mode of interaction hence would be readily accepted by majority of the users.

4.4.1 System Requirements

From the data collected and its analysis the researcher came up with both functional and non-functional requirements for the system. This also helped come up with the system architecture and its elements.

1. Functional Requirements

These requirements define the capabilities and functions that the implemented system or its components must be successful. It includes a set of inputs, behaviour and outputs in line with the objectives of the study. They include:

i. Login and Logout

To gain access to the neighbourhood networking dashboard, users login with their unique usernames and passwords. User needs to logout to exit the system.

ii. View message Notifications

After users have logged into the systems, they are able to view the message notifications and the senders of the message, for instance if it has come from the Agent or the other tenants.

iii. Engage in Conversations

Conversations in the neighbourhood system are two sided where the tenants can communicate amongst themselves or communicate with the agents. The agents are also able to engage the tenants and the landlords in the conversations.

iv. Manage Tenants

This happens from the agent side, where they are able to add details of a new tenant in the system so they can engage in the neighbourhood interaction platform. They can also update their details for instance moving of houses and also delete their information if they have completely left.

v. Respond to Messages

The agent responds to messages from both the tenants and landlords, tenants' queries could include a complain, suggestion and even an update in the neighbourhood.

vi. Generate Reports

The agent is responsible for generating two kinds of reports, an individual report and the neighbourhood updates report. These are deduced from the various messages sent by the tenants.

vii. Manage Houses

The Landlords manage their houses by adding new houses, updating existing houses and deleting houses if they no longer own them.

viii. View Reports

This feature is available for the landlords as they can view the reports generated by the agents and act on them too.

2. Non-Functional Requirements

These are requirements that specify the criteria used to judge the operation of the system. They were constructed in agreement with functional requirements that define specific behaviour and functions. They include:

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

Chapter 5: System Design

5.1 Introduction

The system design and architecture is covered in this section. The system design was done in Unified Modelling Language diagrams to further narrate and elaborate on the system requirements. The design diagrams used include data flow diagram (DFD), use case diagrams, use case descriptions, sequence diagram, class diagram and Entity relationship diagram (ERD).

5.2 System Architecture

The architecture used is client-server it is a model that acts as distributed application that partition workloads between service providers called servers and service requesters called clients. The client side comprises of the Android mobile application and two web applications. The tenants where they verify their phone numbers after registration then they can view neighbourhood updates and engage in chats with their neighbours and agents by sending messages using the mobile application. The first web application is used by the agents to manage the tenants in the houses and also engage in conversations mainly by responding to their messages and generating reports of individual tenants. The second web application is used by the landlords who manage their houses and also engage in conversations with the agents and view generated reports. The web server acts as an intermediary between the web applications and the database server. Figure 5.1 illustrates the conceptual model and Figure 5.2 represents the system architecture.



Figure 5:1: Conceptual Model

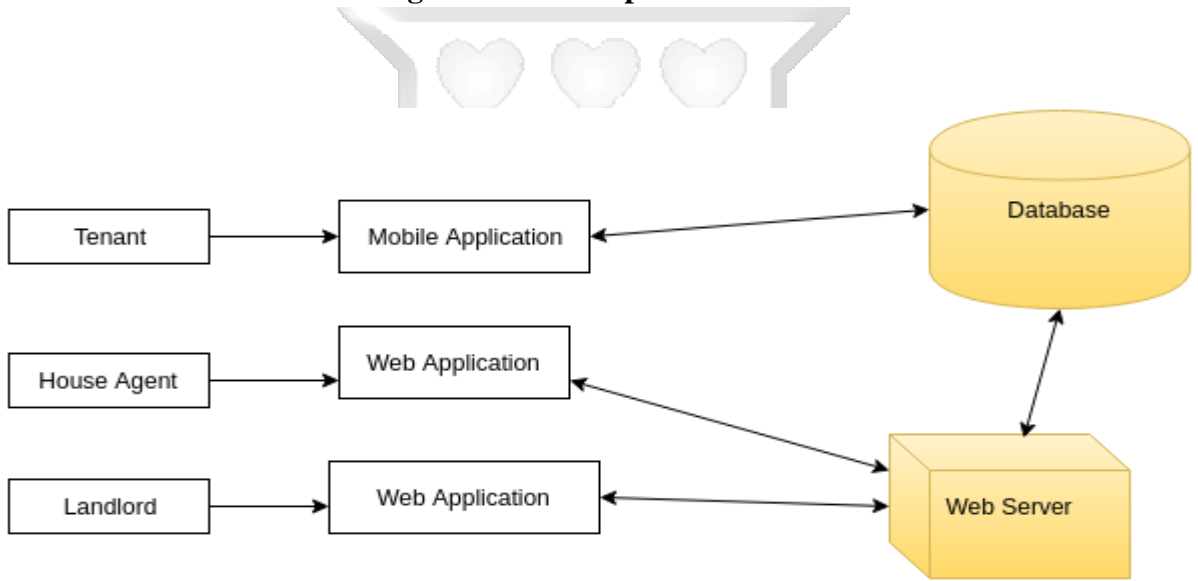


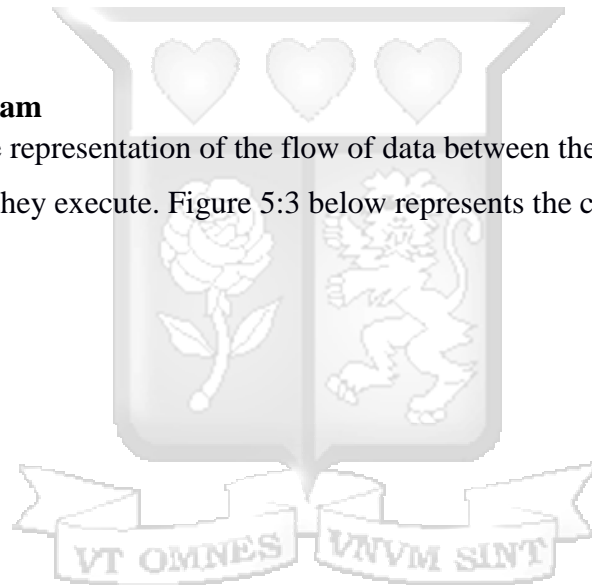
Figure 5:2: Proposed System Architecture

5.3 System Design

The proposed neighbourhood networking platform comprises of 3 main entities; the tenant, agent and landlord the tenant being the key entity. The house agents and landlords are the ones that will make the system functionalities be achieved. They are able to respond and act on the tenants' queries. The tenant interacts with the mobile application by invoking processes such as view notifications, send complains, updates and engage in conversations with their next door neighbours. The agents are able respond to their messages and generate the reports of individual tenants and of the neighbourhood updates. On the other hand, the landlords are able to view the generated reports and respond back to the agents. This section explains the proposed solution processes diagrammatically on how the various classes in the application are related and interact with each other.

5.3.1 Data Flow Diagram

A DFD shows the representation of the flow of data between the users and the system and the respective processes they execute. Figure 5:3 below represents the context diagram.



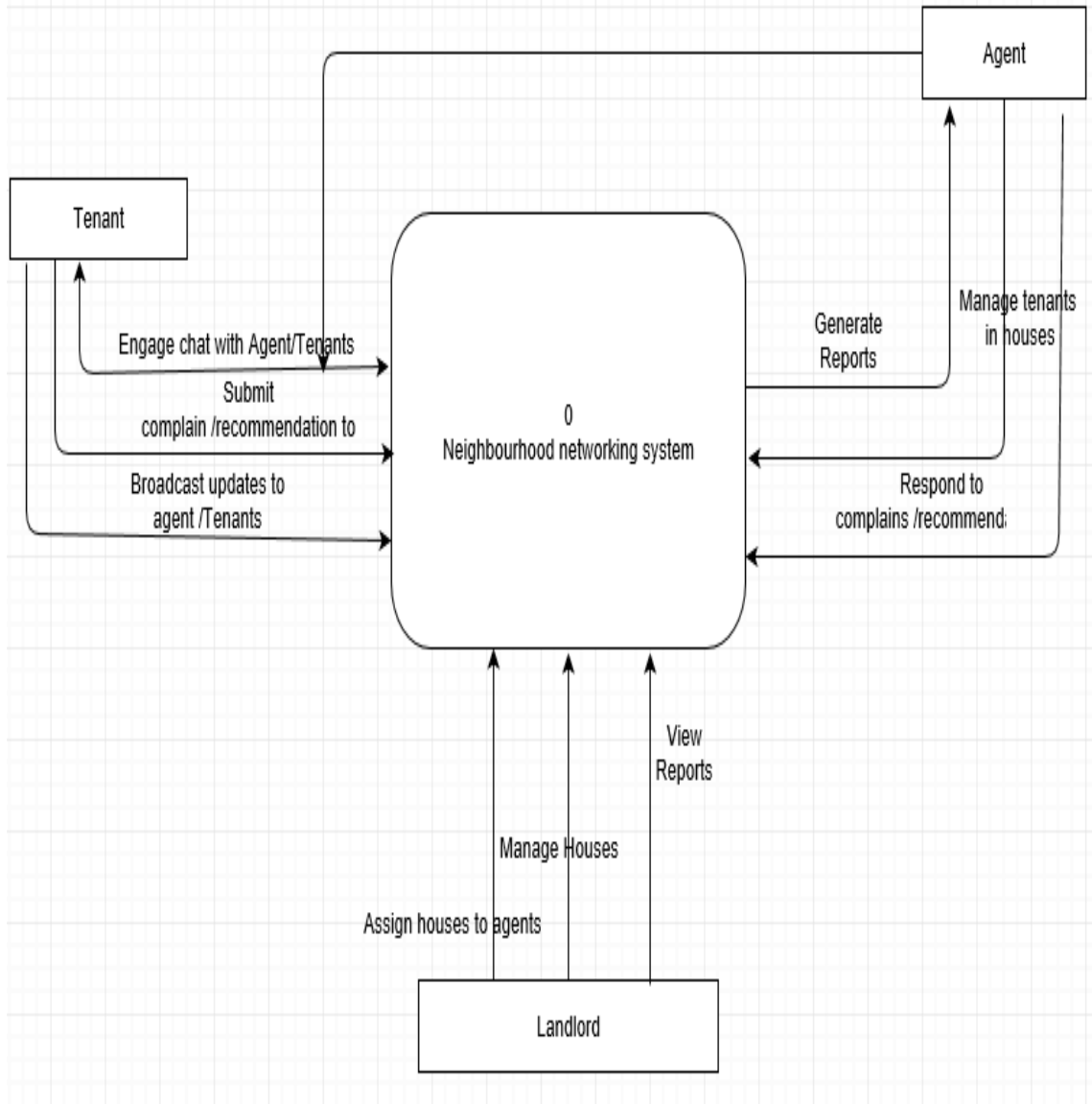


Figure 5:3: Context Diagram

5.3.2 DFD Level 0 Diagram

Figure 5:4 below shows the system's DFD level 0. It illustrates how data is processed. The data is the user input in form of requests and responses received when the system processes them. The diagram shows a more elaborate explanation of the systems context diagram in Figure 5:3 above.

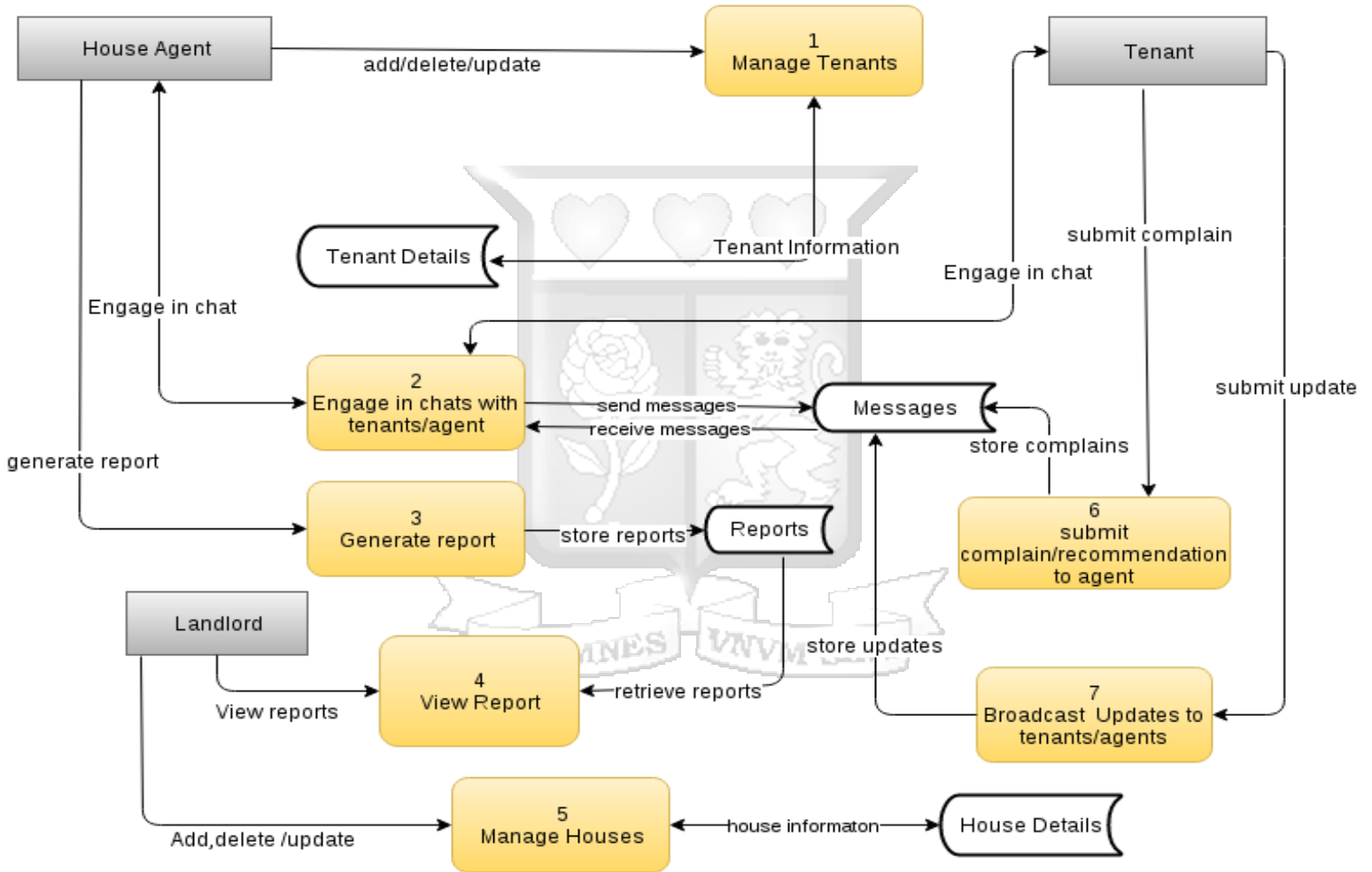


Figure 5:4: DFD Level 0 Diagram

5.3.3 DFD Level 1 Diagram

DFD level 1 further breaks down the processes into their constituent elements from the DFD level 0 diagram Refer to figure 5:4. This is a breakdown of the managing tenants process specifically describing the add tenant sub module and subsequent activities after adding them and their respective data stores.

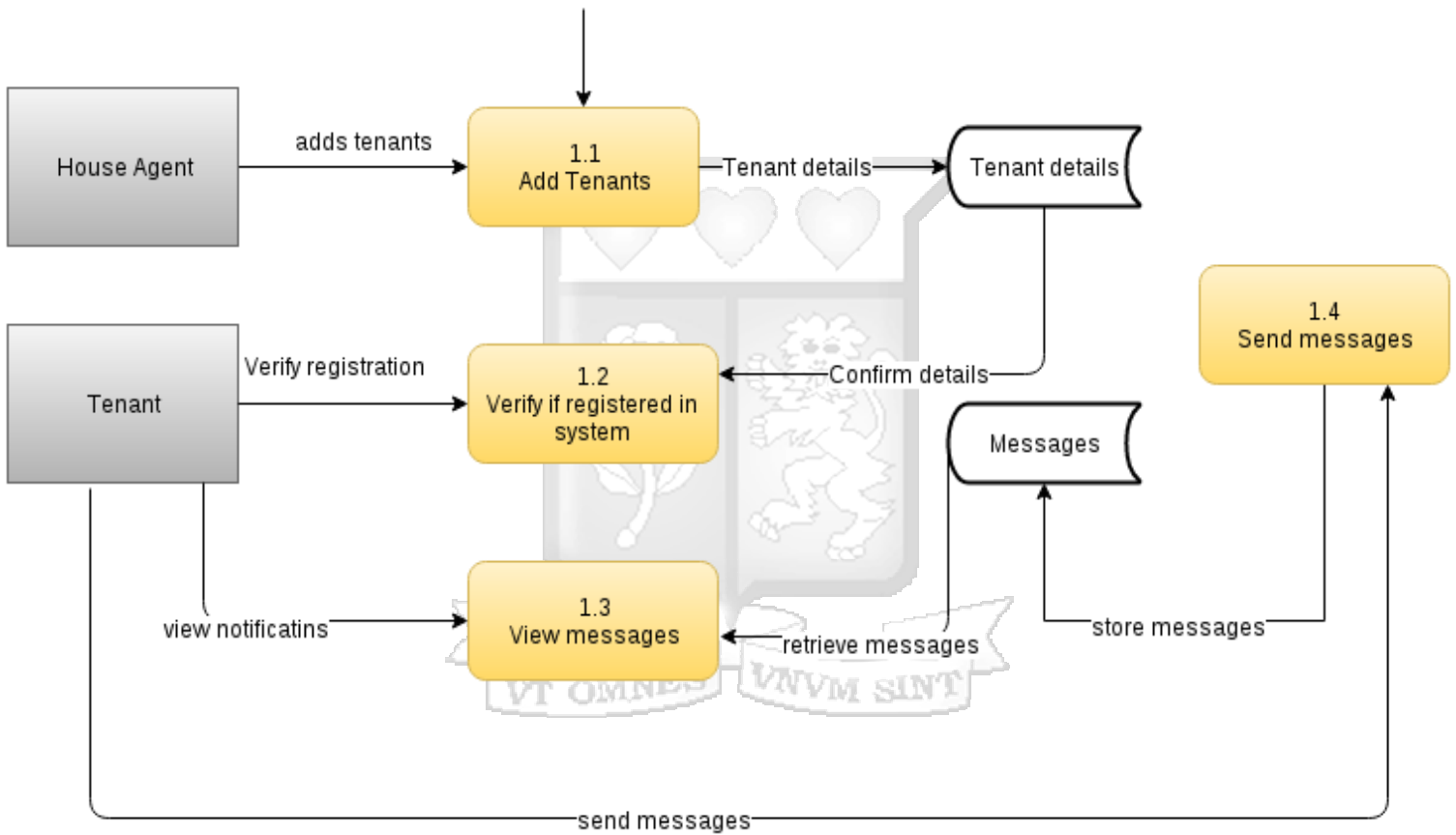


Figure 5:5: DFD Level 1 Diagram

5.3.4 Use Case Diagram

The use case diagram is used to model the different users of the system and their respective actions users are equivalent to the actors and they include; Tenants, House Agents and Landlords. Figure 5:6 below represents the use case diagram.



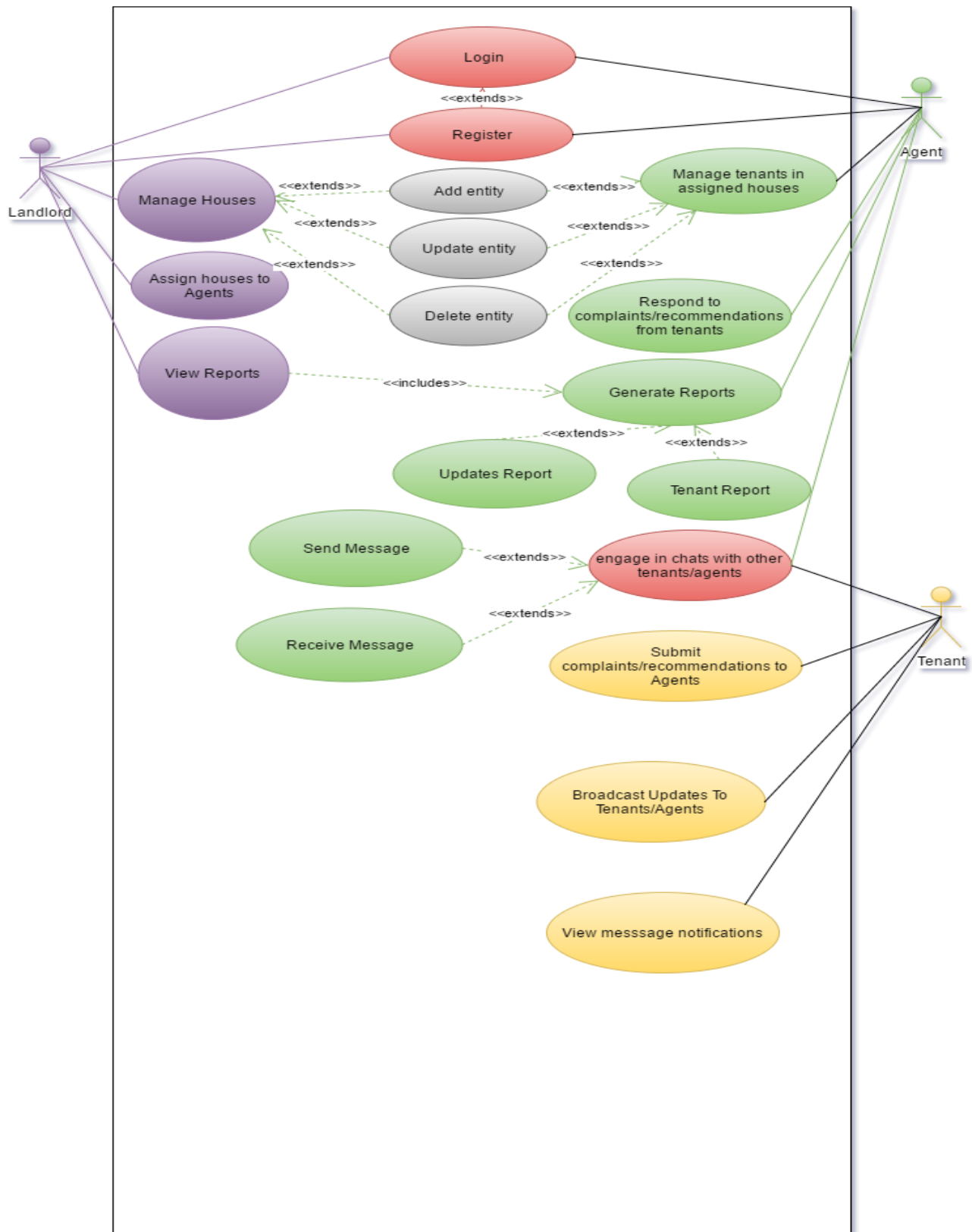


Figure 5:6: Use Case Diagram

5.3.5 Use Case Description

In this section, a use case is described in detail to represent all activities involved for a success scenario and any other alternatives to achieve the end goal. Table 5:1 shows the steps a tenant takes to submit a complain or update in the neighbourhood.

Use Case Name	Submit complain/Updates
Actors	Tenants
Description	describes the steps a user takes to submit a complain or raise an update in the system
Preconditions	The users must have verified their phone numbers in the system
Postconditions	The user can view new notifications
Typical case of Events	System Responses
Actor Response	System commits the type of message chosen
User chooses the type of messages to be sent.	System commits the recipient of the message
User selects the recipient	User hits the send button
User writes the message	
Alternate Flow	
Message fails to send	Message is not delivered to recipient

Table 5:1: Submit Complain/Updates Use Case Description

Table 5:2 below represents the steps followed by the agents while responding to complains and updates from the tenants. Refer to table D.1 and D.2 for generate report use case and login and logout use case description respectively.

Use Case Name	Respond to Complains/Updates
Actors	Agents
Description	Describes the steps the agent takes to respond to a complain or any updates raised.
Preconditions	There must be a message already submitted by the tenant.
Post conditions	The user can view new notifications
Typical case of Events Actor Response User chooses the type of messages to be sent. User selects the recipient User writes the message	System Responses System displays the type of message chosen System displays the recipient(s) of the message User hits the send button
Alternate Flow Message fails to send	Message is not delivered to recipient

Table 5:2: Respond to Complain/Updates Use Case Description

5.3.6 Class Diagram

Figure 5:7 below represents the static models of the classes that will be used in the application. Their attributes and the behaviours. It also shows the relationships between the various classes.

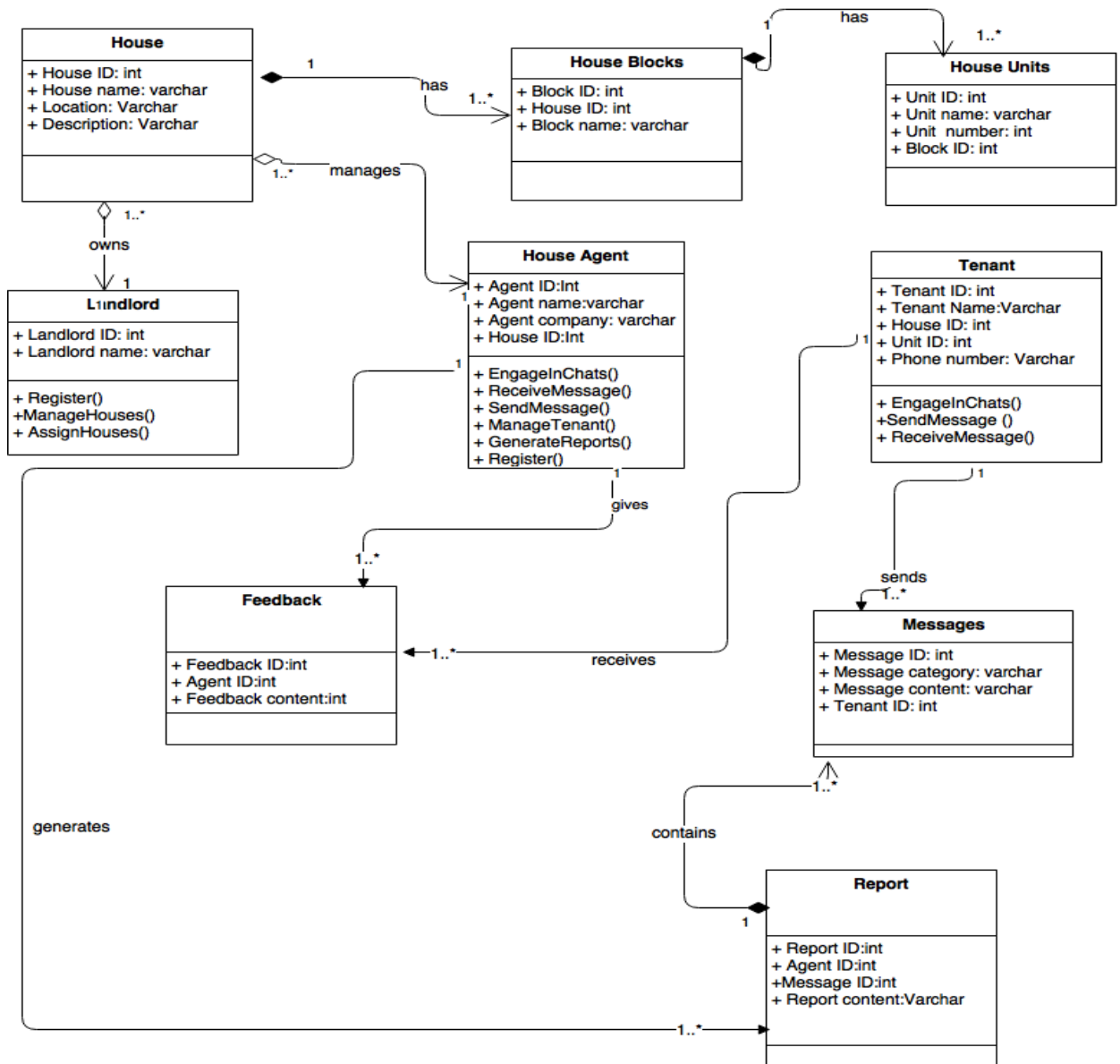


Figure 5:7: Class Diagram

5.3.7 Database Design

The Entity-Relationship Diagrams (ERD) was used to diagrammatically describe the data objects. The ERD shows the interaction between the objects. The database holds sensitive data from the mobile application and the two web applications. The main table in the database schema is the messages table, which contain confidential information of the conversations in the neighbourhood. It relates with the other tables and helps in generating reports. The table below represents the database schema.

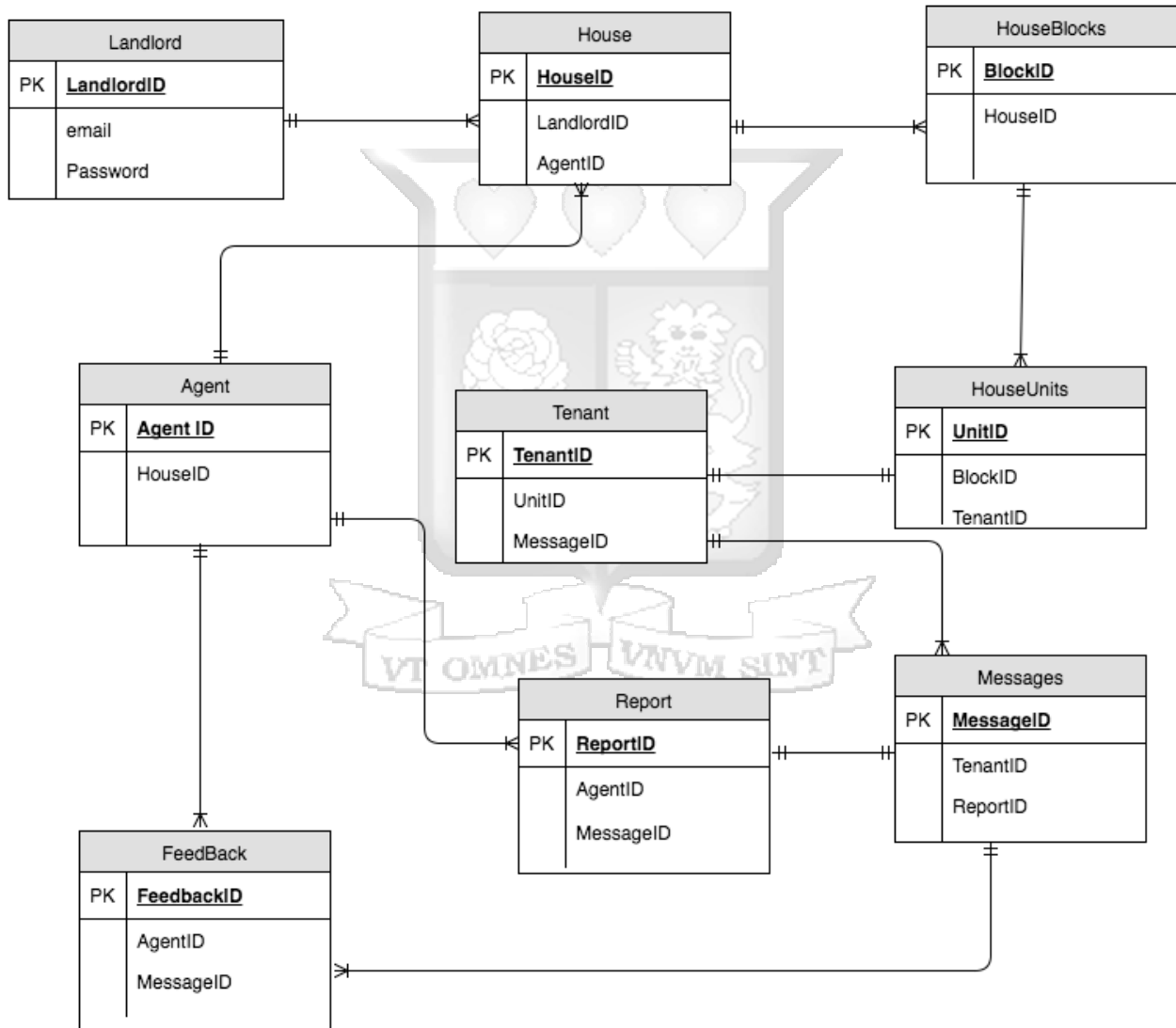


Figure 5:8: Entity Relationship Diagram

5.3.8 Database Schema

Users Table

The users table include three different groups of users that include: tenants, landlords and agents. Refer Table 5:3 below for the users' attributes.

Column Name	Data Type	Index
user_id	Varchar (30)	Primary Key
role_id	Varchar (30)	Foreign Key
email	Varchar (30)	
password	Varchar (30)	
phone-number	Varchar (30)	

Table 5:3: Users Table

House Table

The house table contains the description of the houses in terms of their names, location and the user managing them. Refer to Table 5:4 below for the houses' attributes.

Column Name	Data Type	Index
house_id	Varchar (30)	Primary Key
user-id	Varchar (30)	Foreign Key
house_name	Varchar (30)	
location	Varchar (30)	
description	Varchar (30)	

Table 5:4: House Table

House Block Table

The houses constitute different blocks in them. Each block is associated with a particular house. Refer to Table 5:5 House Blocks Table.

Column Name	Data Type	Index
block_id	Varchar (30)	Primary Key
house_id	Varchar (30)	Foreign Key
block_name	Varchar (30)	

Table 5:5: House Blocks Table

House Units

The house blocks in turn constitute different house units. Each unit is associated with a particular house block. Refer to Table 5:6 House Units Table.

Column Name	Data Type	Index
unit_id	Varchar (30)	Primary Key
block_id	Varchar (30)	Foreign Key
unit name	Varchar (30)	
unit_number	Varchar (30)	

Table 5:6: House Units Table

Messages Table

The users engage in conversations, which are captured in the messages table. Refer to Table 5:7 Messages Table.

Column Name	Data Type	Index
message_id	Varchar (30)	Primary Key
user_id	Varchar (30)	Foreign Key
Message _category	Varchar (30)	
message_content	Varchar (30)	

Table 5:7: Messages Table

Feedback Table

Each message submitted by a particular user requires feedback. The feedback is stored in a feedback table. Refer to Table 5:8 Feedback Table.

Column Name	Data Type	Index
feedback_id	Varchar (30)	Primary Key
user_id	Varchar (30)	Foreign Key
Feedback content	Varchar (30)	
message_id	Varchar (30)	

Table 5:8: Feedback Table

Reports Table

Reports are generated from the messages sent by the tenant user. Each message category is associated to a particular report. Table 5:9 represents the Reports Table.

Column Name	Data Type	Index
Report_id	Varchar (30)	Primary Key
message_id	Varchar (30)	Foreign Key
Report_content	Varchar (30)	
user_id	Varchar (30)	

Table 5:9: Reports Table

5.3.9 Mobile Application Wireframes

i. Mobile Phone Number verification Wireframe

When the Android application user installs the application, they are first prompted to verify their phone numbers. Figure 5.9 represents the Mobile Phone Verification Wireframe.

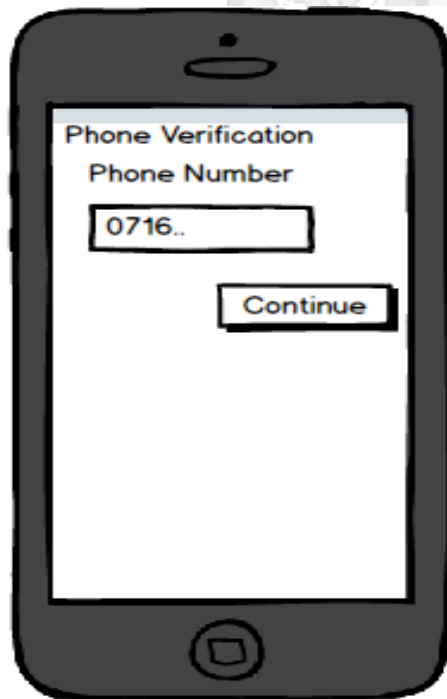


Figure 5:9: Mobile Phone Verification Wireframe

ii. Tenant Homepage Wireframe

If the number is already registered, the tenants are redirected to the homepage in Figure 5:10 below shows the Tenant Homepage Wireframe.



Figure 5:10: Tenant Homepage Wireframe

iii. Viewing Neighbours and sending message wireframes

The second page is a screen to the neighbours, the user has an option of sending a message to one individual neighbour by clicking on the neighbour and afterwards typing the message and click send as shown in the screens in Figure 5:11 below Viewing Neighbours and Sending Message Wireframes.

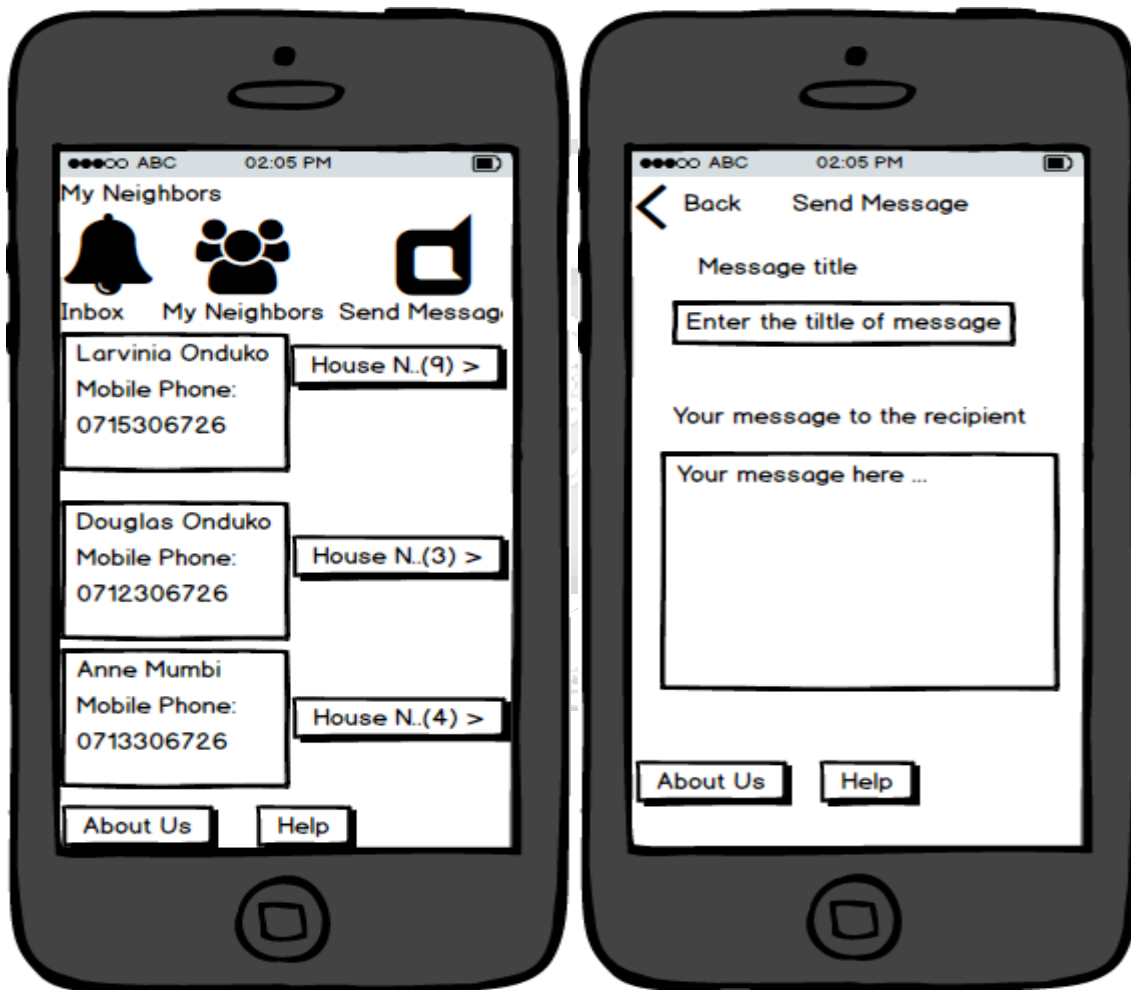


Figure 5:11: Viewing Neighbours and Sending Message Wireframes

iv. Message Category and Recipient Selection Wireframes

The final page is Send Message, the tenant can send a message by first selecting the Send Message tab then the message category and choose either update, complain or recommendation. Afterwards the tenants then chooses the message recipient which is either the agent or neighbours then composes the message and sends it. Refer to Figure 5:12 below Message Category and Recipient Selection Wireframes.



Figure 5:12: Message Category and Recipient Selection Wireframe

5.3.10 Web Application Wireframes

i. House Agent Dashboard

The agents' dashboard enables them to manage the tenants by adding new tenants, updating their details in case they change houses and also deleting them from the system when they move from the neighbourhood. They are also entitled to respond to tenants' complains and updates and also generate reports. Refer to Figure 5:13 Agent Home Page Wireframe.

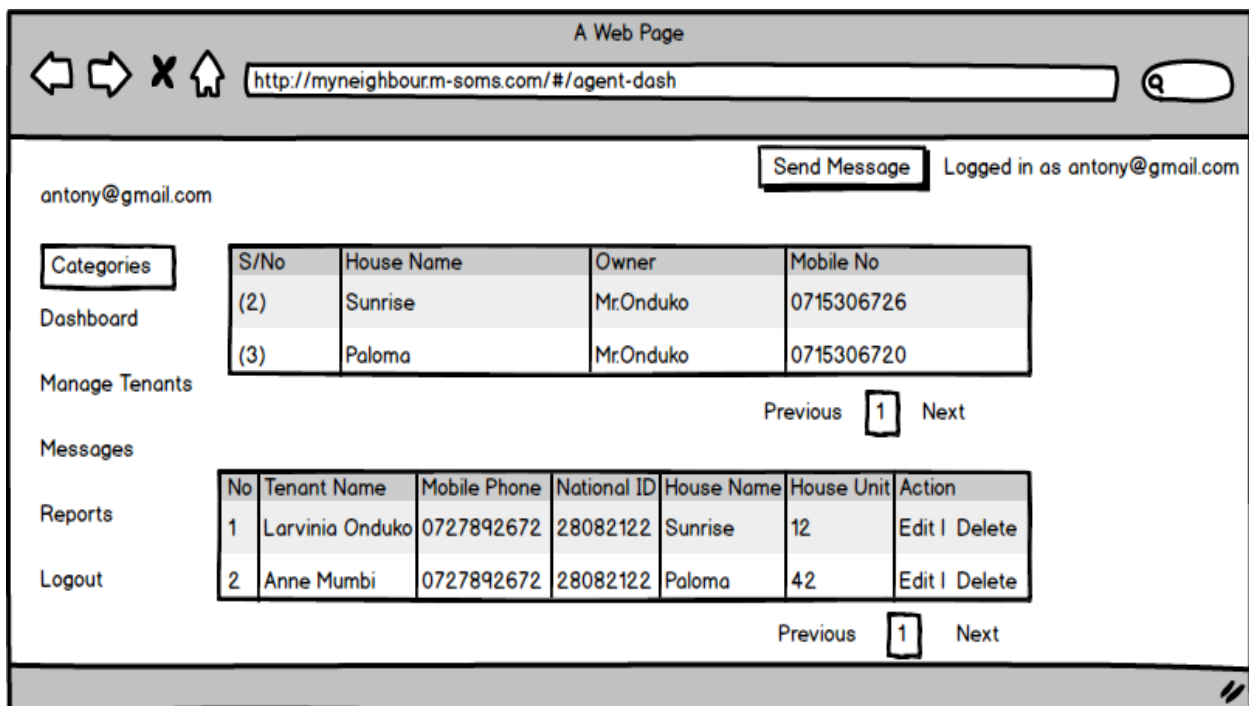


Figure 5:13: Agent Home Page Wireframe

ii. Agent Manage Tenants Wireframe

Agents manage tenants by adding them, editing their details or deleting them when they change houses. Refer to Figure 5:14 Agent Manage Tenants Wireframe.

The wireframe shows a web browser window with the URL `http://myneighbour.m-soms.com/#/agent-dash/tenant`. The page title is "A Web Page". The user is logged in as `antony@gmail.com`. A "Send Message" button is located in the top right. The main content area is titled "New tenant" and contains a form with the following fields: "First Name...", "Last Name...", "Mobile Phone", "National In Number", "Select House" (dropdown), and "Select Unit" (dropdown). A "Submit" button is located at the bottom right of the form. A sidebar on the left contains links for "Categories", "Dashboard", "Manage Tenants", "Messages", "Reports", and "Logout".

Figure 5:14: Agent Manage Tenants Wireframe

iii. Agent Messages Wireframe

The agent receives messages from both the tenants and landlords, they are therefore entitled to give feedback by clicking on the reply button. Refer to Figure 5:15 Agent Messages Wireframe.

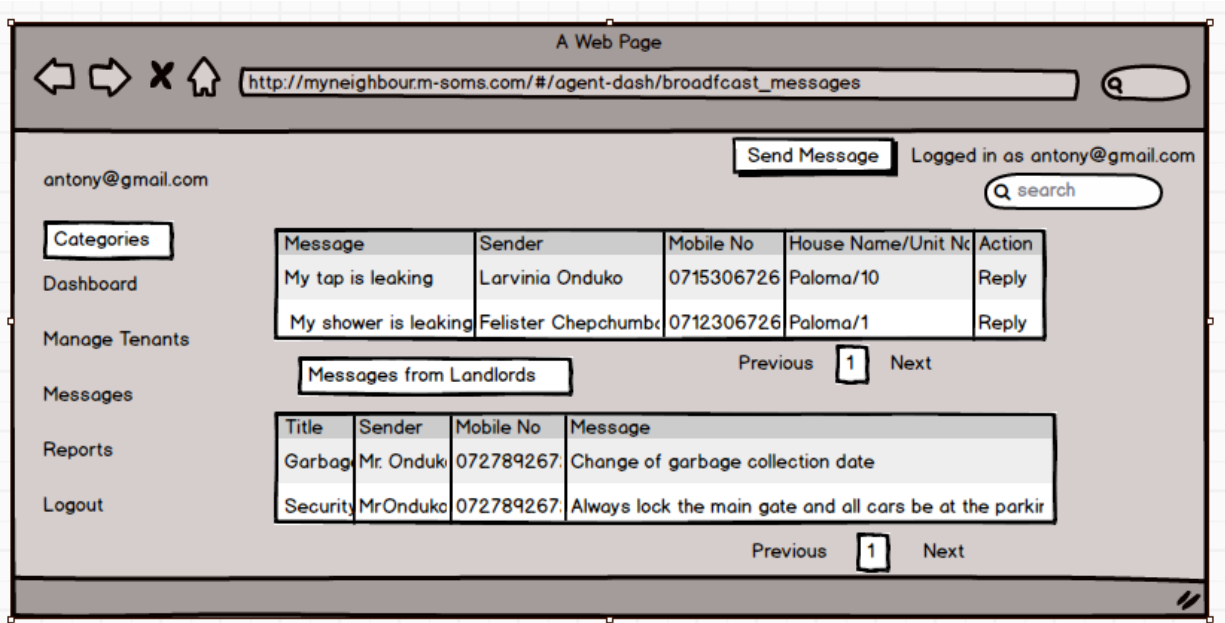


Figure 5:15: Agent Messages Wireframe

iv. Landlord Dashboard

The landlords' homepage enables them view their houses and the agents managing them. They can manage their houses by assigning them to new agents, send messages to agents and view the generated reports. Refer to Figure 5:16 Landlord Home Page Wireframe.

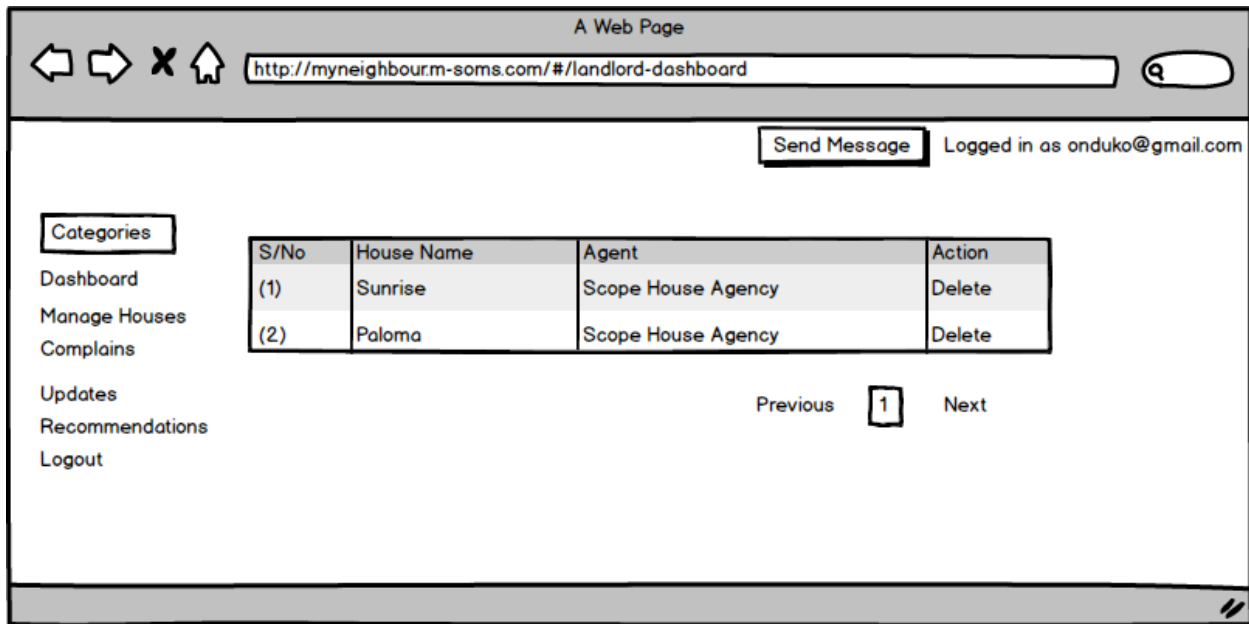


Figure 5:16: Landlord Home Page Wireframe

v. Landlord Messages Page Wireframe

The landlords can view the messages sent from agents managing their houses, and reply to them. Refer to Figure 5:17 Landlord Messages Page Wireframe.

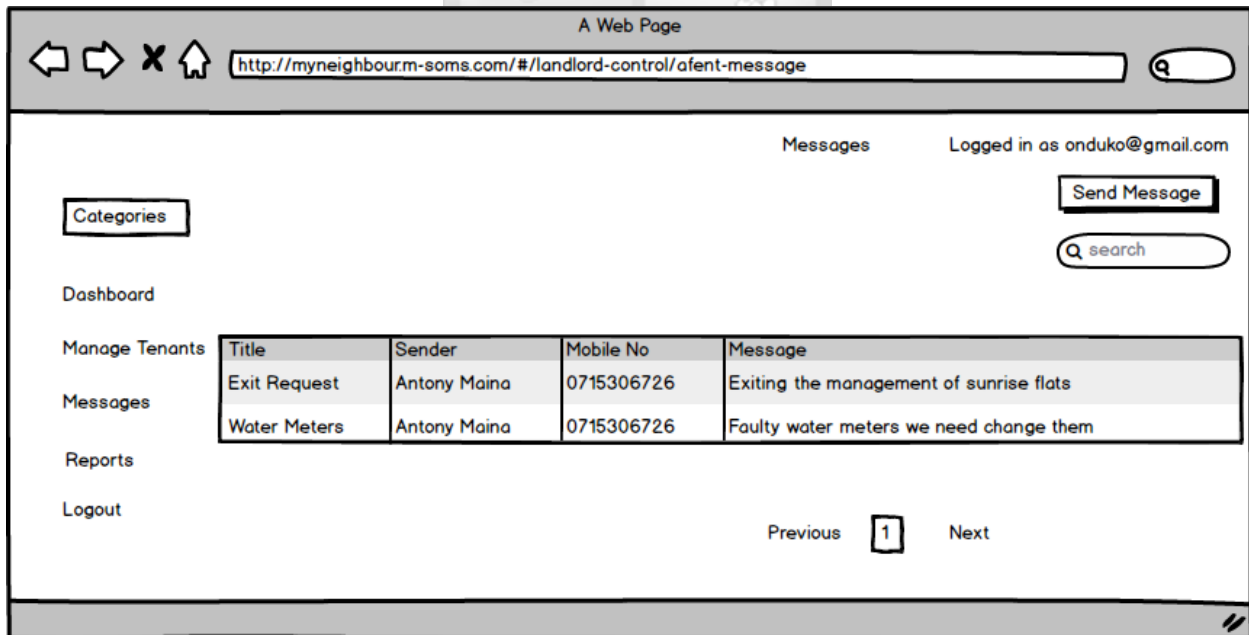


Figure 5:17: Landlord Messages Page Wireframe

vi. Landlord Manage Houses Wireframe

The landlords manage their houses by registering the house names, inputting the number of units and assigning the units to the houses. Finally they assign agents to manage the houses. Refer to Figure 5:18 Landlord Manage Houses Wireframe.

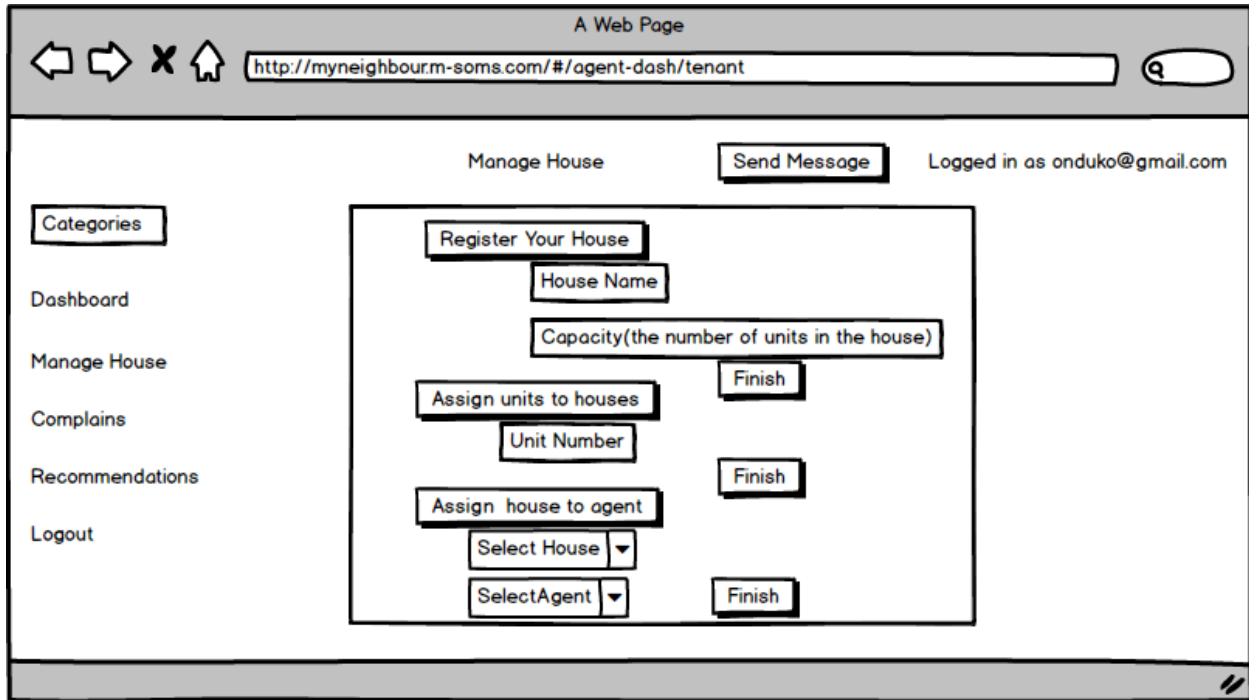


Figure 5:18: Landlord Manage Houses Wireframe

vii. Complains Report Wireframe

Complains report is generated from the complains messages sent by the tenants. They give information about the condition of the houses and surrounding. Refer to Figure 5:19 Complains Report Wireframe

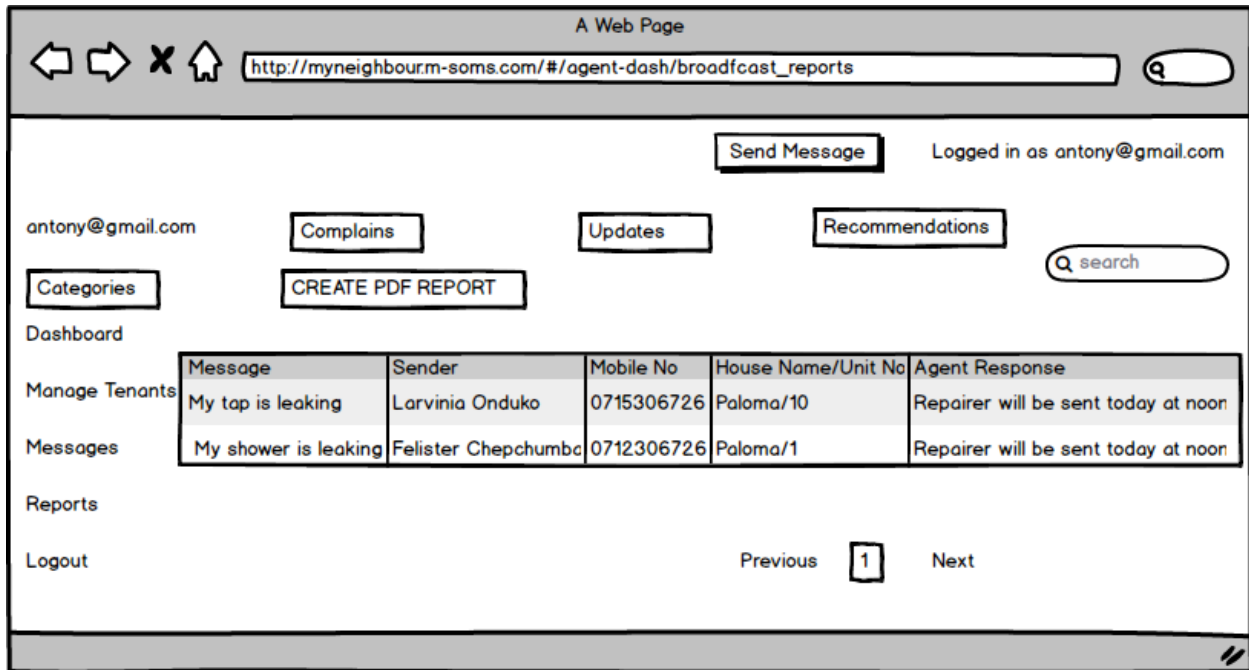


Figure 5:19: Complains Report Wireframe

viii. Recommendations Report Wireframe

The recommendation report is used to understand what the tenants would want changed or made better in the neighbourhood. Refer to Figure 5:20 Recommendations Report Wireframe.

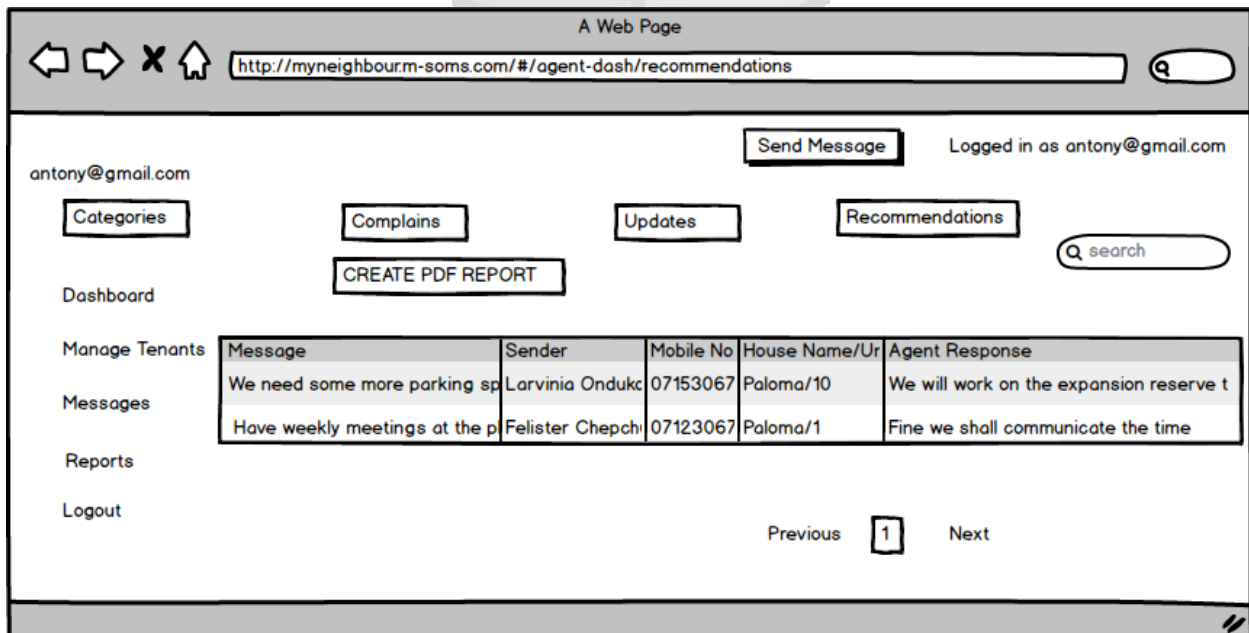


Figure 5:20: Recommendations Report Wireframe

ix. Updates Report Wireframe

The updates report gives information about the nature and quality of the neighbourhoods. It is generated from the messages sent by the tenants about the neighbourhoods. Refer to Figure 5:21 Updates Report Wireframe.

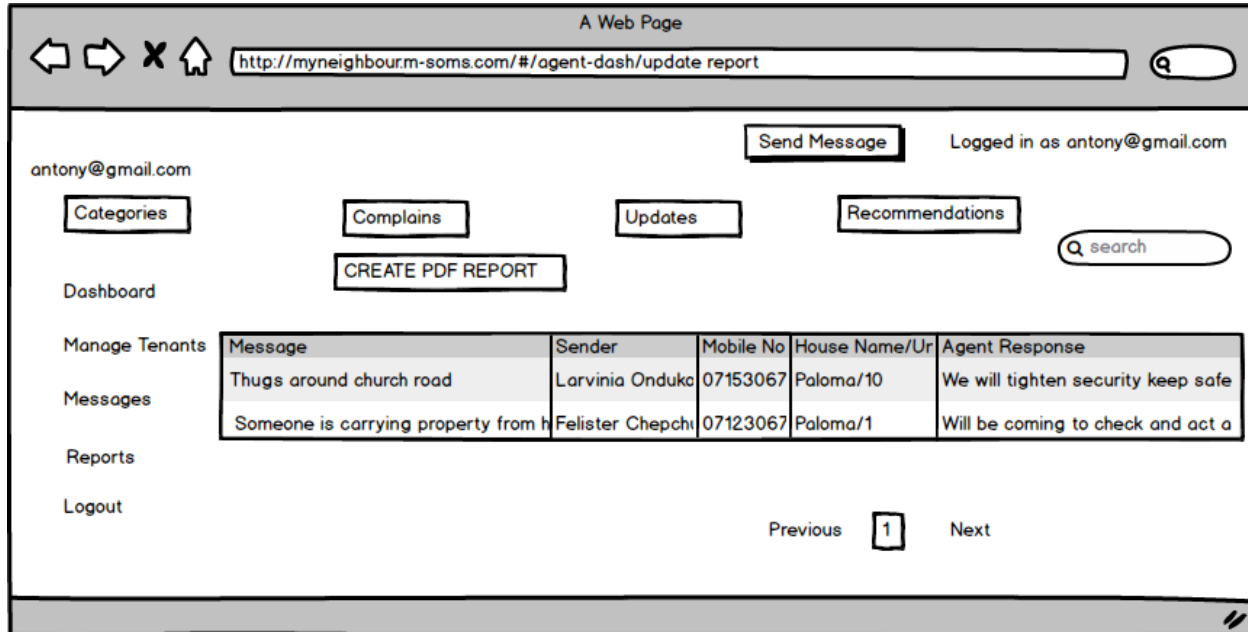


Figure 5:21: Updates Report Wireframe

5.4 Summary

System design and architecture as discussed in this chapter aids in understanding the system requirements. UML notation was used to construct diagrams that helped in understanding the system. These diagrams include:

- i. DFD – Represents the flow of data in the system
- ii. The Use case Diagram – Shows the system requirements.
- iii. Sequence Diagram - Illustrates the system processes.
- iv. Class Diagram – indicates the classes.
- v. ERD – shows the database design.

The proposed system architecture is client server based architecture where the mobile and web application are in the client side and server and database are in the server side. The wireframes give a picture on how the system will look like after development.

Chapter 6: System Implementation, Testing and Evaluation

6.1 Introduction

After design of the system in the unified modelling language (UML) in Chapter 5, the design was then translated into the real application and tested to see if the output is as designed. This chapter therefore contains the implementation of the proposed application. The system functionalities incorporate the system functional requirements as stated in Chapter 4, section 4.3.1. To have a clear understanding of the actual implementation of the system this section provides the implementation environment for the mobile application, web application and database. The implementation details provide description of major system components and explanation of procedures to accomplish the functionalities. This chapter also provides the system testing procedures. The tests performed are: functional testing where the system functionality was tested against the functional requirements, compatibility testing where the applications were tested against different platforms and browsers and usability testing which was conducted by potential users and their feedback analysed.

6.2 Implementation Environment

6.2.1 Mobile Application

The mobile application was implemented on the Android operating system. The source code was written in Java, utilizing Android classes. The application was compiled and tested using the Android Software Development Kit (SDK) emulator and Tecno C8. The application is optimized for Android version 4.3 (API 18) that allows compatibility with higher versions. JSON was used as the web service that provides the interface between the Android application and the database.

6.2.2 Web Application

The web application was developed using Hypertext Preprocessor (PHP). The website was hosted on an online Apache HTTP server.

6.2.3 Database

The database was developed using MySQL database because it is an open platform, fully compatible with PHP and its security as it enables encryption of passwords.

6.3 Implementation Details

6.3.1 Mobile Application

The mobile application is Android based and was built for only the tenants. The smartphone running the application requires Internet connection. The tenants will use the application to network in their neighbourhoods, submit complains to their respective agents and get feedbacks on notifications and any updates in their neighbourhoods. The below are screen shots of the application and their functionalities.

1. Mobile Application Components

i. Phone Verification

When the Android application user installs the application, they are first prompted to verify their phone numbers. Figure 6.1 represents the phone verification screen. This step is necessary to ascertain that only the renters in that particular house get access to the neighbourhood networking platform. If the number does not exist in the system the user gets an error message and is prompted to contact their agent.

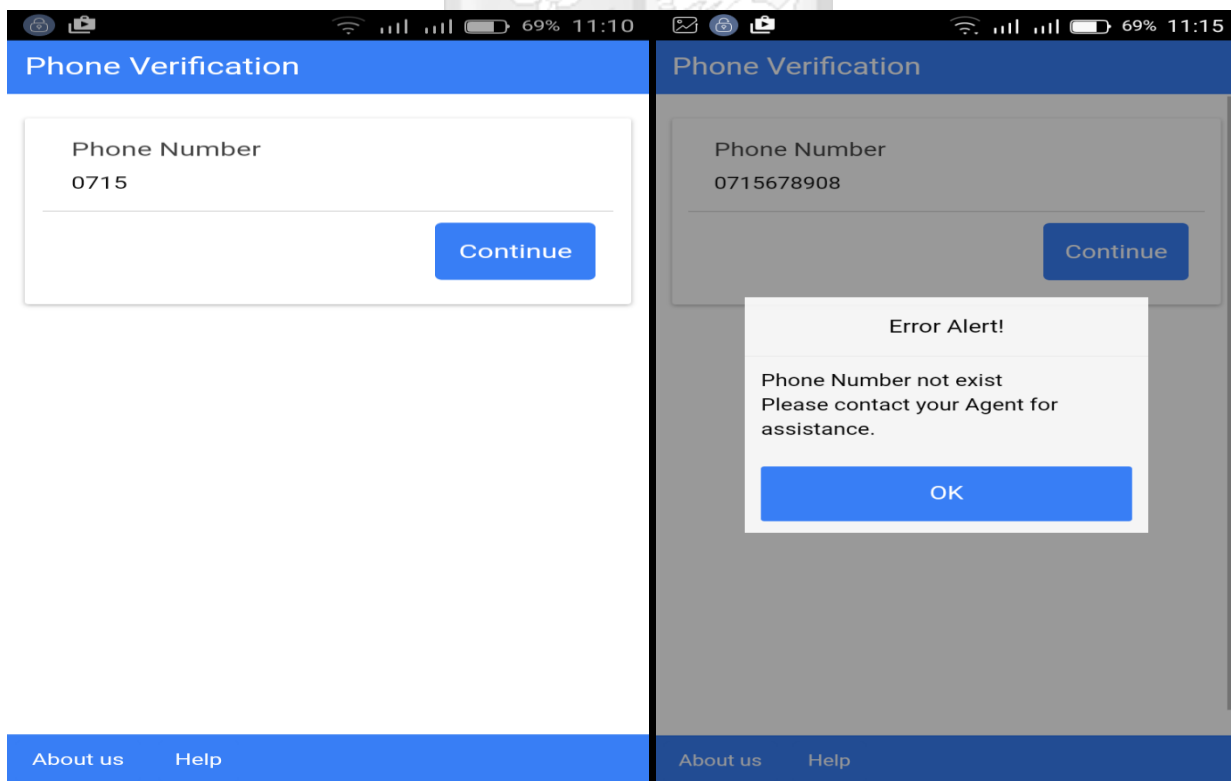


Figure 6:1: Phone Verification

ii. Homepage

If the number is already registered, the tenants are redirected to the homepage in Figure 6.2 below. The first page is the inbox page, it contains the links to feedback messages from the neighbours and the agents. My Messages link contains messages sent from an individual neighbour, Notifications are messages broadcasted to all the neighbours from one neighbour, Agent Feedback are messages from the agent directed to a particular tenant. Finally, the Agent Broadcast has got the messages broadcasted to all the neighbours from the agent.

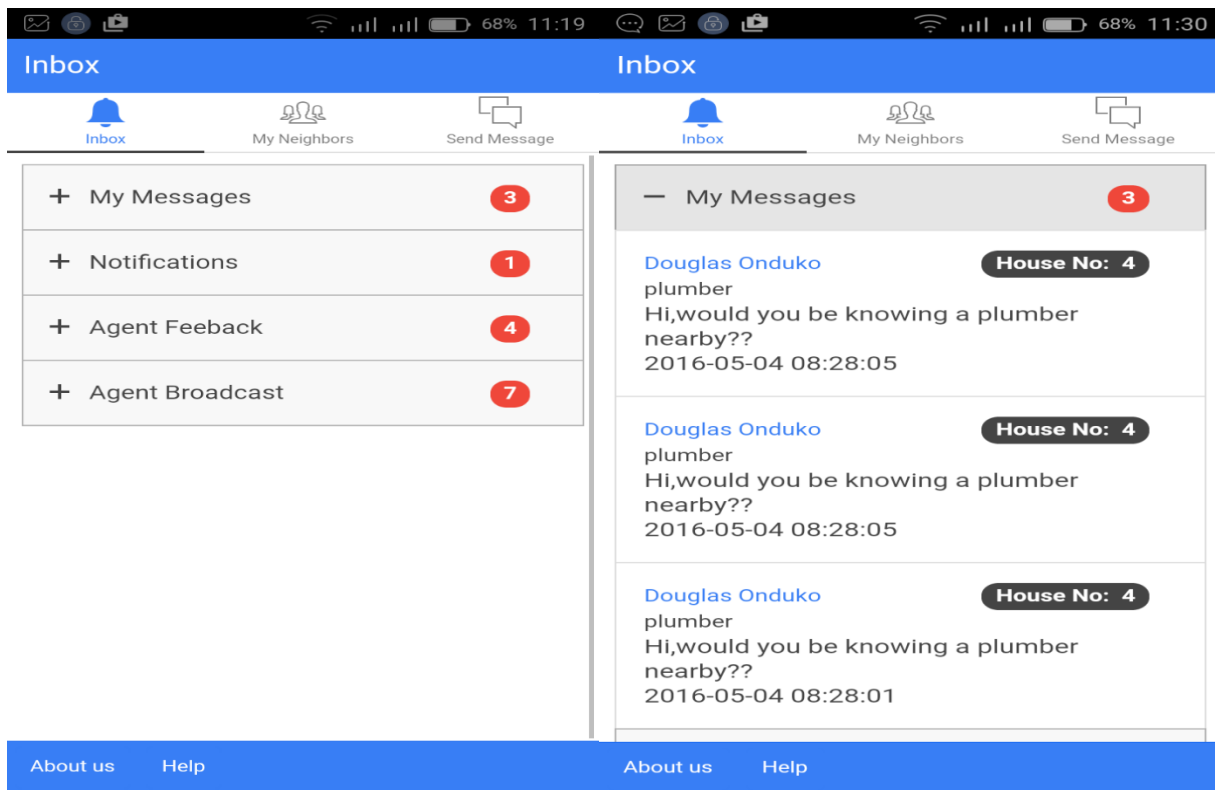


Figure 6:2: Tenant Homepage

iii. Viewing Neighbours and Sending Messages

The second page is a screen to the next door neighbours and the user has an option of sending a message to one individual neighbour by clicking on the neighbour and afterwards typing the message and click send as shown in the screens in Figure 6:3 below.

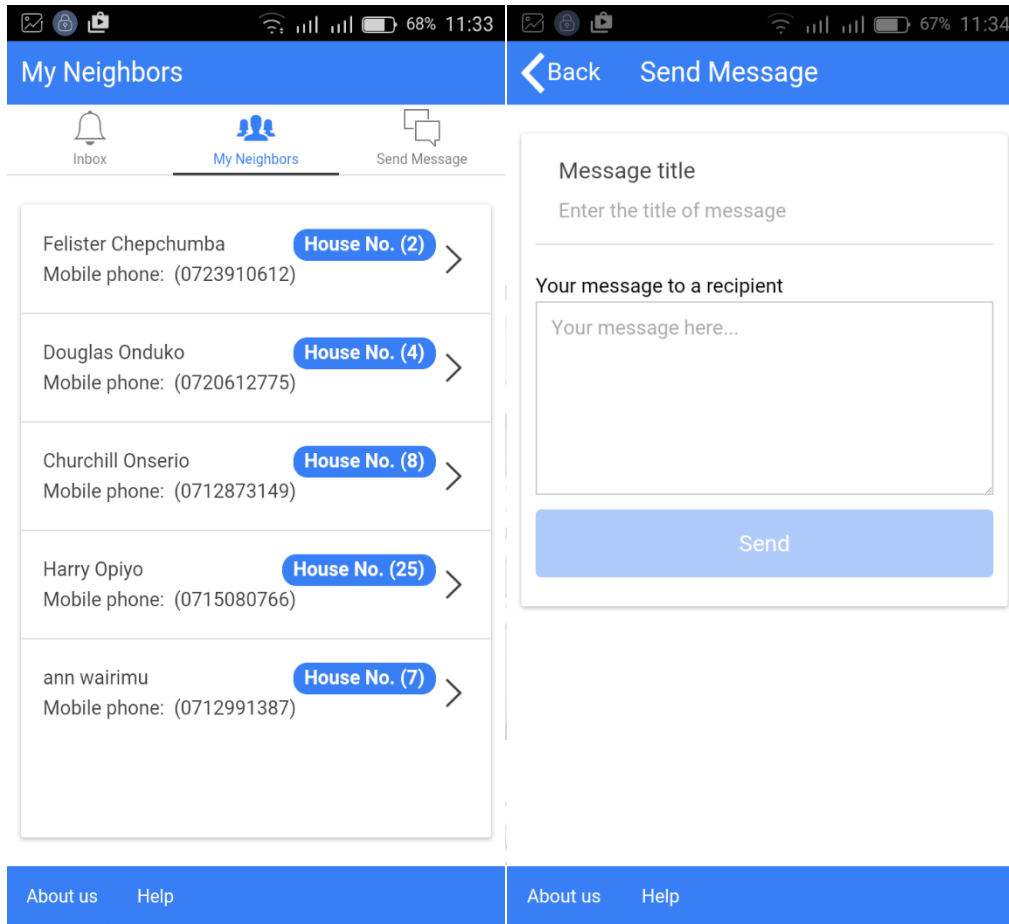


Figure 6:3: View Neighbours and Send Messages

iv. Choosing Message and Recipient Category

The final page is the send Message, the tenant can send a message by first selecting the Send Message tab then the message category and choose either update, complain or recommendation. Afterwards the tenants then choose the message recipient which is either the agent or neighbours then composes the message and sends it. Refer to Figure 6.4 .

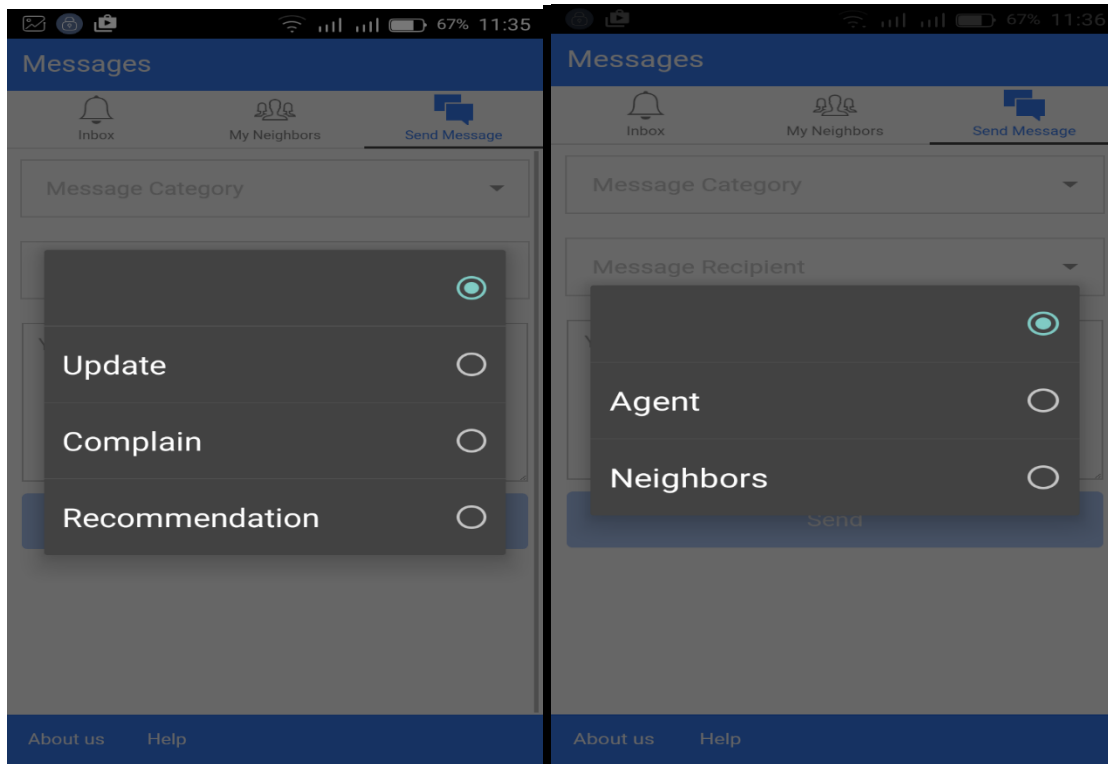


Figure 6:4: Tenant Choosing Message and Recipient Category

6.3.2 Web Application

The web application receives and retrieves information sent from the mobile application to the database. It resides in the HTTP web server and linked to the database. Both the agents and landlords interact with the web application on different portals. The agents interact with the system by managing the tenants which includes, adding, updating or deleting their accounts. They also respond to tenant messages, engage in chats with them and generate reports. The landlords interact with the system to manage their houses, assign houses to agents, view the reports generated by the agents and also engage with conversations with agents. To enhance usability search and sorting functionality is provided.

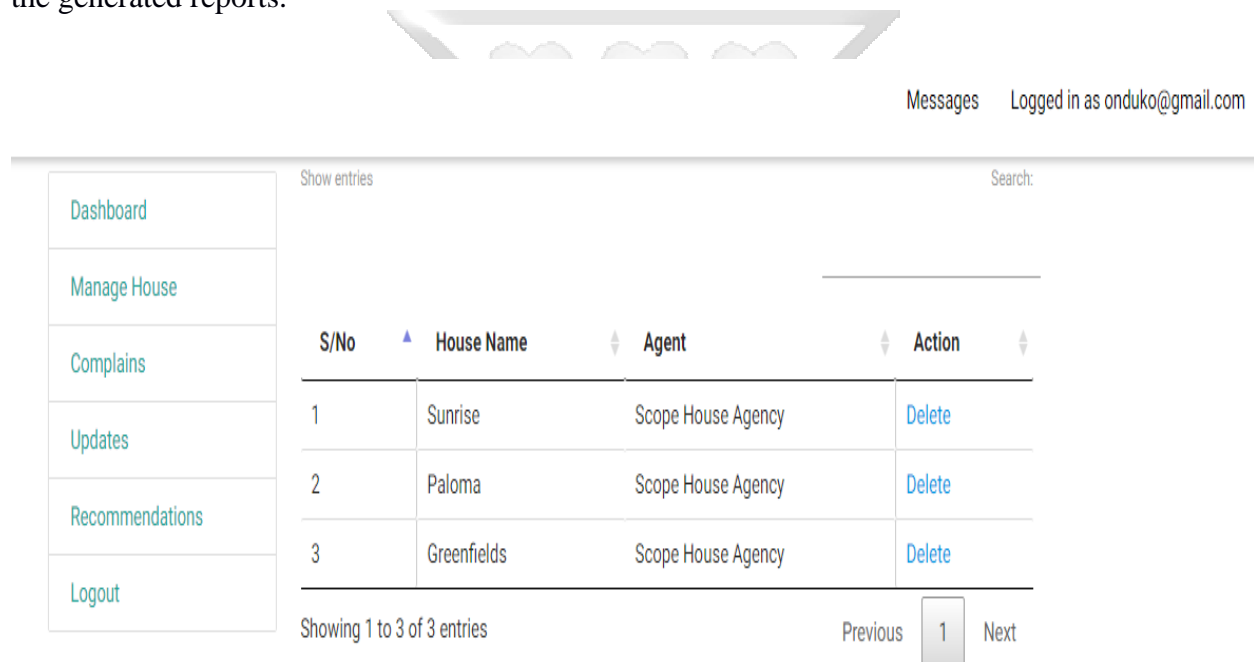
2. Web Application Components

i. Login

To gain access to the web application users have to login using a username and password. The username and password is authenticated and verified then access is granted or denied. This prevents against unauthorized access. Refer to Figure E.11 for the Login screen.

ii. Landlords Homepage

The landlords' homepage enables them view their houses and the agents managing them. They can manage their houses by assigning them to new agents, send messages to agents and view the generated reports.



The screenshot shows the Landlord Homepage interface. At the top right, there are links for "Messages" and "Logged in as onduko@gmail.com". On the left, there is a vertical navigation menu with the following items: Dashboard, Manage House, Complains, Updates, Recommendations, and Logout. The main content area features a table with the following data:

S/No	House Name	Agent	Action
1	Sunrise	Scope House Agency	Delete
2	Paloma	Scope House Agency	Delete
3	Greenfields	Scope House Agency	Delete

Below the table, there is a pagination control showing "Showing 1 to 3 of 3 entries" and "Previous 1 Next".

Figure 6:5: Landlord Homepage

iii. Manage Houses Page

The landlords manage their houses by registering the house names, inputting the number of units and assigning the units to the houses. Finally they assign agents to manage the houses.

Messages Logged in as onduko@gmail.com

- Dashboard
- Manage House
- Complains
- Updates
- Recommendations
- Logout

Register Your Houses

House Name

Capacity (The number of units in this house)

FINISH

Assign units to houses

Assign House to agent

Figure 6:6: Landlords Manage Houses

iv. Sending Messages

The landlords can view the messages sent from agents managing their houses, and reply to them.

Messages Logged in as onduko@gmail.com

- Dashboard
- Manage House
- Complains
- Updates
- Recommendations
- Logout

[SEND MESSAGE](#)

Show entries Search:

Title ▲	Sender ◆	Mobile No ◆	Message ◆
Exit request	Antony Maina	020-8762638	Am requesting you to reassign your Sunrise house to some other agent due to unavoidable reasons
hello	Antony Maina	020-8762638	repair
Now	Antony Maina	020-8762638	This ought to work
Water Meters	Antony Maina	020-8762638	Some of the water meters are faulty and we need to change them

Showing 1 to 4 of 4 entries Previous 1 Next

Figure 6:7: Landlords Messages Portal

v. Agents Dashboard

The agents' dashboard enables them to manage the tenants by adding new tenants, updating their details in case they change houses and also deleting them from the system when they move from the neighbourhood. They are also entitled to respond to tenants' complains and updates and also generate reports.

The screenshot displays the Agents Dashboard interface. On the left is a blue sidebar menu with the following items: **antony@gmail.com**, **Dashboard**, **Manage Tenants**, **Messages**, **Reports**, and **Logout**. The main content area is white and contains two data tables. The top table shows a list of houses with columns: S/No, House Name, Owner, and Mobile No. The bottom table shows a list of tenants with columns: No, Tenant Name, Mobile Phone, National ID, House Name, House Unit, and Action. Both tables include pagination controls at the bottom.

antony@gmail.com Send Message Logged in as antony@gmail.com

Show entries Search:

S/No	House Name	Owner	Mobile No
(1)	Sunrise	Mr. Onduko	0722827284
(2)	Paloma	Mr. Onduko	0722827284
(3)	Greenfields	Mr. Onduko	0722827284

Showing 1 to 3 of 3 entries Previous **1** Next

Show entries Search:

No	Tenant Name	Mobile Phone	National ID	House Name	House Unit	Action
1	Elijah Onduso	0711610517	28015437	Sunrise	12	Edit Delete
2	Larvinia Onduko	0715306726	28567542	Paloma	10	Edit Delete
3	Felister Chepchumba	0723910612	23567788	Paloma	2	Edit Delete
4	Douglas Onduko	0720612775	786098766	Paloma	4	Edit Delete
5	Churchill Onserio	0712873149	28629815	Paloma	8	Edit Delete
6	Harry Opiyo	0715080766	876555444	Paloma	25	Edit Delete
7	ann wairimu	0712991387	7899000	Paloma	7	Edit Delete

Showing 1 to 7 of 7 entries Previous **1** Next

Figure 6:8: Agents Dashboard Homepage

vi. Adding New Tenant

antony@gmail.com

Dashboard

Manage Tenants

Messages

Reports

Logout

New tenant

First Name...

Last Name...

Mobile Phone...

National ID Number...

Select House

Select Unit

SUBMIT

Figure 6:9: Agents Adding Tenants

vii. Agents Messages

The agent receives messages from both the tenants and landlords, they are therefore entitled to give feedback by clicking on the reply button. Refer to Figure 6:10 below.

antony@gmail.com

Dashboard

Manage Tenants

Messages

Reports

Logout

Show entries

Search:

Message	Sender	Mobile No	House Name/Unit No	Action
	Larvinia Onduko	0715306726	Paloma/10	Reply
	Larvinia Onduko	0715306726	Paloma/10	Reply
hallo	Felister Chepchumba	0723910612	Paloma/2	Reply
I suggest that we need a larger parking space due to increased number of vehicles.	Larvinia Onduko	0715306726	Paloma/10	Reply
Leaking taping my house	Larvinia Onduko	0715306726	Paloma/10	Reply
My tap is leaking	Douglas Onduko	0720612775	Paloma/4	Reply
Taps	Larvinia Onduko	0715306726	Paloma/10	Reply

Showing 1 to 7 of 8 entries

Previous 1 2 Next

Messages from Landlords

Show entries

Search:

Figure 6:10: Agents Messages

viii. Complains Report

Reports are essential in giving information at a glance, the complains report in Figure 6.11 is generated from the complains messages sent by the tenants. They give information about the condition of the houses and surrounding.

Message	Sender	Mobile No	House Name	Agent Response
F	Larvinia Onduko	0715306726	Paloma	jjoo
hallo	Felister Chepchumba	0723910612	Paloma	
Leaking shower	Larvinia Onduko	0715306726	Paloma	Repairer will come repair at noon
Leaking taping my house	Larvinia Onduko	0715306726	Paloma	
Leaking taping my house	Larvinia Onduko	0715306726	Paloma	at noon we will send a repairer

Figure 6:11: Complain Report

ix. Recommendation Report

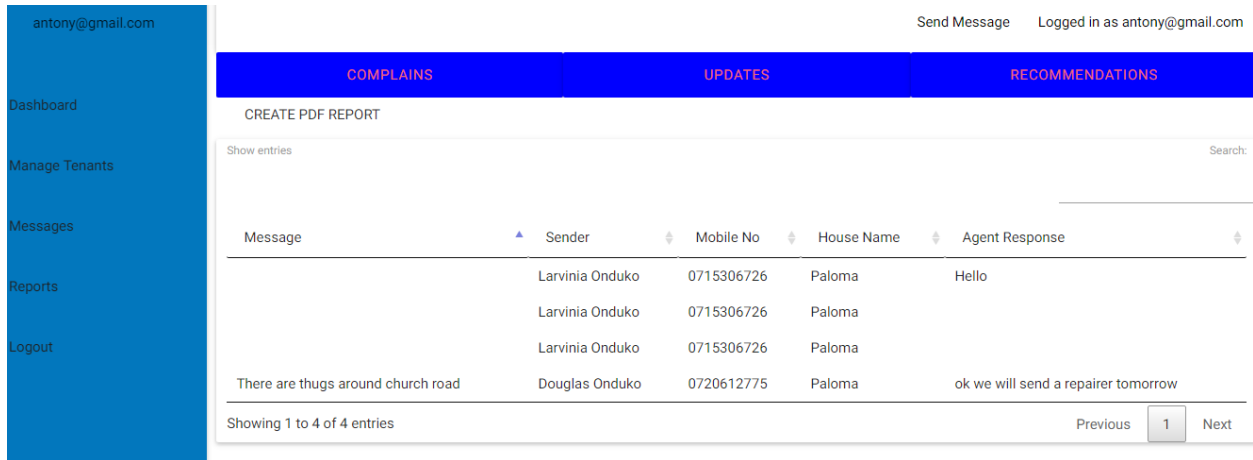
The recommendation report is used to understand what the tenants would want changed or made better in the neighbourhood. Refer to Figure 6:12 Recommendation Report.

Message	Sender	Mobile No	House Name	Agent Response
I suggest that we need a larger parking space due to increased number of vehicles.	Larvinia Onduko	0715306726	Paloma	

Figure 6:12: Recommendation Report

x. Updates Report

The updates report gives information about the nature and quality of the neighbourhoods. It is generated from the messages sent by the tenants about the neighbourhoods. Refer to Figure 6:13 below.



Message	Sender	Mobile No	House Name	Agent Response
	Larvinia Onduko	0715306726	Paloma	Hello
	Larvinia Onduko	0715306726	Paloma	
	Larvinia Onduko	0715306726	Paloma	
There are thugs around church road	Douglas Onduko	0720612775	Paloma	ok we will send a repairer tomorrow

Figure 6:13: Updates Report

6.4 Testing

This section describes the tests performed on both the mobile and web application. The applications were tested against the functional and non-functional requirements as stated in Chapter 4, section 4.3.1. During testing the mobile and web applications were handled as one system because none of them work in isolation.

6.4.1 Functional Testing

The functional test aimed at detecting and removing any development errors in the functionalities of the application. Therefore functional tests were conducted to test the completeness of the system. A test case for each use case was formulated to determine the success or failure of the system. The tables below represent the test cases for the major functions of the system.

Identifier	1
Test Case	View Messages
Description	User gets into their inbox to view messages
Utilized Use case	View message notifications
Results	Read unread messages and the previously received
Pass/Fail	Pass

Table 6:1: View Messages Testing

Identifier	2
Test Case	Communicate with neighbours
Description	User wants to chat with a next door neighbour
Utilized Use case	Engage in chats with other tenants
Results	Select a tenant, write the message and send.
Pass/Fail	Pass

Table 6:2: Communicate with Neighbours Testing

Identifier	3
Test Case	Send message to all neighbours
Description	User broadcast a message to all the neighbours
Utilized Use case	Broadcast message to tenants/agents
Results	A message is forwarded to all tenants.
Pass/Fail	Pass

Table 6:3: Send Message Testing

6.4.2 Compatibility Testing

Both the mobile and web application were tested to ensure they are compatible with the available platforms. The mobile application was tested against the Android versions and the web application was tested against the commonly used browsers, which include Mozilla Firefox, Google chrome and Internet Explorer. Table 6:4 represents Android Versions Compatibility Tests and Table 6:5 shows Web-browser Compatibility Test.



Android Platform Compatibility Testing

Android Version	Compatibility
Android 8(2.2)	Yes
Android 9(2.3.1)	Yes
Android 10(2.3.3)	Yes
Android 11(3.0)	Yes
Android 12(3.1)	Yes
Android 13(3.2)	Yes
Android 14(3.3)	Yes
Android 15(4.0.3)	Yes
Android 16(4.1.2)	Yes
Android 17(4.2)	Yes
Android (5.0)	Yes

Table 6:4: Android Versions Compatibility Tests

Web Browser Compatibility Test

Browser Types	Compatibility
Firefox version 8.0 and above	Yes
Chrome (All Versions)	Yes
Internet Explorer version 4 and above	Yes

Table 6:5: Web-browser Compatibility Test

6.5 User Testing

The target population who ideally are the end users were involved in the usability testing. From the 100 respondents involved in the research 30 of them carried out user testing and provided appropriate feedback which was used to further modify and refine the application. The test performed included, aesthetics, user friendliness, functionality and acceptance testing. Refer to Appendix A (ii) User Testing Questionnaire.

6.5.1 User Interface Aesthetics

The application appearance including the look and feel was tested by the users. 80% of the respondents indicated that application was attractive while 20% indicated that the application was average. A summary of the results is shown below in Figure 6:14.

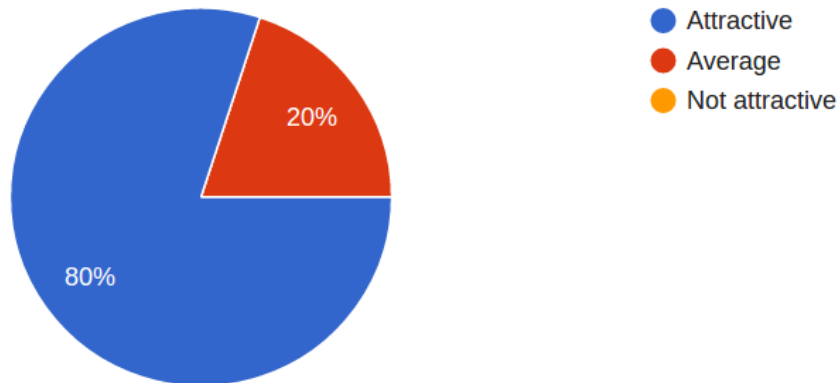


Figure 6:14: User Aesthetics Testing

6.5.2 Functionality

Potential users of the application tested the system functionality against the system specifications. All the users indicated that the requirements had been met after a series of prototype refinements. The functional tests carried out refer to the tables in Appendix F.

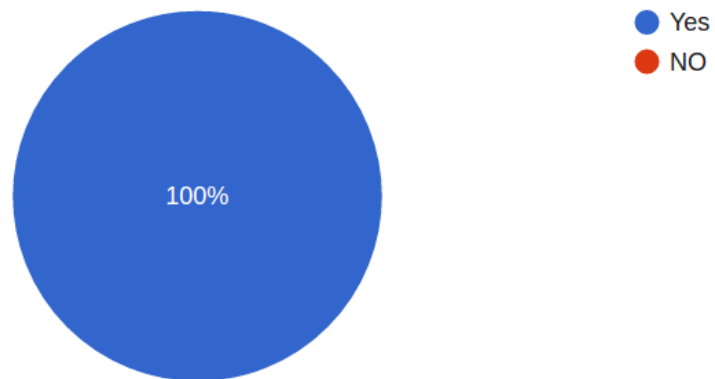


Figure 6:15: User Functionality Test

Ease of Use of Application

Application's ease of use was tested having met the requirements. Majority of the users 70% indicated that the application was easy to use while 30% indicated that it was average

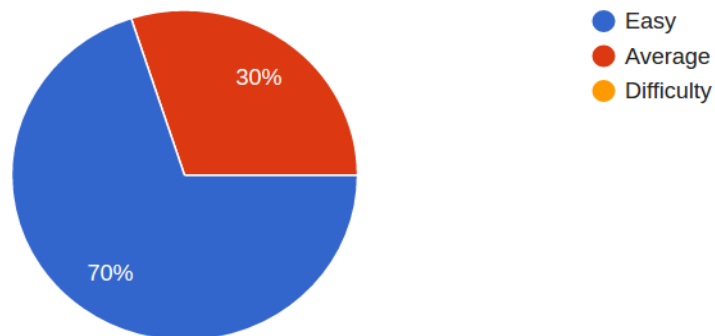


Figure 6:16: Application's Ease of Use

6.5.3 Validation

This was done in order to ascertain whether the implementation addressed the challenges faced in neighbourhood networking. A selected property agent and landlord piloted the system on 28 tenants and thereafter a survey carried out (Refer to Appendix A (iii)). The survey firstly inquired if the users had taken part in requirements collection and usability tests. Figure 6:17 below shows all the respondents participated in the other surveys.

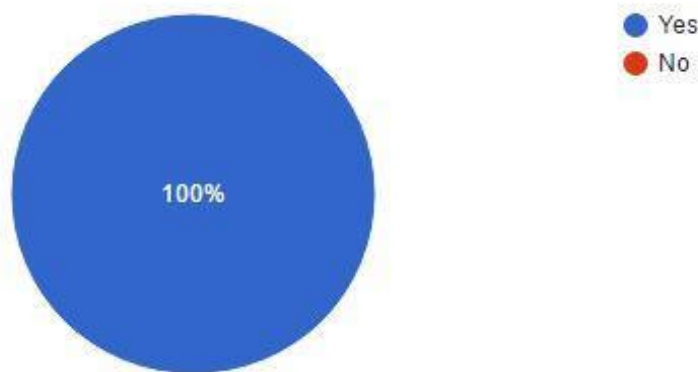


Figure 6:17: Respondents' Participation in User Requirements Survey and Usability Testing

The survey secondly inquired whether the system improved communication and interactions in the neighbourhood. Figure 6:18 below shows that 80% of the potential users were satisfied that their challenges had been solved while 20% remained unsatisfied.

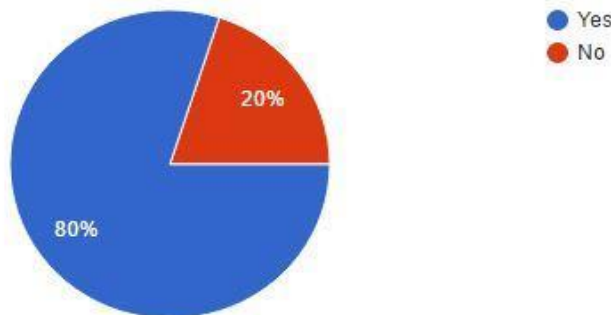


Figure 6:18: User Satisfaction on the Neighbourhood Networking Application

Thirdly the respondents were asked to indicate the key functionalities that solve the problems. The landlord indicated that the reports were a key feature in disseminating real time information and aids in delivery of services and is key in decision making. The tenants said that the direct communication to their agents was impressive as it reduces time wasted passing through the caretakers in channelling their complains or any other updates in the neighbourhood.

Finally the respondents were asked if they would recommend the application to other users who face the same challenges. Figure 6:19 shows that all respondents were willing to recommend.



Figure 6:19: Users Recommendation on the Adoption of the Neighbourhood Networking Application

6.6 Summary

At the requirements Analysis section vital information was provided which was used in system implementation. The system design aimed in practically representing data modelling and information flow in the system and providing details of the system implementation. Apart from the system requirements, the research objectives and questions were put into consideration to ensure that the system was implemented to achieve user requirements provided by potential users.

Majority of the objectives were fulfilled by the development of the mobile and web application. The mobile application was developed on the Android platform. The mobile application connects tenants with their neighbours in a neighbourhood by enabling them make conversations. It also enables them chat directly with their agents. The web application on the other hand was implemented for purposes of management, giving response and generation of reports.

System Testing was performed to ensure all components meet the user requirements and compatibility tests were conducted on various Android platforms and web browsers. User testing tested user interface aesthetics, user friendliness, application functionality and prototype acceptance.



Chapter 7: Discussions

7.1 Introduction

This research was done with the aim of reviewing the current techniques used in promoting neighbourhood networking and identifying a suitable approach to networking that can be adapted to suit the dynamic nature of lifestyles in the urban regions. The research finding helps to identify an appropriate neighbourhood networking platform that was adopted to solve the challenges for instance by helping neighbours familiarize themselves with each other without necessarily meeting physically. By using the Internet, web and mobile technology in this digital age the networking process has been made easier, faster, reliable and efficient. This chapter describes the research findings and achievements, how research objectives were achieved and provide the advantages of the system in relation to the current modes of neighbourhood networking.

7.2 Explanation of Findings

A review of the literature indicated that the techniques used to promote neighbourhood interactions include community based engagements and web based techniques. Community based engagements are normally used by people living in the rural Kenya regions. It comes with the benefit of having permanent residential areas hence people get to know one another through various engagements. The limitation of this mode is shifting of homesteads often. Web based interaction modes help overcome this limitation for community based engagements and facilitates information sharing amongst the people. The limitation is that the people cannot get to interact with their individual neighbours and the house property managers. A mobile based application bridges this limitation by enabling the people interact on a one to one basis with their neighbours, update one another of any important information and raise any complains directly to the involved parties. A report therefore can be generated of the tenants which will further help the renters make the best decisions on the choice of the potential tenants.

The research was performed with respondents from Southlands, Westlands and Eastlands regions in Nairobi County. Questionnaires and interviews were used for the tenants and landlords and property managers respectively.

From the findings the current system was inefficient, landlords had difficulties communicating important information to their tenants, as the mode of communication currently is quite expensive, as it involves printing notices and dropping them in each house, sometimes if the tenant is away chances are they never get the information in the right time. The caretakers sent to deliver word of mouth messages sometimes distort the information and may even forget to deliver it. The study also showed that the tenants have a difficult time submitting their complains directly to the authorities, as they had to pass through the caretakers who normally take a long time to act for instance broken windows and blocked sinks in their houses are among many complains.

Based on the above mentioned findings a mobile based neighbourhood networking system was developed. It comprises both an Android application and a web application. The Android application is used by the tenant to engage in chats and submit any complains and updates while the web application is used for managing the tenants and houses, give feedback and generate reports.

7.3 Discussions of the Objectives

This section looks at how the research objectives have been met in this study in relation to the mobile based neighbourhood networking platform. This study identifies existing neighbourhood/social networking methods from research based on journals, websites, books and user feedback, and their shortcomings. Mobile and web based applications were designed and developed with a selected technique from the literature review and results from system analysis. The research objectives acted as a guideline in development.

The first objective was to identify information used to promote relationships in neighbourhoods from section 1.3. The research identified that people in a neighbourhood consider several categories of information to promote interactions which includes; Information about Health facilities, Schools, Entertainment and social activities, Service delivery referrals and general information in the neighbourhood.

The second objective was to identify shortcomings in the existing neighbourhood interaction methods. Section 2.2.2 points out these challenges the main being the nature of dynamic lifestyles hindering community policing.

Different countries have adopted the web based application that allows people in a region, town or location interact. The mobile based application will be much more efficient and convenient. Figure 4.4 Shows that 92% of the respondents were willing to use a mobile application to help them interact easily in the neighbourhood.

The third objective was to review the techniques used in promoting neighbourhood interactions. They have been discussed in sections 2.2, 2.3, 2.4 and 2.5 several approaches have been proposed and put into practice, but in Kenya they have faced a lot of challenges, Nyumba Kumi for instance is an initiative by the government of Kenya whose aim is to ensure that each individual knows at least 10 of their neighbours in the neighbourhood. This has seen slow adoption due to the dynamic nature of lifestyles in urban regions that actually need to absorb it. This has therefore led to the development of the mobile application that will cater for the challenge.

The fourth objective was to propose and basically design and develop, a neighbourhood networking application. Chapter 5 covers the System Design and architecture while Chapter 6 covers the system implementation. This objective was achieved through practically designing and developing the mobile and web applications. The mobile application was developed for the Android platform while the web application was developed using Hypertext Pre-processor (PHP).

The fifth objective was to test the system that promotes neighbourhood interactions. All the tests performed are included in section 6.5. Developer testing was conducted to remove the program bugs, Functional testing followed where the system core functionality was tested, to ensure it works correctly. Compatibility testing was also performed where the mobile application was tested against different Android versions and the web application was tested against different web browsers and finally user testing where the aesthetics, user friendliness, application functionality and user acceptance tests were conducted. The system passed all the tests and met the requirements.

7.4 Advantages of the Application as Compared to the Current Method

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

- i. Users did not have to physically walk into their neighbours' houses for purposes of interaction or sharing information.
- ii. The house agents were able to easily communicate with the tenants at a low cost, no more notices need be printed and delivered physically at the house steps, this reduces cost and time used.
- iii. Users easily submitted their complains directly to the respective authorities via the application rather than passing through the caretakers who do not normally act rendering tenants uncomfortable in the houses.
- iv. When people move to new neighbourhoods, they easily interact with their neighbours, if one wants handymen for instance, they can be referred via the application
- v. The application also incorporates a web application that help in managing of houses and tenants and also generates reports of the neighbourhoods and individual tenants
- vi. Users conveniently share information regarding their neighbourhoods, give any updates and generally help people keep alert and watch of their neighbourhoods.

7.5 Disadvantages of the Mobile Application

The limitations of the application include the following:

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

Chapter 8: Conclusions and Recommendations

8.1 Conclusions

Neighbourhood Networking techniques and their challenges were reviewed in this research. From the analysis carried out, the results pointed out that there are major problems in neighbourhood networking initiatives for instance in Kenya several initiatives have been brought up to help bring people together to create informed neighbourhoods, an example being the Nyumba Kumi initiative whose aim was to make sure people know at least ten of their neighbours, this would see a reduction of crime and increase safety. Some of the other associations are termed as Interest groups, citizen self-help etc. whose mandate encompasses dealing with special or a group of problems that affect members in a community. These initiatives have faced challenges mainly due to the dynamic nature of lifestyles in the urban regions, which actually need to use it to help create connected neighbourhoods. People shift houses frequently and unfortunately people feel an infringement of privacy when they walk to others' houses to get to know them. This poses a challenge for new people in neighbourhood to interact. On the other hand tenants cannot directly reach their agents /landlords hence challenges escalating complains and any other updates in their neighbourhoods.

The result was the development of a neighbourhood networking system which constitutes a mobile and web application. The key features of the mobile application enable the users read messages in their inbox, send messages to the neighbours and engage in conversations with their agents/landlords. The web application enables perform management activities of add, delete and update of both the tenants and Houses and also generate reports. The application was aimed at convenient, reliable and efficient communication in a neighbourhood anytime anywhere. System testing was performed, look and feel, ease of use, system functionality and acceptance was done.

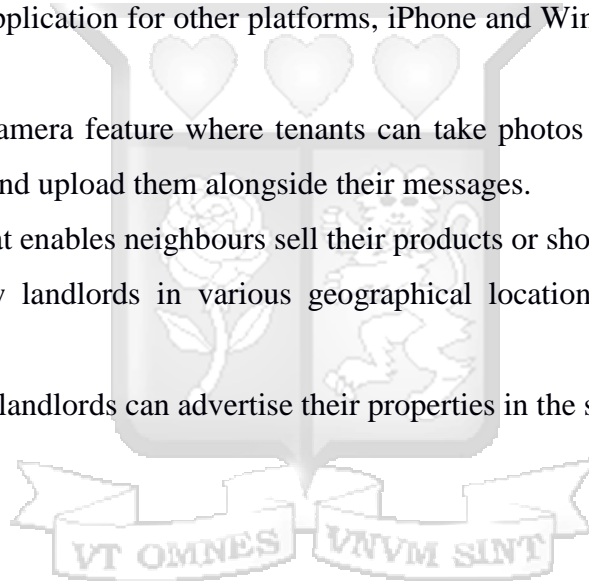
8.2 Recommendations

To be able to use the system a house management agency needs to add the tenants details to the MYSQL database to enable them access the mobile application. Therefore, the tenants can communicate via the mobile application to the house agents. The agents and landlords can then follow up the conversations on the web application and thereafter give feedback and generate reports which will be used in making key decisions regarding the houses and neighbourhoods.

8.3 Future Work

The researcher noted there was more that could be performed on the neighbourhood system and it includes:

- i. Developing the application for other platforms, iPhone and Windows so as to capture the whole market.
- ii. Incorporating a camera feature where tenants can take photos of various issues in their neighbourhoods and upload them alongside their messages.
- iii. Have a feature that enables neighbours sell their products or showcase their talents.
- iv. Research on how landlords in various geographical locations can interact and share information.
- v. Research on how landlords can advertise their properties in the system.



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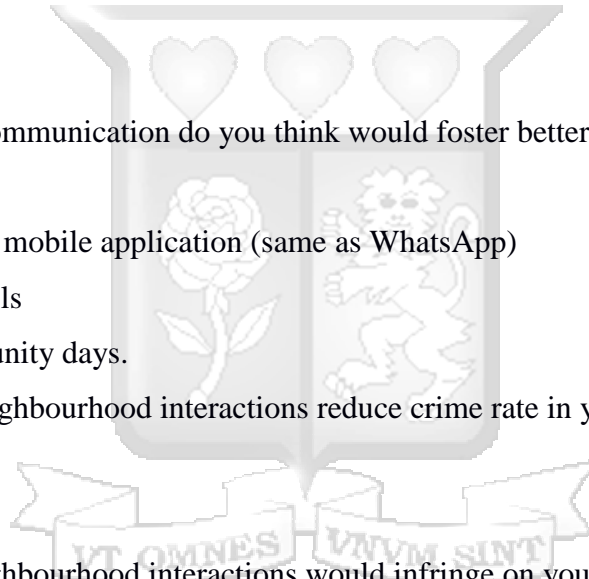
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Appendices

Appendix A: User Questionnaires

i. Tenant Questionnaire

1. What information can promote relationships in your neighbourhoods?
 - Entertainment and social ()
 - Schools ()
 - Health Facilities ()
 - General neighbourhood Information ()
 - Service referrals ()
2. Are you familiar with your neighbours? Their names, occupation and origin?
 - Yes ()
 - No ()
3. What means of communication do you think would foster better interaction with your neighbours?
 - Use of SMS via a mobile application (same as WhatsApp)
 - Making phone calls
 - Setting up community days.
4. Can increased neighbourhood interactions reduce crime rate in your area? *
 - Yes ()
 - No ()
5. Do you think neighbourhood interactions would infringe on your personal privacy?
 - YES ()
 - NO ()
6. In case you have a problem or a concern and you need to talk to your Landlord, how do you reach them? Tick all that apply.
 - Use Agents
 - Use Caretaker
 - Speak to other tenants
 - Other:



7. In case of suspicious behaviour in your neighbourhood, where would you report the incident?

- Landlord
- Agent
- Caretaker
- Other:

8. Would you use a mobile application that facilitates and makes communication easier in

- Yes ()
- No ()

ii. Usability Testing Questionnaire

1. How was it downloading the application *

- Easy
- Average
- Difficult

2. How is the look and feel of the mobile and web application *

- Attractive
- Average
- Not attractive

3. How can you gauge the ease of use of the application *

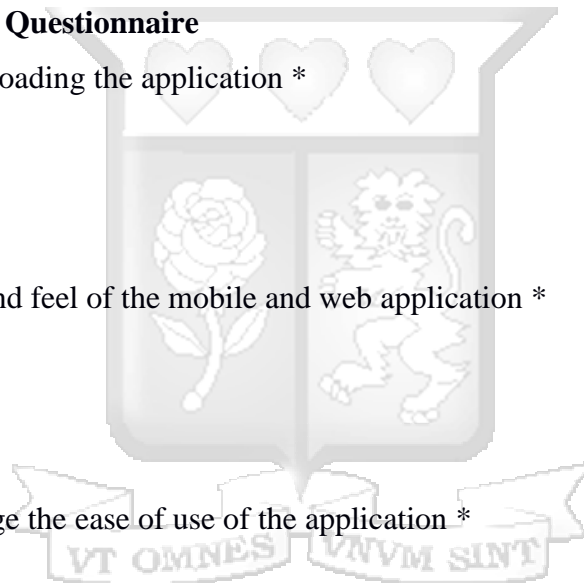
- Easy
- Average
- Difficulty

4. Does the functionality meet the user requirements? *

- Yes
- No

5. Would like to continue using the application *

- Yes
- No



iii. User Verification Questionnaire

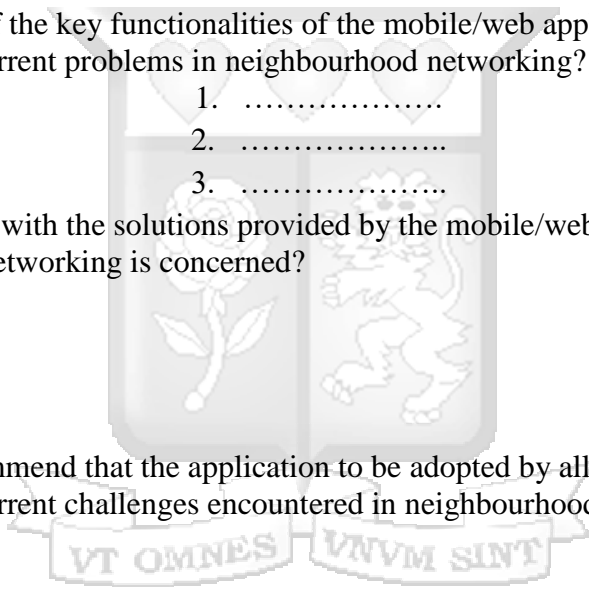
1. Did you take part in the user testing of the mobile or web application for neighbourhood networking application?
 - Yes
 - No

2. If Yes, Does the functionalities provided by the application solve the problems posed by the current systems for neighbourhood networking?
 - Yes
 - No

3. What are some of the key functionalities of the mobile/web application that provides solution to the current problems in neighbourhood networking?
 1.
 2.
 3.

4. Are you satisfied with the solutions provided by the mobile/web application as far as neighbourhood networking is concerned?
 - Yes
 - No

5. Would you recommend that the application to be adopted by all residents in Nairobi as a solution to the current challenges encountered in neighbourhood networking?
 - Yes
 - No



Appendix B: Landlords Interview Questions.

1. What kind of information do you require from your prospective tenants before letting them houses?
2. What means of communication do you use to reach your tenants and agents?
3. What are the challenges you face in the communication processes?
4. Have you at any instance had unruly neighbours, what action did you take?
5. Would you like to communicate directly to your tenants?
6. How often do you perform routine checkups on your tenants to ensure that there is no suspicious behaviour? And how is suspicious behaviour reported?



Appendix C: Data Analysis

i. Information that can promote neighbourhood relationships Analysis.

Several information is used to promote neighbourhood relationships, Service referrals being the one that promotes neighbourhood relationships most, followed by general neighbourhood information, then Entertainment and social information, then health facilities and finally information about schools.

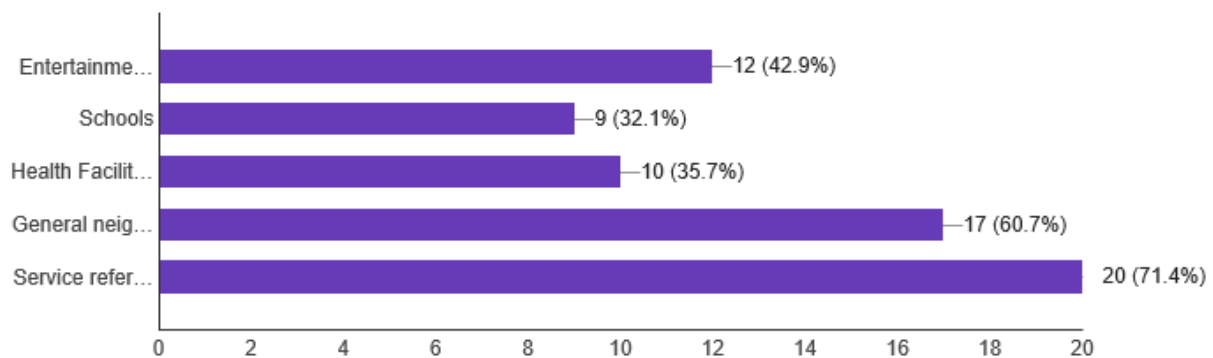


Figure C. 1: Information that Promotes Neighbourhood Relationships

ii. Challenges faced by tenants/Landlords in the communication processes.

Figure C.2 and C.3 represents a particular flat in southlands who after several attempts to solve their water meter issues with the caretaker could not work, resulted to write a letter and addressed it to their property agent manager with their appended signatures.

DRAKON PLAYS,
CINACIN ROAD/ROKOTAP

ALUMEN PROPERTY MANAGERS LIMITED

Dear Manager,

RE: ISSUES WITH WATER METERS

We hope this finds you well, it is with deep concern that we express the problems we have encountered with our water meters over a long time without sign.

The problems include,

- 1) The Actual Current Meter reading does not reflect what is on the bill
- 2) Some tenants are normally a way on job assignments and despite the fact that they stay alone they still receive huge water bills at the end of the month amounting to 7.2 or 7.12 units
- 3) Some others face inconsistency issues where the current reading of water of a previous bill does not reflect the new bill or rather the current bill.

We actually feel that the meters are faulty or are being tampered with.

We kindly request and hope that you will act promptly because this has been on for a while.

Kind regards,
The next page represents the appended tenants.

Figure C. 2: Letter by Tenants Regarding Water Meter Issues

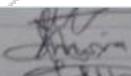
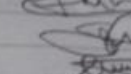
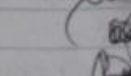
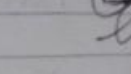
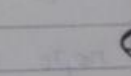
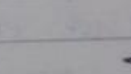
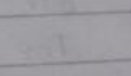

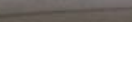


3. Daniel Odongo	F 8	
4. Joshua Mambotto	F 9	
5. Kennedy Gankale	F 10	
5. Joseph Tobichanz	F 11	
7. Innocent Moreka	F 12	
5. Richard Evans	F 13	
1. GEORGE OMANA	F 7	
2. ANNSTELLA	F 19	
BONIFACE KURIA	F 18	
Sospeter Njogu	F 22	
AMOS NGARAMA	F 2	

Figure C. 3: Appended Signatures of the Tenants

Appendix D: System Design

i. Generate report usecase description

Use Case Name	Generate Report
Actors	House Agents
Description	Describes the steps taken by the agent to generate reports.
Preconditions	The agent must have messages to generate the report from
Postconditions	The agent can view the reports generated
Typical case of Events	
Actor Response	System Responses
User chooses the type of report to generate	System displays the type of report chosen
User selects the messages to generate the respective report	System displays the messages selected
User filters and clicks on generate report	System generates report
Alternate Flow	
There are no messages to generate the report	Report cannot be generated.

Table D. 1: Generate Report Usecase Description

ii. Login and Logout usecase description

Use Case Name	Login and Logout
Actors	House Agents and Landlords.
Description	describes the steps a user takes to log in and out of the application
Preconditions	The users must be registered
PostConditions	The user gains access to their respective applications
Typical case of Events	
Actor Response	System Responses
User Enters their username and password/ Requests to logout	System verifies the login credentials and grants access to the system/ Prompts user to confirm logout
User accesses the system /Confirms logout	
Alternate Flow	
User provides the wrong Username and or password	Access to the system is denied

Table D. 2: Login and Logout Usecase Description

iii. Sequence diagram for system events

Figure D.1 below represents a series of events that a user does after installing the application. For the tenants they have to verify their phone numbers to ascertain that they truly belong to that particular neighbourhood. They can exchange in sending and receiving messages. The agent/landlords do login in after registration on the web application and can engage in various tasks like generating reports and sending messages.

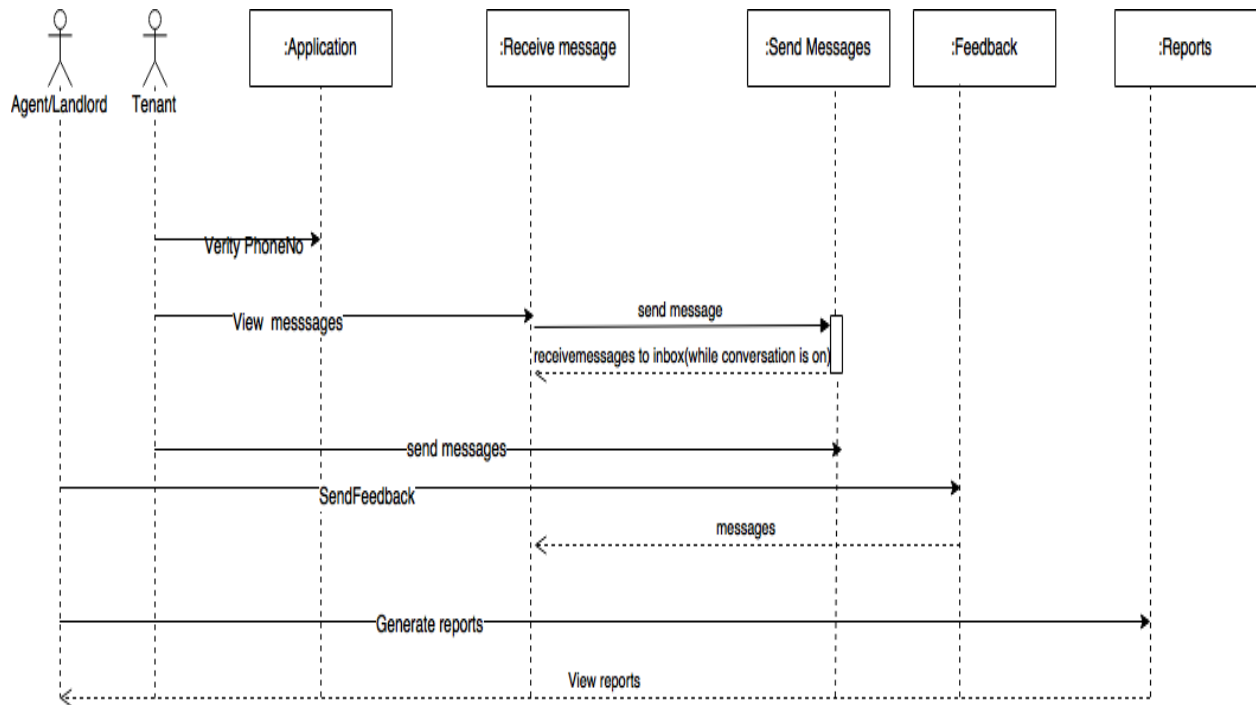


Figure D. 1: Sequence Diagram for System Events

Appendix E: System Implementation

i. Login Screen

Both the agent and landlord use the login screen. They input their email address and passwords and afterwards choose their roles then login.

MyNeighbour

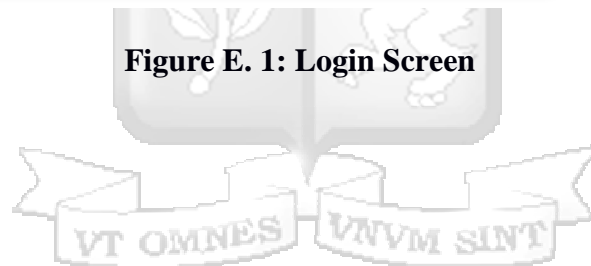


example@yourdomain.com
onduko@gmail.com

Password
.....

Sign In as:
Choose your role ▼

Figure E. 1: Login Screen



Appendix F: System Testing

i. Login Testcase

Identifier	4
Test Case	Login of the application
Description	User provides username and password to login.
Utilized Usecase	Login
Results	Successful login and access granted to the respective applications
Pass/Fail	Pass

Figure F. 1: Login Testcase

ii. Manage Houses Testcase

Identifier	7
Test Case	Manage houses
Description	User wants to add, edit or delete their houses
Utilized Usecase	Manage Houses
Results	Successful update of the houses.
Pass/Fail	Pass

Figure F. 2: Manage Houses Testcase

iii. Respond to Messages Testcase

Identifier	5
Test Case	Respond to messages
Description	User replies to the messages received
Utilized Usecase	Respond to complains/updates
Results	Give feedback to the received messages
Pass/Fail	Pass

Figure F. 3: Respond to Messages Testcase

iv. Generate Reports Testcase

Identifier	6
Test Case	Generate reports
Description	User generates reports from the received messages
Utilized Usecase	Generate Report
Results	Generate reports depending on messages selected.
Pass/Fail	Pass

Figure F. 4: Generate Reports Testcase

Appendix G: Turnitin Report

Originality GradeMark PeerMark

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A MOBILE APPLICATION TO PROMOTE NEIGHBOURHOOD RELATIONSHIPS AND PROVIDE RESIDENTIAL RECORDS: A CASE OF NAIROBI.

By

Larvinia Nyanchama Onduko
084940

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

Faculty of Information Technology
Strathmore University
April, 2016

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Text-Only Report

