2017

A Mobile based casual **labourers** management and payment solution

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A Mobile Based Casual Labourers Management and Payment Solution

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Submitted in partial fulfilment of the requirements for the Degree of Master of Science in Mobile Telecommunication and Innovation (MSc. MTI)

Faculty of Information Technology

Strathmore University

Nairobi, Kenya

June, 2017

Declaration

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

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Abstract

Casual workers or casual labourers are workers who have an explicit or implicit contract of employment which is not expected to continue for more than a short period of time, and whose duration is to be determined by the specific terms of employment or specific task to be carried out.

In the management of these casual labourers, the data collected has replication of data records including the daily or weekly registration of names, national id, and phone numbers. These records are also very prone to change because casual labourers are labour brokers, who can move from one employer to another without notice or any legal approval making calculation of wages very cumbersome and dynamic. There is also a high insecurity risk of theft in paying cash to the casuals in these workers in the remote working sites.

The developed prototype has used agile methodology coming up with a web and mobile component. The web component handles project and task definition, reporting and user management. The mobile component allows for field data collection. Service Oriented Architecture was used, so as to allow connections to payment and SMS gateways. The developed prototype also got an overall acceptance rating of 80% using usability testing and 75% on functional testing.

Keywords: Casual labour Contracts, Business Intelligence, Application Program Interfaces

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List of Abbreviations

API	-	Application Programming Interface
BI	-	Business Intelligence
GBM	-	Green Belt Movement
SMS	-	Short Message Service
SOA	-	Service Oriented Architecture
SOAP	-	Simple Object Access Protocol
USSD	-	Unstructured Supplementary Service Data
WSDL	-	Web Services Description Language

Acknowledgement

My sincere gratitude goes to the Almighty God for giving me the courage perseverance and strength throughout the dissertation period.

I wish to thank my supervisor Dr. Njogu for the advice and direction provided. My gratitude goes to Dr. Sevilla who offered guidance and corrections through class discussions and presentations.

Dedication

I dedicate this to the Almighty God, my parents Jeremy and Gladys for their motivation and advice and my sister Grace who never left my side and always believed in me.

Chapter 1: Introduction

1.1 Background Information

According to Eyraud (2008), casual workers or casual labourers are workers who have an employment contract which is not expected to continue for more than a short period of time. The contract duration is to be determined by the specific terms of employment or specific task to be carried out. These workers are also paid based on a daily rate or operational rate. These workers are therefore classified as independent workers based on the specific circumstances of employment they engage in however, these contracts mostly favour the employers.

The International Confederation of Private Employment Agencies claims there are 36 million temporary and agency workers as a survey done in 2012, 15.7 million of these temporary workers reside within Africa. These workers operate as labour brokers and are not entitled to one employer. This non-standard or unusual form of employment has helped people gain a firm holding in the job market as employers and created jobs to low living standards persons in developing countries as employees. Full time or permanent contracts were still the norm in developed countries but slowly their share based on the total percentage of employment has decreased slightly from 74% in 2004 to 73.2%. There has been a major increase in developing and middle income countries in the casual labour from 5.6% to 13.6% to occupy slightly more than 52.4% of the employment contracts from 2004 to 2015 (O'Connor, 2015).

The Kenyan Constitution Employment Act 2007 regulates and approves the payment of wages to all job groups. According to this Act the employer has an obligation to pay a worker his wages in legal tender which is Kenya Shillings. The Act allows for cash, cheque, money order or directly deposit the amount in that worker's bank account. In the workers absence, the employer can remit the wages to an authorized person. Reidmann (2010) states that the most common payment for casual work used by most employers is cash, because cash is instant and other methods like cheques incur expensive charges while credit cards are not common with African casual labourers.

However, Cash posses a big threat of insecurity and theft for employers. (Xinhua, 2015) The Global times reported in September 2015 construction theft are on rise after a Chinese man was killed after robbery in Nairobi. The robbers made off with cash meant for salaries and construction materials like laptops.

Major industries, in the early 19th century to the 21st century, like construction, logging, sawmilling, agriculture and the service trades, use casual labourers to achieve certain business goals. Part-time or casual labour has often been preferred by these industries because their work can be batched or regularized into specific achievable milestones for budgeting and supervision purposes. There are less implementation costs incurred by the service traders when involving casual labourer as opposed to a fulltime employee for example most businesses in Kenya and the United States of America do not have to pay for Medical and Health insurance or offer any form of leave or salary exclusions on behalf of the casual labourers. There is also greater flexibility and legal acceptance in the hiring and firing of casual employees thus enabling them to adjust and fully adapt in the major variations or drifts in work production (Nollen, 2006).

According to Benjamin (2013), one prominent feature of casual labourers is that they are labour brokers; they can commit to one or more employers within a short period of time. This means they can choose not to appear for work the following day or week without notice or leave from employer. Being that casual work involves the engagement of workers on an occasional and intermittent basis; the casual wages therefore dictated by the terms of employment agreement whether oral or written must be fulfilled within temporary time schedules. These casual wages vary based on the service trade and the task to be performed.

1.2 Problem Statement

In the management of these casual labourers, the data collected has constant replication of records including the daily or weekly registration of names, national id, and phone numbers. These records are also prone to change because casual labourers are labour brokers, who can move from one employer to another without notice or legal approval making the calculation of wages cumbersome and dynamic.

There is also a high insecurity risk of theft by using cash as a form of payment to the casuals in the remote working sites. This research focused on developing a solution to the challenges in casual management. This solution needed to adapt to day to day recording of organizational tasks based on different projects and regions, calculation of payments per casual labourer based on duty rota performed and offer a safe and reliable integrated payment solution for casual's employers. It also needed to provide business intelligence operational and financial reports based on tasks, projects and casuals to be used in decision making.

1.3 Research Objectives

The research objectives for this research are:

i. To identify the data required for coordination and payment of casual labourers.
ii. To review research gaps with the existing casual labour management and payment solutions.
iii. To design, develop and test a working mobile prototype for casual data management and payment.
iv. To validate if the prototype meets the needs of casual labour management and payment system.

1.4 Research Questions

The research questions for this research are:

i. What are the data requirements for the coordination and payment of casual labourers?
ii. What are research gaps with the existing casual labour management and payment solutions?
iii. How does the developed prototype work?
iv. How does the solution meet the needs of casual labour management and payment system?

1.5 Scope

This research focused on The Green Belt Movement (GBM) as the case study. The Green Belt Movement was founded in 1977 by Professor Wangari Maathai. GBM became

internationally famous in 2004 when its founder, Professor Wangari Maathai, was awarded the Nobel Peace Prize for the promotion of social justice and development, environmental health and democracy. GBM has mainly focused on conserving the environment by empowering rural African women and their families and creating sustainable livelihoods. (Berghult, 2014)

GBM conducts tree planting and soil conservation operations within Africa. Between 2012 and 2015 it handled over 200,000 casual labourers predominantly in tree planting operations (Bron, 2016). GBM uses a ten-step process that identifies a common process flows for each project. This research focused on part of the ten step process, which involved project and task identification, field data collection on casual labourers during site preparation and tree planting activities, payment of casual labourers using a duty rota and the main casual data to be analysed and reported.

GBM uses casual payment forms to record casual information on attendance for payment purposes. Data Integrity however, can only be achieved by using quality control and quality assurance. This handwritten data involves constant replication of data records; names national id and phone numbers and task done. This data is then transported to the headquarters for payment processing.

1.6 Limitations

1.6.1 Data Limitations

Data limitations may exist in both primary and secondary research techniques which may not be able to offer the necessary data needed to fulfil the research objectives stated in this research. The researcher may hence be forced to make up or scale down the scope of the study.

1.6.2 Time Limitations

In the process of this study, the researcher has other faculties involved or currently being undertaken hence insufficient time might be a limitation when it comes to effectively finishing the study project. It is however vital for the researcher to guarantee that adequate timing was scheduled for all projects leading to the successful completion of the project beyond time limitation.

1.7 Justification

The findings of this study are relevant to employers in the management and payment of casual labourers. This study addresses key pertinent challenges employers go through in the management and payment of casual labourers. These challenges are further supported with statistics that there is a casual labour involves a non-standard form of employment and it is on the rise. According to Encla (2015) the International Labour Organization discussion report discusses, the major increase of casual labour in developing and middle income countries from 5.6% to 13.6% to occupy slightly more than 52.4% of the employment contracts from 2004 to 2015 in Africa.

The findings of this study are vital to non-government organisations, labour organisations and trade unions to enable them to fight for equal payment rights of casual labourers and gather information on challenges of casual employment.

Furthermore, the Employment Act of Kenya specifies the legal obligation of the employer as to keep a certain set of employee records up to a period of not less than five years. The Kenya Revenue Authority audits require this employee payment and personal information for tax remittance and auditing purposes. The findings of this study may also be useful to policy makers to assist in the development of relevant policies in casual labour.

According to Sacu and Spruit (2010) Business Intelligence is a tool that helps business organizations make sound decisions by transforming data into knowledge through the use of various analytical tools. This study uses business intelligence to transform casual related data into knowledgeable information for decision making purpose for different involved parties.

Chapter 2: Literature Review

2.1 Introduction

Literature review section of this research discusses in detail the related studies and research done by various authors in relation to the study. This chapter starts with an introduction of the types of labour contracts focusing on casual labour contracts. It focuses on the growth of casual labour and the reasons for this growth. It explains how mobile money payments are applicable to casual labour payments and general concepts about business intelligence also it describes the effects or role of using BI in an organization.

2.2 Labour Contracts

There are various types of labour or employment contacts that can implicitly or explicitly explain the terms of employment. These labour contracts help to clearly define to both the employers and the employees their roles and expectations (Eyraud, 2008). An employing organization, individual is any legal unit or person or persons who has in its possession one or more individual performing legal services for it (Muhl, 2002).

2.2.1 Full-Time or Permanent Contracts

According to the UK protection of employees fixed-term work act, 2009 a permanent contract employee is entitled to monthly or annual salaries, leave and other benefits and allowances. The contract's duration cannot exceed three years but can be renewed indefinitely.

Legally Permanent contracts must be in writing and they are centered on trial periods, lump sum salaries and exclusion. A trial period is the corresponding term to the initial stage of a contract which should be, but not limited to three months, allowing the employer to vet the employee's abilities while the employee analyses the ease and convenience of the working conditions provided. A lump sum salary is the form of employee compensation that encompasses all employee benefits including health, travel and insurance benefits. Exclusion is however, the deduction of extra legal fees and payroll taxes from the lump sum salary. (Heshmati, 2008).

2.2.2 Part-Time Employment Contracts

According to International Labour Organisation: Labour Definition Program in 2011 a part-time contract is similar to a full-time employee contract but the difference is it is a seasonal form of employment and hence the employee's working hours and pay differ from the full time contracts. The contract's duration is usually but not limited to 6 months to a year. These are often referred to as consultants and their input is to solve a specific role or operation in the organization (Ryder, 2013).

2.2.3 Freelance and Consultancy Agreement Contracts

According to Mullaney (2012), freelance or consultancy agreement involves a contract between a consultant individual and / or company to offer specific services or products. These consultants are mostly self-employed and they possess a certain skill that can be outsourced for example accounting firms or accountants.

2.2.4 Temporary or Casual Employment Contracts

Casual employment contracts are contracts where the casual labour is engaged for a specific time limit on a project or a task basis. This type of contract is on occasion or seasonal but on an intermittent or regular basis. Casual employment contract are can be oral and written contracts. The workers earn a wage after completing a project or task based agreement or after a certain time period.

2.3 Trends in Casual Employment

The 102nd Session of International Labour Conference Report 2013 states that casual employment is a non standard form of employment that is not easily governed and managed.

This is because casual employment involves a non standard work arrangement. Oral contracts that are binding hence it encourages greater flexibility in work plans for employer. Ryder (2013) claims the Director General to ILO in his report on 102nd Session of International Labour Conference declared that in as much as people target time

permanent jobs with fixed hours and a reliable pension with a predictable and secure career path or single employer more than half of the global population workforce as at 2013 is engage in casual employment.

According to the employment correspondent of Financial Times 2015 casual labour is a non standard form of employment can help people gain a foothold in the job market and create jobs to low living standards people in developing countries. Full time contracts were still the norm in developed countries but their share based on the total percentage of employment has decreased slightly from 74% in 2004 to 73.2%.

There has been a major increase in developing and middle income countries in the casual labour from 5.6% to 13.6%. These workers have no written contracts and rely on oral agreements (O'Connor, 2015).
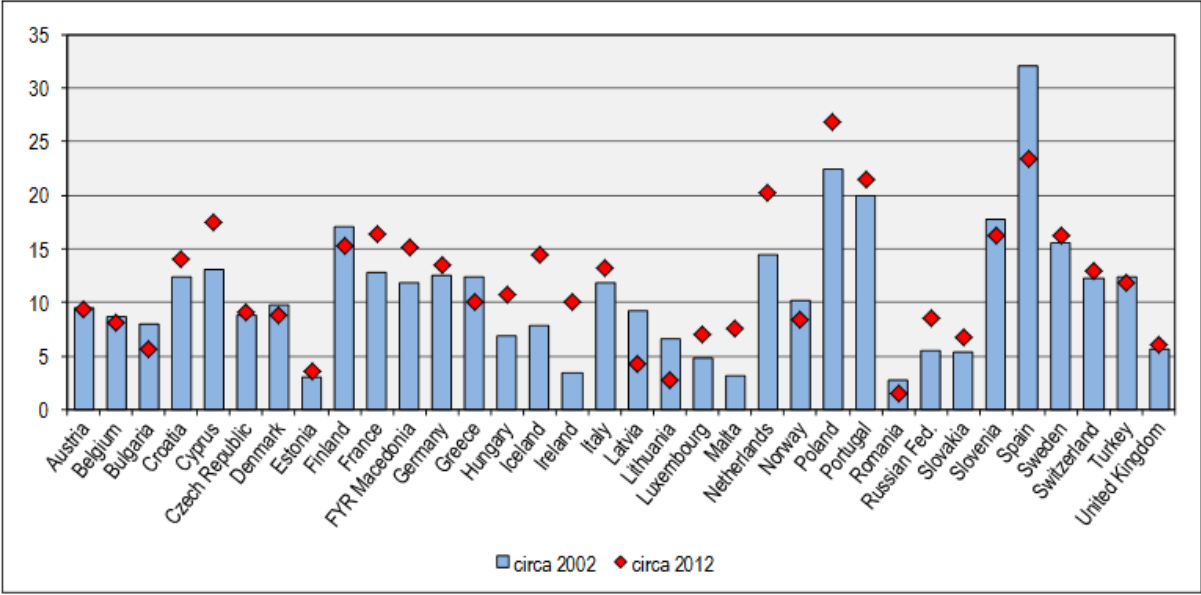
Figure 2.1 Percentage of casual workers growth in some countries (Maurizio, 2014)

Figure 2.1, shows that Europe and most parts of The United States of America have about 70% of the jobs as full time or permanent contracts from the year 2000 (Maurizio, 2014).
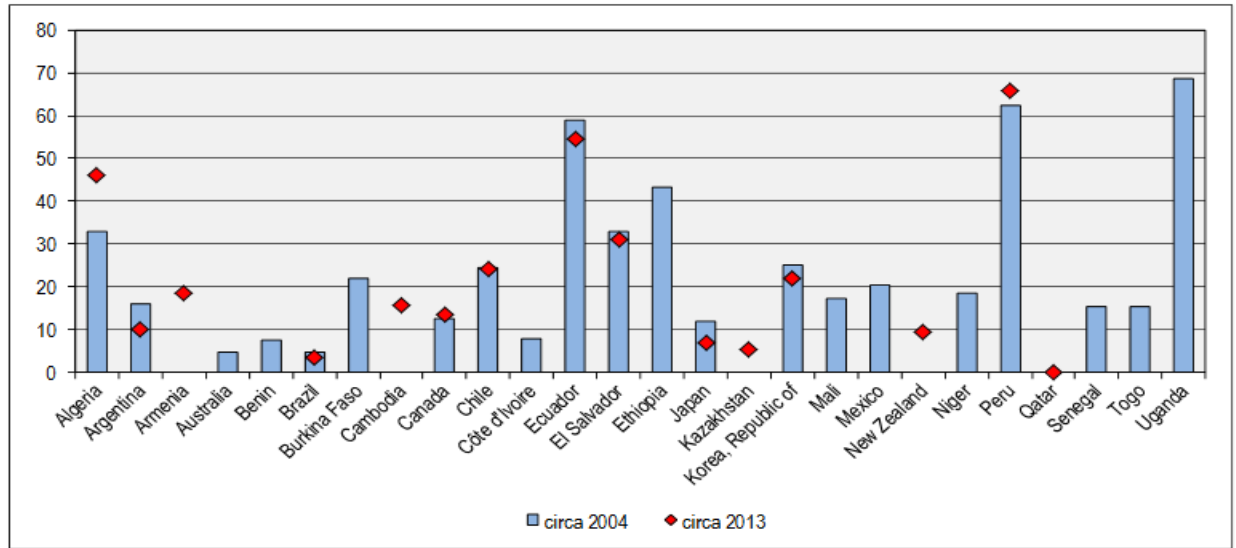
Figure 2.2 Percentages of casual workers growth in some countries (Zhong, 2013)

In developing countries however, casual labour is the most common form of labour and hence highest in Africa as seen above in figure 2.2 In Uganda, Eastern Africa, in 2004 to 2013 there was a rise to 84% of the labour workforce being self employed, 72% being casual labourers (Zhong, 2013).

2.4 Reasons for Growth in Casual Employment
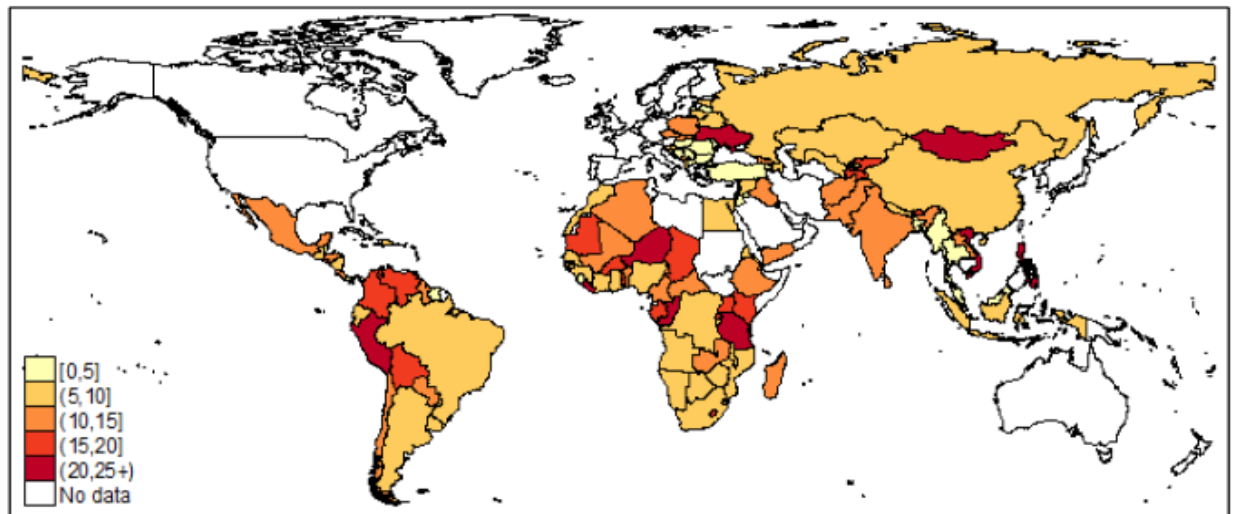
Figure 2.3 Casual data, as a percentage of total employment (Sundar 2011)

Figure 2.3, depicts temporary employment as a percentage of total employment in the world. It shows Africa as the most vibrant in casual employment as opposed to other continents in the world.

There are various reasons for the growth of casual employment worldwide. There is an ease to use casual employment as a stepping stone to achieve future goals. Casual employment at most times is physical and does not require skilled level of labour. The fact that casual employment is an informal type of employment where there is an easy transition from the type of contracts i.e. informal or oral contracts being most common and no reasons submitted to employer to justify employment unlike permanent or full time employment. (Sundar, 2011)

Industrialization took over, in the early 18th century to the 21st century, industries like construction, agriculture and the service trade, started using casual workers to achieve certain business goals. This type of labour has always been encouraged by these industries because their work can be regularized into specific achievable targets for operational planning, financial budgeting and supervisor coordination purposes. There are also less implementation costs of a casual worker as opposed to a full-time employee for example most businesses in Africa and the United States of America do not have to pay for Medical and Health insurance for casual labourers reducing in labour costs. There is greater flexibility in the hiring and firing of employees thus enabling them to adjust and fully adapt in the variations or drifts in work production. (Nollen, 2006)

In developing countries there is a reduced uptake of full time job and employment due to a decrease in job economy and competitive education statue. About 52% in 2007 of the working population in Africa cannot find permanent jobs resulting to temporary jobs. (Ryder, 2013)

2.5 Business Intelligence Implementation in Organizations

According to Olszak and Ziemba (2007) top level decision making has evolved over the years but it always constantly based on justification of its assets, benefits, services or products. This information or knowledge is constantly being looked for hence the need for business intelligence systems to justify an organizations decision making process and actions.

BI systems can therefore be referred to as an integrated set of software technology that are used to collect, integrate, analyze and report on the data made available.

Mulcahy (2014) explains that BI systems have helped business organizations to start running their own analytics of the raw data inputted. These organizations no longer have to wait for technical experts to run complex reporting algorithms or make decisions out of gut feelings.

According to Negash (2004) the main essentials of BI system are real time data storage options, analytical processing tool, data mining, seamless work flow, geographical information systems and data visualization.
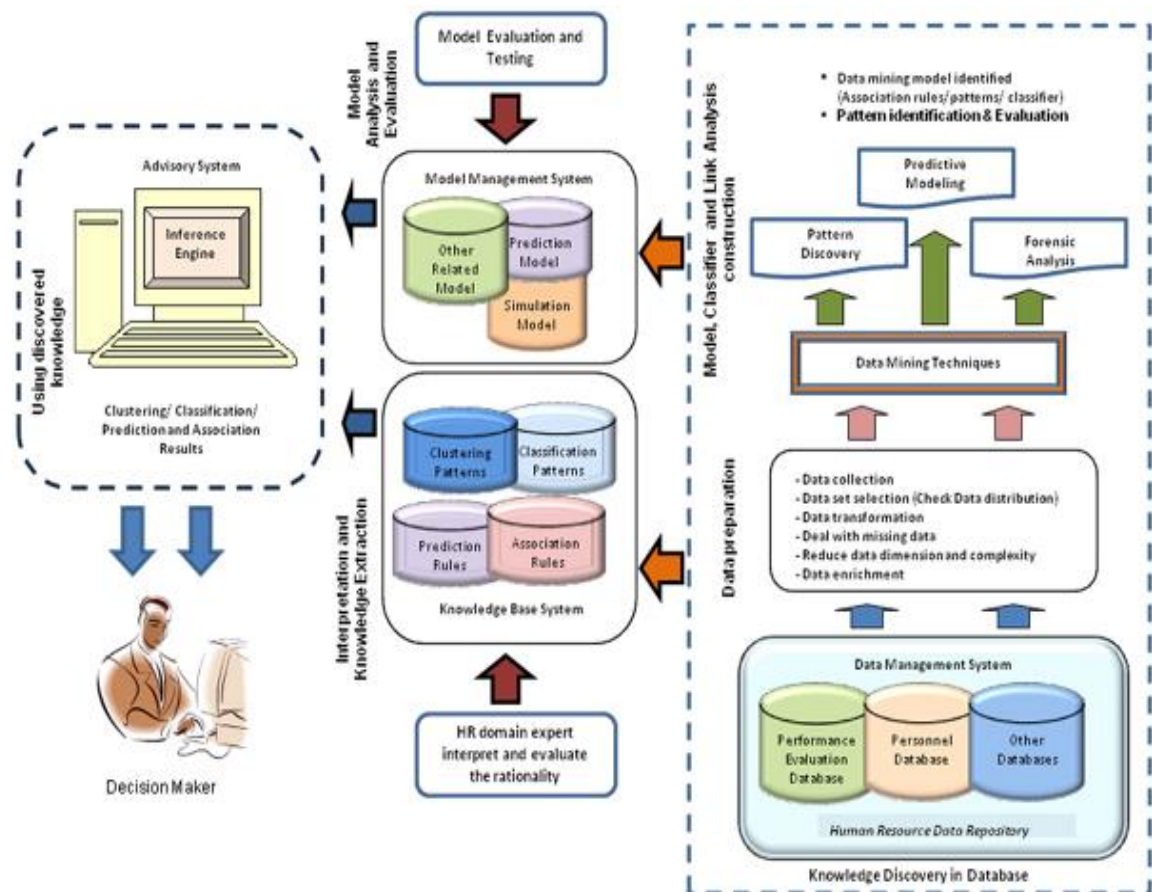
Figure 2.4 BI in HR Domain Expert Systems (Sacu and Spruit 2010)

Figure 2.4 depicts Sacu and Spruit (2010) five steps on how a business intelligence system should conduct its operation:

i. Data collection and cleaning: This involves accessing the data and coordinating the data in order and removing any irrelevant data from the pile collected or for a specific process.

ii. Data Enrichment: This involves adding any more valuable information with the data collected to ensure quality and integrity of the data for example date and timing, geographical position coordinates.

iii. Data Transformation: This involves the conversion of unstructured data collected into well structured data for analysis using analysis processing tools.

iv. Data Mining: This involves getting usable information from the structured data generated in the transformation

v. Knowledge Derived: This involves reports based on the data collected to justify the decision making aspects

2.5.1 Role of Business Intelligence in Organizations
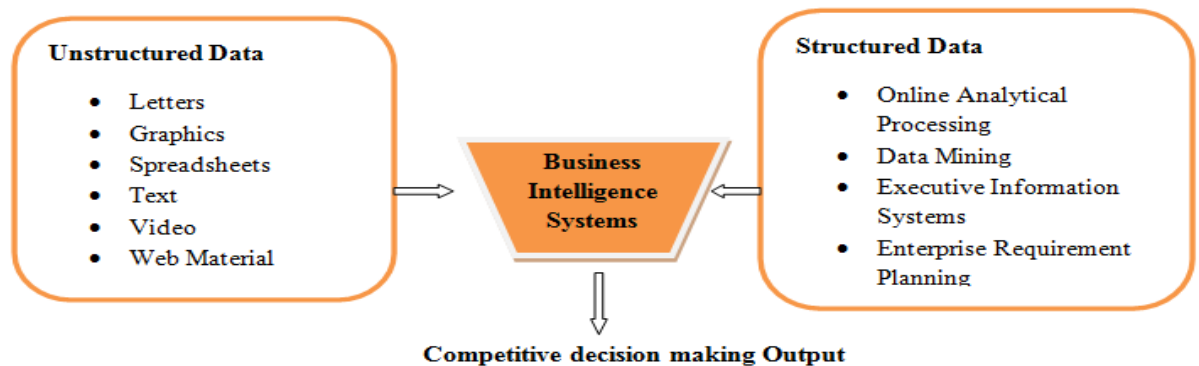
Figure 2.5 The raw inputs available to provide the Business intelligence

According to Negash (2004) the main role of BI systems in an organization is to combine aspects data collection and consolidation of data, data warehousing or storage, and knowledge derivatives or data mining with special processing analytical tools like online analytical processing (OLAP) or querying languages to present break down of complex data similarities or difference with the aim of achieving business competitive information to top level management and decision makers. Figure 2.5, depicts these raw inputs to business intelligence as explained above.

2.6 Technologies Implemented in Casual Labourer Management and Payment Platforms

According to Communication Authority of Kenya Sector Statistics Report 2016 section one on mobile subscription, the mobile penetration is up to 88% by 2015 with 72.4% of these having access to the INTERNET and other telephony services. Statistics report in September 2015 showed 37.8million subscribers up from 36.1 million in July 2015. According to the Government of Kenya Human Resource Information System (2011) there various technologies implemented in Kenyan human resource management platforms which are mobile applications, SMS and USSD platforms. These GSM based platforms are widespread on all smart phones and feature phones.
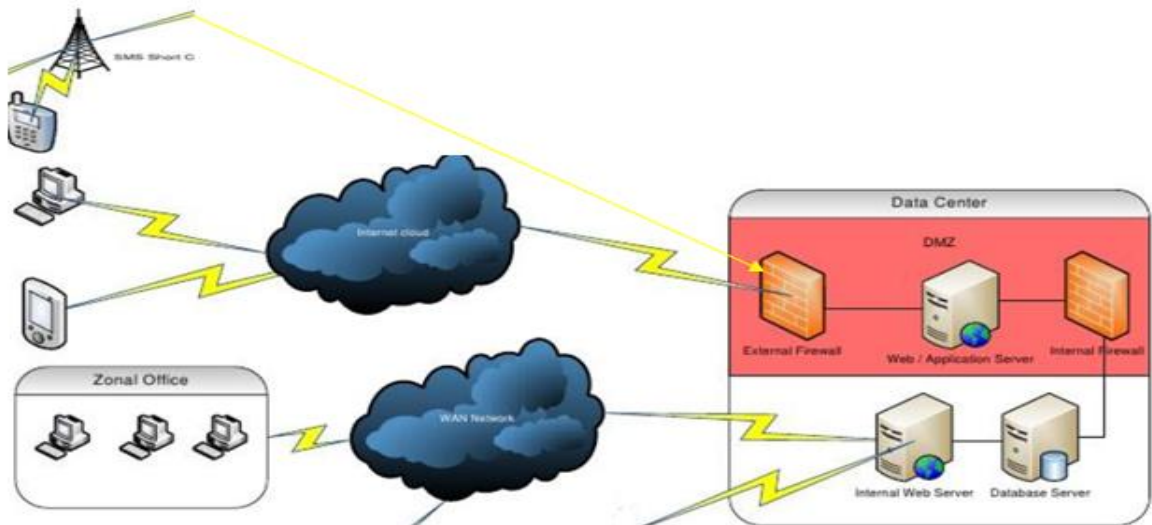
Figure 2.6 Technical human resource management system architecture

The Figure 2.6, above illustrates how the web application server interacts with the mobile application service access points. The SMS and USSD use the GSM network to interact to the data centre while the mobile and web applications use INTERNET cloud to the web server first. Data can be shared in WAN network to other departments.

2.6.1 Short Message Service (SMS) Architecture
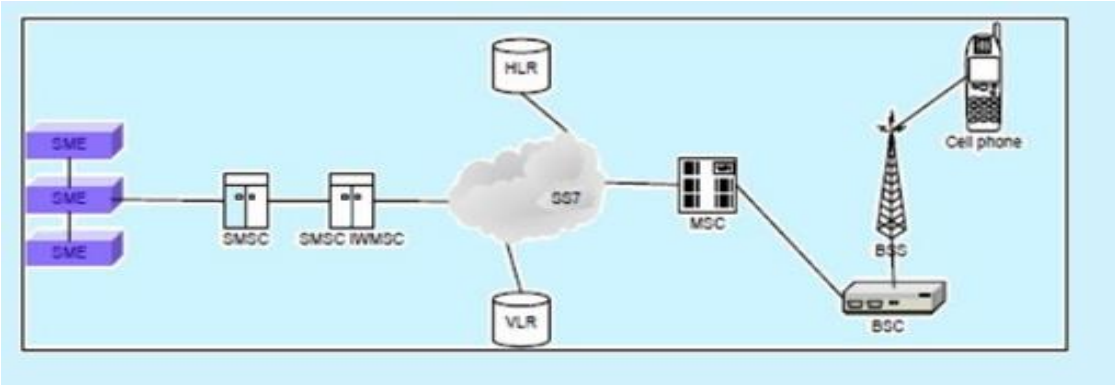
Figure 2.7 Message Service Architecture (Jain, 2014)

The figure 2.7, above according to Jain (2014) describe SMS as a standard messaging service in all GSM network phones.SMS is a single instance session type but since it is not flash messages like USSD it can be stored.

2.6.2 Unstructured Supplementary Service Data Architecture

USSD is a worldwide GSM network mobile application that uses flash type incoming messages and allows for seasonal access to services.
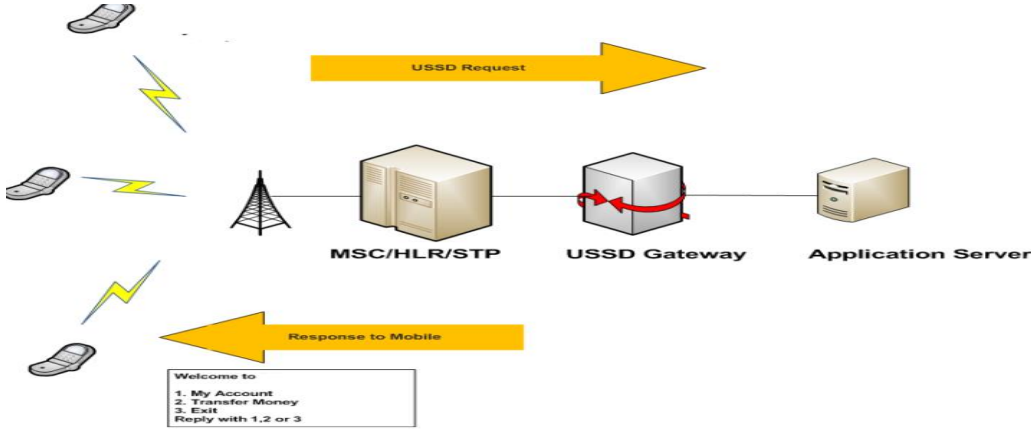
Figure 2.8 Unstructured Supplementary Service Data (USSD) Architecture

Figure 2.8, illustrates how USSD Users dial codes for example *133# then via the GSM network and USSD gateway it reaches the application server.

The application server through the same channel responds with variables that the user can access as menus to keep interacting with the application server.

2.6.3 Third Party Mobile Money Payment Platforms

Christensson (2010) defines an API is a set of functions or protocols used by other programmers to fetch services while interacting with an external system. APIs are created by the owners of the software to achieve specific services. The developers can get APIs in mobile and desktop operating systems depending on the software.

M-Pesa is a mobile money solution offered by Safaricom that started in 2008. It allows its clients to send and receive digital currency over a mobile phone (Jain, 2013). The M-Pesa API was generated on generation 2 and allows it clients integrate with different services. The M-Pesa API allows for payment reversal, disbursements of payments for Business to Customers and service payments from Customers to Business. The reversal of payments is when a business is able to reverse any digital currency for services not rendered. The disbursements of payments can be used to pay casual wages from the organization to the casuals. Using the M-Pesa API external developers can seamlessly integrate with the M-Pesa system and approve transactions to and fro customers from an external system. The M-Pesa system also has integrated an internal web portal that allows organizations to disburse money however; this portal has limitations of the capacity or number of transactions to be handled (Pasquire, 2013).

2.7 Existing Applications on Casual Labour Data Management and Payment

2.7.1 United Nations Food Agriculture Organisation Light Pen Project

The Technical Release Report 2014 for Food Agriculture Organisation Agency: Somalia Water and Land Information Management (SWALIM) is a project that is created and managed by Food Agriculture Organisation Agency (FAO) under the United Nations. It aims to gather data on water harvesting methods, climate change, soil and water conservation methods, which is then processed and analyzed for decision making. In collaboration with partner agencies worldwide like the, they are able to process this farmers or community groups data and produce impacts and reports on climate patterns, river and stream flow, groundwater resources and water harvesting processes, land

features and suitability, forest deforestation and flood and wind management options, degradation and land sustainability. SWALIM then uses this information to hire independent contractors to act on these reports either by digging boreholes or employing casual labourers to plant trees in conjunction with United Nation Environment Programme (UNEP), the Nature Conservancy (TNC) and the Green Belt Movement. (Malapela, 2015)

SWALIM collects this data using a light pen. According to Christensson (2006) light pen is a light-sensitive computer input pointing device that resembles a pen. It is connected digitally to a visual display unit or monitors and allows the user to modify data and text in a backend system that is integrated with the light pen or one can make menu selections on the screen (James, B. 2011, and Pointing Devices).some of the major benefits are the light pen can be used by people who are computer illiterate to collect data and the light pen reduces data migration time and bulkiness as opposed to physical handwritten pen and paper.

Challenges of Light Pen Project

The light pen still required handwriting proof checking and error handling where the handwriting was slightly curly. It was integrated to a backend system where head office staff gets to do this proof reading. Some light pens acquired were more costly than a simple android device. The light pen also lacked any other added feature to enable data integrity like gps coordinates or recorded dates or timing.

2.7.2 Casual Employee Management and Accounting System (CEMAS)

This is a system created in Singapore in 2009. It handles the events of casual labourers by issuing digital cards on registration or hiring of casuals. The supervisor logs in the events to be carried out but still has to log how much each person receives at the end of the day. The system is a java system only applicable to a personal computer. The system however, does enable the printing of receipts and work vouchers as well as end month tax returns. (CEMAS Singapore, 2009)

Figure 2.9 CEMAS Architecture (CEMAS Singapore, 2009)

The figure 2.9, above illustrates the architecture of CEMAS system from Singapore. It highlights key system actors and the roles they perform as well as system control parameters.

Challenges

One of the major downfalls of CEMAS is that System only works on client personal computers hence implementation of the system would require hub in the remote working sites. The supervisor would still have to key in the collected hand payment records if there were no hubs in the remote working sites in order for accounting process to happen. There is also a large cost in the generation of bar-coded vouchers. System does not conduct any mobile money payments for casual labourers so there was also risk of cash insecurity or theft. The system is not also open source and does not allow for customization of reports to suit employer financial and operational reporting requirements.

2.7.3 Ess-Matrix Info-Tech A Casual Labourer Management System

This is a web based Casual Management System by Ess-Matrix info tech that allows for, authentication features, registration of casuals, ID card issuing, Time and attendance. It uses hardware solutions to vet the casuals from different working sites.

Challenges

Installation of these hardware solutions is very costly and could cost up to $10,000 per site depending on the machines to be installed. Data collected has to be integrated to another ERP to derive reports. There is no provision for actual payments options or solutions for the casuals.

2.8 Conceptual Framework
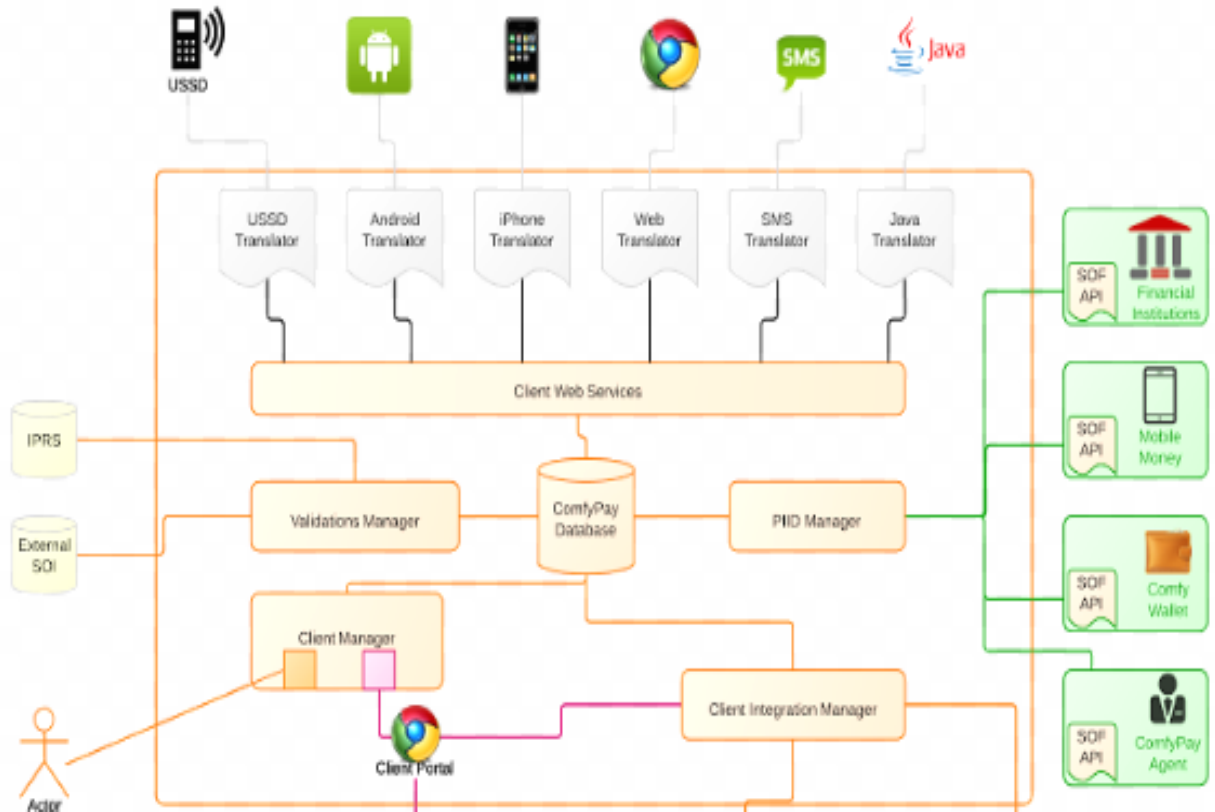
Figure 2.10 System conceptual framework diagram

The figure 2.10 explains a high level concept of the casual management and payment platform. The system is accessed via mobile service access points which then reach the client web services to interact with database. Users can use client manager portal to access

services and add data to the database. The PIID manager interacts with 3rd party APIs to access financial services while validations manage accesses information verification service. The client integration manager integrates to external customer servers to collect and process information via web service.

2.9 Conclusion

It has been proven that in Africa more than half the employment sector is casual labour and that this type of labour is mutually beneficial to both the employer and the casual labourer. However, there some challenges in meeting the business intelligence requirement of the business due to the fractured nature of the data included in the management of casual labourers.

With regard to the four elements of GBM's case from the scope of the study, management of information into projects and tasks would need to be met. The systems discussed have also attempted to solve the issue of tracking the casual labourers involved and calculating their dues. Furthermore, the calculation and disbursements of the dues to the labourers is critical to ensure business continuity. The presentation of these transactions as reports to the relevant members of the organization both assists in the management of the project and delivery to the labourers gives the business a competitive edge.

Chapter 3: Research Methodology

3.1 Overview

This chapter identified the research design and software design methodology that solved the casual management and payment problem. It studied agile software development methodology as software development methodology approach with Object Oriented Programming as designing and programming technique. It further studies Service Oriented Architecture (SOA) as main architecture and Simple Object Access Protocol (SOAP) for network communication. A sample size and Target population was also discussed in the chapter.

3.2 Agile Software Development Methodology

Agile software development methodology is an iterative and continuous process that is focused on how the product can adapt to suit customer's changes. This methodology approach is flexible and often allows feedback from the client which can then be converted to software changes (Conboy, 2009). This development methodology encourages showcasing of a working software as the best way of to communicate with the user. The user then responds to the working software based on the requirements they had. Benefit of this methodology is that it promotes team work between user and the developers in establishing fixed or changing requirements hence creating a realistic, optimal and current approach to software development. There are various agile methods including extreme programming, rapid unified process, dynamic system development and feature driven development.
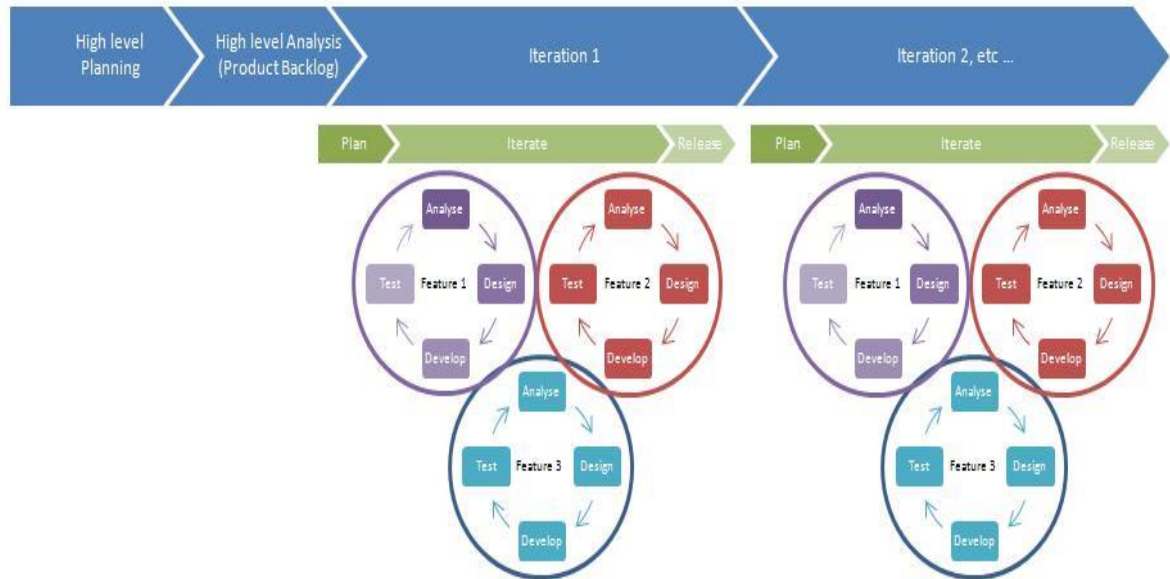
Figure 3.1 Agile Software Development Lifecycle (Cockburn, 2009)

Figure 3.1 illustrates after high level and top management planning has been conducted there are initial reiterations of requirement analysis to gather information on what is required then designing then developing and testing the software. This process can be carried out again after 2 or 3 months to satisfy consumer needs (William and Cockburn, 2009).

Dynamic development Method was the agile delivery method framework used. This framework was beneficial because it is used as a software development especially in business oriented software. This method involves integrating a functional prototype to a feasible business study. It involves the constant remodelling and reviewing of this functional prototype to establish the most suitable prototype. It focuses active user participation, frequent and acceptable delivery of software or project milestones, testing and iteration of the process.
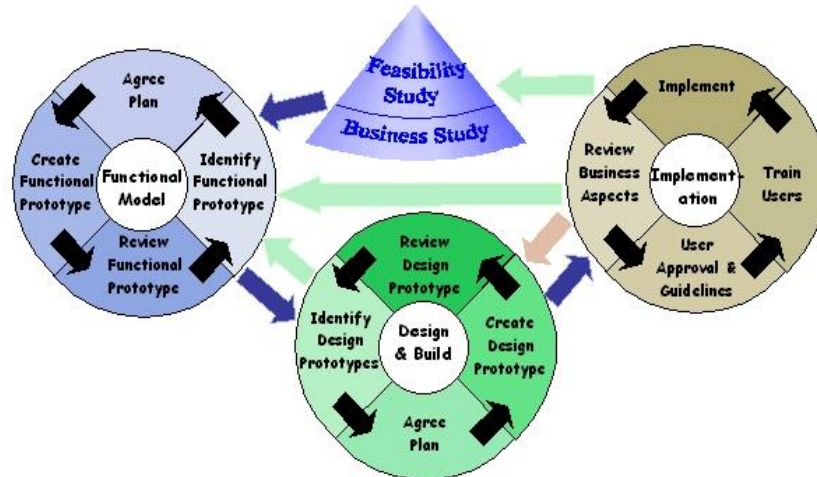
Figure 3.2 Dynamic Development Process (Rico, 2009)

This figure 3.2 shows the dynamic development method process in relation to business feasibility study and the prototypes to be developed. According to Rico, Sayani and Sone (2009) the dynamic development method is agile based projects deliver business value sooner as opposed to other traditional methods. This agile method allows for lower implementation costs and improved software to client acceptance. For this reason dynamic development method is best suited for this prototype.

3.2.1 High Level Planning Phase

According to Branavan (2009), high level planning involves discussion of a project plan on an overall view by top level management. It gives focus and scope to a project but does not go into detail discussion on the project modules and specifics. This studies high level plan includes understanding and creating a working prototype on casual labour management and payment solution.

3.2.2 System Requirement Analysis Phase

The second phase is the system requirements analysis phase. Requirement analysis is the process of determining user definitions and expectations of a new or modified software. These requirements were interpreted into functional requirement that can be coded by developers (Lezsek, 2001). Information on casual labour management and payment was collected from respondents through the use of online questionnaires.

An online questionnaire Appendix section B was administer to respondents with the aim to find the various project and task definition and safest and reliable means of payments. The questionnaire focused on the technological challenges in casual management and payment in the field and in the head quarters.

The researcher also reviewed several sources of secondary information like journals, published articles and books done on technical field data collection and payment methods. Articles focusing on casual labour contracts also created a legal backing to understand the overview in casual employment.

Both qualitative and quantitative research design has been incorporate in this research design. The quantitative research design is useful financial calculations and casual project numbers. The qualitative research design is useful to get information on the rota, project data and task definition.

According to the GBM Financial Report 2015, focusing on Nyeri County, there are approximately 10,000 green rangers working with GBM (Mwangi, 2015). These green rangers are supervisors who check on daily quality of work and send casual payment forms to GBM headquarters. Using a 95 % confidence level in the random sampling technique by Spectrum Troy (2013) the questionnaire was given to 97 green rangers.

Equation 3.1 Random Sampling Technique

$$n = \frac{NZ^2 * .25}{[d^2 * (N-1)] + [Z^2 * .25]}$$

Where n = sample size required

N = total population size (known or estimated)

d = precision level (usually .05 or .10)

Z = number of standard deviation units of the sampling distribution corresponding to the desired confidence level (see Appendix E)

3.2.3 System Design Phase

According to Kendal (2013) system design is the method guide followed by the researcher to understand what was data is needed for storage, analysis and processing purposes in order to get an expected output.

According to Barry (2013), a service is a function or method that is well defined to carry out a particular task in the architecture. To implement web services which are web components found and published in the web for use this research used Simple Object Access Protocol (SOAP) which is an XML based protocol for accessing web. A Web Services Description Language (WSDL) is a collection of endpoint that describes a web service. SOA is a preferred architecture because it has loosely coupled services and there is a separation between the client and services. Sprott (2014), the goal of SOA is to establish a worldwide mesh of published services to be used by clients. Adopting SOA allows for business flexibility and business agility.

The system design tools used in this study are object oriented design tools. According to Anderson (2008) Object oriented design uses classes to define relationships. These classes can then be called by objects which are instances of these classes. The design model created in this study use object oriented tools like:

i. Use-case Diagrams, which model the system functionality based on a specific system actor.
ii. Entity Relationship diagrams, which showed the entities within the system core and their functions and how those different entities relate to each other
iii. Sequence diagrams, which illustrated the functions within a program as well as the function inputs of data. It revealed the relationships of various entities or components within the system.
iv. Database Schema enabled the researcher to create a database for information storage purposes. The designed diagram shows the database table name, the data type and the description. These tables also have a unique id.

3.2.4 System Building Phase

The prototype implementation involved the following:

i. The web backend component; the web component was coded with PHP5 server framework with HTML5 version and CSS3 version. The SMS gateway and payment gateway use PHP5 server Frame work and integrated to the 3rd party by web services.

ii. The android mobile component; the android component uses a JAVA based language with Linux kernel architecture. Android uses a software development kit tools to develop mobile applications for Android Operating System.

iii. Third party API for payment and SMS gateway; according to Christensson (2016), an API is a set of commands or functions created by the owner license holder of a software or service that allows programmers to create services that can interact with their system externally and dynamically have access to the platform. The proposed system has connection to a payment gateway that allows the system to make bulk payment to users based on banking transactions inserted. A connection to SMS gateway is also available to help in better communication to the casual labourers.

iv. The database; the prototype has been developed using MySQL for the web component and a SQLite for the mobile component. Both are SQL based database for storage. This database type is open source and can easily integrate to PHP server functions.

3.2.5 Prototype Testing Phase

The prototype underwent various tests to ensure the validity, functionality and usability of the prototype. These tests were:

i. Usability testing; this involved direct user testing and direct user feedback. The aim is to get the real user experience on the user friendly experience and system flows as well as internal debates on how to solve requirements.

ii. Both functional and non-functional types of testing were performed on the prototype.

iii. Compatibility testing; this focused on the different android versions and web browser to check for compatibility and accessibility in the different versions.

3.2.6 Prototype Validation

The system users evaluated the validity of the prototype to assess if the prototype attains the user requirements and the research objectives as proposed earlier. To validate if the developed prototype satisfies the conditions of a casual labourer management and payment solution using GBM as a case study.

A total of 70 supervisors or green rangers were available to participate is prototype validity from the initial 97 who were used in the requirement analysis phase. An online questionnaire in appendix E designed on Google was used to collect this information from these green rangers. This online questionnaire was then sent to the sample of green rangers to evaluate the system validity.

3.2.7 Research Quality

Beker (2007) states validity as the actual soundness of truth and logic of a study. In order for a study to be valid the study also has to be accurate. The interview and questionnaire had both closed and open ended questions that were tested using a sample. This sample was adjusted over time to ask direct and objective questions that were used in data analysis and actual dissemination of study.

Krampen (2007) describes reliability as the ability to rely upon, depend or use for honesty and accuracy purposes while objectivity is the focus of object external to mind. This questionnaires and interview questions were objectively handed to the green rangers with no external intent or premise or prejudice over a period of 4 days.

3.3 Research Ethics

The researcher avoided plagiarism by acknowledging any citations that were not their own and cited the authors information. The researcher also sought a letter from Strathmore University permitting him to collect information related to the study from different organizations and institutions. Validity and objectivity was adhered to in the research instruments to collect true and honest information and void any bias.

Chapter 4: System Design and Architecture

4.1 Overview

This chapter describes the system architecture based on stakeholders' guided expectations in the study. A detailed Unified Modelling Language (UML) diagram of the web and mobile system are explained by use-case diagrams, sequence diagrams and entity relationship diagrams.

4.2 System Requirements

After the system analysis and survey analysis, it was clear that a new application had to be designed and developed to cover some of the critical issues that current technical systems did not cover in casual management for payment. These critical issues like portability, cost, reliability and safety of financial resources. The new application should be designed to handle aspects of both casual labour management and payment. This resulted in some user defined functional and non functional requirements.

4.2.1 Functional Requirements

a) The administrator should be able to access the system using unique login credentials and add other user profiles.

b) The project manager should be able to add project descriptions to be carried out by the project supervisors.

c) The users should be able to add tasks based on the project added which contain estimated costs and timelines.

d) These tasks added should be allocated and viewed by the project supervisors.

e) The supervisors should be able to recruit casual labourer and register them into the system. This information should also be historically accessed.

f) The supervisors should be able to submit duty rota based on specific tasks and projects conducted.

g) The project managers should be able to receive this data and approve this data before sending it to finance manager for payment

h) The finance manager should be able to carry out bulk payments to the casuals by the use of mobile money

i) The top level management should get intelligent financial and operational reports that guide in decision making

4.2.2 Non-functional Requirements

Some of the non functional requirements involved are:

a) System performance; the system response time should be acceptable and efficient.

b) Usability and flow; the system should be attractive and easy to use. The interface flows should be seamless.

c) Data Integrity; the data recorded in the system should be protected and confidential

d) Security feature; system authentication should be used and architecture and other system tools should be secure.

e) Scalability and Flexibility; the system should have the ability to grow. It should also be easily integrated to any other external systems

f) Reliability and Availability; the system should be accessible for use in most common technological channels and reliable

4.3 System Architecture

The system architecture adopted is Service Oriented Architecture (SOA). SOA is a preferred architecture because it has loosely coupled services and there is a separation between the client and services. Sprott (2014), the goal of SOA is to establish a worldwide mesh of published services to be used by clients. Adopting SOA allows for business flexibility and business agility.

The core part of application resides on RESTFUL web services that link it to the 3rd party Application Programming Interfaces (API) for the payment and SMS gateway. This model allows for clients to access requested services and interact with the server. The client side comprises of a web portal and an android application.

CASUAL LABOUR MANAGEMENT AND PAYMENT SOLUTION ARCHITECTURE

Web System Access Point

Android System Access Point

Web Service Access Point Translator

Android Service Access Point Translator

RESTFUL WEBSERVICE INTERFACE

3rd party SMS Gateway

Communication Manager
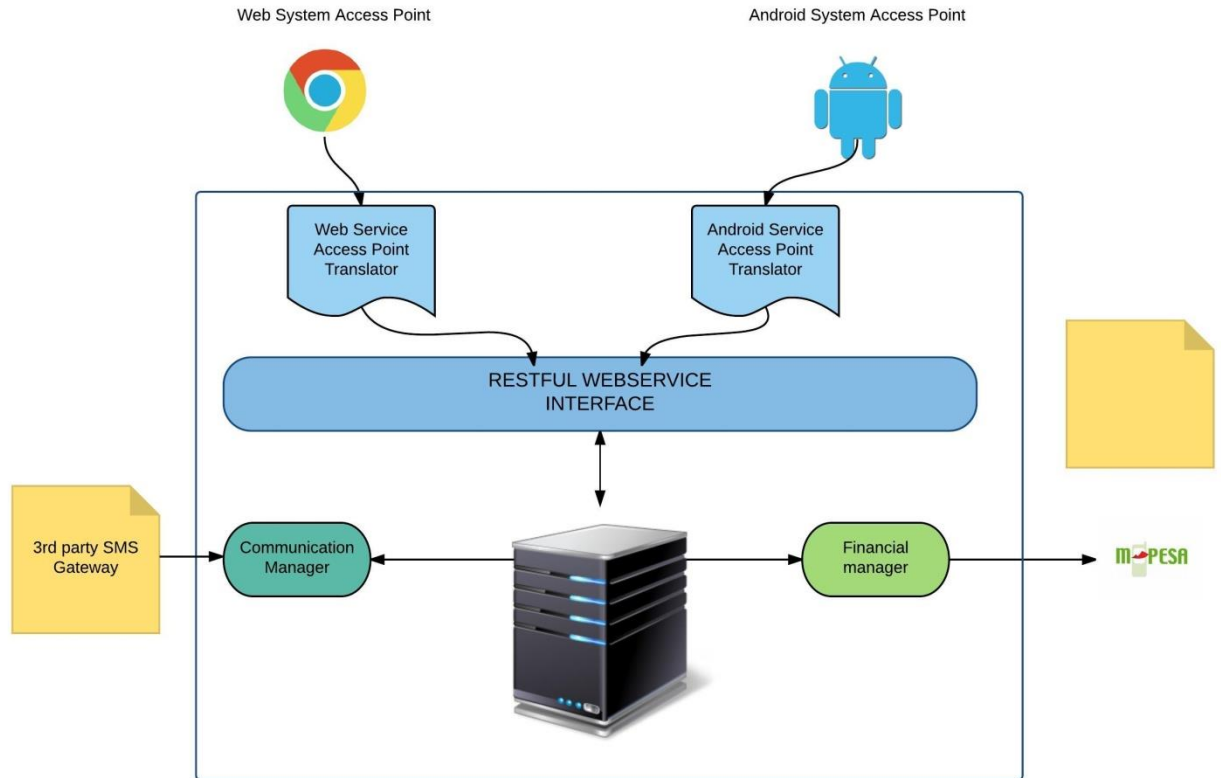
Financial manager

M-PESA

Figure 4.1 System Architecture

Figure 4.1 depicts how the different modules within the system interact with each other. The web component is a backend portal that registers projects and project supervisors within the projects. These projects have allocated tasks, which have estimated timelines and casuals numbers required. The mobile application is used in the field to handle casual registration and the day to day duty rota recordings based on the projects and tasks allocated. The web is also used for payment via mobile money and communication via SMS gateway to the casuals using third party application programming interfaces. The web portal has financial and operational report tool based on the project and tasks conducted.

4.4 General Processes

Some of the general processes within the system include:

i.   *User management process*; this involves the management of users and user role within the application. User information like names, gender, emails and phone number are used to create an account. The users get a username and temporary password to be able to access their account. The users can also reset their passwords.

ii. *Project management process*; this involves the definition of projects based on project name, location, goal and value. The projects once setup can be accessed by supervisors and data can be keyed in based on per project basis.

iii. *Task management process*; this involves defining a task under a project based on expected time taken and expected cost incurred versus the actual time taken and actual cost incurred.

iv. *Casual payment data process*; this involves the registration of casual, calculation of dues based on a duty rota function and actual payment of casuals.

v.   *Reporting process*; this involves the creation of reports based on the data collected. These reports could be casual gender reports, casual payment reports, overall project or overall task reports.

4.5 System Design Tools

The system design was affected by functional and non-functional requirements. The diagrams explain the flow, relationship and intent of the system. It involves both android mobile and web portal pre-implementation processes. It consists of the following components:

a. Use case diagrams and descriptions
b. Sequence diagrams
c. Context diagrams
d. Entity relationship diagrams
e. Database schemas
f. User Interface Flow Diagrams

4.5.1 Use-case Diagrams and Descriptions

The use case diagram shows the functional requirement of a system based on the user or actor. It a behavioural diagram that links use cases to its dependency cases as the main system processes to major system actors. Some of the major system actors are:

i.   *Project Manager*; the project manager set the vision of the project describes the various phases or modules of the project. He aligns the project into various milestones and does calculation on the costs involved and timelines based on operations within a phase.

ii. *Project Supervisor*; the project supervisor handles the recruitment process of casual labourers based on specific tasks with is allocated estimated time and budget constraints from the project manager. The supervisors inspect the work done day to day and record the duty rota based on the task conducted by the casual labour.

iii. *Finance Manager*; the finance manager does the actual payment of the calculated casual payments. The financial manager also checks the financial estimations based on actual estimations used.

iv. *System Administrator*; the system administrator registers personnel into the system and their roles. They also manage and maintain personnel accounts.
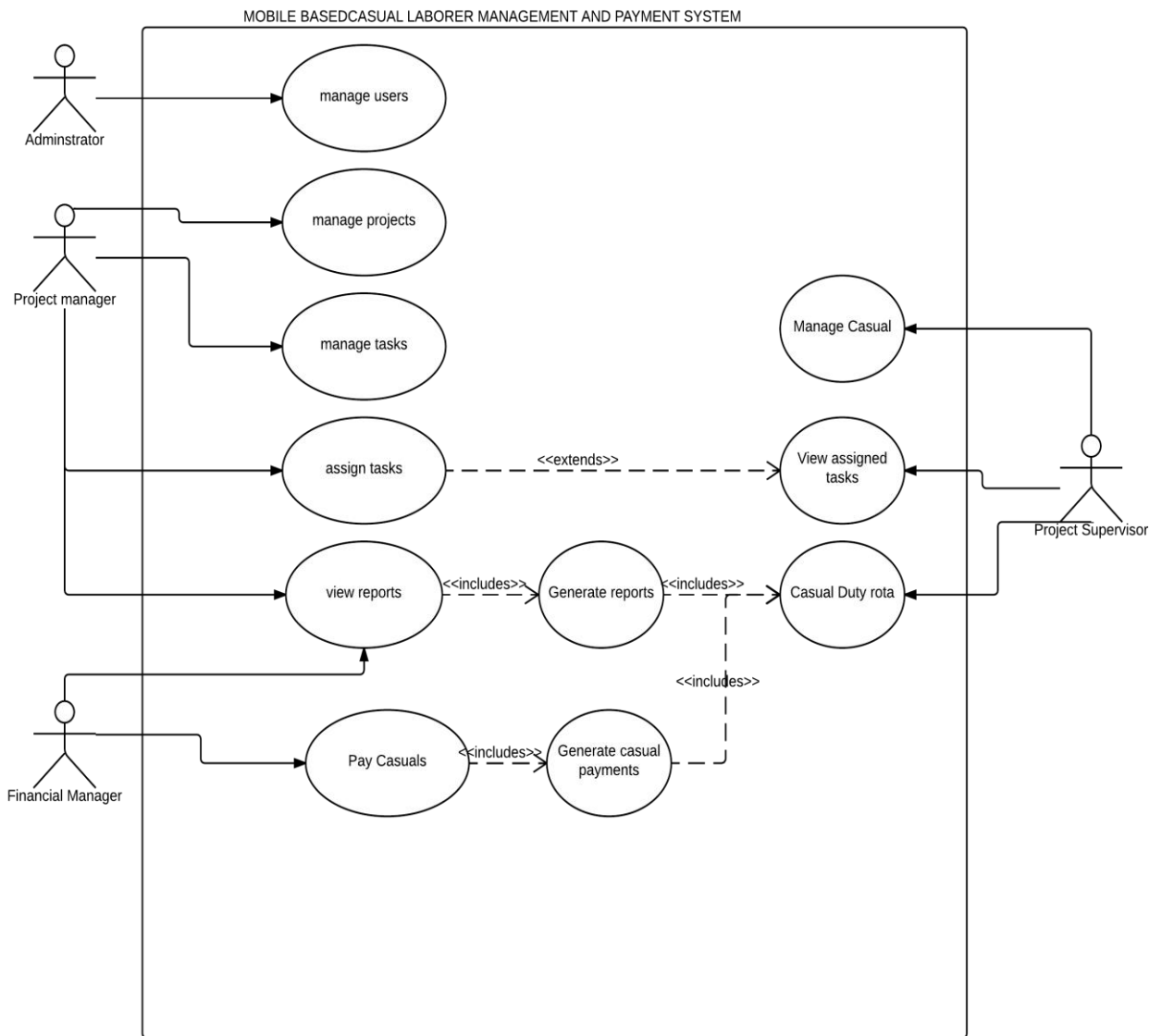
MOBILE BASEDCASUAL LABORER MANAGEMENT AND PAYMENT SYSTEM

Figure 4.2 Use-case Diagram

Use case Description

Figure 4.2 illustrates the use-case diagram. The main use cases in the application are:

Manage users

Table 4.1 details the management of users. This involves the creation of accounts based on roles i.e. donor, project managers and financial managers by the system administrators.

It also allows the system administrators to activate and deactivate user or reset user login passwords.

Table 4.1 Manage Users Description

Use case	Description
UC 1 manage users	**Primary Actors:**
	Administrator
	Stakeholders:
	Project manager, project supervisor, financial managers
	Pre-condition:
	The administrator has an account and has logged in
	Post condition
	The user management request is sent
	Success scenario
	The user management request is performed
	Frequency
	The process occurs frequently

Manage project

Table 4.2 shows the project management case used to register a project and link it to a donor. The project then is divides into phases and timelines along with estimated total budgets.

Table 4.2 manage projects description

Use case	Description
UC 2 manage projects	**Primary Actors:**
	Project manager
	Stakeholders:
	Project manager, project supervisor, financial managers

	Pre-condition:
	The project manager has an account and has logged in
	Post condition
	The project management request is sent
	Success scenario
	The project management request is performed
	Frequency
	The process occurs frequently

Manage Tasks

Table 4.3 show the task management process. This allows a project manager to register a tasks based on a project. These tasks have their own timelines along with estimated budgets.

Table 4.3 Manage Tasks Description

Use case	Description
UC 3 manage tasks	**Primary Actors:**
	Project manager
	Stakeholders:
	Project manager, project supervisor, financial managers
	Pre-condition:
	The project manager has an account and has logged in
	Post condition
	The task management request is sent
	Success scenario
	The task management request is performed
	Frequency
	The process occurs frequently

Manage Casual

Table 4.4 shows the casual management case. This allows a project supervisor to register a casual labourer based on a task. The data collected helps in duty rota and identifying the casual.

Table 4.4 Manage Casual Description

Use case	Description
UC 3 manage casual	**Primary Actors:**
	Project supervisor
	Stakeholders:
	Project manager, project supervisor, financial managers
	Pre-condition:
	The project supervisor has an account and has logged in
	Post condition
	The casual management request is sent
	Success scenario
	The casual management request is performed
	Frequency
	The process occurs frequently

Assign Task

Table 4.5 shows how tasks are assigned. This allows a project manager to assign a task to the project manager. The data collected helps in mapping the manager projects to the supervisor tasks.

Table 4.5 Assign Task Description

Use case	Description
UC 4 assign task	**Primary Actors:**
	Project manager
	Stakeholders:
	Project manager, project supervisor
	Pre-condition:
	The project manager has an account and has logged in
	The project manager can access projects and has registered tasks
	Post condition
	The assign task request is sent
	Success scenario
	The assign task request is performed
	Frequency
	The process occurs frequently

Casual Duty Rota

Table 4.6 details the casual duty rota. This allows a project supervisor to mark attendance and link a casual labourer to a specific task. The data collected helps in duty rota management and casual payment.

Table 4.6 Casual Duty Rota

Use case	Description
UC 5Casual Duty Rota	**Primary Actors:**
	Project supervisor
	Stakeholders:
	Project manager, project supervisor
	Pre-condition:
	The project supervisor has an account and has logged in

	The project supervisor can access assigned projects and tasks
	The project supervisor has registered casuals
	Post condition
	The duty rota request is sent
	Success scenario
	The dutyrota request is performed
	Frequency
	The process occurs frequently

Pay Casual

Table 4.7 illustrates how the financial manager can access the duty rota and pay casuals based on a specific time period.

Table 4.7 Pay Casual

Use case	Description
UC 6 Pay casual	**Primary Actors:**
	Financial manager
	Stakeholders:
	Project manager, project supervisor
	Pre-condition:
	The Financial manager has an account and has logged in
	The Financialmanager can access projects and tasks
	The Financial manger can access duty rota
	Post condition
	The payment for duty rota request is sent
	Success scenario
	The payment for duty rota request is performed

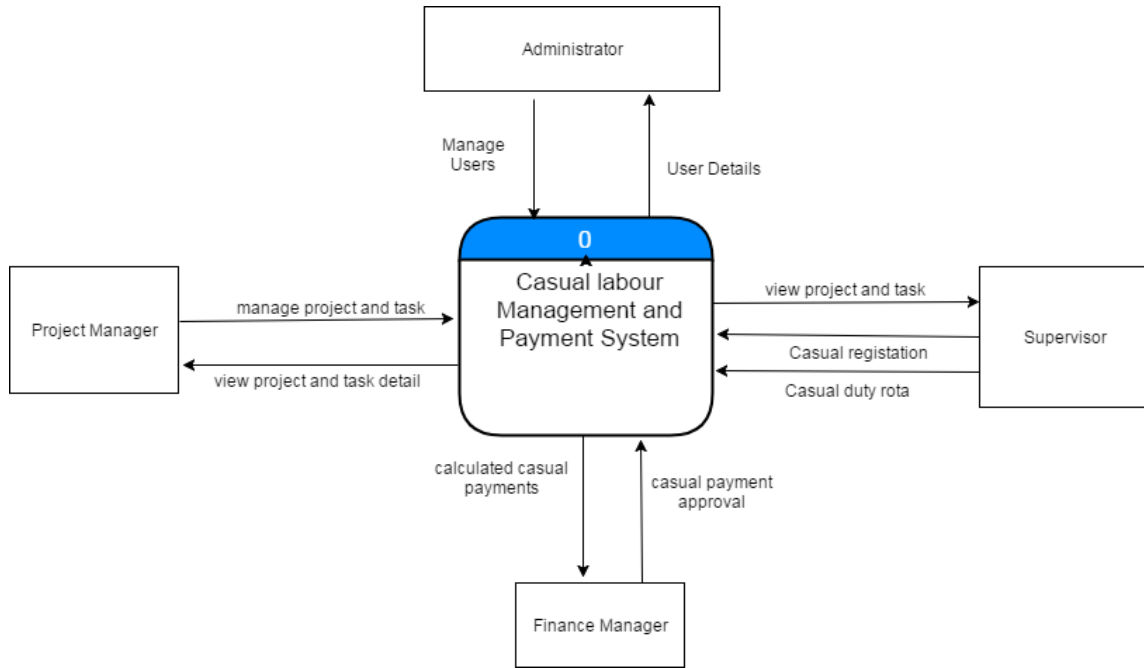|	**Frequency**
	The process occurs frequently

4.5.2 Context Diagram

Figure 4.3 context diagram

Figure 4.3 shows a context diagram of the casual labour management and payment system. It shows the key features performed by the major actors of the system.

4.5.3 Level 1 Data-flow Diagrams

The level 1 data-flow diagrams have a more in-depth look of the system processes covered. Some of the major flows can be found in the appendix chapter, section C which explain the data stores used and actors role in the processes performed.
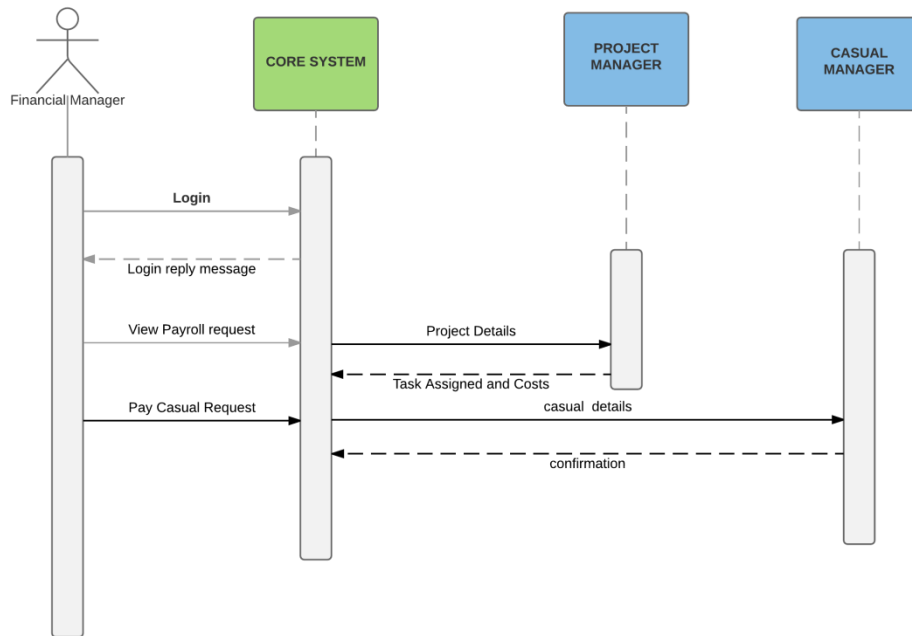
4.5.4 Sequence Diagram
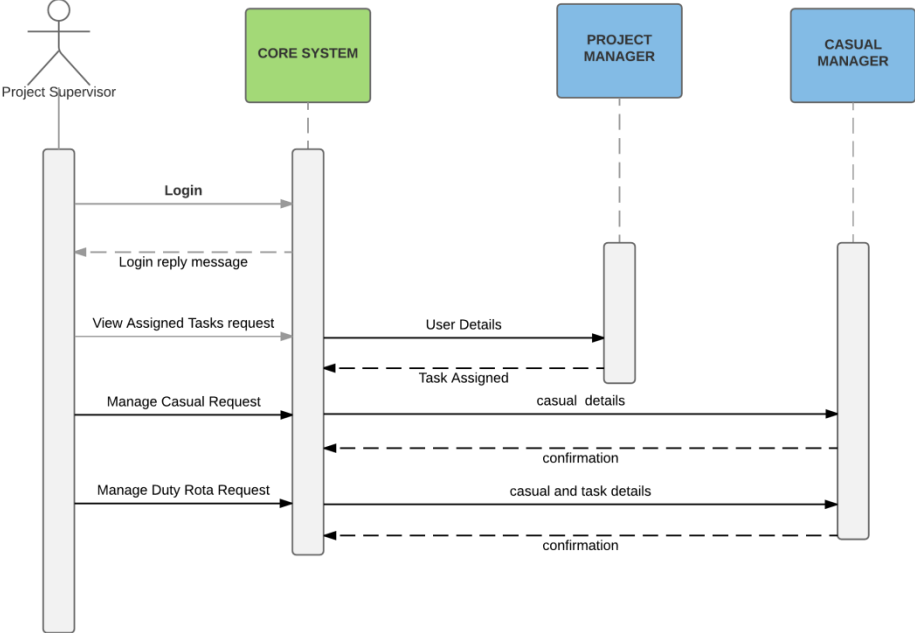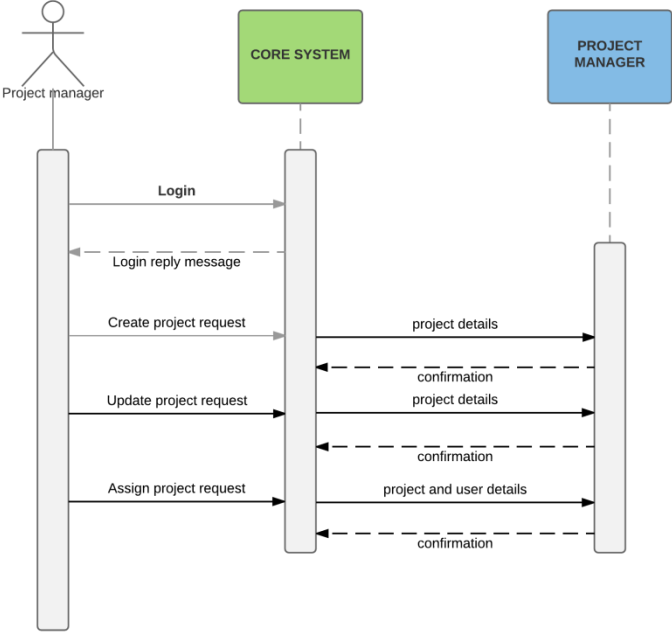
Figure 4.4 Sequence Diagram

Figure 4.4 depicts how the system users interact with the system showing to and fro messages within the system. It also shows how the major system entities influence and interact with each other to derive data.
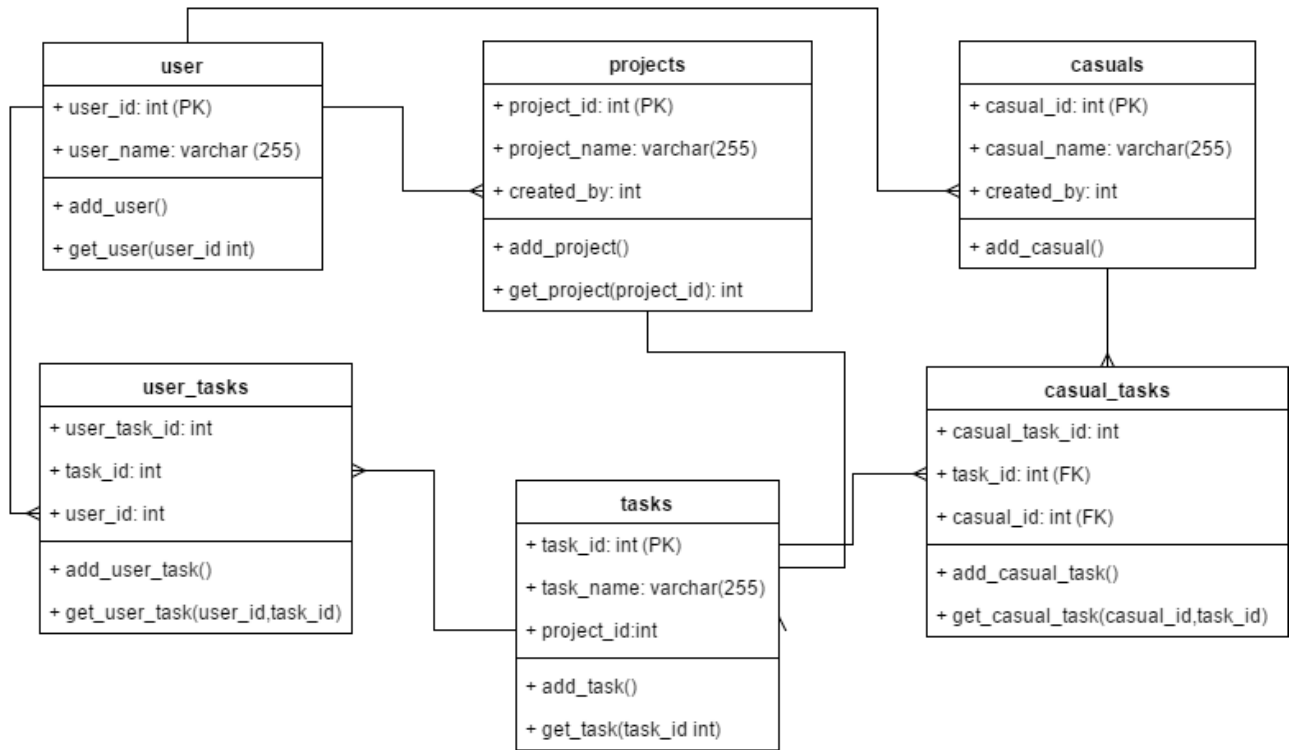
4.6 Database Design

4.6.1 Entity Relationship Diagrams

Figure 4.5 Entity Relationship Diagram

The figure 4.5 illustrates the entity relationship diagrams show a conceptual view of the system entities and their relationship. It also shows the required entities data fields.

4.6.2 Database Schema

The database schema depicts the database tables their data columns, data type and descriptions.

Table 4.8 Users Table

Table 4.8 shows user table column name, data types and index.

Column name	Data Type	Index
user_id	int(100)	PK
first_name	Varchar(30)	
last_name	Varchar(30)	

phone_number	Varchar(30)	
Email	Varchar(100)	
Username	Varchar(30)	
Password	Varchar(30)	
user_status	int(11)	

Table 4.9 Projects Table

Table 4.9 shows Projects table column name, data types and index.

Column name	Data Type	Index
project_id	int(100)	PK
project_name	Varchar(30)	
project_donor	Varchar(30)	
project_goal	Varchar(30)	
project_budget	Varchar(100)	
project_status	int(11)	
user_id	int(100)	FK

Table 4.10 Tasks Table

Table 4.10 shows Tasks table column name, data types and index.

Column name	Data Type	Index
task_id	int(100)	PK
task_name	Varchar(30)	
task_period	int(30)	FK
task_is_parent	int(30)	
task_duration	int(100)	
task_status	int(11)	
project_id	int(100)	FK
user_id	int(100)	FK

Table 4.11 Casuals Table

Table 4.11 shows Casuals table column name, data types and index.

Column name	Data Type	Index
casual_id	int(100)	PK
casual_name	Varchar(30)	
casual_gender	int(30)	FK
casual_phone	Varchar (30)	
casual_national_id	int(10)	
user_id	int(100)	FK

4.7 User Interface Flow Diagrams
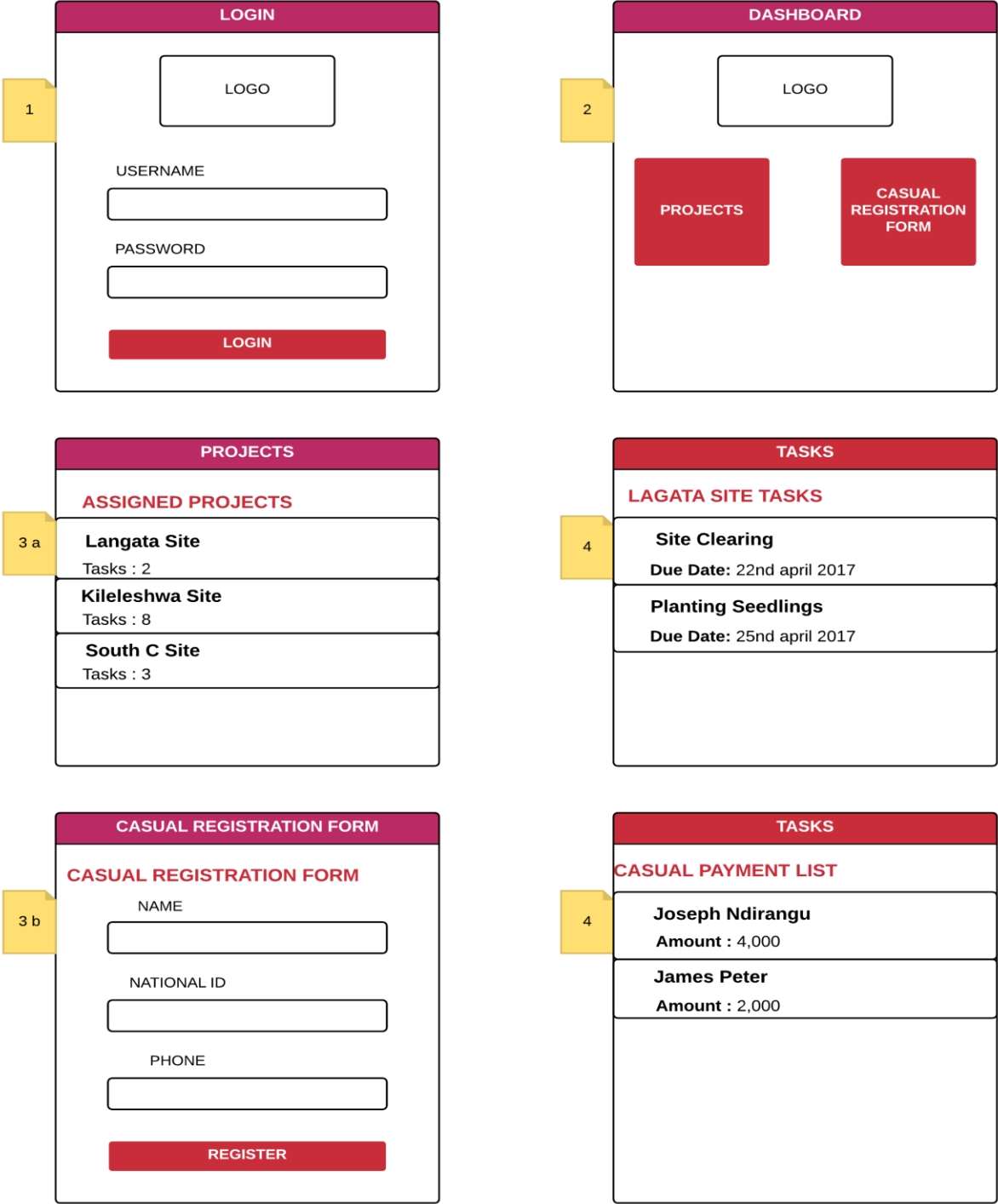
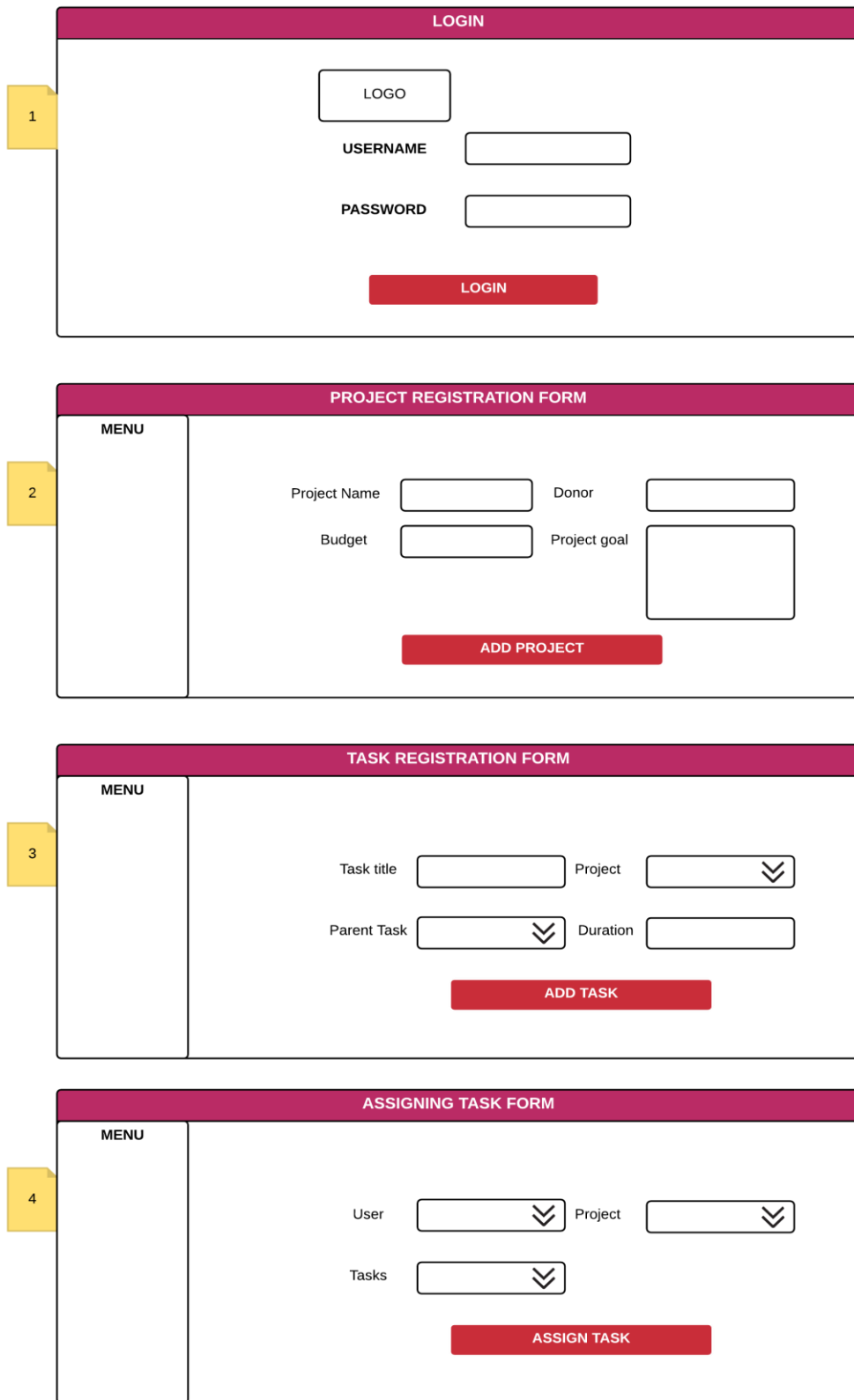**Figure 4.6 Mobile user interface flow diagrams**

Figure 4.7 Web client user interface flow diagrams

Figure 4.5 illustrates the mobile client user interface flow diagrams while figure 4.6 shows the web client user interface flow diagrams. The mobile client focuses on data collection and presentation of assigned tasks. The web client focuses on managing, defining and assigning these tasks and roles to the users of the mobile client.

Chapter 5: System Implementation and Testing

This chapter describes the development and testing of core system modules and other external system related components. The server part of the system is developed using PHP5 web server while the client android part uses native android programming tools. The web client uses HTML5 and JavaScript. Connection to third party Application Programming Interface (API) is done by SOAP web services. Testing was done based on the functional requirements provided in Chapter 4 section 4.2 observing the system designs incorporated for the system.

5.1 Implementation Environment

5.1.1 Mobile Application

The mobile component was developed using native android tools. Android classes were developed based on java inheriting android functions. JSON was used to push data to and from the server application files. The application was compiled and tested using android System Development Kit (SDK). Emulation tests we conducted using geny motion software that allowed for different phone types and screen sizes.

5.1.2 Web Application

The web application was developed using Hypertext Preprocessor (PHP). The PHP5 framework was integrated to because it open source and allows for various server and database connections. The web application was also hosted in an apache HTTP server that can be accessed from a browser.

5.1.3 Database

The database used was MySQL which is SQL based database. The reasons for using this database are it is open source, compatible with the PHP5 framework and ensures password encryption and other security features.

5.1.4 Hardware implementation

The mobile component requires an android device with an API level 15 and higher. The RAM of 512mb and internal storage memory of 100mb to install the application while the web client can be accessed through a browser computer of RAM 2GB or higher.

5.2 Implementation Details

The android mobile application is optimized for API Level 15 and higher versions after that. On installation the application requires permission to access the camera, INTERNET, phone location and read local storage information.

The procedure involved allows the supervisor using the mobile application to:

a) Login to have access to the system and the data sent to him by the project manager based on a specific time period

b) Register new casual labourers from the field recruited in the casual job provided by the organization

c) Conduct the daily project duty rota of the casuals available and work done to estimate the percentage of work done and the amount of money owed

5.3 System Components

5.3.1 Mobile Application Components

The mobile application components are used by the project supervisors to input project and task data in the field. The projects manager can then verify the tasks conducted and confirm the quality of work.

Some of the major mobile application components are:

Splash screen

Figure 5.1 shows the splash screen that is displayed on every launch of the mobile system application. It contains the logo of the organization and the name of application.

| **Figure 5.1 Splash Screen** | **Figure 5.2 Login After Splash screen** |

Figure 5.2 shows the login screen allows the project supervisor to access the system. Once their username and password are determined to be correct he can access a list of services from the dashboard.

Main menu

Figure 5.3 shows the main menu contains a list of services that can be accessed by the system. These lists of services are based on the project and task chosen. They involve registering a new casual labourer, conducting the duty rota and viewing historical information.

Figure 5.3 The main menu   **Figure 5. 4 The assigned Projects**

Figure 5.4 shows the page allowing the project supervisor to see the projects assigned to them. These projects are inserted by the project managers.

Assigned Tasks

Figure 5.5 shows the allowed tasks per project supervisor. To see these tasks one has to choose a project assigned to them. These tasks are inserted by the project managers.

| **Figure 5. 5 Assigned Project Tasks** | **Figure 5. 6 Casual labourer Registration** |
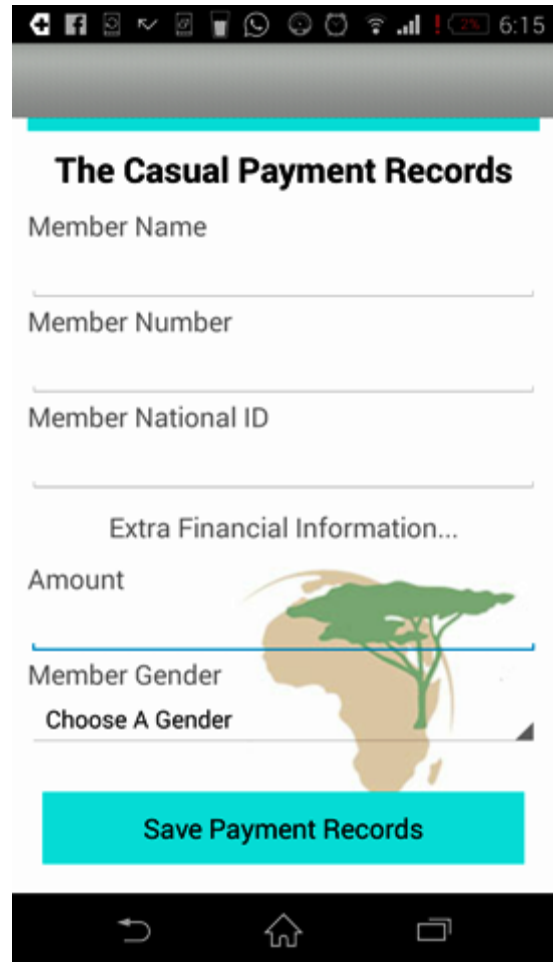
Figure 5.6 shows the necessary information to be saved to identify a casual labourer into the system.

Adding Duty Rota

This allows the project supervisor to insert information based on a project or a task based on a national ID number. Once recorded it means that the casual labourer was one of the members who performed the task given and should be paid for the day based on task description.
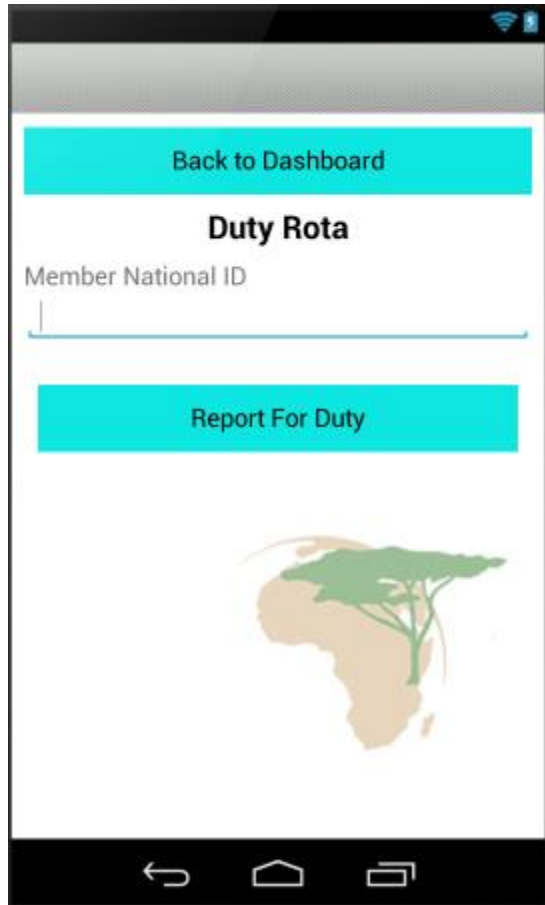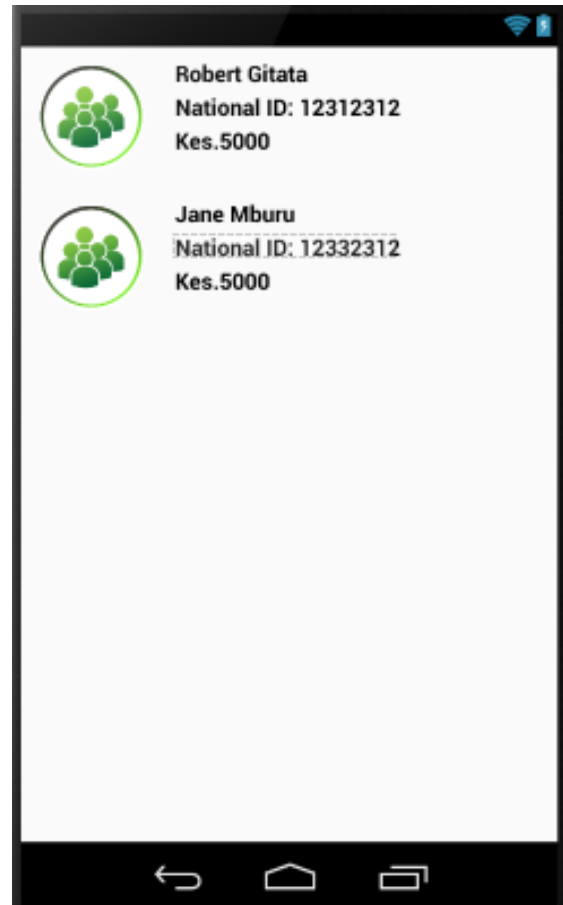
Figure 5.7 Duty Rota   **Figure 5.8 Final Cost Balances**

Figure 5.7 shows how the duty rota is to be performed. While Figure 5.8 shows final cost balances

5.3.2 Web Application Components

The web application functions display the android mobile data inputted and analyses this information to generate reports. The historical information stored can be accessed and used for any purposes deemed necessary.

The main components of the web application are:

Administrator Login

This allows the administrator to login to access the system.
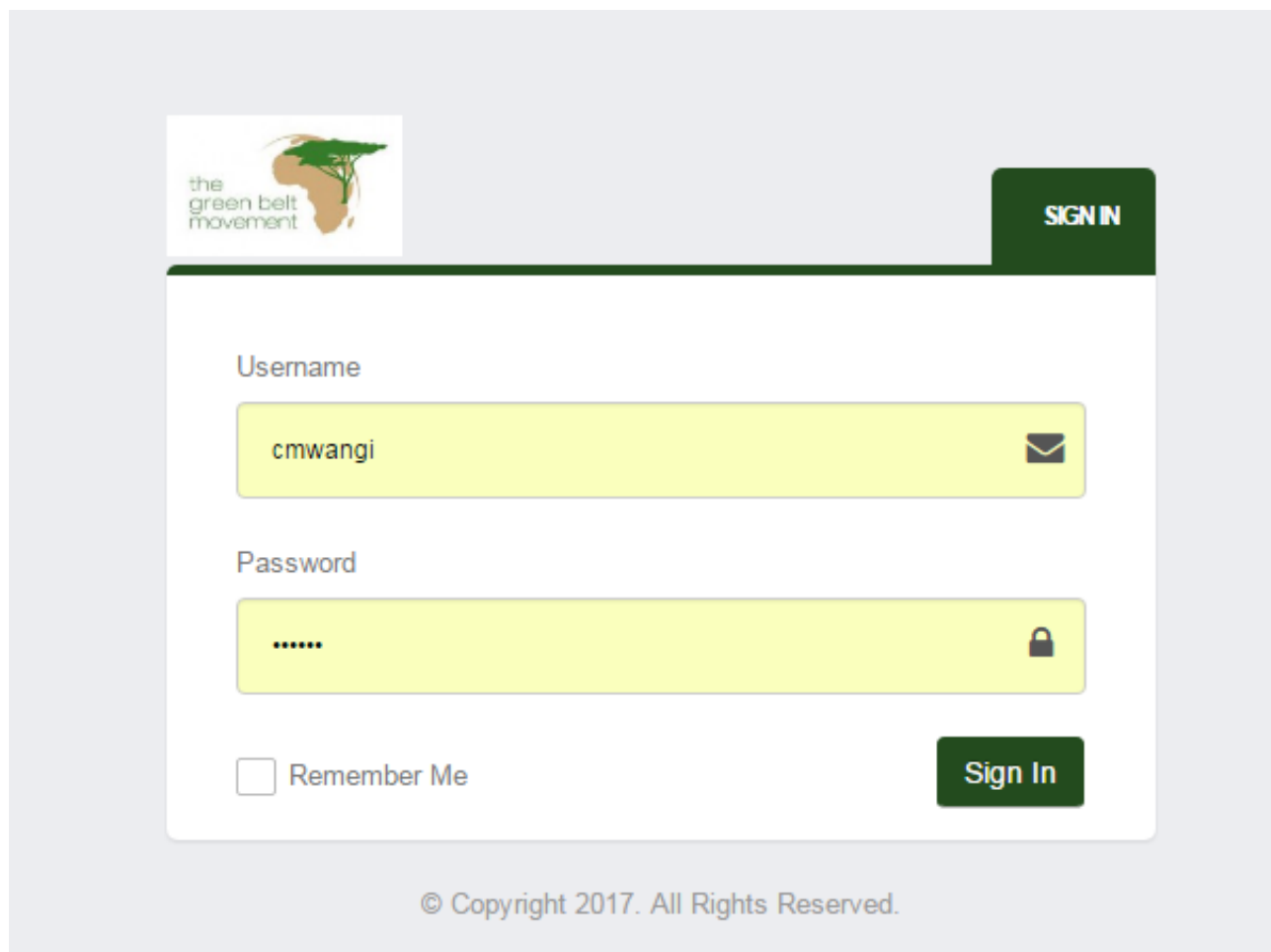
Figure 5.9 The web authentication page for project managers

Figure 5.9 shows the administrator login. Once accepted the administrator can access the system services provided.

User Management

Figure 5.10 shows user management feature which allows for the administrator to add, edit or view users within the system. These users are added based on a specific role. The users have auto-generated passwords that they can use to login into the system. The user management module allows for resetting of passwords, activation and deactivation of user accounts.

Figure 5.10 The user management and user profile roles project for administrator

Projects Management

The project management allow for the projects and the specific tasks to be added into the system.

Figure 5.11 The project manager dashboard for project manager

Figure 5.11 shows how these projects are linked to donor information and timelines and cost schedules. Once the project manager sets these tasks as complete they can be sent to finance manager.

Financial Managements

.

Figure 5.12 financial management module for the finance manager

Figure 5.12 shows the financial management module. The finance manager is able to access all complete financial casual labour calculations based on the total sum calculate for the task conducted. The financial manger then pays the casuals by clicking the pay casual button using mobile money based on the tasks conducted

Reports Manager

This module contains reports relevant to the management for decision making and financier future planning. The reports involved are:

a) Figure 5.13 shows Casual operation reports: the best performing casuals based on quality of work and the project manager rating of work

b) Figure 5.14 shows overall project reports: the number of males and females performing a specific task in a project

c) Figure 5.15 shows casual payment reports: the best performing project manager or project supervisor based on time and costs incurred

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E-mail: gbm@greenbelthmovement.org.

INTERGRATED COMMUNITY BASED NATURAL RESOURCE MANAGEMENT IN CHANIA WATERSHED OF ABERDARE ECOSYSTEM
SUMMARY REPORT

Date/Year :		2017-04-11	
No of watersheds covered by the projects:		1	
No of GBM Community Groups:		118	
No of Members:	Male :		1430
	Female :		1204
No of community meetings conducted in the community:		0	
Total Number of seedlings in GBM TN groups:	Ready :		0
	Not Ready :		0
No of ready seedlings in GBM project Central Tree Nursery:	Indigenous :		0
	Exotics :		0
Total No of ready seedlings in the GBM Central Tree Nurseries:		0	
No of tree planted:		0	

Figure 5.13 Casual labourer reports

Projects								Export
#	Project Title	Location	Project Donor	Project Dates	Grant County	Created By	Status	
1	Promotion of sustainable land management Practices in Upper Tana (Gura-Sagana sub watersheds) in Ken	Nyeri	The Nature conservancy	2015-10-01 - 2017-09-30	Kirinyaga Constituency	Teresa	Active	
2	Intergrated community based Natural resource Management in chania watershed of Aberdare Ecosystem	Kiambu	CA Idosuez	2015-02-01 - 2016-03-31	Kiambu	Teresa	Active	
3	Effective Resource Management in Chania Watershed of Aberdare Ecosystem	Nyandarua	The Jonathan Aurbach memmorial fund	2015-04-01 - 2016-03-31	Kiambu	Teresa	Active	
4	Catalyzing Forest and landscape Rehabilitation for climate Resilience and Biodiversity conservation	Kipipiri	BMU	2014-04-01 - 2016-03-31	Nyandarua	Teresa	Active	
5	Sustainable peace cohesion and intergration through Decentralized governance in Nakuru and Baringo counties in Rift valley region	Nakuru and Baringo	Folke Benadotte Acadamy through Green Cross Sweden	2015-09-01 - 2016-08-31	Nakuru	Teresa	Active	
6	Training Rural Women for Environmental Economic and livelihood Empowerment in the great lake region	Upper Nile, Lake victoria Basin and Omo-turkana	MacArthur Foundation	2013-07-01 - 2016-08-31	Nakuru	Teresa	Active	
7	Sound chemical management mainstreaming and UPOPs Reduction in Kenya	Nakuru, Nairobi, Kisumu and Mombasa	UNDP/GEF	2016-05-01 - 2021-06-30	Nakuru	Teresa	Active	
8	Groups in Meru county	Meru	N/A	2016-12-01 - 2016-12-01	Meru county	Teresa	Active	

Figure 5.14 The Overall project reports

CASUAL PAYMENT FORM

Green Belt Movement
P.o Box 67545 - 00200 Nairobi, Kenya 0 Nairobi
E-mail: gbm@greenbelthmovement.org
Tel : +254(0)20 3860157/0721 342696
Kilimani

Grant Name: UNDP/GEF
Activity Title: ggg
Grant County: Nakuru

Payment Date: 19th Mar 2017
Reason for paying: cvv

#	Name	Gender	National Id	Phone Number	Amount Paid
1	vvvb	Male	555	888	888

Figure 5.15 The Casual Payment Form Report

5.4 System Testing

This section focuses on the various tests performed on the mobile and web application. These tests were in relation to the functional and non-functional requirements of the system.

5.4.1 Functional Testing

The functional tests were designed to test the success or failure of the system's implementation of designs and logical user requirements. Each test in the table below has the input variables the expected output and the success result or fail result.

Table 5.1 Test Identifiers

Test Identifier: Login

ID GIVEN	TEST CASE	USER INPUT	PASS CRITERION	FAIL CRITERION
CRL1	Authentication (No username, no password)	Username =" " Password=" "		"Invalid login credentials"

ID GIVEN	TEST CASE	USER INPUT	PASS CRITERION	FAIL CRITERION
CRL2	Authentication(Correct username, Wrong password)	Username= g@gmail.com Password="ewew"		"Invalid Login credentials"
CRL3	Authentication(Correct	Username= g@gmail.com Password="!B768345#"	"Welcome to GBM George"-	

Test Identifier: Project Registration

ID GIVEN	TEST CASE	USER INPUT	PASS CRITERION	FAIL CRITERION
CRPR1	Project Registration (Missing details)	Project Name="", Project Financier="", Project		"Please enter all details"
CRPR2	Project Registration (Missing name)	Project Name="", Project Financier="Mo", Project Objective="Obj", Project		"Please enter the Project Name"
CRPR3	Project Registration (Missing Financier)	Project Name=" Langata Site", Project Financier="", Project Objective="Obj",		"Please enter the Financier"

ID GIVEN	TEST CASE	USER INPUT	PASS CRITERION	FAIL CRITERION
CRPR4	Project Registration (Missing Location)	Project Name=" Langata Site", Project Financier="Mo", Project Objective="Obj",		"Please enter the Location"
CRPR5	Project Registration (Correct New Project Details)	Project Name=" Langata Site", Project Financier="Mo", Project Objective="Obj",	"New Project Langata site was successfully created"	

Test Identifier: Project Task Registration

ID GIVEN	TEST CASE	USER INPUT	PASS CRITERION	FAIL CRITERION
CRPT1	Project Task Registration (Missing details)	Task Name="", Task Duration="", Period ="", Cost="", Casual		"Please enter all details"

CRPT2	Project Task Registration (Missing name)	Task Name="", Task Duration ="3", Period ="Per Day", Cost="500",		"Please enter the Task Name"
CRPT3	Project Task Registration (Missing Duration)	Task Name="Phase One", Task Duration="", Period ="Per Day",		"Please enter the Duration"
CRPT4	Project Task Registration (Missing Period)	Task Name="Phase One", Task Duration="3 ", Period ="", Cost="500",		"Please enter the Period"
CRPT5	Project Task Registration (Missing Casual Number)	Task Name="Phase One", Task Duration="3 ", Period ="Per Day", Cost="500",		"Please enter the number of casuals required"

CRPT6	Project Task Registration (Missing Casual Number)	Task Name="Phase One", Task Duration="3", Period ="Per Day", Cost="500",	"New Project Task was successfully created"	

Test Identifier: Casual Registration

ID GIVEN	TEST CASE	USER INPUT	PASS CRITERION	FAIL CRITERION
CRPR 1	Casual Registration (Missing	Full Name="", Phone Number="", Gender=""		"Please enter all details"
CRPR 2	Project Registration (Missing	Full Name="", Phone="07221142 34",		"Please enter your full names"
CRPR 3	Casual Registration (Missing	Full Name="jane om", Phone="07221142		"Please enter a valid gender"
CRCR 1	Casual Registration (Missing	Full Name="", Phone Number="", Gender=""		"Please enter all details"
CRCR 5	Casual Registration (Missing	Full Name="", Phone="07221142 34",		"Please enter your full names"
CRPR 6	Casual Registration (Missing	Full Name="jane om", Phone="07221142		"Please enter a valid gender"

CRPR 7	Casual Registration (Missing	Full Name="", Phone Number="", Gender=""		"Please enter all details"
CRPR 8	Casual Registration (Missing	Full Name="", Phone="07221142 34",		"Please enter your full names"
CRCR 1	Casual Registration (Missing	Full Name="jane om", Phone="07221142		"Please enter a valid gender"
CRCR 2	Casual Registration (Missing	Full Name="", Phone Number="", Gender=""		"Please enter all details"
CRCR 3	Casual Registration (Missing name)	Full Name="", Phone="0722114234", Gender="Male"		"Please enter your full names"
CRCR 4	Casual Registration (Missing	Full Name="jane om", Phone="0722114234", Gender=""		"Please enter a valid gender"

Test Identifier: Recording Duty Rota

ID1	ID Duty Rota (Missing details)	National ID=""		"Please the National ID"
ID2	ID Duty Rota (New National ID)	National ID="12312312"		"Register this Casual Labourer"
ID3	ID Duty Rota (National ID that exists)	National ID="23234342"		"Casual Labourer Attendance recorded"

5.4.2 CRUD Matrix

Table 5. 2 CRUD Matrix

CRUD TEST ACTORS INVOLVED	CREATE	READ	UPDATE	DELETE
MANAGERS	YES	YES	YES	NO
SUPERVISORS	YES	YES	YES	NO
CASUALS	YES	YES	YES	NO
SYSTEM ADMINISTRATOR	YES	YES	YES	NO

The table 5.2 shows the CRUD matrix of actors involved.

5.5 Compatibility Testing

The compatibility testing was conducted to ensure that the mobile and web application is compatible with versions currently available. The web application was tested against different browsers while the mobile application against current android platforms.

Android Compatibility test

Table 5.3 Android Compatibility Test Table

ANDROID VERSION	TEST RESULT
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 18 (4.3)	Yes
Android 19 (4.4)	Yes
Android 20 (4.4W)	Yes
Android 21 (5.0)	Yes
Android 22 (5.1)	Yes

Web Compatibility Test

Table 5.4: Web Compatibility Test Table

WEB BROWSER	TEST RESULTS
INTERNET Explorer (versions 4 and above)	Yes
Firefox (version 8.0 and above)	Yes
Chrome (All versions)	Yes

5.6 Usability Testing

Usability testing involves the use of end users testing the products with the aim of understanding the final product better. Using an online questionnaire in appendix section B, the usability testing got 20 respondents. These respondents, from Nairobi focussed on giving appropriate feedback based on:

a) Functionality Tests: A functionality test was conducted by the users of the application. 75% of the test respondents both the mobile and web application to be functional and were satisfied. 25% of the respondents wanted minor changes in logic flow of the system and additional reports.

Is the system safisfying GBM functional requirements and Logical flow? If No, kindly suggest improvements

■ Yes
■ No
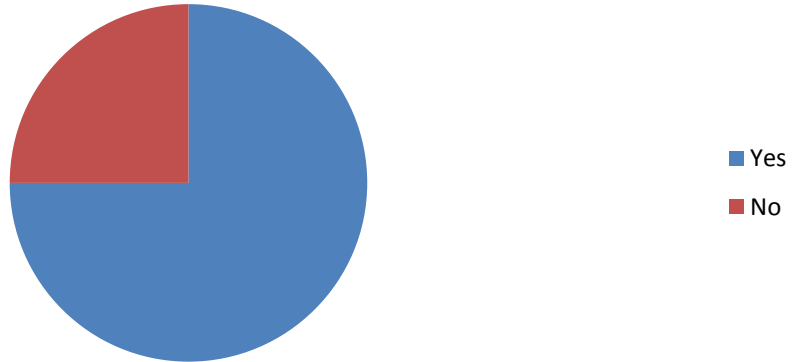
b) User friendly Test: The test encompassed the flow of the user interfaces, the output messages received and how they were understood by the user. 75% considered the system to be user friendly and gave it a rating of 4 and above. These users conducted application processes without any help or assistance. 25% had difficulty in understanding the message responses from the system.

Rate the User Friendly ness of the application? (a rate of 5 being the most user friendly)

■ Rate: 5
■ Rate: 4
■ Rate: 3
■ Rate: 2
■ Rate: 1
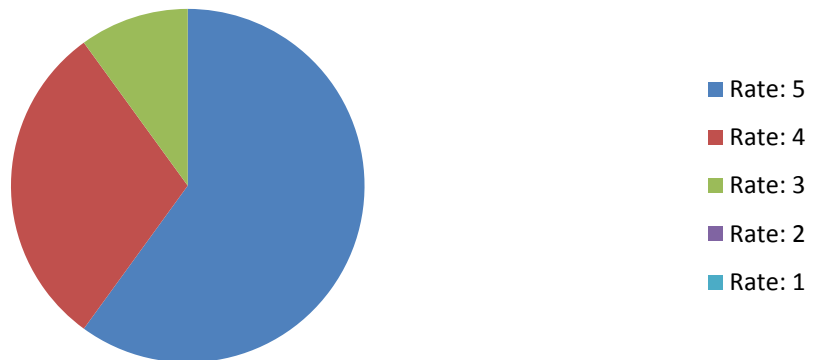
c) Acceptance Test: This test confirms the overall acceptance of the system. 83% of test respondents gave the system an acceptance test rate of 4 and above. They felt the system is acceptable and can be launched at the current state. 17% rejected the system and felt it needed more functionality before being launched.

Overal System Acceptance for training and role out in the field

Rate: 1
Rate: 2
Rate: 3
Rate: 4
Rate: 5
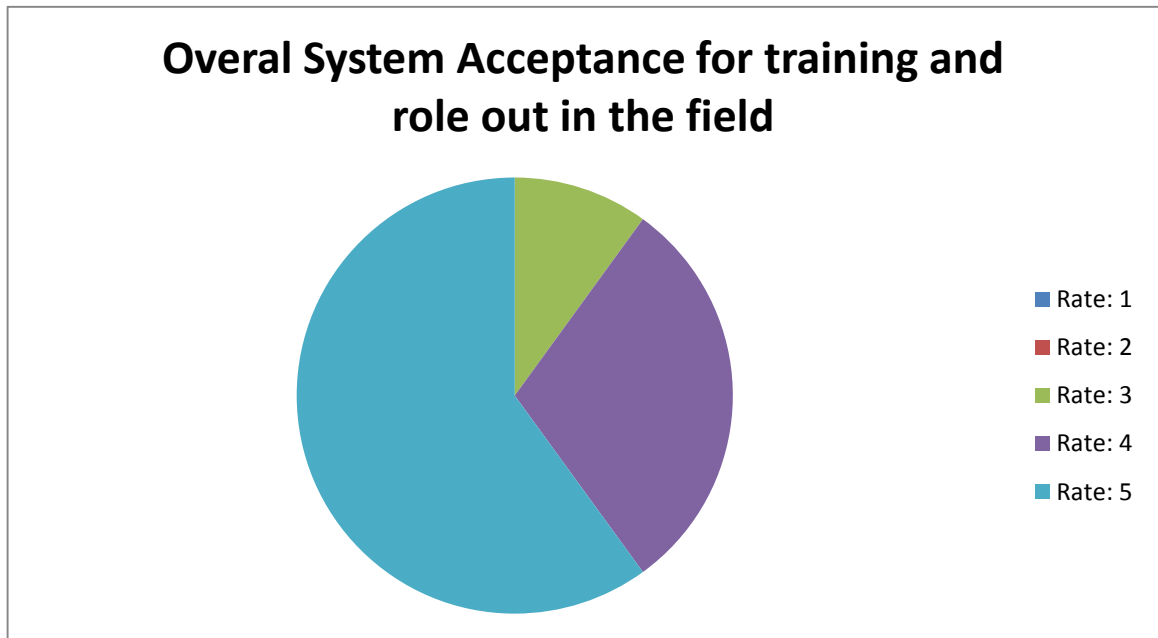
5.7 Validation

The study validation was conducted to ensure that the system satisfied the objectives and concerns of the requirements raised. 10 respondents in different departments including finance, project management and supervisors used a Google Forms online questionnaire attached in Appendix Chapter section B validate the study. The summary of their answers were as follows:

a) All respondents who participated in the validation and testing were still part of the users in the requirements gathering phase.

Yes ⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀ (100%)

No ⠀— 0 (0%)

b) 75% of the respondents felt the system captured most of the functionality in the coordination and payment practices within GBM. 25% required more functionality and reports in the system

1 ⠀— 0 (0%)

2 ⠀— 0 (0%)

3 ⠀— 0 (0%)

4 ⠀⠀⠀⠀⠀⠀⠀⠀ — (25%)

5 ⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀ . (75%)
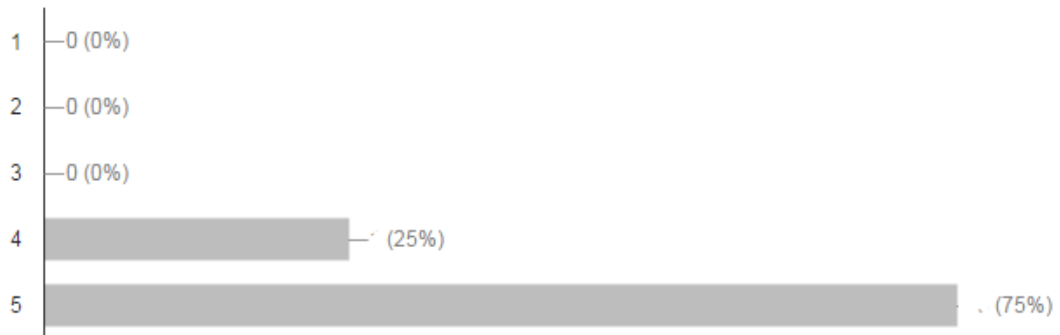
c) The system was designed and implemented was found to be user friendly by 75% of the respondents in the study. 25% felt more reports and functionality should be added to the prototype

1 ⠀— 0 (0%)

2 ⠀— 0 (0%)

3 ⠀— 0 (0%)

4 ⠀⠀⠀⠀⠀⠀⠀⠀ — (25%)

5 ⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀⠀ . (75%)
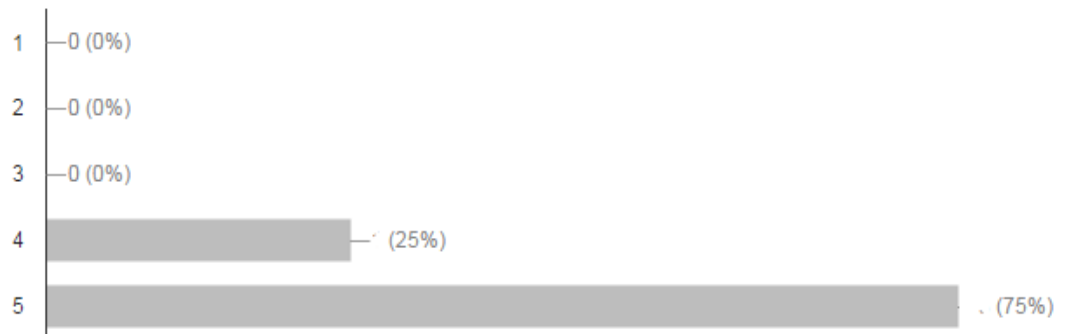
d) 80% of the respondents in the study agreed that the prototype created was acceptable and could be launched to be used in the field while other 20% disapproved with minor corrections.

1 —0 (0%)

2 —0 (0%)

3 —0 (0%)

4 —1 (20%)

5 -. (80%)

Chapter 6: Discussion of Results

6.1 Introduction

This research was conducted with the aim of identifying challenges in the payment and coordination of casual labourers. Once these challenges were derived we needed to focus on any current technologies used in the management, coordination and payment of casual labourers to see if they can be a solution to the problem identified in the study. Some of the existing applications researched on tackled some of the challenges identified but not all. Some of the other applications were only web based and require costly online payments to maintain and purchase. As a solution to the problem this research designed developed and validated a mobile and web integrated solution to tackle these challenges. This chapter discusses the research findings and achievement based on research objectives and literature review as well as the advantages and limitations of the developed application

6.2 Finding and Achievements

A review of the literature indicates that there are various forms of employment. Casual employment contracts are contracts based on a specific time limit or a project or a task work done. These contracts are seasonal but intermittent or regular. The need for a casual management system is justified because 52.4 % of Africa's employment contracts in 2015 are casual employment contracts. Kenya specifically faced a growth improvement of 5.6% to 13.6% for the casual labour contracts. In Europe and Most parts of The United States of America only 30% of the contracts are casual contracts. In developing countries however, casual labour is the most common form of labour and hence highest in Africa. In Uganda, Eastern Africa, in 2004 to 2013 there was a rise to 84% of the labour workforce being self employed, 72% being casual labourers.

There are existing technologies that can be used in the management of casual labourers. Some of these technologies however only encompass casual management related features and lack the payment aspects or vice versa. Other technologies ate web based and can only be used by a laptop or personal computer. The union of these technologies could allow GBM to improve on service delivery. According to Communication Authority of Kenya mobile penetration is up to 88% by 2015 with 72.4% of these having access to the

INTERNET and other telephony services. A USSD application for the data collection was found to be easily accessible to all but very expensive. A web application and android mobile application were designed developed under agile methodology to allow for iterative user processes and changes.

The application went through functional and non-functional test based on the user requirements. In user testing there was a cumulate result of 80% for user interface and aesthetics 75% for functionality tests, and 80% in the acceptability tests.

6.3 Review of Research Objectives in Relation to Mobile Applications

The research objective acted the major guideline to the design, development and validation of the mobile application.

The first objective was to identify the data required for coordination and payment of casual labourers. The study explained the various forms of employment focusing on casual employment. It explained the nature of casual employment as labour brokers hence the challenges in casual labour management and payment. Using requirement system analysis of the data collected from both primary and secondary sources of information the research indicated the key element in coordination and payment of casual labourers. The study discovered that most of casual information has to be collected in the field hence issue of portability and bulkiness were factors to be considered. The data collected needed to be group based on projects and tasks. Payment of these casual required initial registration of the casuals and duty rota processing.

The second objective was to review research gaps with the existing casual labour management and payment solutions. The study identified the some applications that exist currently and could be used for casual labour management. However, most of these applications were found lacking or limited versus the client expectations. The applications either could manage casual labourer but had no integrated payment options while others were financial oriented system or had no aspects of casual labour management or project management. Other applications were personal computer applications which were not portable hence could not be used in the field.

The third objective was to design, develop and test a working prototype that can be used in data management and payment of casual labourer. The application designed had to allow real time data from the field as well as be integrated to external application programming interfaces to enable communication via messages and mobile money payments to the casual labourers. Service oriented architecture was found best suited. A web and mobile integrated solution was developed based on design diagrams and user functional requirements stated by respondents. The web application used Hypertext Preprocessor (PHP) framework while the mobile application used the android operating system. The database used is MySQL database.

The final objective was to validate the solution meets the criteria of a casual labour management and payment solution. The prototype developed was handed for usability testing, functional and non functional testing and compatibility testing. The prototype got an overall mark of 80% for user acceptance.

6.4 Review of the Application in Relation to Current Casual Labourer Management and Payment Solutions

6.4.1 Advantages of the Application

Some of the advantages of the application developed are:

a) Access of any historical information based on projects and tasks is much more efficient as opposed to searching in file rooms for different files

b) Real time historical and current information is accessible globally to the management

c) Bulk mobile money payments feature allows for safe, fast and easier payment of casual labourers as opposed to carrying cash

d) Reduced bulkiness in the data collection and management needs of project supervisors in the field

e) The system enabled constant communication with casual labourer by the use of messaging text especially when recruiting a new site.

f) The instantaneous business intelligence reports assist the top level management in better service delivery and decision making

g) The application data captured is integral with specific time and location attributes.

6.4.2 Limitations of the Application

There are some limitations to the application developed. These are:

a) The mobile application was developed in Android operating system and therefore focuses on android platforms.

b) The applications used INTERNET connectivity to push and pull data from the server. The mobile application can use mobile data in the field which can be affected by lack of service.

c) The applications was designed and developed based on the information provided by the respondents and it assumes this information is not biased

Chapter 7: Conclusions, Recommendations and Future Work

7.1 Conclusion

Information about casual labourer management in the coordination and payment of casual labourers was reviewed. From the review and analysis, this dissertation highlighted common major problems in the coordination and payments of casual labourers as well as transfer of data between the planting sites and country head quarters using the Green Belt Movement as a case study.

The solution to this problem was a system architecture that could handle real time transfer of data to and from the planting sites. A mobile application was also developed to help in the data management and coordination needs of casual labourer within the planting site. This helped in reducing the bulkiness of data collection and highly optimized the data that was collected. A web application was also integrated to create projects, tasks and handle user management. This increased organization and better flow of historical information. Functional and operational reports were also generated based on the data collected from the field. This made decision making easier for the top level management and project financiers. The system architecture was also connected to 3rd party application programming interfaces that allowed payments via payment gateways and communication of casual labourers via SMS gateways. This assisted in safer, faster and easier payments to casual labourers.

7.2 Recommendations

Due to the unique aspect of casual labour being an independent and diverse form of labour, most countries worldwide have come to accept casual labourers as labour brokers. Recommendations to the other stakeholders, whether in construction, agriculture or any other casual labour intensive fields is they should focus on safer and easier means for the coordination and payment of casual labourers.

7.3 Future Work

The researcher noticed there are some limitations and weaknesses for the proposed solution to the problem faced in the study these are:

a) The system should be developed in other mobile platforms to enable user flexibility and availability

b) More functionality on the web to handle other project or task costs apart from just casual labour management costs

c) Scheduled accounting reports to be generated by the web application

d) Research on how project managers can advise casual labourer on better duty performance and how to improve their skills

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Appendices

Appendix A: Requirement Analysis Questionnaire

Survey Questionnaire

This is a questionnaire has five sections

1. **Name** *
   First and last name

   _____

2. **Email**

   _____

3. **Phone number**

   _____

Definition of Projects and Tasks

This section focuses on what project data is collected and systems offering this service

4. **Which tool do you use to manage your projects?** *
   Check all that apply.

   ☐ I use manual system only

   ☐ I use a automated system

5. **Which tool do you use to manage your tasks?** *
   Check all that apply.

   ☐ I use manual system only

   ☐ I use an automated system

6. **If automated, which tool do you use? (if other kindly mention it)**

Mark only one oval.

    ◯ Microsoft Excel

    ◯ Microsoft Word

    ◯ Google Forms

    ◯ GBM Customised Software

    ◯ Other

7. **How do the various managers access their data or reports**

Mark only one oval.

    ◯ Automatic real time data

    ◯ Manually-generated reports

8. **Is the tool connected to field data collection or automatic payment?**

Mark only one oval.

    ◯ Yes

    ◯ No

Field Data Collection Section

This section handles field data collection and the technologies used

9. **What current device are you using to collect data?**

Check all that apply.

    ☐ Manual (pen and paper)

    ☐ Digital light pen

    ☐ Mobile or Tablet device

    ☐ Laptop or personal compute

10. **If device was chosen, Does this device contain a customised software for collection of casual data?**
   Mark only one oval.

   ◯ Yes

   ◯ No

11. **If device was chosen, is the data collected the final presented data or it requires some analysis using another software?**
   Mark only one oval.

   ◯ Yes it does

   ◯ No its final data

12. **Does this device or manual process allow for easy portability and flexibility in the field**
   Mark only one oval.

   ◯ Yes

   ◯ No

Payment Section
This focuses on payment of casual labourers

13. **On average what is the normal payment period to pay a casual labourer?**
   Check all that apply.

   ☐ Per day

   ☐ Per Week

   ☐ Per Month

   ☐ Other: _____

17. **Suggest a practical, safer and more reliable substitute to the payment method suggested above**
   Mark only one oval.

   ◯ cash

   ◯ bank deposit

   ◯ mobile money

   ◯ cheque

   ◯ credit card

Reports Section

18. **Apart from gender reports, project casual data reports and financial reports name any other reports you would like in the system**

   _____

   _____

   _____

   _____

   _____

14. **What is the most common payment method?**

Mark only one oval.

⬭ cash

⬭ bank deposit

⬭ mobile money

⬭ cheque

⬭ credit card

15. **Would you term the payment method suggested above as safe? Give a rating 1(not safe) -5 (very safe)**

Mark only one oval.

⬭ 1

⬭ 2

⬭ 3

⬭ 4

⬭ 5

16. **Would you term the payment method suggested above as reliable? Give a rating 1(not reliable) -5 (very reliable)**

Mark only one oval.

⬭ 1

⬭ 2

⬭ 3

⬭ 4

⬭ 5

Prototype Satisfaction

Kindly rate the prototype developed based on:

* Required

User Interface flows and transitions to next interface? *

	1	2	3	4	5	
Bad Flow	○	○	○	○	○	Very good Flow

Kindly rate the user interface aesthetics (colors and logos and icons)? *

	1	2	3	4	5	
Bad	○	○	○	○	○	Good

Kindly rate the overall system functionality (project and task definition, casual registration, casual disbursement of payment)? *

	1	2	3	4	5	
Bad	○	○	○	○	○	Good

Kindly rate the overall system acceptance? *

	1	2	3	4	5	
This system can not be launched	○	○	○	○	○	This system can be launched

Any other system comments?

Your answer

SUBMIT

Never submit passwords through Google Forms.
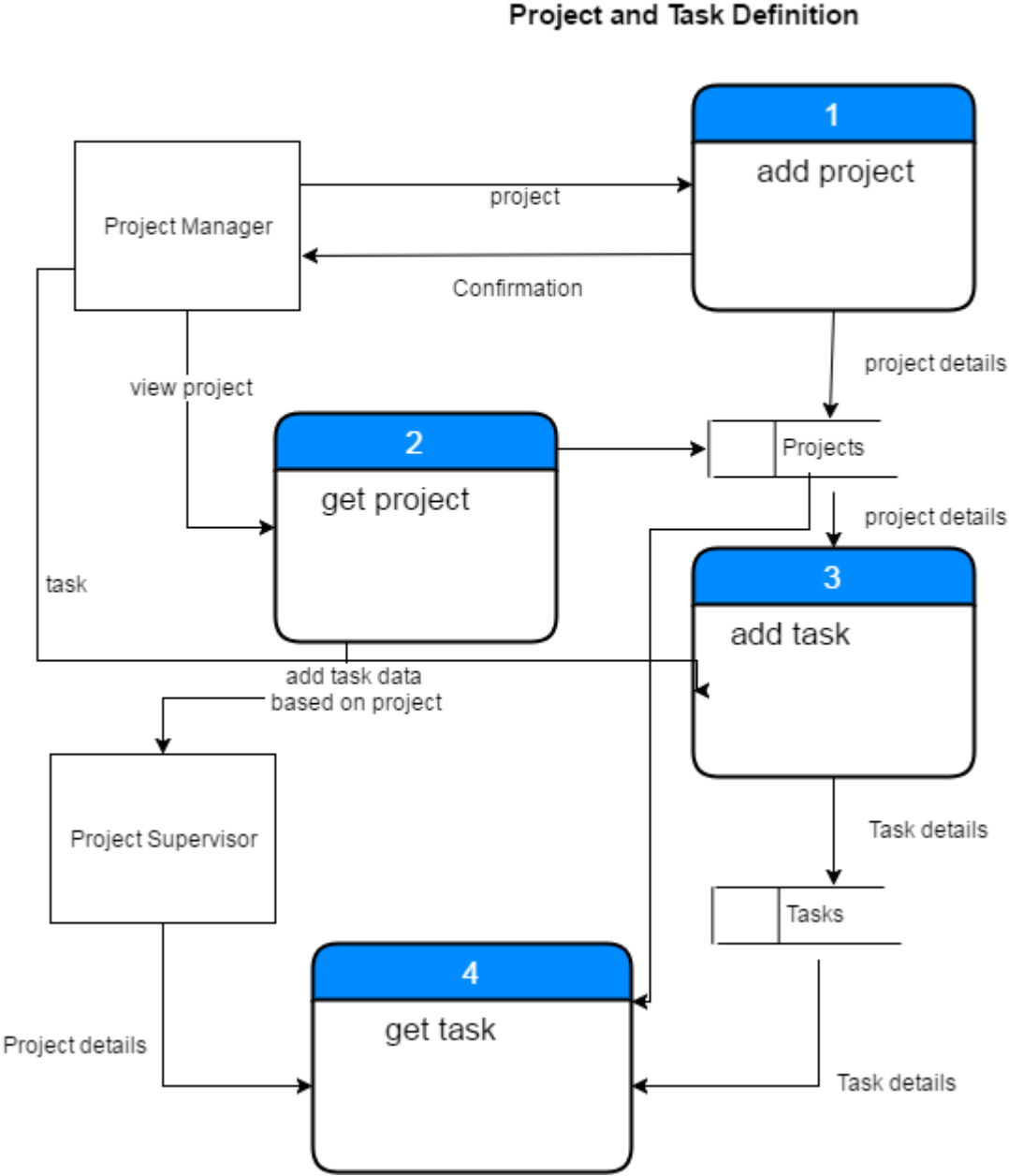
Project and Task Definition

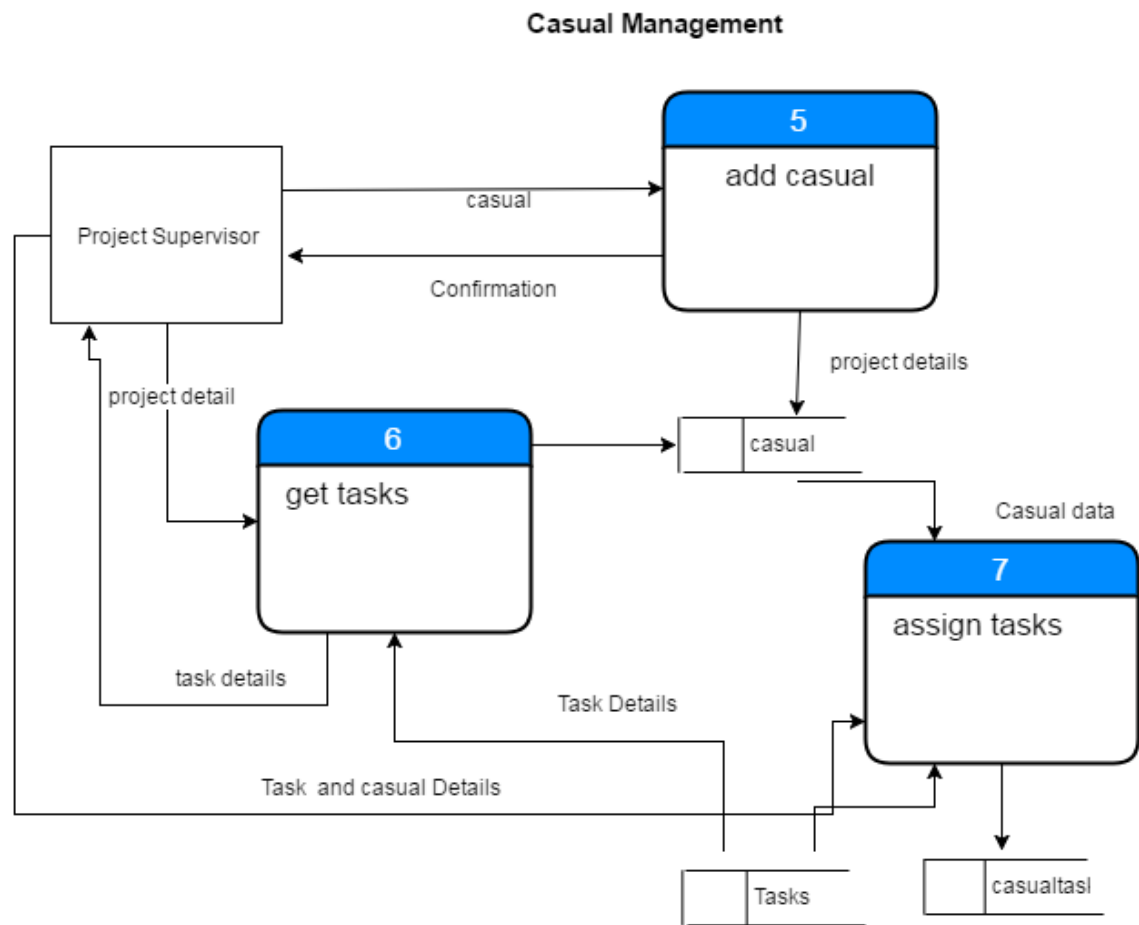**Figure F.1: project definition**

Figure F.2 casual management

Figure f.1 and f.2 show project definition and casual management DFD diagrams. They explain how projects and tasks are added and viewed as well as how casual data is added and assigned to a task.

Appendix D: Functional Testing

ID GIVEN	TEST CASE	USER INPUT	PASS CRITERION	FAIL CRITERION	CLIENT SIGNATURE
CRL1	Authentication (No username, no password)	Username =" " Password=" "		"Invalid login credentials "	
CRL2	Authentication(Correct username, Wrong password)	Username= G@GMAIL.COM Password="ewew"		"Invalid Login credentials "	
CRL3	Authentication(Correct	Username= G@GMAIL.COM Password="!B768345#"	"Welcome to GBM George"-		
CRPR1	Project Registration (Missing details)	Project Name="", Project Financier="", Project Objective="", Project Location=""		"Please enter all details"	
CRPR2	Project Registration (Missing name)	Project Name="", Project Financier="Mo", Project Objective="Obj", Project Location=" Meru"		"Please enter the Project Name"	
CRPR3	Project	Project Name=" Langata Site",		"Please enter the Financier"	

	Registration (Missing Financier)	Project Financier="", Project Objective="Obj", Project Location=" Meru"			
CRPR 4	Project Registration (Missing Location)	Project Name=" Langata Site", Project Financier="Mo", Project Objective="Obj", Project Location=""		"Please enter the Location"	
CRPR 5	Project Registration (Correct New Project Details)	Project Name=" Langata Site", Project Financier="Mo", Project Objective="Obj", Project Location="Meru "	"New Project Langata site was successfull y created"		
CRPT 1	Project Task Registration (Missing details)	Task Name="", Task Duration="", Period ="", Cost="", Casual Number=""		"Please enter all details"	
CRPT 2	Project Task Registration (Missing name)	Task Name="", Task Duration ="3", Period ="Per Day", Cost="500",		"Please enter the Task Name"	

		Casual Number="10"			
CRPT 3	Project Task Registration (Missing Duration)	Task Name="Phase One", Task Duration="", Period ="Per Day", Cost="500", Casual Number="10"		"Please enter the Duration"	
CRPT 4	Project Task Registration (Missing Period)	Task Name="Phase One", Task Duration="3 ", Period ="", Cost="500", Casual Number="10"		"Please enter the Period"	
CRPT 5	Project Task Registration (Missing Casual Number)	Task Name="Phase One", Task Duration="3 ", Period ="Per Day", Cost="500", Casual Number=""		"Please enter the number of casuals required"	
CRPT 6	Project Task Registration (Missing Casual Number)	Task Name="Phase One", Task Duration="3 ", Period ="Per Day",	"New Project Task was successfully created"		

		Cost="500", Casual Number="10"			
CRPR 1	Casual Registration (Missing details)	Full Name="", Phone Number="", Gender=""		"Please enter all details"	
CRPR 2	Project Registration (Missing name)	Full Name="", Phone="0722114 234", Gender="Male"		"Please enter your full names"	
CRPR 3	Casual Registration (Missing gender)	Full Name="jane om", Phone="0722114 234", Gender=""		"Please enter a valid gender"	
CRC R1	Casual Registration (Missing details)	Full Name="", Phone Number="", Gender=""		"Please enter all details"	
CRC R5	Casual Registration (Missing name)	Full Name="", Phone="0722114 234", Gender="Male"		"Please enter your full names"	
CRPR 6	Casual Registration (Missing gender)	Full Name="jane om", Phone="0722114 234", Gender=""		"Please enter a valid gender"	
CRPR 7	Casual Registration (Missing details)	Full Name="", Phone Number="", Gender=""		"Please enter all details"	
CRPR 8	Casual Registration (Missing name)	Full Name="", Phone="0722114 234", Gender="Male"		"Please enter your full names"	

CRCR1	Casual Registration (Missing gender)	Full Name="jane om", Phone="0722114234", Gender=""		"Please enter a valid gender"	
CRCR2	Casual Registration (Missing details)	Full Name="", Phone Number="", Gender=""		"Please enter all details"	
CRCR3	Casual Registration (Missing name)	Full Name="", Phone="0722114234", Gender="Male"		"Please enter your full names"	
CRCR4	Casual Registration (Missing gender)	Full Name="jane om", Phone="0722114234", Gender=""		"Please enter a valid gender"	

Appendix E: 3rd party API

i.   Sample PHP Client

```php
<?php

//Disable    caching    of    WSDL
ini_set("soap.wsdl_cache_enabled
", "0");

//Declare System WSDL URL
$SMS_CLIENT                                    =                                new
SoapClient("http://198.12.159.194/casual/api/wsdl/payment_system.ws
dl");

//Provide required parameters
$params=array();
$params["username"]="robert.gichohi@gmail.com";
$params["api_key"]="4XDMSNFLM343434GT2234ER32HFDUR";

$response=$SMS_CLIENT->GetPaymentDetails($params);

print_r($response);

?>
```

Appendix F: Web Client

Figure F.3 Reports

Figure F.4 Setup page

Appendix G: Turn It In Report

turnitin

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