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# **A Mobile Prototype for Payments and Contributions: Case of National Hospital Insurance Fund**

**Stephen Gichohi Njoroge**

**Submitted in partial fulfillment of the requirements for the Degree of  
Master of Science in Mobile Telecommunication and Innovation at  
Strathmore University**



**Faculty of Information Technology  
Strathmore University**

**Nairobi, Kenya**

**June, 2015**

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Stephen Gichohi Njoroge

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## Approval

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## **Abstract**

The availability of M-Pesa payment system has enabled NHIF to increase its revenue collection as a notable success. However, despite the availability of such system, the report done by United States Agency for International Intelligence states that the system is not able to detect information that might have been erroneously entered and also contributions paid are not reflected on members account in a timely manner. Beneficiaries of health facilities would learn that they could not access services because contributions were not reflected on their member accounts. Also, there is lack of transparency on the audited financial statements and reports which is associated with a failure in internal controls around reconciliations. The aim of this research is to develop and test a mobile prototype for payments and contributions that will validate users so as to detect information that might have been erroneously entered by users to enable their contributions to reflect on their member account on timely basis and also to assist NHIF management to have real-time reports on revenue collected to avoid reconciliation problems. A descriptive study method was used and a target population was sampled out using systematic random sampling method and questionnaires were used to collect data. One set of questionnaires was given to users and the other set was issued to NHIF agents and Management. Data analysis was performed using statistical package for social sciences then summarized and presented in tables using totals and percentages in Microsoft Excel. The proposed application was designed and tested. It was found to be very convenient to the end user since the user can avoid making erroneous payments because the user is validated using their membership details and National ID details. The management is able to view the reports for all payments in real-time therefore enhancing effective reconciliation process to allow comprehensive and continuous monitoring of key financial controls in the reports with increased business visibility.

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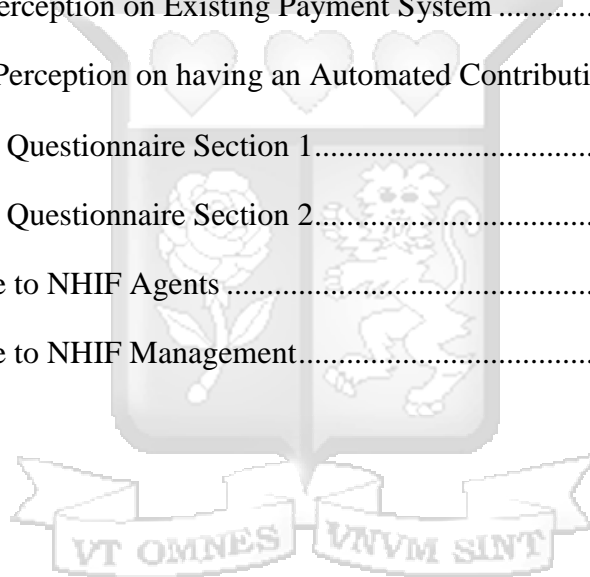
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## Abbreviations/ Acronyms

<b>ADE</b>	-	Advanced drug events
<b>CMHI</b>	-	Center for Medical Health Innovations
<b>EFT</b>	-	Electronic Funds Transfer
<b>ER</b>	-	Enterprise Resource
<b>FY</b>	-	Financial Year
<b>IHI</b>	-	Institute of Healthcare Improvement
<b>IPRS</b>	-	Integrated Population Registration System
<b>KSHs</b>	-	Kenya Shillings
<b>MOH</b>	-	Ministry of Health
<b>MPLS</b>	-	Multiprotocol Label Switching
<b>NHA</b>	-	National Health Accounts
<b>NHIF</b>	-	National Housing Insurance Fund
<b>NRI</b>	-	Nomura Research Institute
<b>PCI-DSS</b>	-	Payment Card Industry Data Security Standard
<b>SMS</b>	-	Short Messaging Service
<b>SSADM</b>	-	Structured System Analysis and Design Methodology
<b>SOAP</b>	-	Simple Object Access Protocol
<b>SOX</b>	-	Sarbanes-Oxley
<b>SPSS</b>	-	Statistical Package for Social Science

- UML** - Unified Markup Language
- USAID** - United States Agency for International Development
- USSD** - Unstructured Supplementary Service Data
- VPN** - Virtual Private Network
- VUV** - Virtual Upgrade Validation



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## Dedication

This work is dedicated to my family and friends.



# Chapter 1: Introduction

## 1.1. Background

Kenya has one public insurance scheme, the National Hospital Insurance Fund. Since its inception in 1966 under CAP 255 of the laws of Kenya, its main aim is to cater for the health care needs of Kenyans by giving them a medical insurance cover enabling them to get affordable treatment when in need. There is a notable improvement towards realizing the goal of offering comprehensive medical cover to all Kenyans and that is voluntary and self-employed members can be able to pay their NHIF contributions through M-Pesa (Patkay, 2014). A state insurance fund like NHIF has a fairly simple business model: it takes in contributions from employees, and it pays out benefits. Of course, in order to manage the intake and outflow of these funds, it employs personnel, and so there are some administrative costs that must be covered from revenues (Lakin & Magero, 2012).

NHIF has increased the level of pay-out to members and their beneficiaries. The pay-out ratio has increased to 60% in FY10 from 32% in FY06 grown from Ksh 1.1 billion to Ksh 3.1 billion. NHIF has had notable success in increasing investment in ICT including revenue collection, EFT payments, use of M-Pesa, online registration and online banking (Chacha, 2012). Unfortunately, despite the availability of such a payment system, the report done by the United States Agency for International Development (2014) states that the NHIF M-Pesa payment system is not able to detect information that might have been erroneously entered and also the contributions are not reflected in membership accounts in a timely manner.

Lakin and Magero (2012) argue that lack of transparency at NHIF is representative of a broader problem of inadequate public reporting on the financial activities of Kenyan state corporations. They went ahead to offer suggestions that exclusive posting of reports and audited financial statements through internet and local media will eradicate discrepancies in how public funds is been managed. On a report highlighted by the Ethic and Anticorruption Commissions (2011), there are allegations of irregular payments to Clinix Health Care limited, Meridian Medical center and Thika Road Health Services for medical cover services for civil servants before any services were rendered. The estimated amount involved was Kshs. 500,000,000.

## 1.2. Problem Statement

NHIF has netted 80,000 additional members from databases of other government agencies after unraveling discrepancies in employee registration (Okulo,2014). The reduction in risk can be measured by the avoidance of costs associated with a failure in internal controls around account reconciliations, if material weaknesses are found and announced in external audits, the consequences can be costly (Lynds & Rourke, 2012). On current challenges, Beneficiaries of the health facilities would learn that they could not access services because of contributions were not reflected on their membership accounts on a timely manner and that NHIF M-Pesa payments was not able to detect information that might have been reflected erroneously (United States Agency for International Development, 2014). On the highlights of ongoing investigation, there are allegations of irregular payments.

Without an effective reconciliation mechanism for NHIF payments on contributions, penalties and generated E-Slip payments, a new approach to create a mobile prototype for performing NHIF payments and contributions is needed so that proper validation is achieved to enable users to be validated on entering their details so as to avoid users from sending contributions to wrong accounts and also to solve reconciliation problems experienced by the NHIF finance team and management by deploying a real-time reporting dashboard that allows real-time reflection of payments and contributions on members accounts. The reports will allow continuous monitoring of key financial aspects of revenue collected therefore increasing business visibility and control.

## 1.3. Research Objectives

- i. To analyze what is required to aid in effective reconciliation process for NHIF.
- ii. To determine the validation data to be used to avoid erroneous payments.
- iii. To review other existing reconciliation and reporting systems.
- iv. To develop the payments and contributions mobile prototype.
- v. To test the Mobile prototype in performing validation of members and reflect contributions and payments in real-time report dashboard.

#### **1.4. Research Questions**

- i. What will be needed to aid the reconciliation of payments and contributions collected by NHIF?
- ii. What data will be used by the system to validate the user?
- iii. What are the challenges in achieving proper reconciliation and reporting in other existing systems?
- iv. How will the developed mobile prototype work?
- v. How will the Mobile prototype test for validation and detail the contributions and payments to be reflected in real-time reports to enable business visibility?

#### **1.5. Significance of the Study**

This research is aimed to developing a proposed solution that enables NHIF to collect payments and contributions with a validation mechanism in place to eliminate errors in payments and to enable payments to be reflected on reports dashboard in real-time basis to achieve proper reconciliation in financial accounts. Working with our proposed solution, the prototype will be able to validate data such as registered member's NHIF number with their national identity numbers. Timely reflection of payments and contributions made by a member will be displayed immediately on reports so as to enable them to access benefits offered by NHIF without any suspicion of payments made. Reconciliation of all payments will be made much easier with real-time reports display. In essence, this project is meant to help in automation of processes such as validation and reconciliation of funds. Revenue collected on all contributions and payments will be displayed on a reports dashboard in order to improve efficiency and management of funds so as to avoid fraud and misappropriation of funds.

#### **1.6. Scope**

To develop a mobile prototype that will use a common web service or SOAP function that will validate a user while paying for contributions and allow real-time reports to be displayed on a backend reports dashboard. The report dashboard will provide a summary on all transactions especially revenue collected for all contributions, E-Slip payments and penalties on a daily, weekly and monthly basis.

## 1.7. Limitation of the Study

There are a number of limitations that are likely to be encountered during the course of the project that includes data limitations, time constraints and financial limitations. Data limitations might be encountered as there might be instances where primary and secondary research techniques might not be able to provide all information in order to completely satisfy the research objectives. Insufficient time may be encountered when it comes to successfully completing all the research and also financial constraints in deploying MPLS or VPN connectivity from NHIF database and IPRS database. Fees will be required for acquiring a pay bill number to allow M-Pesa transactions in transferring funds to the E-wallet account of the user in making payments using the prototype.



## Chapter 2: Literature Review

### 2.1. Introduction

Over the last decade, it has become clear that Kenya's National Hospital Insurance Fund (NHIF) is the vehicle through which the government hopes to eventually offer health insurance to all Kenyans (Lakin & Magero, 2012). Contributions are supposed to be used to pay for healthcare services to its members. To that end, contributions collected must be managed and invested appropriately to ensure that the Insurance fund is able to pay for the healthcare goods and services ("Strategic Review of the National Insurance Fund", 2011). The present focus of NHIF is to process the contributions of members and pay the claims for their stays in hospitals. The fund is as of yet employing manual work to a large degree, especially in the branches. Most of its communication with organizations outside the fund is done on paper (Lankers, 2003).

Contributions are deducted monthly and remitted to the Insurance Fund by Employer or self-employed individuals by paying a voluntary monthly contribution via M-Pesa or a banking agent (Shirikiana Government Shared Services, 2011). Once an organization obtains an employer code, the Employer is obliged to make monthly deductions and remitting to NHIF before the due date. A penalty of five times amount of contributions due is levied for late payment payable by the employer. All payments for contributions must be accompanied by payroll information showing individual employee's contributions paid (Mwatu, 2012). An employer uploads a by-product payroll like Table 2.1 in an excel sheet.

**Table 2. 1: Payroll By-Product Sample (Kamau, 2012)**

<b>EMPLOYER CODE</b>	12345				
<b>EMPLOYER NAME</b>	WEBTRIBE LTD				
<b>MONTH OF CONTRIBUTION</b>	2009-11				
<b>PAYROLL NO</b>	<b>LAST NAME</b>	<b>FIRST NAME</b>	<b>ID NO</b>	<b>NHIF NO</b>	<b>AMOUNT</b>
392	KAMAU	JOSPHAT KIMANI	1085678	125	320
987	MUCHEMI	DANSON	26380045	654	320
398	IKARA	JUSTUS GITHUA	26380045	456698	320
399	MOMANYI	SAMUEL INCWARA	223654	63545	320
				<b>TOTAL</b>	1280

A By-Product number is generated each month for all corporates and organizations entitled to contribute towards the insurance fund. Employers submit to NHIF a list of their employee’s brief details such as name, National/passport ID, their NHIF membership numbers etc., together with the respective rate each employee should be deducted as on Table 2.1. Once the payroll by-product has been uploaded on the NHIF web portal, an E-slip in Figure 2.1 is generated automatically that holds the E-slip Byproduct number. The E-slip Byproduct number will be used to make payment to any Co-operative Bank or National Bank (Kirwa, 2010).

The image shows a screenshot of a web-based 'E-slip' form. The form is titled 'Eslip' in blue text. It contains a table with the following data:

Byproduct Number	0515131	
Employer Code	Company Name	Month of contribution
57551	WEBTRIBE	2014-01
Total Amount	5440	
<input type="button" value="Print"/>		

**Figure 2.1: Generated E-Slip (Kamau, 2012)**

Safaricom Limited, a leading telecommunication company in Kenya, was mandated to provide a flexible and convenient platform for remittance of monthly insurance premium contributions from informal sector populations (Center for Health Market Innovations, 2015). The use of highly successful and innovative M-Pesa money transfer platform has enabled the insurance fund to extend health services to informal sector workers who are not captured in formal payroll systems and whose incomes are often less regular or predictable. The option to make monthly insurance contributions using M-Pesa has helped minimize travel to NHIF offices and time spent in long lines away from productive livelihood activities (Patkay, 2014). Self-employed members make payments using the current system of contribution towards the insurance fund as illustrated in Table 2.2.

**Table 2. 2: How to Make Contributions and Payments Using M-Pesa (Patkay, 2014)**

**How M-Pesa Payment Collection Works:**

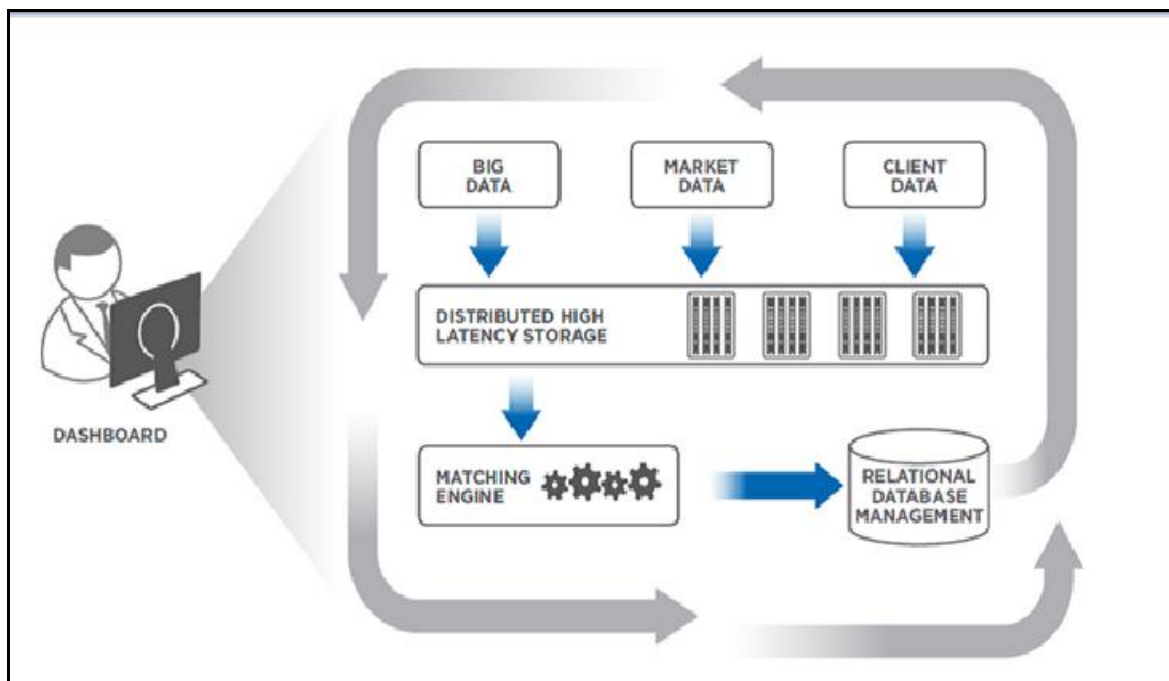
- 1. Select Pay Bill option**
- 2. Enter Business Number** (Type 200222)
- 3. Enter a/c no** (Type in contributor's National ID Number)
- 4. Enter amount** (Type in the amount you wish to contribute)
- 5. Enter Pin (Enter Secret Pin Number)**
- 6. Confirm details are correct and hit OK**

**You will receive two confirmation SMS's from M-Pesa**

## **2.2. Automated Reconciliation Solutions that Help Minimize Financial Risks**

Account reconciliations fulfill an important role in ensuring financial statements contain accurate information ("Oracle White Paper", 2012). The banks reconciliation solutions has delivered a good return on investment by decreasing financial risk to clients and the business, enhancing reconciliations operations, and providing Saxo bank with a platform from which to expand its services without increasing resourcing overheads (Deacon, 2011). Nomura Research Institute (NRI) Reconciliation solution offers financial institutions a highly scalable; exception based automated reconciliation product enabling firms of any size to increase efficiencies while controlling cost (Nomura Research Institute, 2014). According to NRI (2014), the reconciliation workflow brings together data transformation, reconciliation processes and a break management through the comprehensive, easy to use dashboard allowing users to visually review in real-time the results and statuses of the web interface as illustrated in Figure 2.3. A leading bank was looking for consolidations of its reconciliation functions and moving to an Infosys platform. The business challenge was on metrics and reporting as the client business units have had limited or no reporting; internal reporting was largely focused around age and risk profile. Infosys developed a standardized reporting procedure for management across business lines with business critical information. This included age and risk profiles, value of breaks, escalation and

issues. The reports have enabled increased business visibility and control leading to improved decision making (Infosys, 2011).



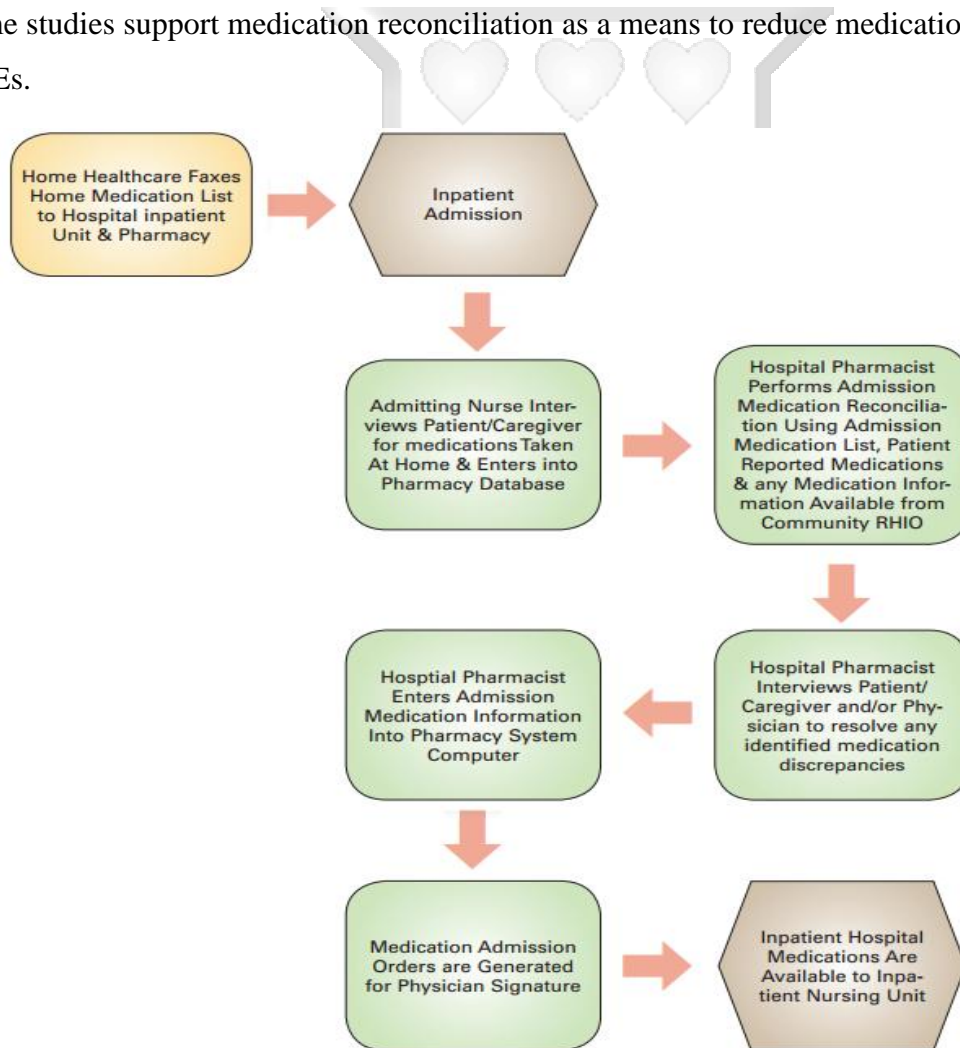
**Figure 2. 2: NRI Reconciliation Solution (NRI, 2014)**

Bank reconciliation is a straightforward concept from an accounting standpoint; however unresolved debits and credits carried over into following months without resolution, increases the risk of misstatements or inaccuracies in financial accounting and reporting records (Datamark, 2014). In using an automated complex reconciliation process to strengthen its ability to monitor and manage operational risk, Saxo bank has boosted its position in the investment market, doubling daily transactions and increasing revenues. In addition it has decreased financial risk for itself and its customers and has ensured compliance with today's regulatory requirements hence gained a very strong European status (Deacon, 2011).

### **2.2.1. A System Based Medication Reconciliation Process**

The application of intensive pharmacotherapy to the medication reconciliation process, in excess merely identifies discrepancies on a medication list, involves the identification and resolution of medication-related problems including assessment of adherence to evidence-based guidelines and clinical appropriateness of therapy. Tracking of identified medication

discrepancies at the time of transition to the next setting and sharing discrepancies details with the sending provider allowed for concurrent feedback, trending and intervention to correct the discrepancy and prevent avoidable omissions (Myrka et al., 2011). American Medical Association (2011) states that Medication reconciliation is a process of identifying the most accurate list of all medications a patient is taking and using this list to provide correct medications for patients anywhere within the health care system. Because medication discrepancies are important contributor to adverse drug events (ADE) among hospitalized and recently discharged patients, the joint commission on accreditation of health care organizations designated reconciliation as a “National safety Goal “in 2005 (Schnipper, et al., 2009). In Figure 2.4, hospitals have undertaken diverse approaches to comply with the joint commission mandate. Some studies support medication reconciliation as a means to reduce medication discrepancies or ADEs.



**Figure 2. 3: Hospital Healthcare Discharge Medication Reconciliation Process (Myrka et al., 2011).**

Medication errors continue to be one of the most frequent causes of preventable harm in health care. The Institute of Healthcare Improvement (IHI) and the joint commission include medication errors and the process of medication reconciliation in their top priorities for improvement today (Steeb & Webster, 2012). Decision support tools may be incorporated into the electronic medication reconciliation software that provides an additional layer of support to the clinician. In contrast to Figure 2.5 manual reconciliation, It include but not limited to automated documentation of discharge summaries, alerts and reminders for improving compliance and elimination of transcription errors (Belmont, et al., 2013).

### **2.2.2. Effective Operational Controls Reconciliation**

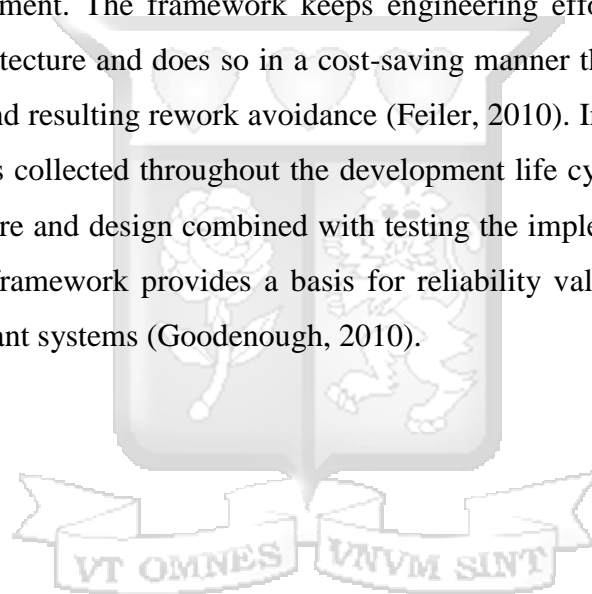
Operational controls should be periodically assessed in light of changing business needs, particularly where there have been changes to the activities of the organization. A daily profit and loss reconciliation process that is undertaken internally addressing unforeseen events in an emergency. Anti-money laundering is becoming an increasingly important consideration to be addressed by best practices (Umit et al., 2009). The reconciliation of the specialized statistics with national accounts has several advantages. First, it is useful for analytical purposes, because it enables the analysts to use the variables of national accounts together with variables of specialized statistics in economic models and other types of analysis. Second, it improves the reliability of data. If a large number of specialized statistics are integrated into the national accounts compilation process, more consistency checks are generated, resulting in more accuracy of national accounts data. Third, it makes it possible to define more clearly the flows of information between different types of compilation. Results of studies can be used for the improvement of national accounts and vice versa; this will lead to an optimization of the use of human resources in the area of statistics (United Nations, 1998).

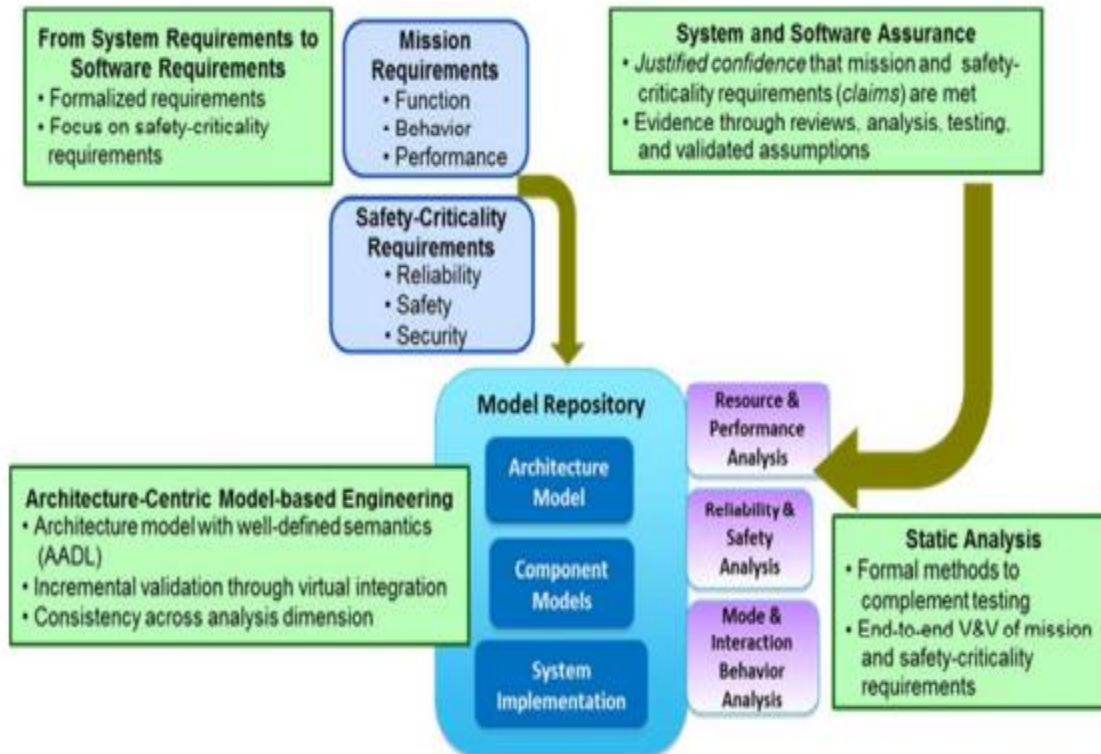
Wageworks, a provider of tax-advantaged programs for consumer-directed, commuter and other employee spending account benefits in the US realized that after several years of rapid growth, its manual reconciliation processes required automation to keep up with the demands of its business thus ensuring data integrity and efficient client responses to financial enquiries (Iskow, 2012). Wageworks searched for an automated solution for validating and reconciling

financial data- one that would improve data accuracy while enabling users from different areas of business to access and share information. As stated by Iskow (2012), Wageworks chose frontier which allows automation data imports and validate data: quickly identify data issues and ensure timely resolution; trust the consistency of financial reports; promptly identify and explain exceptions; and securely share information and reports across the enterprise.

### **2.2.3. Reliability, Validation and Improvement Framework**

Applied throughout the life cycle, reliability validation and improvement leads to an end-to-end Virtual Upgrade Validation (VUV) approach (Denitz et al., 2012). This approach builds the argument and evidence for sufficient confidence in the system throughout the life cycle, concurrent with development. The framework keeps engineering efforts focused on high-risk areas of the system architecture and does so in a cost-saving manner through early discovery of system-level problems and resulting rework avoidance (Feiler, 2010). In support of qualification, the assurance evidence is collected throughout the development life cycle in the form of formal analysis of the architecture and design combined with testing the implementation. In Figure 2.5, the architecture-centric framework provides a basis for reliability validation and improvement program of software-reliant systems (Goodenough, 2010).





**Figure 2. 4: Reliability and Validation Framework (Goodenough, 2010)**

The top-up and bottom-up method were applied in the customer satisfaction measurement framework at IBM. Unexpected association between key variables prompted new business insights, and revealed problems in the process used to collect data (Mendonca & Basili, 2000). Building a software-reliant systems through an architecture-centric, model-based analysis of requirements and designs allows the discovery of system errors earlier in the life cycle than system intergration time when majority of errors are currently detected (Feiler et al., 2012).

### **2.3. Optimizing Financial Reconciliation and Reporting**

A report done by Infogix control solutions on a large commercial bank which experienced challenges in having increased transaction volumes, states that the bank authorized improvements including centralizing data, reducing cumbersome processes, improving visibility through reports and enabling automatic alerts (Infogix, 2014). As stated by Infogix (2014), the objectives were as follows; Implement automated, real-time methodologies to notify business partners of reconciled item, which would replace off-line email notifications that had to be captured by the existing audit process, automate manual ledger entries and paper transactions

that were established around the resolution of items. The solution provided was an Infogix ER solution chosen to improve bank's reconciliation process and drive cost savings. The solution included a centralized controls engine with a work flow based user interface to manage unmatched and mismatched exceptions and as a result real-time reports improved operational efficiency, resource productivity and significant risk reduction.

Reconciling accounts prior to issuing financial statements can be challenging especially when companies use spreadsheets to perform reconciliations. Spreadsheets employ tedious processes that are labor intensive, error prone, unsecure, unverifiable and often inconsistent. Today's compliance-focused environment, prompted by Sarbanes-Oxley (SOX), the Payment Card Industry Data Security Standard (PCI-DSS) and other requirements, means scrutiny of internal controls, data security and process flows will only increase and become more tasking (Total Reconciliation Solution, 2013).

Oryx solution enabled many accounts challenges to be addressed by automating reporting tasks. The process involves: acquire and process to which data was automatically obtained from the different sources and combined with manual input with a single process. It then validates data through a series of diagnostic tests designed to report and correct data quality issues. Analyze through summarization and ensure rapid agile implementation (Oryx , 2013). The reconciliation of an organisation's finances in Figure 2.6 is time consuming, costly and prone to human error with reconciliation errors having potentially major consequences on a company's financial well being. High transaction volumes, multiple bank accounts, different transaction types, multiple currencies and various bank file formats exacerbate the problem (Savatier, 2012). Firms are under pressure to identify potential discrepancies across multiple sources of business data and enhance visibility and reliability in their business and financial results (MyDas, 2013).



► **Reconciliation processes**

- **Acquisition & Normalisation** (data integration, mapping, enrichment)
- **Transaction Reconciliation** (One to One matching)
- **Position Reconciliation** (Balances, Cash, Securities, Commodities)
- **Investigation** (Exception management)
- **Archiving**

**Figure 2. 5: Reconciliation Processes (Savatier, 2012)**

Organizations invest significant effort and resource in managing complex reconciliation activities between payments and its associated data. Reconciliation is required for accounting and compliance reasons. Fast and accurate reconciliation reduces risk and improves cash management and liquidity. Reconciliation activities are in fact mission-critical and mandatory for businesses and government agencies when making and receiving payments. Reconciliation processes are considered as an operational overhead and businesses strive to reduce the associated costs by introducing automated management and straight-through-processing hence businesses have developed and maintained a complex and costly combination of electronic and manual reconciliation processes to address these challenges (Whittle, 2014).

MyDas is a reconciliation platform that assists firms to match and reconcile business data from multiple sources on an ongoing basis. It has the ability to come with a set of operational reports and dashboards that meaningfully portray reconciliation status across various data prioritizing based on age and importance of business as well as provide audit-ready reconciliation statements. As stated in Figure 2.7 by MyDas (2013), the solution provides capability for ‘unmatching’ matched items to provide for corrections or handle erroneous matches through various report dashboards that enable firm to measure operational efficiency, quality of services delivered by service providers.

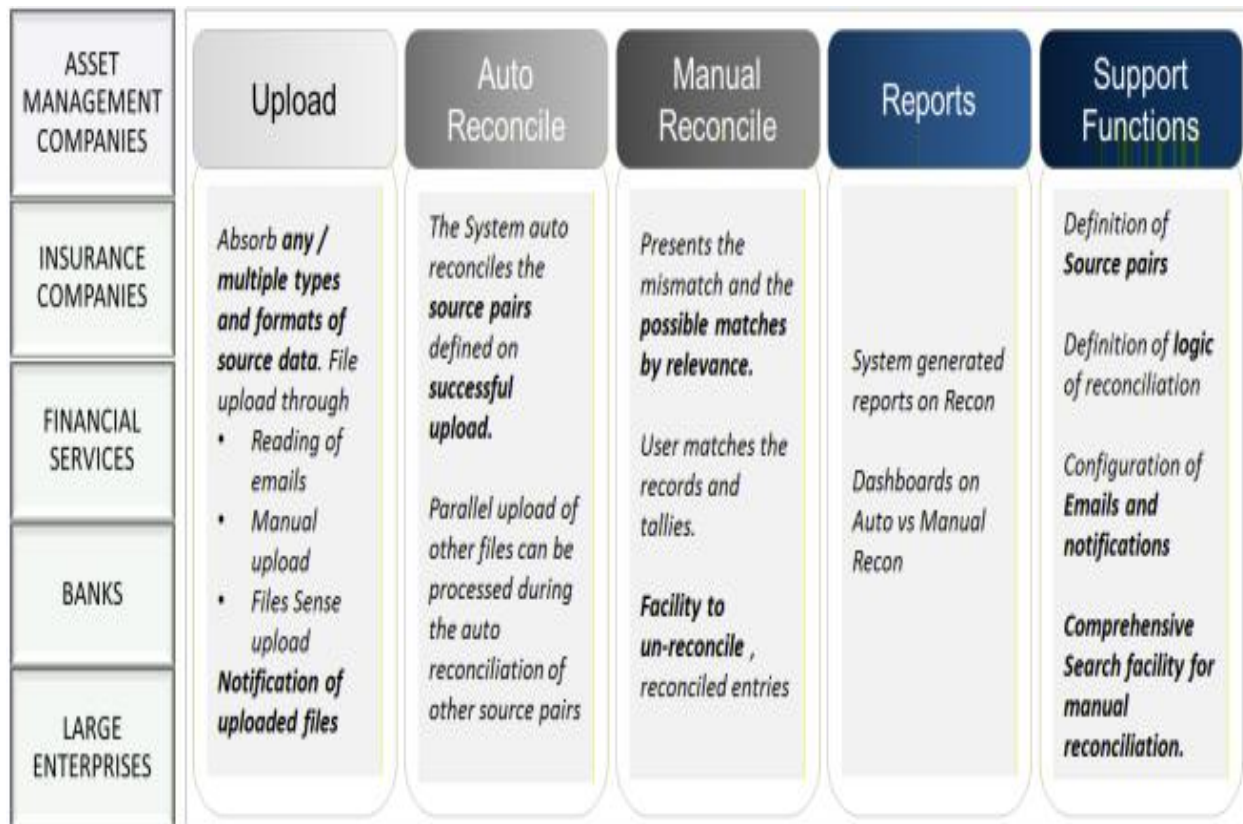
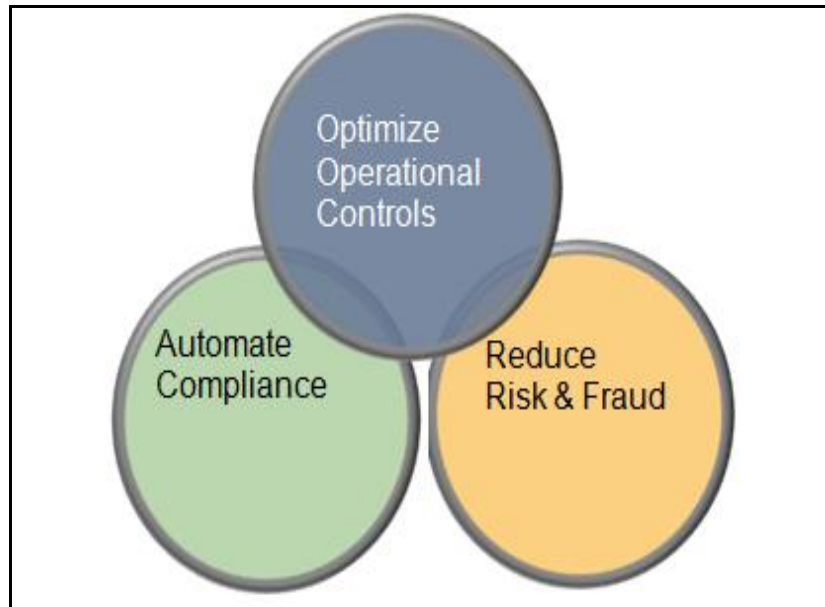


Figure 2. 6: MyDas Reconciliation Solution (MyDas, 2013)

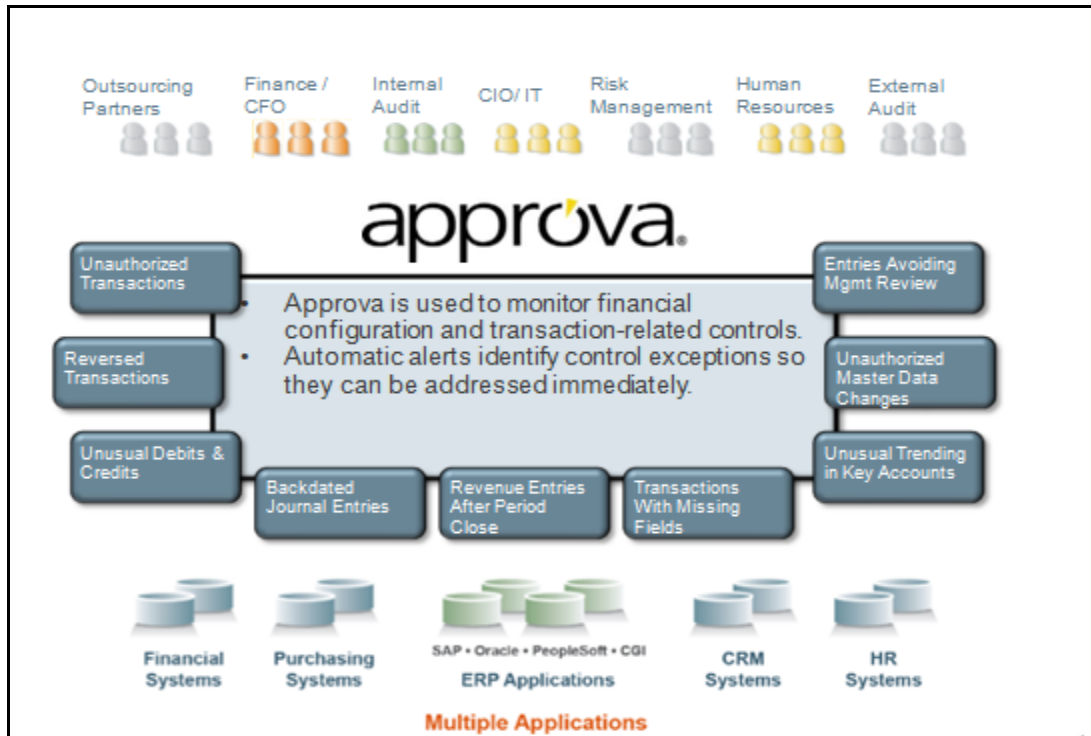
## 2.4. Managing Risk and Control Intelligence Solutions

A control Intelligence strategy must address the entire Life cycle of controls in a company that would envision on managing risk especially in an economic downturn (Boyce, 2008). The financial controls in Figure 2.8 as illustrated by Boyce (2008).



**Figure 2. 7: Approva Automating Financial Controls (Boyce, 2008)**

Approva intelligence software allows an organization to optimize operational controls by improving efficiency through avoiding too much time being wasted researching financial anomalies for audits thus allow improved utilization and retention of internal audit and finance task resulting from elimination of low value tasks. Automating compliance reduces time required for internal audit team to test controls and respond to external audit requests, and also reduces travel and expenses costs for internal audit team. Figure 2.9 reduces risk and fraud in financial statements due to comprehensive and continuous monitoring of key financial controls and also elimination of errors resulting from people circumventing existing financial controls and policies.



**Figure 2. 8: Approva Detailed Financial Controls (Boyce, 2008)**

Oracle financial services analytical applications reconciliation framework ensures that balances from a bank’s operational system match those in their financial systems. Data consistency and transparency is increasingly required to support various institutional internal needs like internal audits and controls, etc (Oracle Financial Service, 2013). The oracle framework provides pre-configured reports to provide users with detailed information once the general ledger reconciliation is performed. These reports detail reconciliation differences, adjustment entries and details of the correction entries including general ledger codes and amounts. It also provides a “Threshold breach Report” that details all the general error codes the threshold limit has been exceeded. Dashboard also includes the reconciliation audit trail report and captures all the actions/ changes performed.

Bravo bill reconciliation in Figure 2.10 has been designed specifically for Australian engineers and analysts to be as automated as possible. It uses full power of its reconciliatory framework. It has a standing data manager and meter data store to identify discrepancies in billing system output files. Its key features include: automated processing of files and

reconciliation to reduce manual handling, integrated tasks and user workflow functionality, management reporting and reconciliation analyzer tools (Bravo Energy Systems, 2008).

Sitemap | Tuesday, September 10, 2013 | Logged In: meredith LOGOUT

Approvals (5) | Reports | Dashboard | Leave (6) | Management | Configuration | Preferences | Help

Reports → Rate Reports → Monthly Costing

Past Period | View As | HTML (regular) | Future Period

**General Monthly Costing Report**  
Records From Sunday, September 1, 2013 Through Monday, September 30, 2013

User	Project	Employee Type	Function	Location	Hours	Pay	Bill 1	Bill 2	Bill 3
Brian Chordi	Build Install Images	Contractor	Sr. Engineer	Austin, TX	8.0	\$776	\$1,800	\$3,500	\$5,200
<b>Subtotal for Brian Chordi</b>					<b>8.0</b>	<b>\$776</b>	<b>\$1,800</b>	<b>\$3,500</b>	<b>\$5,200</b>
Bryan Bernard	1.3.4.2.1 Interview/ Survey Customer Control Group	Contractor	Business Analyst	Austin, TX	7.0	\$385	\$577.50	\$577.50	\$577.50
	1.3.4.3.3 Create Needs Analysis Document	Contractor	Business Analyst	Austin, TX	10.0	\$550	\$825	\$825	\$825
	Admin/ Time Off	Contractor	Business Analyst	Austin, TX	8.0	\$440	-	-	-
	Solicit Internal & External Review & Feedback	Contractor	Business Analyst	Austin, TX	13.5	\$742.50	\$1,113.75	\$1,113.75	\$1,113.75
<b>Subtotal for Bryan Bernard</b>					<b>38.5</b>	<b>\$2,117.50</b>	<b>\$2,516.25</b>	<b>\$2,516.25</b>	<b>\$2,516.25</b>
Curt Randall	Infrastructure	Contractor	Sales Engineer	Austin, TX	40.0	\$3,840	\$12,000	\$28,000	\$26,000
	System Promotion Strategy Authorization	Contractor	Sales Engineer	Austin, TX	18.0	\$1,728	\$5,400	\$12,600	\$11,700
<b>Subtotal for Curt Randall</b>					<b>58.0</b>	<b>\$5,568</b>	<b>\$17,400</b>	<b>\$40,600</b>	<b>\$37,700</b>
<b>REPORT TOTAL</b>					<b>104.5</b>	<b>\$8,461.50</b>	<b>\$21,716.25</b>	<b>\$46,616.25</b>	<b>\$45,416.25</b>

Figure 2. 9: Bravo Bill Reconciliation (Bravo, 2008)

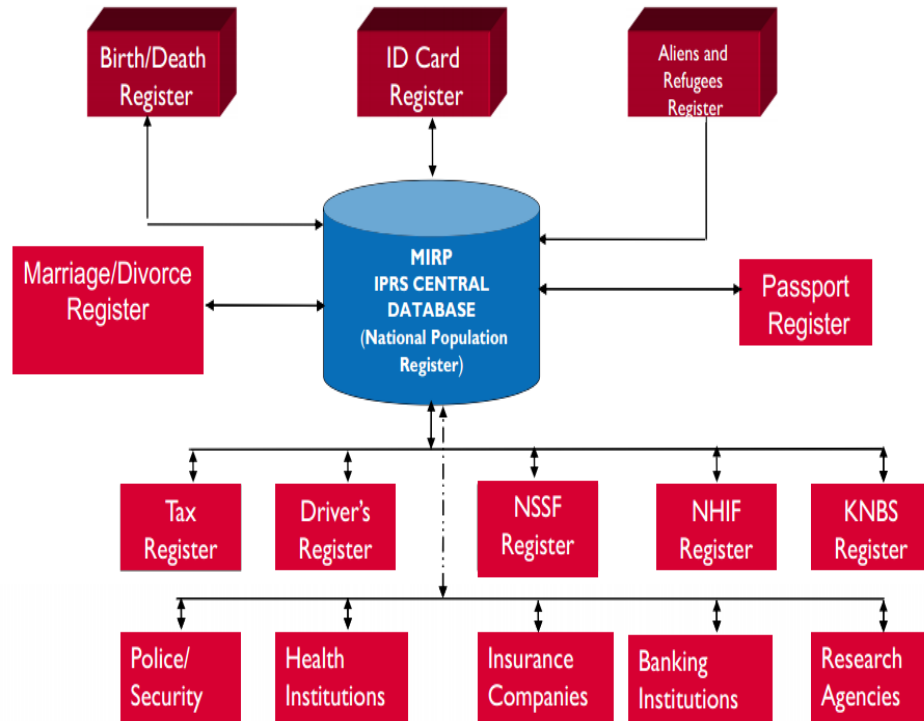
## 2.5. Use of Lean Six SIGMA to Improve Accounting Processes

In recent years companies have begun using Six Sigma Methodology to reduce errors, excessive cycle times, inefficient processes, and cost overruns related to financial reporting systems. The Six Sigma implementation resulted in a significant reduction in the average cycle time and cost, per unit of activity, needed to produce the required reports (Ansari et al., 2010). Users of financial statements need to be able to compare the financial statements of an entity over time to identify trends in its financial position, financial performance and cash flows (Braunbeck, 2010).

Lean Six Sigma is effective at enhancing the efficiency of service operations, which include accounting functions within organizations, removing waste and defects from accounting processes, increasing service quality, strengthening internal audit control and mitigating risks. Performing reconcilements normally involves matching general ledger activity to bank activity for a given reporting period. Discrepancies between the general ledger and bank statements are often attributed to defects in accounting, cash management and treasury tasks therefore applying Lean Six Sigma to reconcilements will improve operational efficiency and accuracy of financial reporting (Scotty, 2014). Six Sigma provides a universal measurement standard for all processes throughout the organization. It uses a four phase approach: measure which involves determining the error rate, analyze which involves understanding the process, improve which involves reach for a higher Sigma and control monitors through measurement (Senvar & Tozan, 2009).

## **2.6. Kenya Population Registry System**

Kenya is the only country in Africa with a functioning automated population database that compiles details of citizens living locally or in Diaspora, as well as non-citizens in the country (Kamau, 2013). The compulsory population registries were established primarily with an eye to the local authorities, particularly to their need for reliable registration of persons liable to taxation within the municipality, however, the extension of the national insurance system and the need for homogenous and effective taxation procedures, gradually increased the central authorities' interest for adequate population registration and individual identification (Skiri, 1994). In Figure 2.11, the IPRS central database provides a single version of truth about an individual and can be used to offer secondary registration for validation of individuals in any system that requires registration of services. The benefit of IPRS (Integrated Population of Registration system) is that it provides properly organized and coordinated registration systems that are vital for socio-economic and political development (Consortium, 2012).



**Figure 2. 10: IPRS Scheme Registration Services (Consortium, 2012)**

Information such as both medical and personal information about patients is stored centrally and is used to build up a single patient file for all the health insured people (Maneva, 2013). Maneva (2013), goes on to state that by extending the capabilities of the already functioning integration system services are more accessible as well as do full reporting in which the architecture consists of database server, which is responsible for the collection and centralization of all data stored as well as maintenance of the application modules of the system.

## **Chapter 3: Research Methodology**

### **3.1. Introduction**

This study sought to develop a relevant mobile prototype to support and strengthen collection of contributions towards the NHIF. In trying to come up with the methods to help in data collection, analysis and presentation, the researcher considered the following areas to give a clear outcome of the research: the research design, sample population, data collection methods, data analysis, system analysis and modeling. A survey was conducted in Nairobi. Consent was sort from the participants in the research process. A random sampling was used to avoid biasness using the nth factor. Both primary and secondary methods of data collection were used. The collected data was analyzed using descriptive statistical method. The data was presented using tables and pie charts for comparison purpose.

### **3.2. Research Design**

The study used a descriptive study design. The descriptive study method was appropriate because it explores and describes the relationship between variables in their natural setting without manipulating the variables. The study aims at developing a solution that will validate users while making payments and enable NHIF management obtain real-time reports.

Mugenda & Mugenda (2003), states that descriptive study has been defined as a systematic gathering of information from respondents for the purpose of understanding or predicting some aspect of behaviour of the population of interest therefore both qualitative and quantitative data are obtained for comparison purposes.

### **3.3. Target Population**

The target population was public and private sectors Employers/ Self-employed who contribute towards NHIF scheme. Other populations targeted are the NHIF Agents and NHIF Management staff.

### 3.4. Sample Size and Sampling Procedure

Systematic random sampling method was used to select a sample for the purpose of this study in which 150 members were selected, 30 NHIF agents and 15 NHIF management team members as illustrated in table 3.1. According to Umasekaran (2006), systematic sampling design involves drawing every  $n$ th element in the population starting with a randomly chosen element between 1 and  $n$ . The sampling criteria used for selecting formal and Informal sector members; NHIF agents and management used the following steps:

- i. Step 1: Define the population
- ii. Step 2: Choose your sample size
- iii. Step 3: Assign numbers to cases
- iv. Step 4: Calculate the sampling fraction
- v. Step 5 Select the first Unit
- vi. Step 6 Select your sample

The estimated population of formal and Informal sector members is 10,500. The population is expressed as  $N$  therefore  $N= 10,500$ . The researcher decided to choose a sample size of 150 which is expressed as  $n$  therefore  $n= 150$ . We need to assign a consecutive number from 1 to  $N$ . in our case; this would mean assigning a consecutive number from 1 to 10500. We calculate the sampling fraction as follows:

Where:

$N$  = is the population size.

$n$  = is the sample size

Members Sampling fraction =  $n / N = (150 / 10500) = 1/ 70$  (i.e. 1 in every 70 respondents)

Sampling Fraction = 70

The researcher randomly selected 1 contributor in every 70 members until the population of 150 members is achieved. After doing this 150 times, the researcher randomly selected the 20<sup>th</sup> contributor in every 70 members. The sampling fraction tells us that we need to select 1

contributor in every 70 members. All the respondents were given the questionnaires randomly as they come to NHIF offices in Nairobi. If my random number is 20 i.e. the 20<sup>th</sup> respondent, then respondents numbered 20, 90, 160, 230, and 300 and so on would be sampled and given questionnaires until a total number of 150 respondents were selected. The NHIF agents were selected using the same formula applied on estimating the sample population for members.

NHIF Agents Sampling Fraction =  $n/N = (30 / 180) = 1/6$  (i.e. 1 in every 6 respondents)

Sampling fraction = 6

NHIF Management Sampling Fraction =  $n/N = (15/75) = 1/5$  (i.e. 1 in every 5 respondents selected)

Sampling fraction = 5

**Table 3. 1: Sampling Design**

<b>Category</b>	<b>Total Number</b>	<b>Sampling Interval (nth) factor</b>	<b>Number in the sample</b>
Formal and Informal Sector Members in Nairobi	10500	20 <sup>th</sup> Member in every 70 members/members was selected	150
NHIF Agents	180	3 <sup>rd</sup> Agent in every 6 agents was selected	30
NHIF Management	75	4 <sup>th</sup> Management team member in every 5 Management person was selected	15
<b>Total</b>	<b>10755</b>		<b>195</b>

### 3.5. Data Collection

Both primary and secondary data was used in this study. According to Ochola (2007), primary data is the one collected directly by the researcher for the purpose of his research while secondary data is information that has been collected by others for their specified use that a researcher intends to use.

### **3.5.1. Data Collection Instruments**

The data collection instrument to be used in this study was self-administered questionnaires involving both structured and unstructured question items. The structured items enabled the researcher to tabulate and analyze data with ease, while unstructured items facilitated in-depth responses and opinions important for the study. Self-administered questionnaire is a suitable method in a descriptive study since it avoids subjectivity due to absence of interviewer's influence. It also allows respondents sufficient time on items that require consultation before responding.

### **3.5.2. Data Collection Procedures**

Permission and authority to conduct research were sought first from NHIF. The researcher then waited for the respondents as they come to NHIF office. He introduced himself, briefed the NHIF members and distributed the questionnaires to every 20<sup>th</sup> respondent. Later on, the NHIF agents in Nairobi County office were all distributed questionnaires and lastly the management was distributed separate questionnaires.

### **3.6. Data Analysis Techniques**

When all data was collected, data cleaning was done in order to determine inaccurate, incomplete, incomplete or unreasonable data and then improve the quality through correction of detected errors and omissions. After data cleaning, the data was coded and entered in the computer for analysis. Data analysis procedure employed involved both quantitative and qualitative procedures. Quantitative data was analyzed using descriptive statistics. Quantitative data analysis required the use of computer spreadsheet and for this reason the Statistical Package for Social Sciences (SPSS) was used. Qualitative data was analyzed qualitatively using content analysis based on analysis of meanings and implications emanating from respondent information and comparing responses to documented data on Users satisfaction. The qualitative data was presented thematically in line with the objectives of the study. The results of data analysis were presented using pie charts.

### 3.7. System Analysis

The system prototype employed the Structured System Analysis and Design Methodology (SSADM), an extension of waterfall model. The methodology was chosen because it provides a thorough understanding of the business logic, process and data, which is expected to produce a more complete and correct system. The SSADM framework went through seven main stages in developing the proposed system as illustrated in Figure 3.1. These deliverables need to be brought out clearly before the completion of the system. Before going to the next stage, the end product of current stage must be met as required.

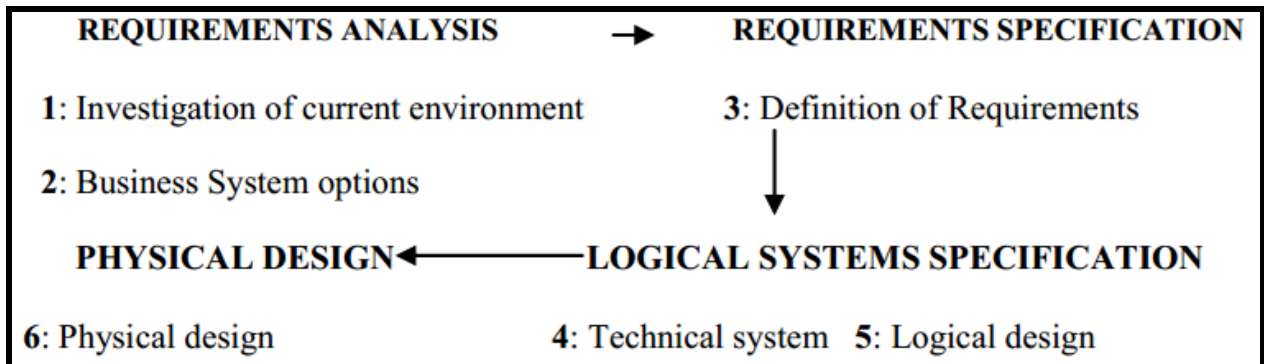


Figure 3. 1: SSADM flow of events (Avison & Fitzgerald, 2002)

This framework is also known as structural model. It defines the development environment in terms of modules, stages, steps and deliverables. The rationale behind SSADM version 4 in Figure 3.2 is that it may be customized to fit any development environment or application environment therefore the researcher need only undertake those modules deemed necessary for the successful development of an information system.

The steps as stated by Avison and Fitzgerald, (2002) involved in developing the proposed system:

- i. Investigation of the current environment- The researcher, through observation and review of current existing system and also review of the existing literature on reconciliation solutions, it helped in acquiring full understanding of the system and its requirements.

- ii. Business system options- upon thorough investigation of the current system for payments and contributions, the researcher settled on developing a solution that automatically validates user details. This was the chosen business option.
- iii. Technical specification option- this stage involved various technical requirements for the proposed system. The consideration taken into account is hardware requirements in which the system required an android Smartphone handset with a touch screen capability and internet connection. The software requirement required an android operating system version 2.2 and above.
- iv. Logical Design- This stage concentrated on the user interface aspects of the proposed system. Users would interact with the system via a touch screen of the android handset. The proposed system entails a mobile application that can be launched by touching the application button. Application interface objects incorporated included: buttons, menus, lists, icons and text views. These form the main methods of interacting with system.
- v. Physical Design- This stage involved conversion of logical designs into a real application that runs on the android handset. The physical design included the user interface design and functional design.

### **3.8. The System Design Requirement**

It entailed three main activities as stated by Avison and Fitzgerald, (2002):

- i. Logical data modeling- This involved identifying and documenting the data requirement of the proposed system. An entity relationship database model was developed showing the entities and relationships of the prototype.
- ii. Data flow modeling- data flow diagrams were developed showing how data moves around the proposed system. This was represented using activity diagram (Flowchart). Use case diagrams, Use case specifications and sequence diagrams were also developed.
- iii. Entity Event Modeling- involved identifying and modeling events affecting each entity and showing the sequence in which they occur. A sequence diagram was developed.

### 3.9. The Chosen System Architecture

The system architecture that was used is the smart client architecture. Smart client applications are powerful alternative to thin client applications. They can provide users with a rich and responsive user interface, the ability to work offline, and a way to take advantage of local hardware and software resources. In addition, they can be designed to run on a broad spectrum of client devices, including desktop PCs, tablet PCs, and hand held mobile devices such as smart phones. Smart client gives users access to information and remote services within a powerful and intuitive client environment, and are an effective solution for flexible user-oriented applications and for increasing user productivity and satisfaction. Smart client helps one to build and maintain more usable, portable, efficient web applications, faster, propelled by an open, extensible stack of industry-tested components and services (Isomorphic Software, 2005). Figure 3.5 shows the comparison between thick clients, thin clients and smart clients.



Figure 3. 2: Thick clients, Smart Clients and Thin clients

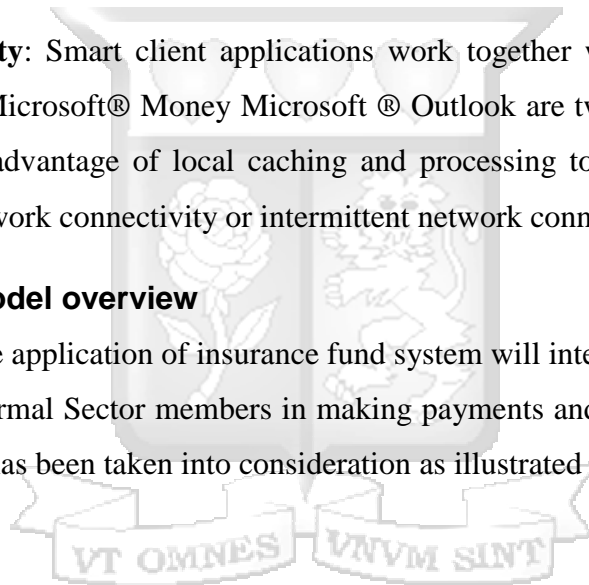
#### 3.9.1. Justification for Smart Client Architecture

The smart client architecture was chosen because of the following reasons:

- i. **Connected:** smart client are able to readily connect to and exchange data with systems across the enterprise or the internet. Web services allow smart client solutions to utilize industry standard protocols such as XML, HTTP and SOAP to exchange information with any type of remote system;
- ii. **Local Resources and user experience:** Smart client applications share an ability to exploit local resources such as hardware for storage, CPUs and scanners. They offer high-fidelity end-user experiences by taking full advantage of the local resources. Examples of well-known smart client applications are Outlook, and MS Money. Unlike “browser-based” applications such as e-bay.com, smart client applications live on your PC, laptop, or tablet PC.
- iii. **Offline Capability:** Smart client applications work together whether connected to the network or not. Microsoft® Money Microsoft® Outlook are two great examples. Smart clients can take advantage of local caching and processing to enable operation during periods of no network connectivity or intermittent network connectivity.

### 3.9.2. The System model overview

Figure 3.5 shows how the application of insurance fund system will interact with both the Formal sector members and Informal Sector members in making payments and contributions. Technical Support for the systems has been taken into consideration as illustrated by Humba (2011).



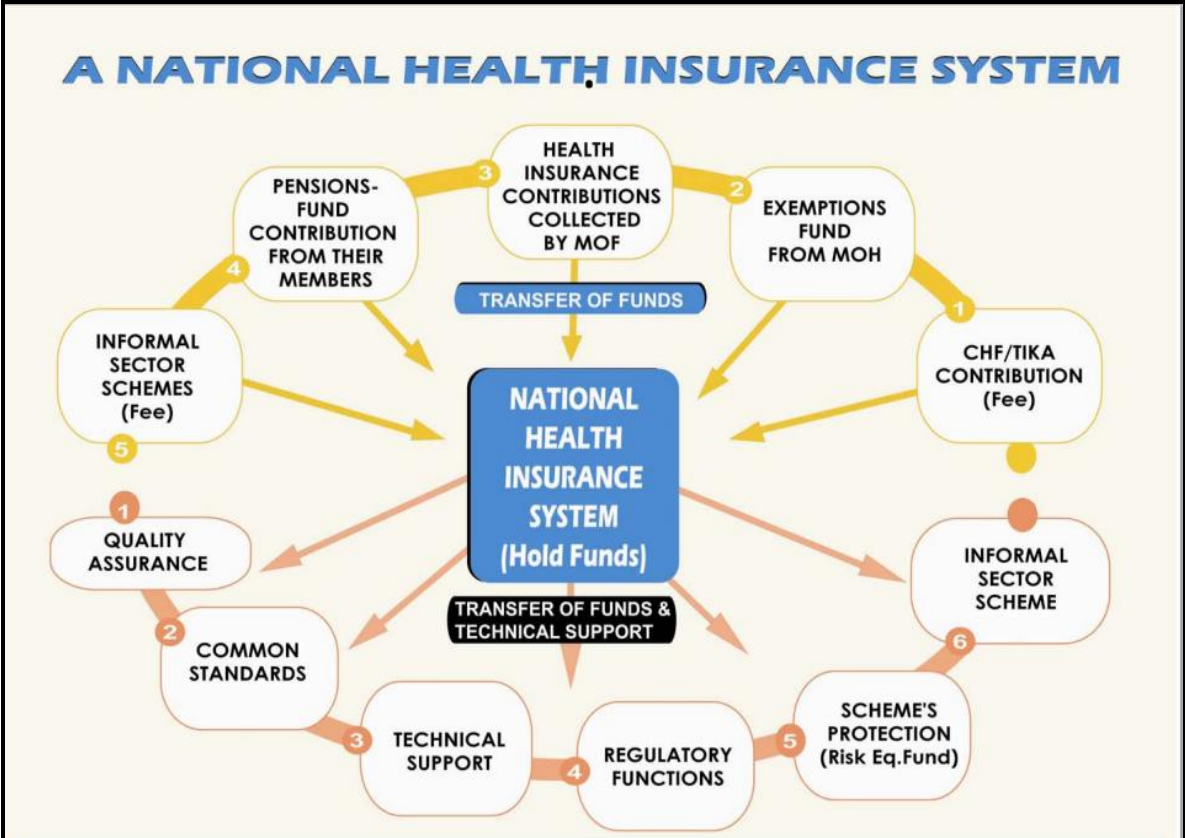
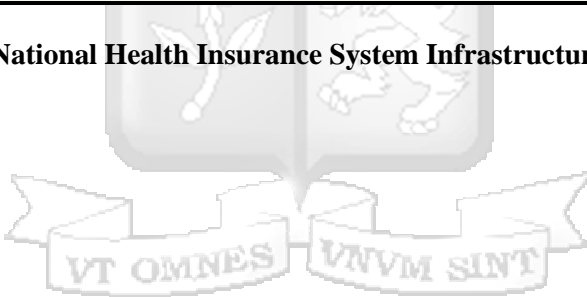


Figure 3. 3: The National Health Insurance System Infrastructure (Humba, 2011)



# Chapter 4: System Design and Architecture

## 4.1. Introduction

Design diagrams under the Unified Modeling Language are drawn and detailed information for each design diagram put down which will include Use Cases, Class Diagram, Sequential Diagram and Entity relationship Diagram. This section details the design and architecture structure of the proposed solution.

## 4.2. Use Case Diagram

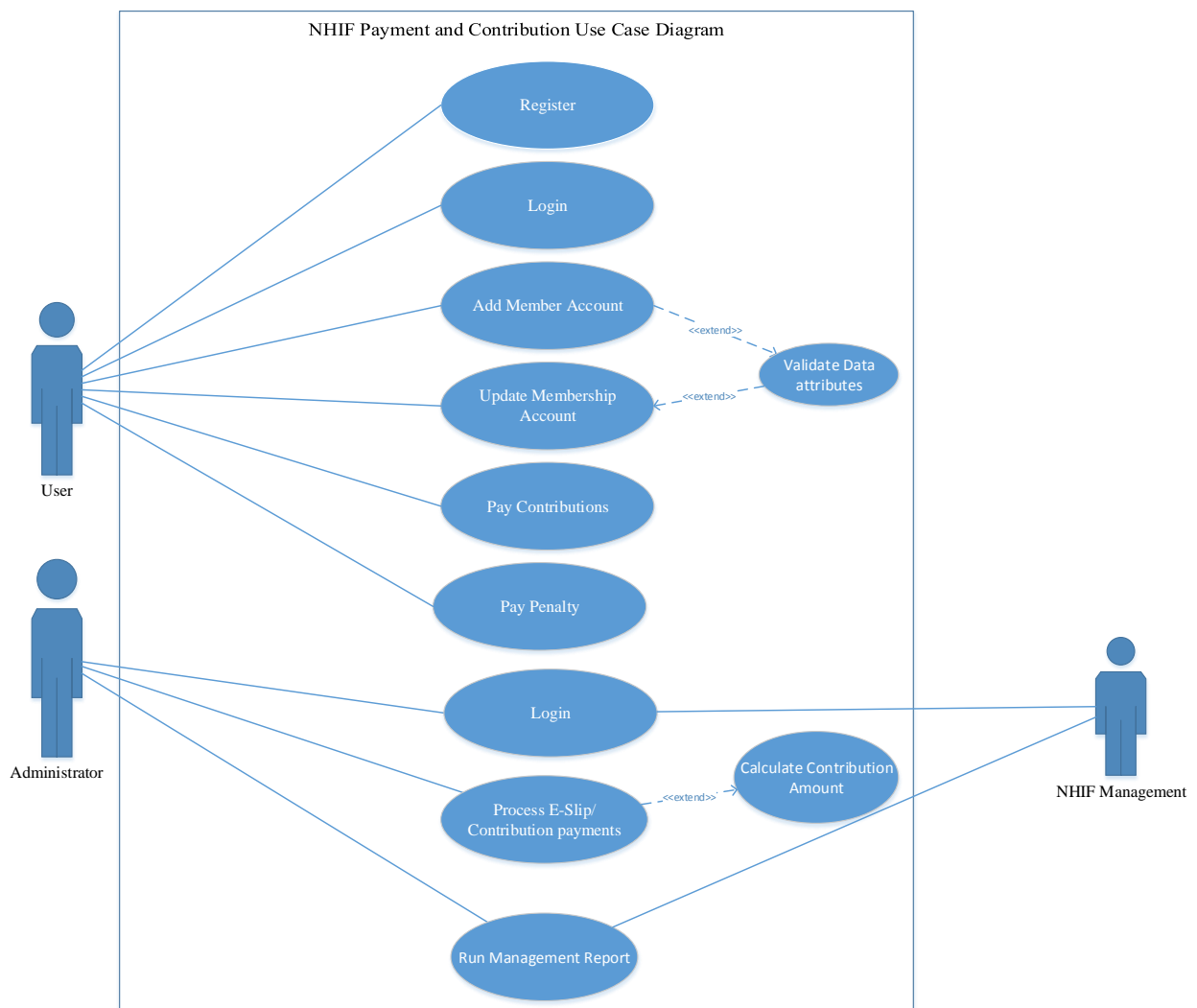
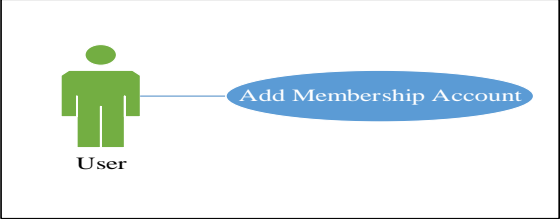


Figure 4. 1: Use Case Diagram

This UML was used to identify and map actors with their specific use cases in an iterative unified process that related each actor to their respective actions. The use case on Figure 4.1 three main system actors: the NHIF member, Administrator and NHIF Management.

#### 4.2.1. Use Case Specifications

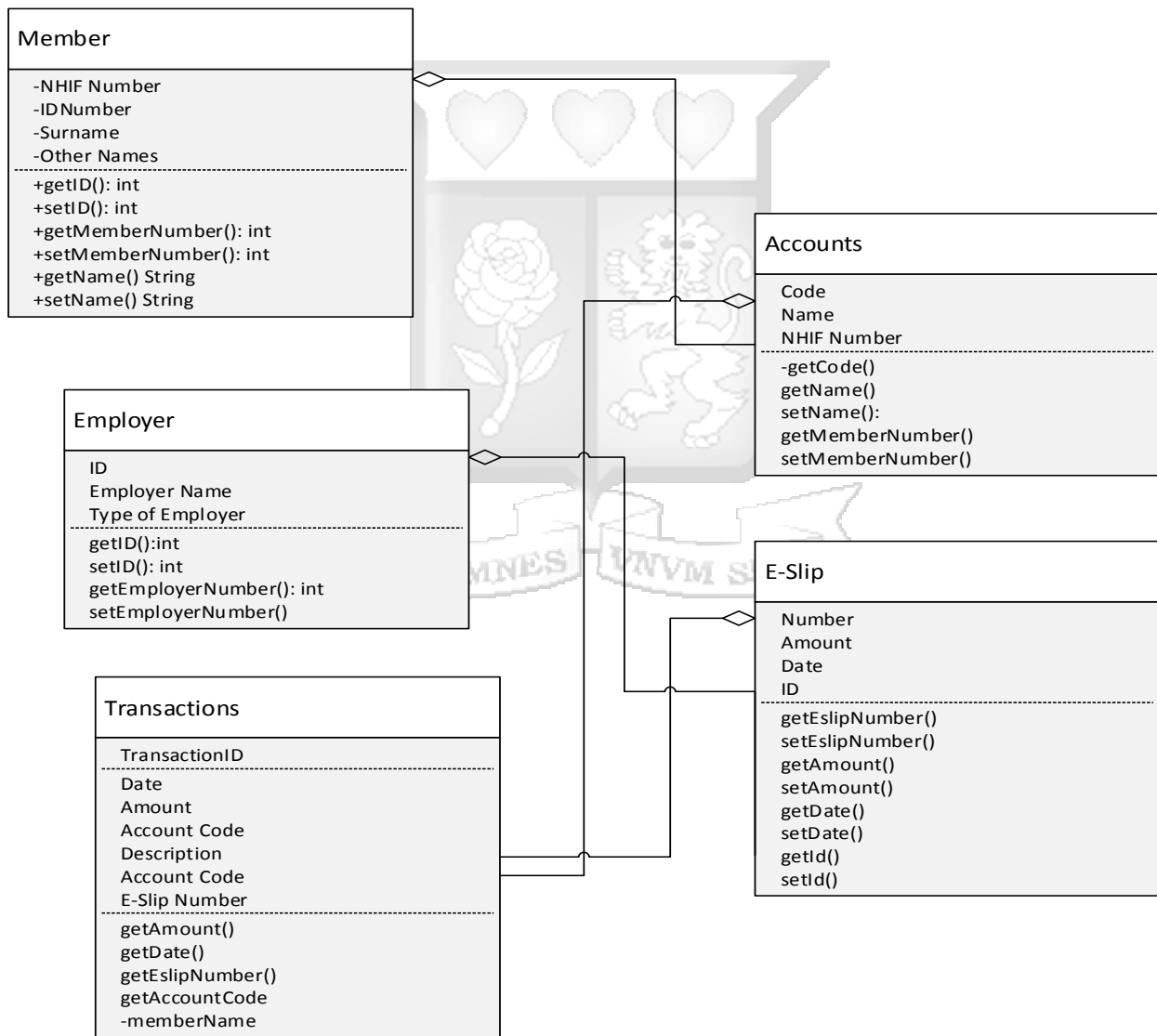
	<p>USE CASE: Add NHIF Account</p> 
	<p><b>Brief Description</b></p> <p>This use case will be used by user / client to Add NHIF account by entering their NHIF Membership Number</p> <p><b>Pre- Condition</b></p> <p>The User will be required to have registered their E-wallet account</p>
	<p><b>Characteristic of Activation</b></p> <p>An individual will be required to enter their NHIF Membership Number</p>
	<p><b>Flow of Event</b></p> <ul style="list-style-type: none"> <li>• <b>Basic Flow</b></li> </ul> <p>This use case will begin when the user choose “Add account” button. The system displays a form to add NHIF membership Number.. Once user submits Membership Number it validates against ID number</p> <ul style="list-style-type: none"> <li>• <b>Exceptional Flow</b></li> </ul> <p>System Displays error if user ID does not correspond to the NHIF Membership number of the user hence the NHIF Number is validated with their ID numbers in the System</p>
	<p><b>Post Condition</b></p> <p>The Rest of the Menu is displayed for making payments such as Eslip , Top Up and pay contributions</p>

**Figure 4. 2: Add Membership Account Use Case**

The use case in figure 4.2 illustrate how a user can add membership account and a basic flow on validation process will be performed when the user enters his or her NHIF member ID card number. Other use case specifications are illustrated in Appendix B

### 4.3. Class Diagrams

A class diagram is used to show hierarchical relationships as illustrated in Figure 4.3. A class diagram is also used to show other relationships, like whole/part “has-a” relationships using aggregation and composite connectors, interaction “uses” relationships with dependency arrows, or associations with connecting lines.



**Figure 4. 3: The Payments and Contributions Prototype Class Diagram**

#### 4.4. Data Flow Activity Diagram

Activity diagram in Figure 4.4 give a summary of the general flow activities, the member starts by login with a registered PIN and ID number. Thereafter the credentials are authenticated and if a member is not registered, it goes back to login page. If a user is authenticated he will be prompted to enter their membership number. If a Member is valid, the application proceeds to check if a member has available funds in their wallet to make payments or contributions. If the funds are available on the wallet, the member will proceed to make contributions else he will be prompted to top up their wallet account.

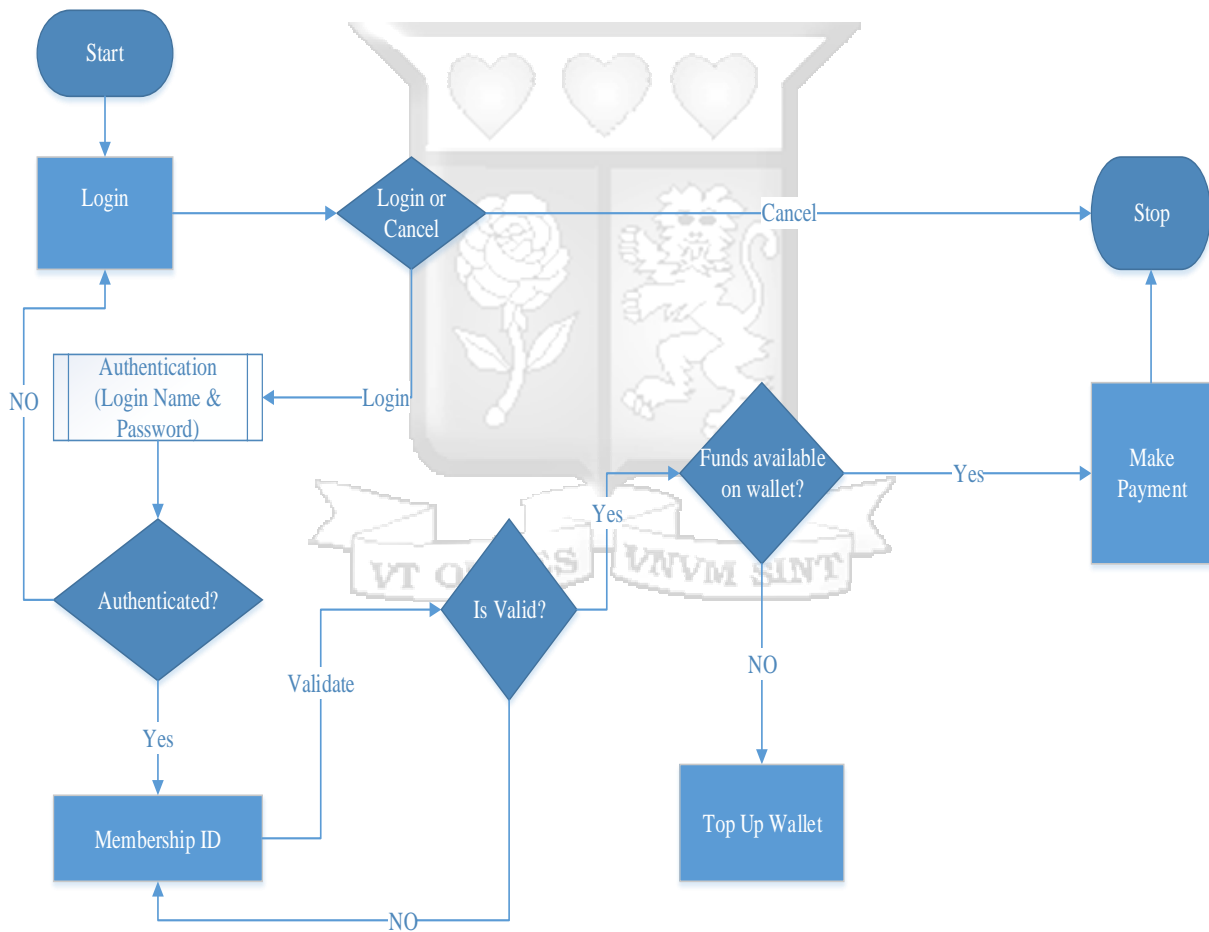


Figure 4. 4: Activity Flow diagram for contributions

#### 4.5. Sequence Diagram for Making Contributions

The sequence diagram in Figure 4.5 depicts how objects interact with each other via sending and reception of messages in the execution of a use case or operation. In the mobile prototype for payments and contributions, the member or contributor is required to login the application with their PIN and the application validates the user credentials. Once the user credentials are accepted, the user goes ahead and adds an E-wallet account for NHIF by inputting their Membership number. The member ID is validated on the NHIF Database and verifies information entered and acknowledges if a member exists. Once a member is validated the main menu for contributions is displayed. The member may choose to make contributions by entering the amount to contribute. The System checks if the wallet has funds to make contributions. If funds are available the member then may proceed with making contributions.

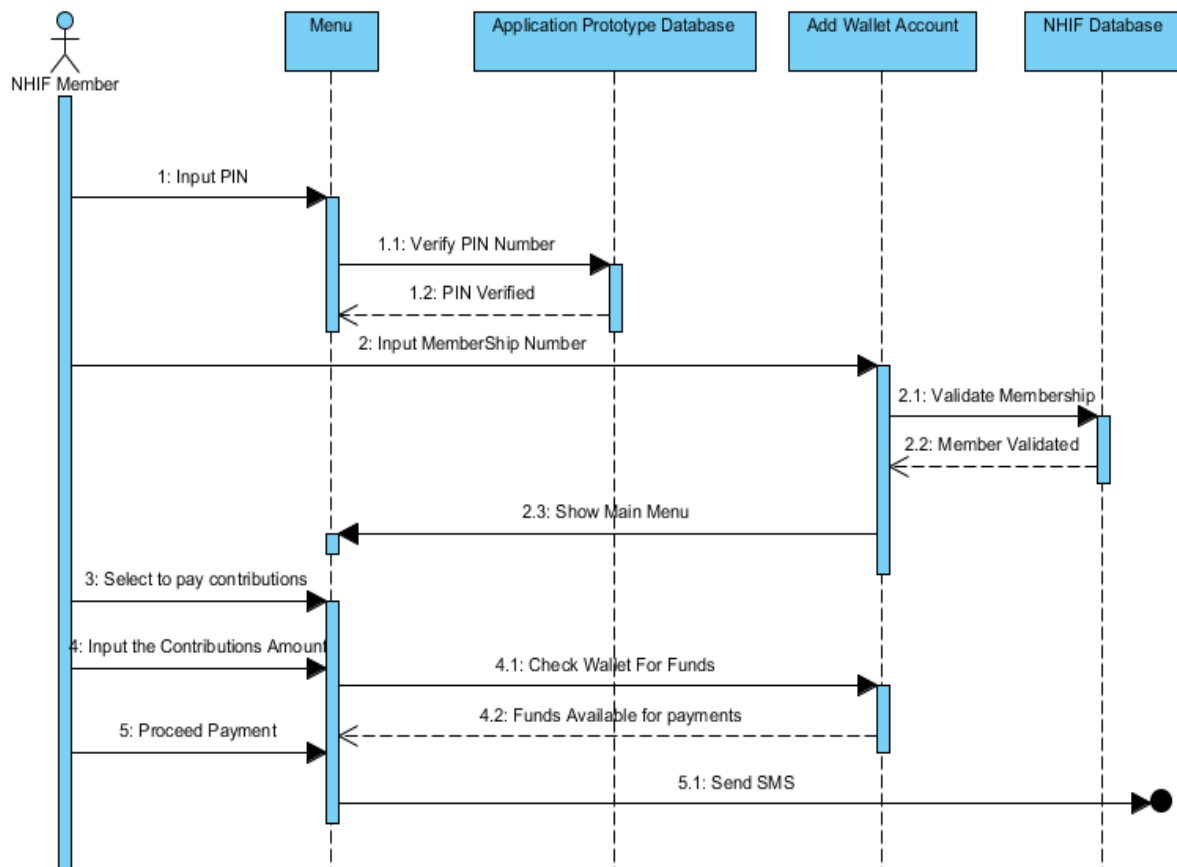


Figure 4. 5: Sequence Diagram

#### 4.6. The Payments and Contributions Database Model

The Figure 4.6 depicts the database model for the payments and contributions prototype. It defines the logical design of data and describes the relationships between different parts of the data. It consists of entities such Member, Accounts, Employer, E-Slip and Transactions.

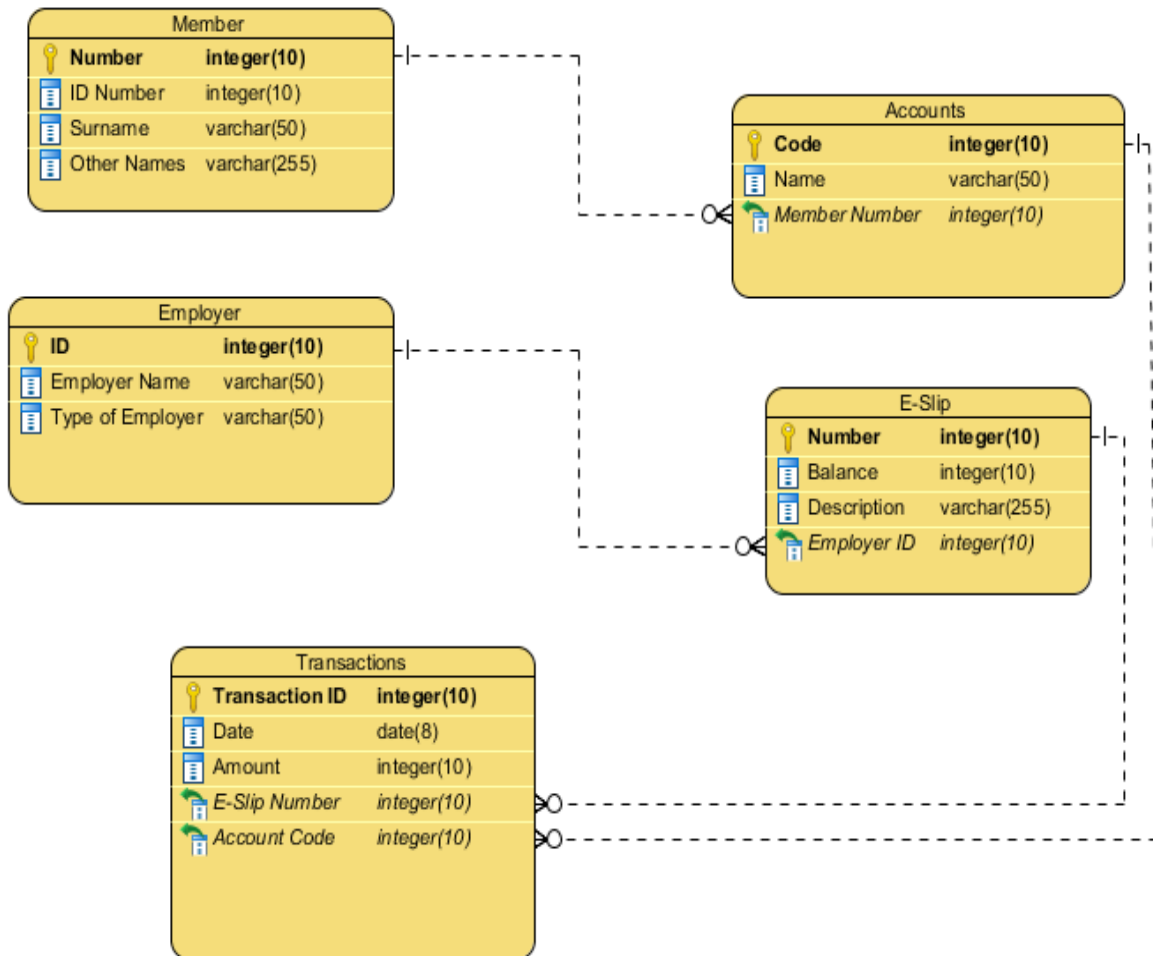


Figure 4. 6: Payments and contributions database model

# Chapter 5: System Implementation and Testing

## 5.1. Introduction

The implementation of the actual prototype was deployed and tested. The functionalities incorporated include the views and user requirements as gathered during the information gathering stage. To have an in-depth feel of the system implementation, this section shall include screenshots of the prototype and admin backend. The order of presentation of the implementation screenshots shall be done in a hierarchal order, breaking down each stage into it component screens and only relevant screenshots displayed.

## 5.2. The Payments and Contributions Prototype Screenshots

### 5.2.1. Add Membership Account Form

Once a user logs in to the application they will be prompted to add a user membership account as illustrated in Figure 5.1. The user will be required to enter their NHIF membership number and then proceed to add an Account by choosing add account. The ID number is included by default when the user first registered..

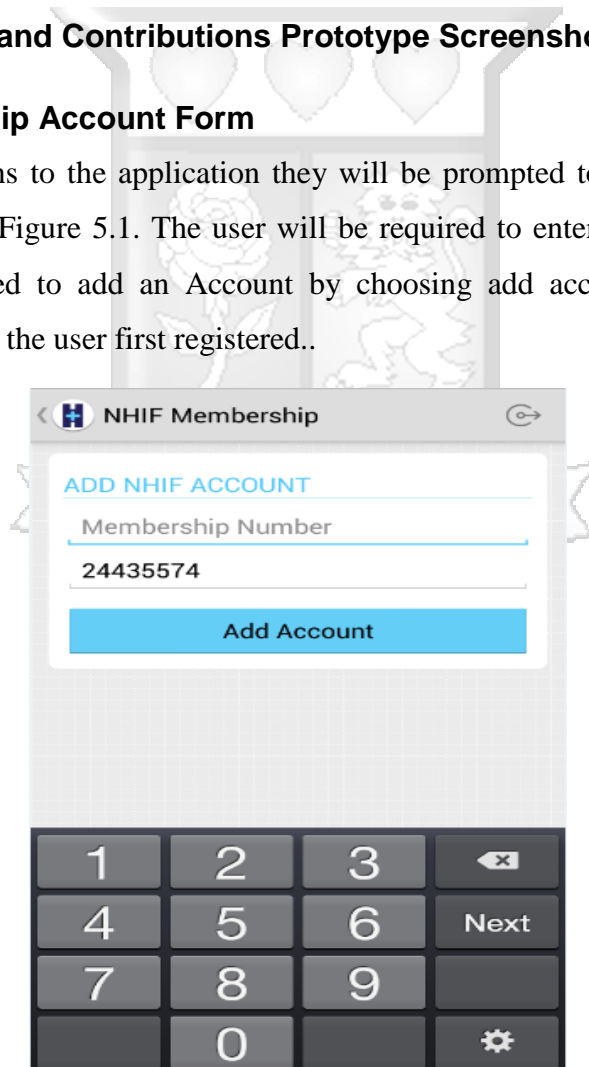
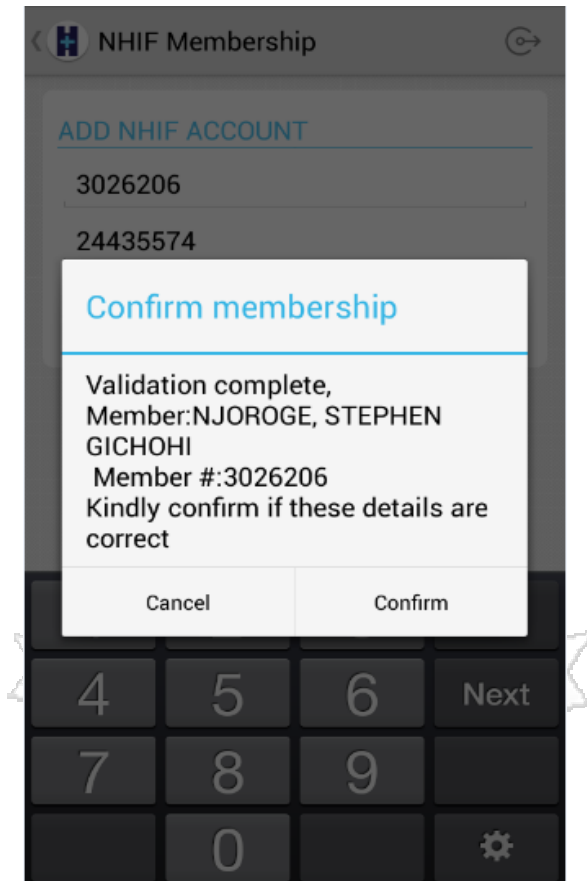


Figure 5. 1: Membership Account Form

### 5.2.2. Membership Validation

In Figure 5.2, upon entering a member account number, the Membership number is validated with the ID number of the user registered with NHIF. If both match, then a message displays showing that the user has been validated and the users name appears with their membership number found in NHIF database prompting the user to confirm if details are correct.



**Figure 5. 2: User Membership Validation**

Once the user is validated, a menu form in Appendix C displays. The user can proceed by choosing the options for making contributions, E-Slip payment, Top up wallet account, pay penalties and view account statement as illustrated with screenshots in Appendix C.

### 5.2.3. Collected Revenue Summary

Figure 5.3 and 5.4 illustrates complete revenue collected on a report platform. The screenshot of report on all contributions and payments made using E-Slip payments, individual contributions and penalties if any. The revenue streams are summarized on total revenues received today, total revenue received yesterday and total revenues received for the whole week and month. The reports are real-time and the summary is provided in real-time to provide NHIF management to view of all transactions and revenue.

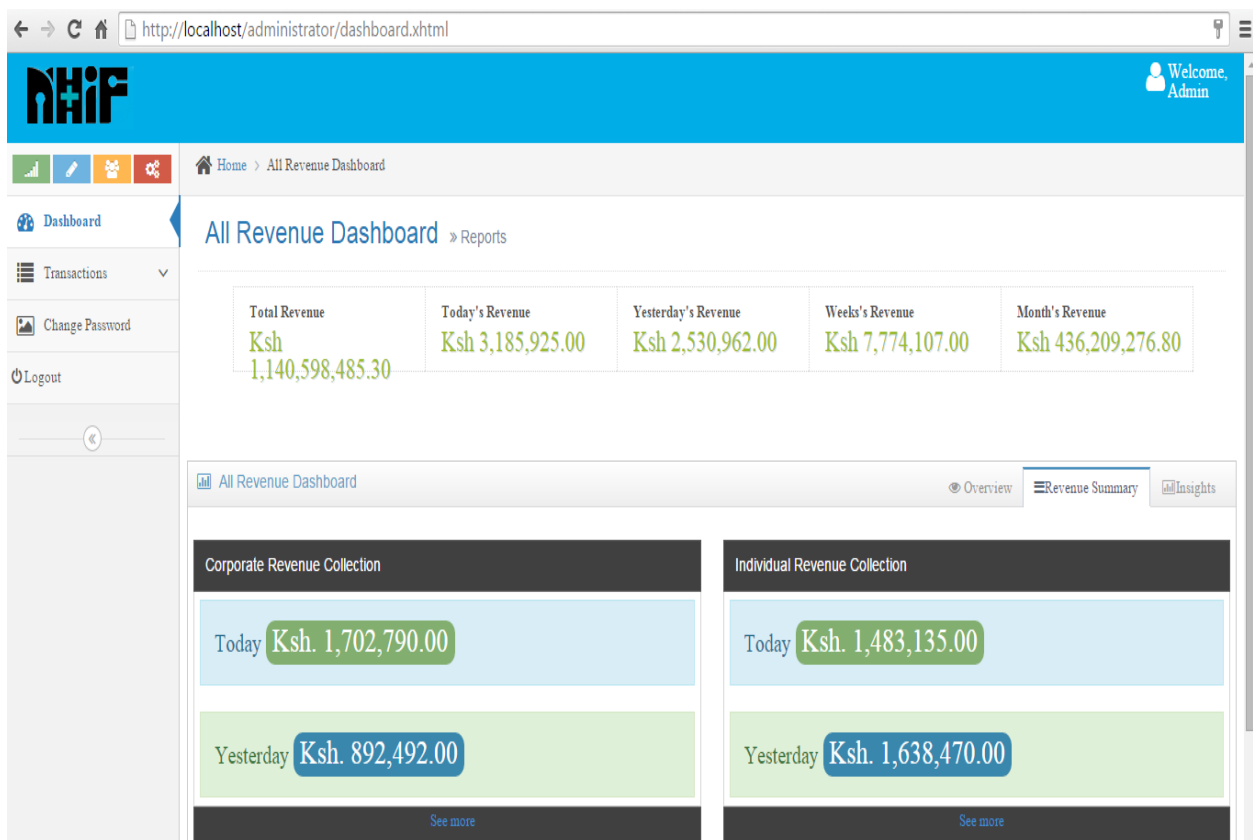
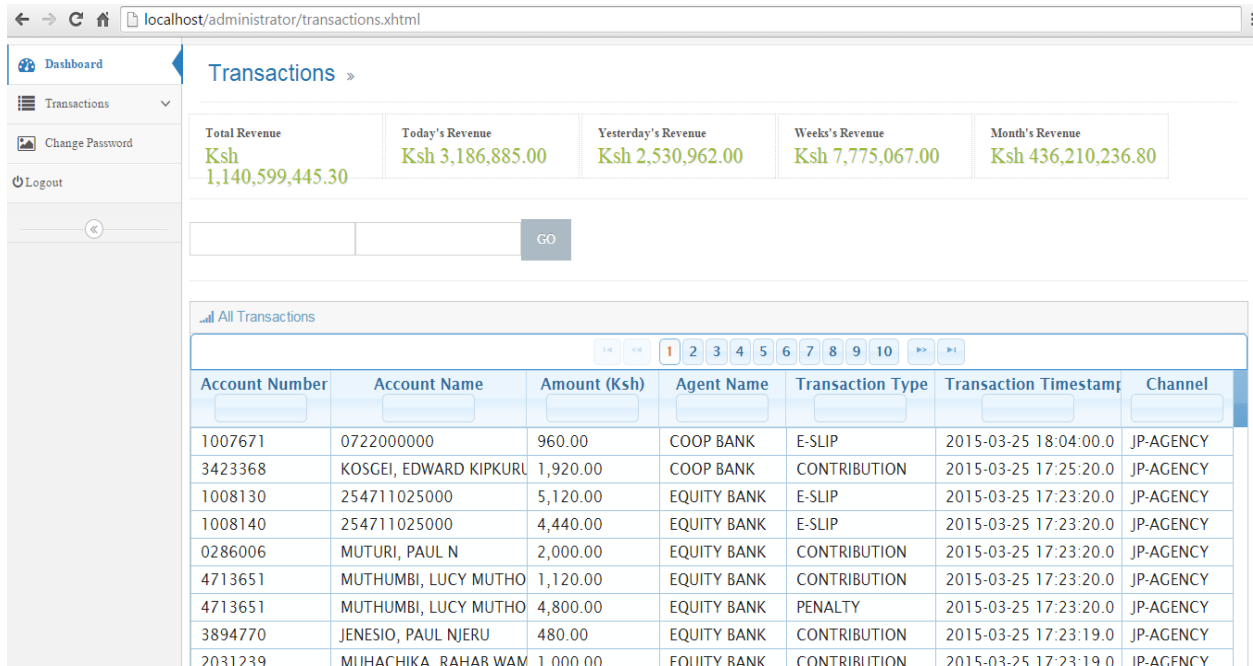


Figure 5. 3: Collected Revenue Summary

### 5.2.4. Transactions Report Dashboard Summary

All Transactions are summarized in real-time in Figure 5.5 and the type of transaction type displayed whether it is an individual contribution, an E-Slip payment or a Penalty charge. Individual payments are indicated by the type of payment and in this case it is contributions while corporate payments are determined by E-Slip payments.



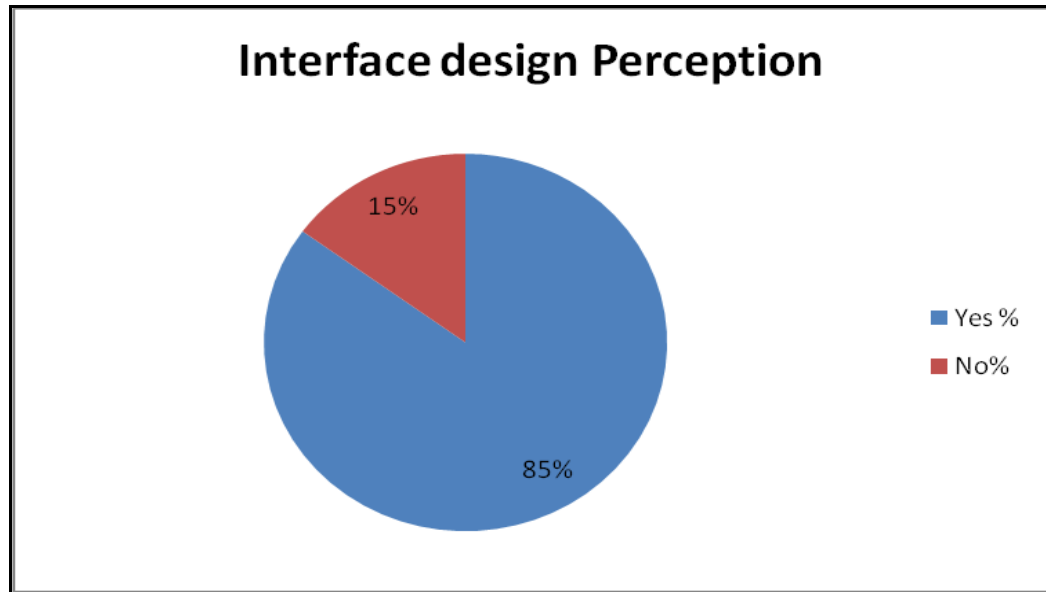
**Figure 5. 4: Transactions Report Summary**

### 5.3. Usability Testing

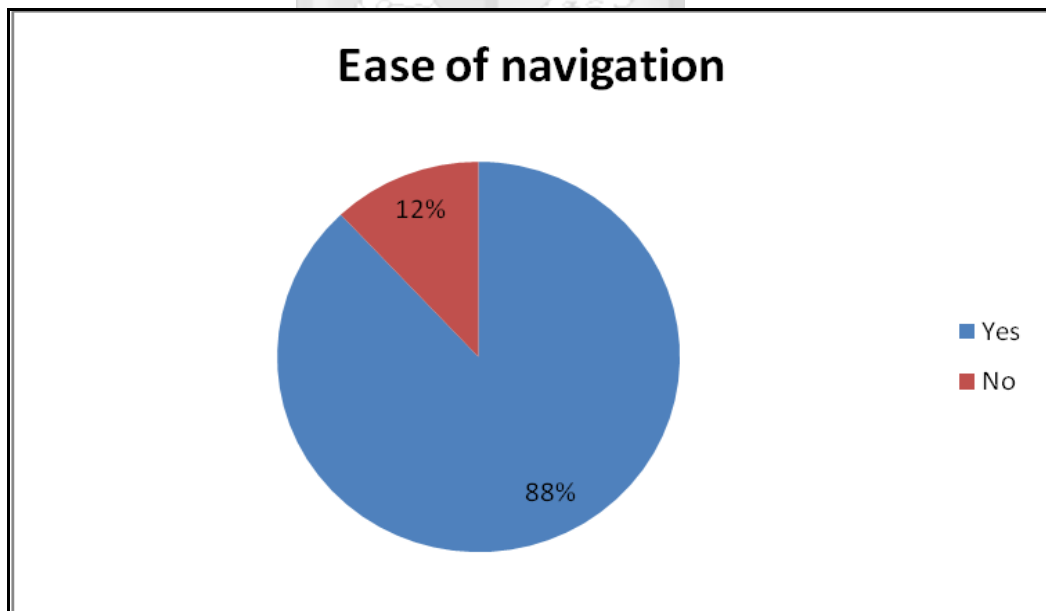
**Table 5. 1: Users response on the New System usability criteria**

Indicators	Yes % (Acceptable)	No% (Unacceptable)
Interface design Perception	85	15
Ease of navigation	88	12
User Experience	67	33

From the Table 5.1, it contains summary of respondents' perception based on the user interface design of the proposed application. 85% of respondents mentioned that the interface design is strong. Overall the percentage of optimistic reply indicates that the application is confidently strong to provide high quality service than the current existing payment mode. On user's perception on Ease of navigation, 88 % of the users agree that the application is easy to navigate and simple to perform tasks such as make payments, create accounts and check wallet balance.

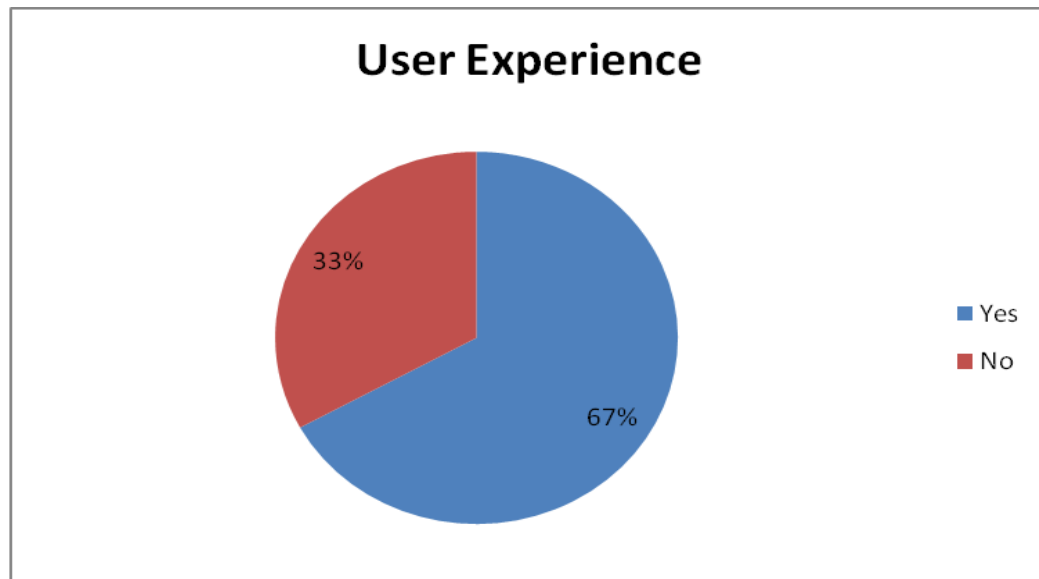


**Figure 5. 5: Users' Perception to the Interface Design of the Proposed System**



**Figure 5. 6: Users' Perception to the Ease of Navigation of the Proposed System**

The user experience is good with 67% of users in terms of user been validated upon making payments and access of the application within their phones. The application rarely crushes and resistant to errors as it is updated to debug the application on current changes



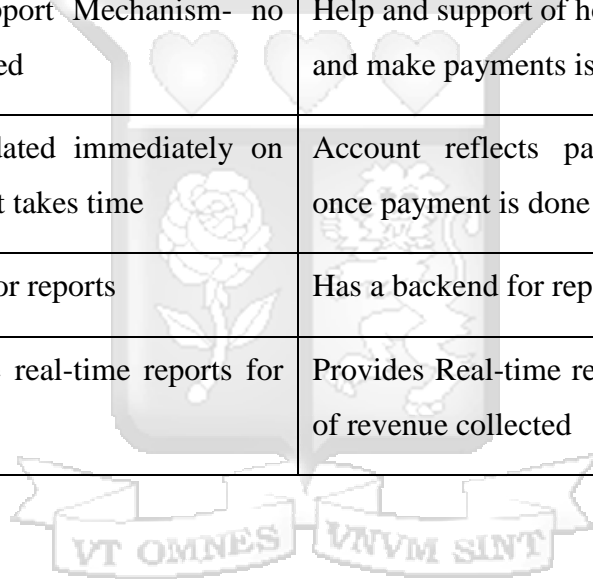
**Figure 5. 7: Users' Perception to the Interactivity with the Proposed System**

#### **5.4. Comparison between the Current System to the New Proposed System**

Based on the responses of the users, we have noted that the current way of making contribution and payments has been very challenging to users and that the proposed new system has been tested to deal with the current issue and it has improved on the users way of making contributions towards the insurance scheme through using a mobile application. It has also provided the NHIF management team and NHIF agents with automation of processes and financial controls in preparing end of year financials without reconciliations problems. Figure 6.7 illustrates the comparison between the existing and proposed system.

**Table 5. 2: Comparison between Current and Proposed Solution**

<b>Current System</b>	<b>Proposed New System</b>
1. No validation of user members is in place; inaccurate data entered won't be detected	Validation mechanism of members is in place. Does not allow wrong payments
2. Does not keep track of payments made. No issuing of mini statements. Only SMS's are sent for confirmation	Mini statements, reports and SMS confirmations are issued. Users accounts are personalized
3. Poor or No Support Mechanism- no help facility offered	Help and support of how to transfer funds and make payments is available
4. Account not updated immediately on payments made. It takes time	Account reflects payments immediately once payment is done
5. Has no backend for reports	Has a backend for reports
6. Does not provide real-time reports for financial controls	Provides Real-time reports and a summary of revenue collected



## Chapter 6: Discussions

### 6.1. Introduction

The purpose of this study was to develop a solution that enables NHIF to collect payments and contributions with a validation mechanism in place to eliminate errors in payments and to enable payments to be reflected on reports dashboard. The proposed solution was implemented based on the findings of the research. The study covers on analysis of demographic findings, system usability and functionality findings. The discussion on demographic research findings talk about results for analysis of the respondents 'demographic data'. The discussion on the system usability and functionality and finally discusses on comparison between the proposed and the current existing system.

### 6.2. Prototype Evaluation Based on Survey Results

The Table 6.1 identified the variables to account for in the questionnaire design in Appendix A

**Table 6. 1: Item for the Questionnaire in Identifying User Requirement**

<b>Variable</b>	<b>Indicator</b>
User behavior and Perception to making contributions using mobile application	User convenience Ease of use (navigation) User experience Confirmation message after transaction with transaction ID number
Perception of NHIF Agents to having the proposed contribution system	Ability to overcome errors through validation, ease of use. Applicability of application to cater all NHIF agent needs during accounting processes
Perception of NHIF management towards the proposed mobile application	Ability of application to produce timely reports Ability of the system to curb fraud

### 6.2.1. Response on Users Behavior towards the Current Manual Process

**Table 6. 2: Respondent Perception on Current Payment Processes**

Questions	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
	F	%	F	%	F	%	F	%	F	%
1 I usually pay for Monthly contributions using M-Pesa pay bill 200222	70	46.7	68	45.3	0	0	0	0	12	8
2 I might need to pay for my contributions any time of the day	0	0	2	1.3	0	0	25	16.7	123	82
3 I always have my account payments reflected immediately towards my claims	143	95.3	7	4.7	0	0	0	0	0	0
4 I encounter problems in making payments through M-pesa or manually by visiting NHIF agent	12	8	26	17.3	0	0	12	8	100	66.7
5 I always find the customer service poor and slow to handle processes	0	0	17	11.3	0	0	9	6	124	82.7

Table 6.2 looks at respondents' perception towards the current system and in this case the questionnaires were distributed to 150 Users. 70 members (46.7%) 'strongly disagree' on using current M- pesa payment service to pay for their contributions while 68 member (45.3%) chose 'disagree' on the same while only 12 members (8%) 'strongly agree' on using Mpesa for making their contributions. Out of 150 respondents, 123 members (82%) 'strongly agree' that they may

need to make contributions any time of the day. 25 members (16.7 %) ‘Agree’ while 2 members (1.3%) ‘Disagree’. 143 members (95.3%) out of 150 members ‘Strongly Disagree’ that their payments are reflected immediately in their accounts when they make payments. Only 7 members (4.7%) ‘Disagree’. 100 Members (66.7%) ‘Strongly Agree’ that they always encounter problems in making payments manually and also using the MPesa system . 12 members (8%) ‘Agree’ while 12 members (8%) and 26 members (8%) other ‘Strongly disagree’ and ‘Agree respectively’ . On the last question, if the customer service employed with the current system is poor and slow to handle processes, 124 members (82.7%) users reponded ‘Strongly Agree’ while 9 members (6%) chose ‘Agree’ and 17 members (11.3%) chose ‘Disagree’

Table 6.3 looks at users’ perception towards having a mobile application and over 80 % have access to a smart phone in which 120 members (80%) ‘Strongly agree’ and only 20 members (13.3%) ‘Agree’ while 8 member (5.3%) ‘Disagree’ and 2 members (1.3%) ‘Strongly Disagree’. On the second question, 110 members (73.3%) ‘Strongly Agree’ that having a mobile application for paying NHIF Contribution is more convenient while 30 Members (20%) only ‘Agree’ while 10 members (6.7%) are just ‘Neutral’ on question three, 137 members (91.3%) find paying online more convenient. On question four, 60 members (40%) ‘Strongly Agree’ that they encounter problems paying through an M-Pesa agent, 10 members (6.7%) only ‘Agree’ while 45 members (30%) only ‘Disagree’ and 35 members (23.3%) ‘Strongly Disagree’. On question five, 140 members (93.3%) ‘Strongly Disagree’ that they can reach NHIF support while 5 members (3.3%) ‘Disagree’ while other 5 members (3.3%) ‘Agree’. On question six, 142 members (94.7%) ‘Strongly Disagree’ that they can make late payments without the worry of incurring penalties, 4 members (2.7%) ‘Disagree’ while 2 members (1.3%) chose to ‘Agree’

Table 6.4 looks at respondent’s perception on current payments system. On question one asked to the NHIF agents 21 agents (70%) chose ‘Often’ to show that with current system in place they cannot track contributions, while 3 agents (10%) chose ‘always’ and 3 agents (10%) chose ‘Rarely’. On question two, 15 members (50%) chose ‘Often’ that fraud happens during and before accounting reports are reconciled, while 5 members (16.7%) chose ‘Often’ , 7 members (23.3%) chose ‘Rarely’ and 3 agents (10%) chose ‘Never’. On question 3, on cases involving money lose if NHIF staff takes full responsibility, 11 agents (36.7%) chose ‘Often’ while 16 agents (53.3%) chose ‘Sometimes’ 3 agents () chose ‘Always’. On question 4 regarding

defaulting payments, 18 agents (60%) chose it is 'Rare' to easily track defaulters, while 12 agents (40%) chose sometimes it is easier.

### 6.2.2. Response on Users' Attitude towards having a Contribution Application

**Table 6. 3: Respondent Perception and Attitude towards Having a Mobile Application**

	Questions	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
		F	%	F	%	F	%	F	%	F	%
1	I have access to a smart or a feature phone	2	1.3	8	5.3	0	0	20	13.3	120	80
2	I think having a mobile application for paying NHIF contribution is more convenient	0	0	0	0	10	6.7	30	20	110	73.3
3	It is more convenient to pay online than visiting NHIF offices	0	0	0	0	5	3.3	8	5.3	137	91.3
4	I always face trouble paying NHIF contributions directly through the current system or Agent	35	23.3	45	30	0	0	10	6.7	60	40
5	I can always reach NHIF support through Mobile phone	140	93.3	5	3.3	0	0	5	3.3	0	0
6	In case of late payment I can easily pay NHIF without worry incurring penalties	142	94.7	4	2.7	0	0	2	1.3	0	0

### 6.2.3. Response from NHIF Agents towards the Existing Payment System

**Table 6. 4: Respondent Perception on Existing Payment System**

	Questions	Never		Rarely		Sometime		Often		Always	
		F	%	F	%	F	%	F	%	F	%
1	We lose track of contribution payments	0	0	3	10	4	13.3	21	70	3	10
2	Fraud happens during before accounting reports are produced	3	10	7	23.3	5	16.7	15	50	0	0
3	In case of money lose, NHIF staff takes full responsibility	0	0	0	0	16	53.3	11	36.7	3	10
4	In case of defaulting of payments, we can easily track defaulters	0	0	18	60	12	40	0	0	0	0
5	Late payments can be easily traced and penalties imposed immediately	0	0	23	76.7	7	23.3	0	0	0	0
6	Errors on contributions received can be easily tracked and reversed	13	43.3	16	53.3	1	3.3	0	0	0	0
7	Reports are easily generated on timely request basis	15	50	15	50	0	0	0	0	0	0

On question 5 from Table 6.4, regarding if late payments can be easily traced and penalties imposed immediately, 23 NHIF agents (76.7%) chose 'Rarely' 7 agents (23.3%) chose 'Sometimes' On question 6, regarding if errors on contributions received can be easily tracked,

16 agents (53.3%) chose ‘Rarely’ while 13 agents (43.3%) chose ‘Never’ while only 1 agent (3.3%) chose ‘Sometimes’ On question seven regarding if reports are easily generated on timely request basis, 15 agents (50%) chose ‘Rarely’ while 15 agents (50%) chose ‘Never’.

#### 6.2.4. Questionnaire Response from NHIF Management

**Table 6. 5: Respondents Perception on having an Automated Contribution System**

	Questions	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
		F	%	F	%	F	%	F	%	F	%
1	We are considering allocating a budget to have an automated payments and contribution system	0	0	0	0	1	6.7	2	13.3	12	80
2	An automated payments system will positively ease everyday tasks	0	0	0	0	0	0	0	0	15	100
3	A mobile app will help us expand revenue collected	0	0	1	6.7	4	26.7	3	20	7	46.7
4	An automated payments and contribution system will provide accurate revenue reports to eliminate discrepancies	0	0	0	0	0	0	8	53.3	7	46.7

Table 6.5 looks at Respondents perception (NHIF Management) on having an automated contribution system, on question one regarding if the management is considering allocating a budget to have an automated payments system, 12 members (13.3%) respondents ‘Strongly Agree’ while 2 members (13.3%) only ‘Agree’ while only 1 member (6.7%) is ‘Neutral’. On question 2, regarding if an automated payment system will positively ease everyday tasks, the entire 15 members (100%) management team member chose ‘Strongly Agree’.

## Chapter 7: Conclusions and Recommendations

### 7.1. Conclusions

Based on the finding derived from the survey process, it can be concluded that the proposed contribution and payment system prototype has satisfied the objectives of the study. More than 80 % of the NHIF agents and management team ‘Strongly Agree’ that with the proposed system providing real-time reports will eliminate discrepancies and provide accurate revenue reports. The first objective of enhancing effective reconciliation process has been achieved through use of a reports dashboard that is real-time thus it reduces risk and fraud in financial statements due to comprehensive and continuous monitoring of key financial controls in the reports has enables business visibility and control leading to improved decision making. Use of the real-time based reports eliminates errors resulting from people circumventing existing financial controls and policies. All revenue streams are summarized and reports can be produced and downloaded according to users’ needs. Reports shall be used to aid in reconciliation.

Errors made during performing of contributions has been noted with the current system and in most cases it is not easy to reverse the transaction therefore the transaction is either never reversed or it is rarely reversed as suggested by over 85 % of the users. With the proposed application, a user can be validated upon creating a membership account and also while making payments therefore eliminating the error in making payments to a wrong account thus eliminating the technicalities involved in performing reversals of wrong payments. The researcher goes ahead to conclude that the proposed mobile prototype for payments and contribution design is confidently reliable, easy to use and user friendly as the usability test was performed on a selected sample of users and 85 % of the respondents perception based on the user interface were pleased with the interface as they suggested it has a strong design. More than 80 % of the users were impressed with the ease of navigation of the application. The navigation is straight forward and to the point. The user experience using the application is good as suggested by 67 % of the sampled population as the application is stable and has help and support mechanism.

## **7.2. Recommendations**

- i. A web portal for users who do not wish to use a mobile application due to reasons such as preference and adaptability to changes to technological trend need to be developed. It will enable convenience for users without smart phones.
- ii. Members who prefer to document their payments in form of receipts will be required to use the web portal to print receipts.
- iii. Members should be educated and trained on importance of mobile solutions
- iv. NHIF agents should adopt the system to avoid manually collecting contributions to deter automatic reconciliation from happening.
- v. True transformation needs NHIF to strictly implement the system and pay close attention to the re-engineering process, reforming the institution and creating an environment for all members to adopt the system.

## **7.3. Suggestions for Further Research**

More areas for further study should be conducted on how Banks such as National bank and Equity bank can be integrated with the payment system to allow member to make contributions to NHIF through cheque payments and have users validated against their banking details. Another area of further research is how to automate charge backs on suspicious fraudulent contributions and payment performed and minimizing fraudulent transactions.

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## Appendices

### Appendix A: Survey Questionnaires

Please circle the statement, which is the most appropriate answer for you.

**Section 1:** user behavior: Attitude of users towards having a mobile application to pay their contributions to NHIF

Indicate your level of agreement with the following statements from 1 (Strongly disagree) to 5 (Strongly Agree).

**Table A. 1: Users Survey Questionnaire Section 1**

	Questions	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	I have access to a smart or a feature phone					
2	I think having a mobile application for paying NHIF contribution is more convenient					
3	It is more convenient to pay online than visiting NHIF offices					
4	I always face trouble paying NHIF contributions directly through Mpesa or Mpesa Agent					
5	I can always reach NHIF support through Mobile phone					
6	In case of late payment I can easily pay NHIF without worry incurring penalties					

**Please circle the statement, which is the most appropriate answer for you,**

**Section 2:** Users behavior towards the current manual process for making NHIF contributions.

Indicate your level of agreement with the following statements from 1 (Strongly disagree) to 5 (Strongly Agree).

**Table A. 2: Users Survey Questionnaire Section 2**

	<b>Questions</b>	<b>Strongly disagree</b>	<b>Disagree</b>	<b>Neutral</b>	<b>Agree</b>	<b>Strongly agree</b>
1	I usually pay for Monthly contributions using M-Pesa pay bill 200222					
2	I might need to pay for my contributions any time of the day					
3	I always have my account payments reflected immediately towards my claims					
4	I always encounter problems in making payments through Mpesa or manually by visiting NHIF agent					
5	I always find the customer service poor and slow to handle processes					

**Please circle the statement, which is the most appropriate answer for you.**

**Section 1:** Attitude of NHIF workers towards the current M-Pesa based payment system

Indicate your level of agreement with the following statements from 1 (Never) to 5 (Always).

**Table A. 3: Questionnaire to NHIF Agents**

	<b>Questions</b>	<b>Never</b>	<b>Rarely</b>	<b>Sometimes</b>	<b>Often</b>	<b>Always</b>
1	We lose track of contribution payments					
2	Fraud happens during before accounting reports are produced					
3	In case of money lose, NHIF staff takes full responsibility					
4	In case of defaulting of payments, we can easily track defaulters					
5	Late payments can be easily traced and penalties imposed immediately					
6	Errors on contributions received can be easily tracked and reversed					
7	Reports are easily generated on timely request basis					

**Please circle the statement, which is the most appropriate answer for you.**

**Section 2:** NHIF Management behavior: Attitude of NHIF employers towards having an automated contribution collection system

Indicate your level of agreement with the following statements from 1 (Total Disagreement) to 5 (Total agreement)

**Table A. 4: Questionnaire to NHIF Management**

	<b>Questions</b>	<b>Strongly disagree</b>	<b>Disagree</b>	<b>Neutral</b>	<b>Agree</b>	<b>Strongly agree</b>
1	We are considering allocating a budget to have an automated payments and contribution system					
2	An automated payments system will positively ease everyday tasks					
3	A mobile app will help us expand revenue collected					
4	An automated payments and contribution system will provide accurate revenue reports to eliminate discrepancies					

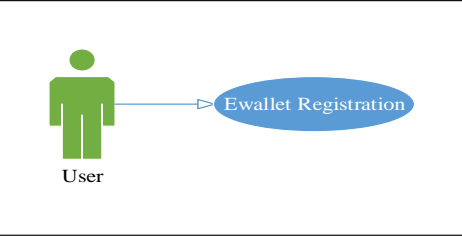
What do you consider the main advantages to be for your company in respect to deploying a real-time contribution and payment reporting system?

1. Reduce misappropriation of funds.
2. Determine weekly and daily reports for reconciliation purposes
3. Trace Fraud

Is there any additional functionality you would like from a contribution and payment solution?

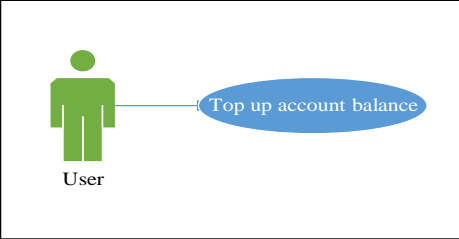
- a) .....
- .....
- b) .....
- .....

## Appendix B: Use Case Specification Diagrams

	<p>USE CASE: NHIF E-wallet Registration</p>  <p>The diagram shows a green stick figure labeled 'User' on the left. A blue arrow points from the figure to a blue oval labeled 'Ewallet Registration' on the right.</p>
	<p><b>Brief Description</b></p> <p>This use case will be used by user / client to create a new E-wallet account using Phone Number and PIN</p>
	<p><b>Pre- Condition</b></p> <p>User will automatically enter this page if a user does not have an existing account</p>
	<p><b>Characteristic of Activation</b></p> <p>It is used when a new user intends to create to activate their account by using his/her Phone number and Pin Number</p>
	<p><b>Flow of Event</b></p> <ul style="list-style-type: none"> <li>• <b>Basic Flow</b></li> </ul> <p>This use case will begin when the user click “Register” button. The system displays a page which is used as a form to input info such as ID number, Phone number and PIN about the user. Once user submits requested info it is input is inserted into database.</p> <ul style="list-style-type: none"> <li>• <b>Exceptional Flow</b></li> </ul> <p>System Displays error is user submits invalid mail address</p>
	<p><b>Post Condition</b></p> <p>User can login to the NHIF Menu by using phone number and PIN after E-wallet Registration</p>

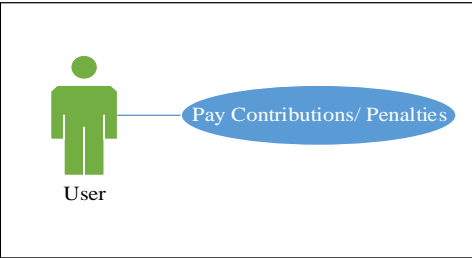
**Figure B. 1: E-wallet Registration**

A user is required to create a wallet account as illustrated in the use case specification Figure B.1. The use case further displays the basic flow and characteristics of the user when creating a new wallet account with the pre condition and post condition statements for creation of a wallet and after creating a wallet

	<p>USE CASE: Top Up Account</p> 
	<p><b>Brief Description</b></p> <p>This use case will be used by user / client to top up their wallet accounts</p>
	<p><b>Pre- Condition</b></p> <p>User will need to have an M-pesa account with Money so as to use the paybill number provided to load their E- wallet account</p>
	<p><b>Characteristic of Activation</b></p> <p>It is used when a new user intends to make payments to NHIF against their Membership Number</p>
	<p><b>Flow of Event</b></p> <ul style="list-style-type: none"> <li>• Basic Flow</li> </ul> <p>This use case will begin when the user selects “Top up” button. The system displays a page on top up instructions with the provided MPESA paybill number and instruction on how to send money to their E-Wallet using the Paybill number</p> <ul style="list-style-type: none"> <li>• Exceptional Flow</li> </ul> <p>System will send an SMS confirming transactions success or failure</p>
	<p><b>Post Condition</b></p> <p>NHIF E-wallet account shows the balance after the transactions</p>

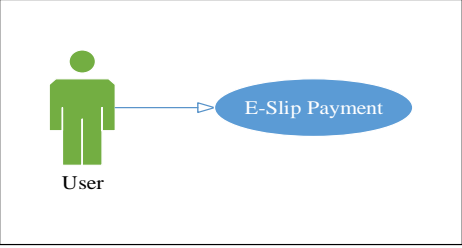
**Figure B. 2: Top Up Account**

The use case specification for top up account as illustrated in Figure B.2 gives a brief description on how the user can top up their wallet and that they will need an M-Pesa account as a precondition in toping up their wallet account. The basic flow is explained and after toping up the wallet account a user account will display the account balance.

	<p>USE CASE: Pay Contributions / Penalties</p> 
	<p><b>Brief Description</b></p> <p>This use case will be used by user / client to make payments to NHIF</p>
	<p><b>Pre- Condition</b></p> <p>The User has Phone Number and PIN to their login</p>
	<p><b>Characteristic of Activation</b></p> <p>User will require to enter their PIN number to complete payment</p>
	<p><b>Flow of Event</b></p> <ul style="list-style-type: none"> <li>• <b>Basic Flow</b></li> </ul> <p>This use case will begin when the user enters amount to pay and Confirm payment and enter their PIN numbers to complete payments as money will be deducted from their E-wallet</p> <ul style="list-style-type: none"> <li>• <b>Exceptional Flow</b></li> </ul> <p>System will send an SMS displaying insufficient funds and prompting to top up of E-wallet</p>
	<p><b>Post Condition</b></p> <p>Confirmation SMS is sent after transactions</p>

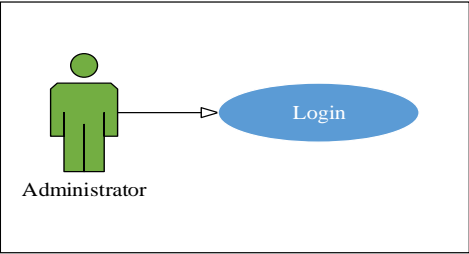
**Figure B. 3: Pay Contributions / Penalties**

Figure B.3 illustrates the use case for paying contributions. The user will require their Membership ID number validated as a precondition for making payments and an SMS will be sent after payment has been confirmed as a post condition

	<p>USE CASE: E-Slip Payment</p>  <pre> graph LR     User((User)) --&gt; ESlipPayment(E-Slip Payment)   </pre> <p>The diagram shows a green stick figure labeled 'User' on the left. A blue arrow points from the figure to a blue oval labeled 'E-Slip Payment' on the right.</p>
	<p><b>Brief Description</b></p> <p>This use case will be used by Employers to enter a generated E-Slip Number</p>
	<p><b>Pre- Condition</b></p> <p>User will need an E-Slip number generated from NHIF website</p>
	<p><b>Characteristic of Activation</b></p> <p>It is used when an Employer intends to make payments against the E-slip Number generated from NHIF</p>
	<p><b>Flow of Event</b></p> <ul style="list-style-type: none"> <li>• <b>Basic Flow</b></li> </ul> <p>This use case will begin when the user selects “Eslip payment” button. The system displays a page where you enter E-slip Number where one is required to verify and check out</p> <ul style="list-style-type: none"> <li>• <b>Exceptional Flow</b></li> </ul> <p>System error generates If it's a non-existent E-slip number is entered</p>
	<p><b>Post Condition</b></p> <p>System will send an SMS confirming transactions success or failure</p>

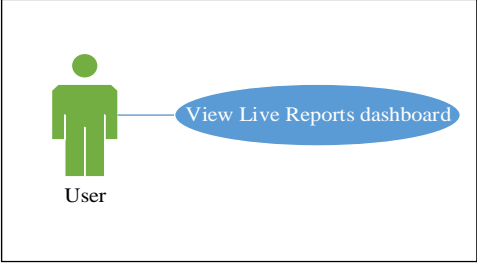
**Figure B. 4: E-Slip Payment**

The use case show a brief description of how a user can insert an E-Slip number provided to an employer to the prototype. The E-Slip number will be able to be processed to provide details of the payments. Figure B.4 depicts how a user can make an E-Slip transaction using the mobile prototype

	<p>USE CASE: Admin Login</p> 
	<p>Brief Description</p> <p>This use case will be used by Admin to login to system</p>
	<p>Pre- Condition</p> <p>The Admin must have Username and Password to login to system</p>
	<p>Characteristic of Activation</p> <p>Execution depends on administrator's demand</p>
	<p>Flow of Event</p> <ul style="list-style-type: none"> <li>• Basic Flow</li> </ul> <p>Use case will begin when admin inserts his username and password</p> <ul style="list-style-type: none"> <li>• Exceptional Flow</li> </ul> <p>System display an error message and then the user must enter the valid username and password.</p>
	<p>Post Condition</p> <p>Menu for Reports Appears after Admin Login</p>

**Figure B. 5: Backend Admin Login**

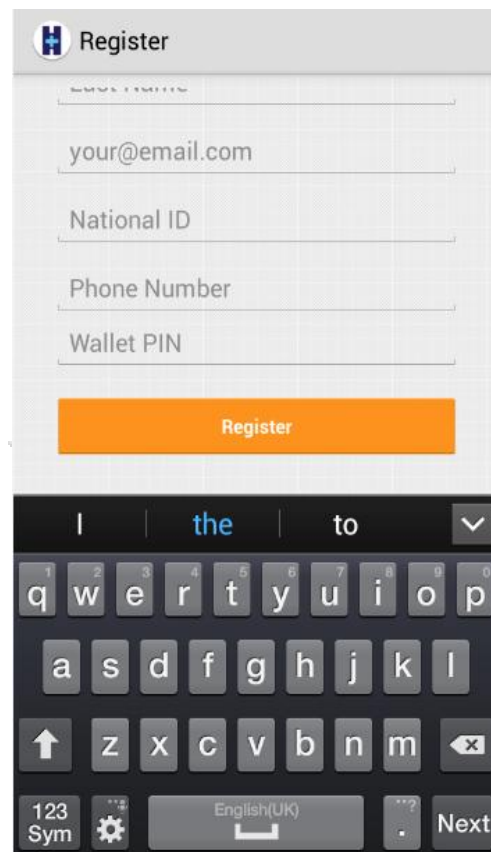
The admin login Use Case is illustrated in Figure B.5. The admin login requires the admin username and password. Once the correct Login credentials are provided, the reports dashboard will then display.

	<p>USE CASE: Admin View Live Reports Dashboard</p>  <pre> graph LR     User((User)) --- UC([View Live Reports dashboard])   </pre>
	<p><b>Brief Description</b></p> <p>This use case will be used by Admin to view all timely reports of transactions performed</p>
	<p><b>Pre- Condition</b></p> <p>The Admin must have a username and Password to login to the system</p>
	<p><b>Characteristic of Activation</b></p> <p>Execution depends on administrators demand</p>
	<p><b>Flow of Event</b></p> <ul style="list-style-type: none"> <li>• Basic Flow</li> </ul> <p>This use case will begin when the Admin reports dashboard displays reports on NHIF contributions and payments and the Admin can navigate to reports displayed by any payment method used</p>
	<p><b>Post Condition</b></p> <p>Admin can print out reports on timely, daily, weekly or monthly basis</p>

**Figure B. 6: Admin Dashboard Report**

The Admin Dashboard displays reports and it is used to provide timely reports to the admin and management.

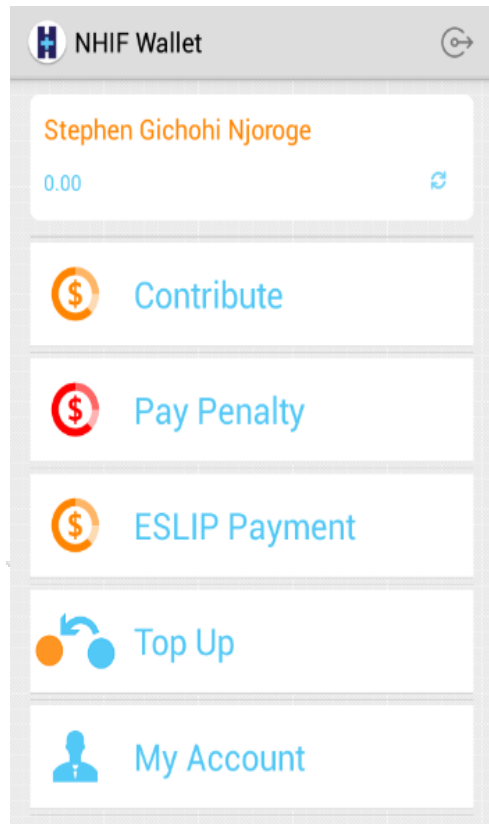
## Appendix C: Implementation Screenshots



The screenshot shows a mobile application interface for user registration. At the top, there is a header with a blue icon and the text "Register". Below the header, there are four input fields: the first contains "your@email.com", the second is labeled "National ID", the third is labeled "Phone Number", and the fourth is labeled "Wallet PIN". Below these fields is a prominent orange button with the text "Register". At the bottom of the screen, a virtual keyboard is visible, showing the text "I the to" in the prediction bar and various keys including "q w e r t y u i o p", "a s d f g h j k l", "z x c v b n m", and "Next".

**Figure C. 1: User Registration Form**

Figure C.1 illustrates a screenshot of user registration form. The user will be prompted to register to the prototype before accessing the menu. The user will be required to enter details such as First name, Last name, email address, National identity number, phone number and wallet PIN.



**Figure C. 2: User Menu Form**

Once the user registers and logs in to the prototype, the menu will be displayed in Figure C.2. The Menu consists of Contribute option, Pay Penalty option, E-Slip payment option, Top up option and my account option. The user will proceed by adding an account as illustrated in Figure 5.1 in chapter 5 where validation will take place for user or member in making contributions to NHIF.

Payment

Enter the amount of contribution you would like to make to NHIF

Contribution Amount

Select Account:

NJOROGE, STEPHEN GICHOHI  
3026206

Proceed to Payment

1 2 3

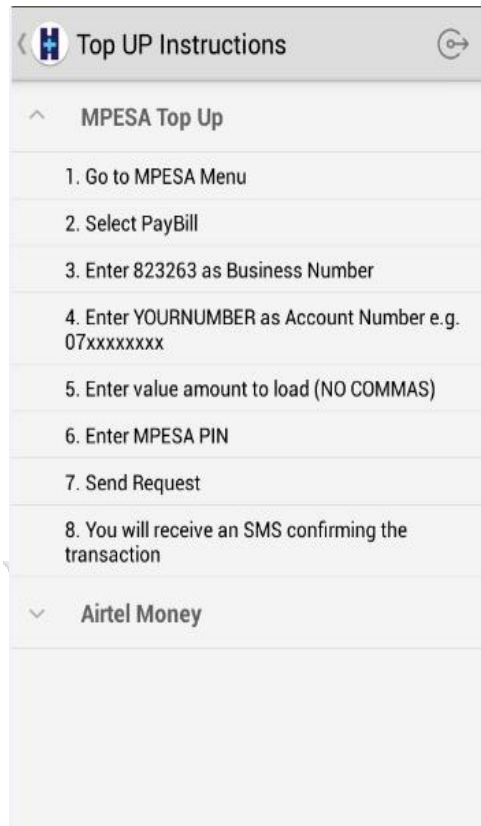
4 5 6 Done

7 8 9

0

**Figure C. 3: Make Contribution Form**

Once the member is validated upon with their membership details, the member will choose to contribute by choosing the contribute button in the menu. In Figure C.3, the validated member can choose to insert the amount to contribute.



**Figure C. 4: Top up Menu**

Instructions on how to load the members account with money to make payments is explained in the Figure C 4. This page display if a user attempts to make payments and they have insufficient funds in their account.

The screenshot shows a mobile application interface for making a payment. At the top, there is a header with a back arrow, a home icon, and the word 'Payment', followed by a refresh icon. The main content area has a light gray background with a grid pattern. It starts with the text 'Enter Eslip Number' above a text input field containing the placeholder 'Eslip Number'. Below the input field is the text 'Select Account:' followed by the account name 'NJORGE, STEPHEN GICHOHI' in orange and the account number '3026206' in blue. A red button with a white right-pointing arrow and the text 'Proceed to Payment' is positioned below the account information. At the bottom of the screen, a standard numeric keypad is displayed, featuring digits 1-9, 0, a backspace key with an 'x', a 'Done' key, and a settings gear icon.

**Figure C. 5: E-Slip Payment Form**

Payments against Generated E-Slips will be required for corporate members to provide the E-Slip number to the form in Figure C.5. The user will then proceed with payment.

Payment

Enter the amount of penalty to pay to NHIF

Penalty Amount

Select Account:

NJORGE, STEPHEN GICHOHI  
3026206

Proceed to Payment

1 2 3

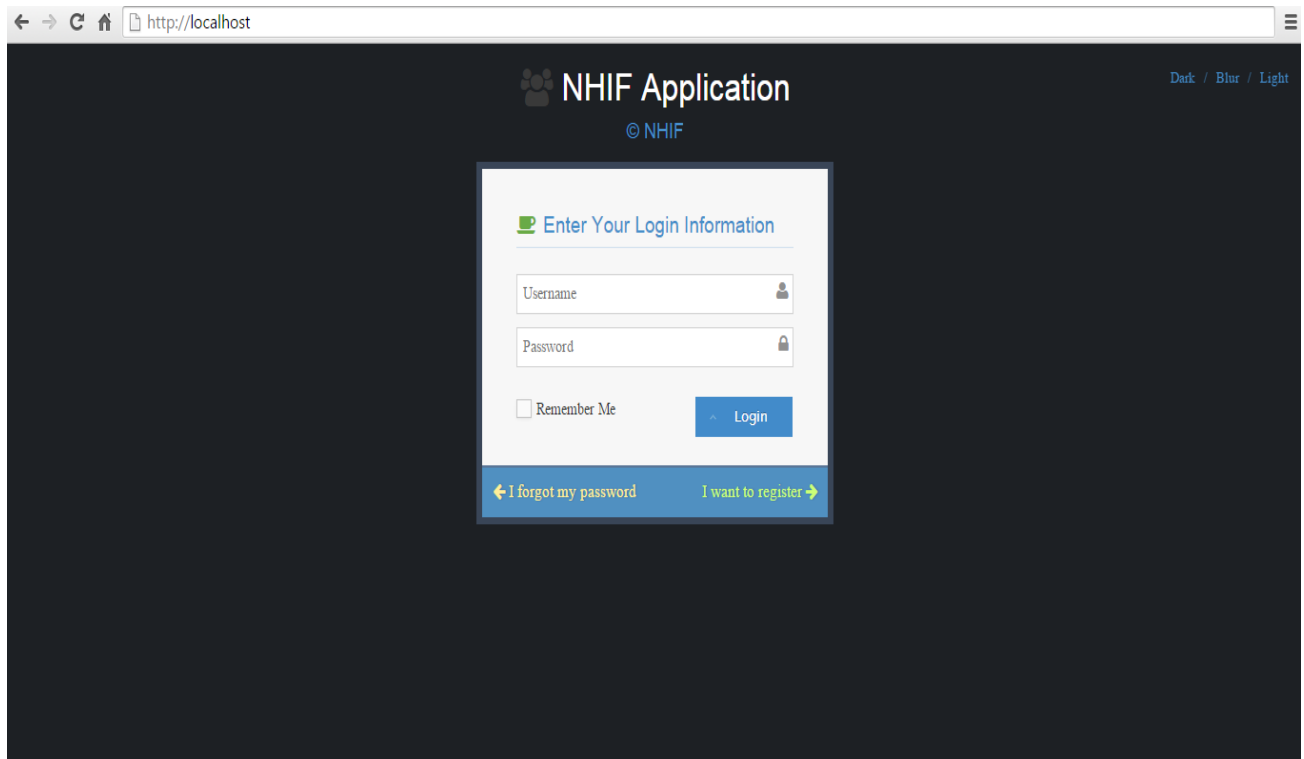
4 5 6 Done

7 8 9

0

**Figure C. 6: Penalty Payment Form**

A user can choose to use the penalty option if they are imposed penalties due to late payments. The user will be required to enter the amount to pay as penalty to the menu in figure C.6. Once the amount has been provided the user may choose to proceed with payments.



**Figure C. 7: Admin Login Page**

Figure C.7 is the administrator reports dashboard backend where an admin is prompted to enter his username and password in order to login into reports dashboard.

