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A Mobile Based Accounting and Sales Management System for Small Retail Shops

Magerer Lawrence Kibet

**A Dissertation Submitted in Partial Fulfilment of the Requirements for the Award of a
Master of Science Degree in Mobile Telecommunications and Innovation (MSc. MTI)**

Faculty of Information Technology

Strathmore University

June, 2017

DECLARATION

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

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APPROVAL

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ABSTRACT

The study showed that most of small scale retailers have not yet embraced technology in their business with only 17% having implemented a computer-based system. The study proposes an application for accounting and management of inventory to be adopted by the small scale retailers in Kenya. The application enhances the accounting and inventory management processes of retail shops by countering the challenges of the traditional paper-based system which is used by most small scale retailers. The application assists retailers to manage kiosk's products, stock and to review product sales. It has integrated a barcode system for easier tracking of the shops inventory. It has implemented the VMI system that allows suppliers to keep track of the product stock levels thus making the management of inventory more efficient and effective.

The proposed solution was developed following the agile development life cycle which provides flexibility in reworking of the solution. The solution was built to have a front-end that was implemented as a mobile application and the backend as a web application. The mobile application is used by the retailers to manage their shop and suppliers to keep track of inventory levels and the web application provides sales analytics and system administration.

Keywords: Bookkeeping, Inventory Management, Vendor Managed Inventory

TABLE OF CONTENTS

DECLARATION	i
ACKNOWLEDGEMENT	ii
ABSTRACT.....	iii
LIST OF TABLES.....	viii
LIST OF FIGURES	ix
LIST OF ABBREVIATIONS.....	xi
CHAPTER 1: INTRODUCTION	1
1.1 Background of Study.....	1
1.2 Problem Statement	3
1.3 Research Objectives	3
1.4 Research Questions	3
1.5 Justification of Study.....	4
1.6 Research Scope and Limitations	4
1.7 Summary	4
CHAPTER 2: LITERATURE REVIEW	5
2.1 Introduction	5
2.2 Kiosks Bookkeeping	5
2.3 Bookkeeping in Small Medium Enterprises.	6
2.4 Inventory Management	7
2.5 Vendor Managed Inventory	7
2.6 VMI and Performance of SMEs.....	9
2.7 Smart Stock Management Control	10
2.8 Barcode System.....	11
2.9 Mobile Technologies in Business	11
2.10 Related Solutions.....	13
2.10.1 MYOB	13

2.10.2 GOIS	13
2.10.3 On Shelf.....	14
2.10.4 Inventory Now	15
2.11 Gaps and Limitations	15
2.12 Conceptual Framework	16
2.13 Summary	16
CHAPTER 3: RESEARCH METHODOLOGY	17
3.1 Introduction	17
3.2 Agile Software Development	17
3.2.1 Planning Phase.....	18
3.2.2 Requirement Analysis.....	18
3.2.3 System Design Phase.....	19
3.2.4 Building or Implementation Phase	20
3.2.5 Testing Phase.....	20
3.3 Reasons for Using Agile Methodology.....	21
3.4 System Development Tools and Technologies	21
3.5 Ethical Measures	21
3.6 Conclusions	22
CHAPTER 4: REQUIREMENT ANALYSIS.....	23
4.1 Introduction	23
4.2 Requirement Analysis	23
4.2.1 Functional Requirements	23
4.2.2 Non-Functional Requirements.....	24
4.3 Current Method of Accounting and Managing Inventory.....	24
4.4 Smart Phone Ownership.....	25
4.5 Use of Mobile Applications	25
4.6 Mobile Device Operating System	26

4.7 Challenges in the Current Methods of Inventory Management	26
4.8 Suitability of a Mobile Application for Accounting and Managing Inventory	27
4.9 Conclusions	28
CHAPTER 5: SYSTEM DESIGN AND ARCHITECTURE.....	29
5.1 Introduction	29
5.2 System Architecture	29
5.3 System Design.....	30
5.3.1 Use Case Diagram	30
5.3.2 Sequence Diagram	34
5.3.3 Partial Domain Diagram.....	36
5.3.4 Context Diagram.....	37
5.3.5 Entity Relationship Diagram	37
5.3.6 Database Schema	39
5.3.7 User Interface Flow Diagrams.....	41
5.4 Conclusions	53
CHAPTER 6: PROTOTYPE BUILDING AND TESTING	54
6.1 Introduction	54
6.2 Functionality of the System.....	54
6.2.1 Mobile Application.....	54
6.2.2 Web Application.....	55
6.3 Implementation Environment.....	55
6.4 System Modules	56
6.4.1 Mobile Application.....	56
6.4.2 Web Application.....	61
6.5 Testing.....	63
6.5.1 Usability Testing.....	63
6.5.2 Functional Testing	63

6.5.3 Compatibility Testing	69
6.5.4 Security Testing	70
6.5.5 Integrity Testing	70
6.5.6 User Testing.....	71
6.6 Conclusions	72
CHAPTER 7: DISCUSSIONS	73
7.1 Introduction	73
7.2 Findings and Achievements	73
7.3 Discussions.....	74
7.4 Limitations of the Application	75
CHAPTER 8: CONCLUSIONS AND RECOMMENDATIONS.....	76
8.1 Summary	76
8.2 Recommendations	76
8.3 Suggestions for Future Studies.....	76
APPENDICES	77
Appendix A: User Requirements Questionnaire.....	77
Appendix B: User Testing Questionnaire	79
Appendix C: Android Platform Test	80
Appendix D: Turnitin Report	81
REFERENCES	82

LIST OF TABLES

Table 5.1 Users Table	39
Table 5.2 User Type Table.....	39
Table 5.3 Products Table	39
Table 5.4 Product Category Table	40
Table 5.5 Sales Transactions Table	40
Table 5.6 Expense Table.....	40
Table 6.1 Usability Test.....	63
Table 6.2 Account Creation Test	64
Table 6.3 Login and Logout Test.....	65
Table 6.4 Adding Product Test Case	66
Table 6.5 Sales Processing Test Case	67
Table 6.6 Post Expense Test Case	68
Table 6.7 View Sales Analysis Test Case.....	69
Table 6.8 Web Browser Testing	70
Table 6.9 Security Test Case	70

LIST OF FIGURES

Figure 2.1 The Traditional Ordering Process vs VMI	8
Figure 2.2 GOIS Standalone	14
Figure 2.3 Conceptual Framework	16
Figure 3.1 Agile Development Methodology	17
Figure 4.1 Current Methods of Accounting and Managing Inventory	25
Figure 4.2 Smart Phone Ownership	25
Figure 4.3 Mobile Applications Usage	26
Figure 4.4 Mobile Phone Operating System.....	26
Figure 4.5 Challenges Experienced in Current Methods of Inventory Management	27
Figure 4.6 Suitability of a Mobile Application for Accounting and Managing Inventory	27
Figure 5.1 System Architecture	29
Figure 5.2 Use Case Diagram	30
Figure 5.3 System Diagram	35
Figure 5.4 Partial Domain Model	36
Figure 5.5 Context Diagram	37
Figure 5.6 Entity Relationship Diagram	38
Figure 5.7 Login Wireframe	42
Figure 5.8 Register Wireframe	43
Figure 5.9 Dashboard (Retailer) Wireframe	44
Figure 5.10 Add Product Wireframe	44
Figure 5.11 Product Stock Wireframe	45
Figure 5.12 Statistics Wireframe	45
Figure 5.13 Product Sale Wireframe	46
Figure 5.14 List of Sale Products Wireframe	46
Figure 5.15 Add Expense Wireframe	47
Figure 5.16 Expense List Wireframe	47
Figure 5.17 Sales Report Wireframe	48
Figure 5.18 Accounting Wireframe	48
Figure 5.19 Retailer List Wireframe.....	49
Figure 5.20 Product Stock Level Wireframe	49
Figure 5.21 Login Wireframe	50
Figure 5.22 Dashboard Wireframe	50

Figure 5.23 List of Supplier Wireframe.....	51
Figure 5.24 Sales Records Wireframe	51
Figure 5. 25 List of Retailers Wireframe	52
Figure 5.26 Product Sales Wireframe	52
Figure 5.27 Add User Wireframe	53
Figure 6.1 Login Screen.....	56
Figure 6.2 Account Creation Screen.....	57
Figure 6.3 Dashboard Screen.....	57
Figure 6.4 Add Product Screen.....	58
Figure 6.5 Product List Screen.....	58
Figure 6.6 Barcode Reader Screen.....	59
Figure 6.7 Products Screen	60
Figure 6.8 Product Sale Screen.....	60
Figure 6.9 Sales Statistics Screen	61
Figure 6.10 List of Retailer.....	62
Figure 6.11 List of Suppliers	62
Figure 6.12 User Friendliness Feedback.....	71
Figure 6.13 Functionality Test.....	71
Figure 6.14 Acceptability Feedback	72

LIST OF ABBREVIATIONS

VMI - Vender Managed Inventory

SMEs - Small Medium Enterprises

GOIS - Goods Order Inventory Management System

IDE - Integrated Development Environment

OS - Operating System

RFID - Radio-Frequency Identification

CAS - Computerized Accounting System

CHAPTER 1: INTRODUCTION

1.1 Background of Study

The small and medium enterprises (SMEs) plays a significant role in today's Kenyan Economy. Despite their significance, past statistics shows that three of five businesses tend to fail during their first few months of operation (Kenya National Bureau of Statistics, 2007). In Kenya SMEs refers to micro and small enterprises (MSEs) or micro, small and medium enterprises (MSMEs). Under the Micro and Small Enterprise Act of 2012, micro enterprises have a maximum annual turnover of KES 500,000 and employ less than 10 people. Small enterprises have between KES 500,000 and 5 million annual turnover and employ 10 to 49 people. The failure of most of the SMEs is as a result of improper record keeping and poor inventory management mechanisms. The accounting and inventory management processes greatly affects the growth and profitability of the business. The success of a business is attributed to the profitability of the business. Profits are mostly realized through cost savings, reduction of risk and through improving working capital. To achieve this business owners need to account for the business transaction at the end of each business day. This daily routine helps the retailers to gauge the financial performance of the business.

The retail industry has grown over the recent years with retailers adopting the use computer based systems in running their business. In Kenya, supermarkets such as Naivas, Tuskys, Nakumat and Uchumi have implemented point-of-sale and accounting systems in order to make the process of bookkeeping and inventory control more efficient. These two business processes are the core activities of most retail shops. A research by Mwangi (2011) found that most of the kiosks in Kenya which fall under micro and small enterprises (MSEs) were still using the traditional manual system of accounting which is paper-based. It involved keeping records on counter books and manually balancing revenue and expenses of the business. Tavakolian (1995) emphasized that the manual accounting systems consisted of book ledgers and use of calculators. The manual system was prone to errors that could go undetected for quite some time. This led to the introduction of computerized accounting systems (CAS). The CAS utilizes a computer and an accounting software application which may not be affordable to the small scale traders. From his research, Manyonde (2014) found that most of the SMEs were using MS Excel as a tool for bookkeeping. MS Excel was found to be the most used system due to its versatility and ability to be adapted to many uses. However, an equal number were not aware of any system at all. QuickBooks was the next most used system. Some reported the perceived high cost of the system. The cost challenge was also a finding cited by

Essalaar et al. (2008). At this technological age, the rapid advancements in mobile devices and mobile technologies offers many new possibilities to improve the performance of business operations (Gebauer & Zhao, 2003). The small scale trader are now able to conduct their business operation with the help of a computer-based system that they can access via a mobile phone that is easily affordable. The mobile based application is able to perform accounting and has integrated a barcode systems that assist in tracking the inventory.

The adoption of the mobile technology in business has made inventory management process more efficient. Inventory control plays an important role in balancing between the benefits and disadvantages that come with holding inventory. It should be one of the key factors in the overall business plan (Gupta, 2012). A well-managed inventory gives a business or organisation a competitive advantage which result to a superior financial performance (Isaksson & Seifert, 2013). An effective and efficient inventory management is realized through utilization of computer based systems that automates the inventory management process. The systems enables the business to determine the amount of stock that can be held at a particular time, when to reorder, the best inventory model for the business and how the stock can be controlled based on sales of a particular product.

Vendor Managed Inventory (VMI) has become popular in the retail industry. It is an approach to inventory management and order fulfilment which involves the collaboration between suppliers and their customers. It is also known as supplier-managed inventory or continuous replenishment process (Blatherwick, 1998). It is an initiative for encouraging collaboration among trading partners (Angulo, 2007). In VMI, the retailer provides the supplier with access to the real-time inventory level. Through this collaboration, the retailer may set the product stock level which are taken into consideration by the supplier of the product (Watson, 2005). The benefits for adoption of VIM include reduced reordering cost, better management of cash flows, increased sales, faster inventory levels and reduced cost incurred from out-of-stock among others (Angulo, Nachtmann, & Waller, 2004). According to Irungu (2011), the VMI model has been effective in Kenyan retail supermarkets since it has improved stock management, cash flows and risk management. The adoption of the VMI model by kiosks would make inventory management more effective and efficient.

1.2 Problem Statement

The accounting and management of inventory processes are key contributors to successful growth and profitability of a business. Gikenye and Ocholla (2012) conducted a research in Nairobi which showed that only 0.3% of SMEs in Kenya used computers for record keeping. This research indicated that most small scale retailers' had implemented the traditional paper-based bookkeeping in their businesses. Some of the retailers tend to relay on their memory rather than keeping records. This poses a challenge to the business in regards to the accuracy of the records. A simple recording mistake that may go undetected over time may affect the accuracy of the records. The other key contributor to business failure is inventory control. Poor methods of inventory management leads to loss of sales, spoilage and excess inventory. The suppliers have no way of knowing the available stock on retailers' shop. The information about the stock level may assist the supplier to determine how much stock to resupply in order to avoid excess inventory.

1.3 Research Objectives

- i. To investigate the challenges of the current methods used by small scale retailers to account and manage inventory.
- ii. To review the current models/architecture that provide accounting and management of inventory.
- iii. To design, develop and test a mobile application that enhance the accounting and inventory management by small scale retailers.
- iv. To validate the mobile application solve the challenges of the current methods used by small scale retailers to account and manage inventory.

1.4 Research Questions

- i. What are the challenges of the current methods used by small scale retailer to account and manage inventory?
- ii. What model/architecture exists that provide accounting and management of inventory?
- iii. How will the mobile application developed to enhance the accounting and management of inventory by small scale retailers'?
- iv. Will the mobile application solve the challenges of the current methods used by small scale retailers to account and manage inventory?

1.5 Justification of Study

Entrepreneurs who are looking forward to the growth of their business should consider proper bookkeeping a priority. A retailer always keep records of the business daily transaction and also monitor the inventory level in the shop. The proposed solution provides efficiency with reduced cost on how business financial records and inventory levels are managed and monitored. It provides a platform for the retailers to account for the business daily transactions. A small scale retailer is be able to use less effort to keep track the activities of the business in terms of the sales, expenses and inventory levels. With the VMI approach, it ensures that the kiosk holds the right quantities of stock to provide a balance between the cost and customer satisfaction. The research has assisted retailers to be able to manage their business effectively and boost their profits margins.

1.6 Research Scope and Limitations

Nairobi County was be the centre of the research. Nairobi town being the capital city of Kenya and its population attracts a lot of different business persons. Retail shops are direct contact to the customer supplying furnished good from their supplier. The research targeted those retail shops that are located near residential areas.

The limitation of the research is that the end solution is an Android mobile application which requires the use of an Android mobile phone that supports the proposed solution.

1.7 Summary

The success of a business is mostly influenced by proper bookkeeping and good inventory management mechanisms. Most of small scale retails are still using the traditional paper-based mechanism of bookkeeping that poses a challenge accuracy of the information. The research assisted small scale retailers to effectively and efficiently account and manage inventory of the business. The next chapter has discussed the current literature and put the study in context to related work.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

In the previous chapter the research provided a background on the importance of bookkeeping and inventory management by small scale retailers. Chapter one highlighted the challenges that comes with poor bookkeeping and inventory management. It also discussed the scope and limitation of the proposed research. This chapter has reviewed the literature pertaining bookkeeping and its importance in a business; inventory management; the concept of Vendor Managed Inventory and mobile technologies in business.

2.2 Kiosks Bookkeeping

Bookkeeping is the first essential step of accounting which as a system provide a source of information to SMEs owners operating in any industry for use in the measurement of financial performance. According to Maseko and Manyani (2011), bookkeeping is the backbone of micro and small businesses. It is through keeping accurate records is actual profit is realized. A study on SMEs discovered that about 60% of the small enterprises fail within the first three years of operation due to inefficiencies in management brought about by poor bookkeeping (Muchira, 2013). Further studies have indicated that the failures are also as a result of inefficient or absence of bookkeeping. An adequate bookkeeping system will provide the required information to assist SMEs to make informed decision for the future plans of the business.

Many kiosk owners perceive bookkeeping and accounting as being complex but in reality it is just simple. It is recording of all business financial transaction in a logical and systematic manner. For retail shops, transactions include the daily sales and purchases conducted by the business. The goal of bookkeeping and accounting is to keep track of the business income and expenses which increases the chances of making profit. Nickels et al. (1999) concluded that the size of the business will determine whether to rely on accounting information or create own ledgers and reports. Bookkeeping can be performed using common methods such as single entry and double entry accounting systems.

Bookkeeping software can be used to speed up the manual calculation of the single entry accounting system (Haber, 2004). In the double entry system the transaction are recorded in at least two different accounts which is done using debit and credit in the modern accounting systems. The debit and credit system serves like an error system. When the sum of the debit does not equal to the sum of the credit indicated that an error occurred. Other than the two

methods above any process that involved recording business financial transaction is said to be a bookkeeping process (Haber, 2004). The choice of bookkeeping method depends on the operator of the business (Enno, 2000).

2.3 Bookkeeping in Small Medium Enterprises.

Record keeping is essential to effectively manage a business. This involves recording the day to day business transactions in respect to the receipts and expenditure. A serious entrepreneur should ensure that they maintain proper records of the business. According to Kenya National Bureau of Statistics (2007), proper bookkeeping is key to sustaining and the expansion of a business. Lack of proper records one risks wastage of money, crunches and missed opportunities could contribute to the expansion of the business. Proper bookkeeping allows the business owner to be positioned properly to carry out proper business evaluation and know the current financial position of the business. The objective of bookkeeping is to assist the business manager and tax agencies to evaluate the activities of the business. This provides an assurance that the business is moving in the right direction.

Peacock (2008) investigated on the effect and causes of the failure in over 1,000 proprietary companies in South Australia and found that 4.6 percent of failure was due to poor or no accounting records. In a different study of why companies failed in South Australia, Peacock (2008) managed to review the bankruptcy reports of 418 businesses and found that 50.5 percent of them used single entry method of bookkeeping with 2.1 percent used double entry system whereas 30.8 percent used taxation and bank records. From his research he recommended further research to be conducted on double entry systems used in various businesses. This finding is very important in examining the impact of proper bookkeeping on the growth and profitability of SMEs in Nairobi town.

Hank et al. (2008) assessed accounting records for 10570 small enterprises in Australia and found that a significant number of the businesses owners kept inadequate and insufficient accounting records. According to Ikechukwu (1993), bookkeeping plays a crucial role in the performance success of a business. Having a comprehensive record keeping mechanism enables the business owners to timely and accurately develop financial reports that inform the progress and condition of the business. The performance of the business during various periods of time (quarter or year) can be compared. The business accounting records serve as a reference point for making good decisions about the business. This includes the decision to expand, maintain, drop, or decide on product lines and buy or make decisions. Therefore it is important to properly

keep accounting records for they will facilitate efficient, proper and timely decision making; and improve the performance in SMEs.

2.4 Inventory Management

The literature on inventory management optimization has mostly been based on cost minimization and profit maximization. The goal of a retailer is to minimize cost or maximize profit while satisfying customer demands. Inventory significantly influences the profitability of the business hence inventory management should be included in the business strategic plan (Gupta, 2012). Proper inventory management enhances competitive ability and market for small manufacturing businesses (Chalotra, 2013).

A well-managed inventory can result in a superior financial performance and also give the business a competitive advantage (Isaksson & Seifert, 2013). Too much inventory or stock tend to consume lots of space, increases possibility of damage, loss and even spoilage. Furthermore, having excess inventory often compensates for poor forecasting and inefficient inventory management. Womack, Jones, and Ross (1990) pioneered the lean principle that has been linked to the reduction of inventory level. However it was argued that the demand volatility may limit the application of the principle. On the other hand, having little inventory increases poor customer service and also disrupts manufacturing operations. In most cases good customers may be dissatisfied and decide to take their business elsewhere if their desired product is not immediately available which in the long run effect the business profitability.

2.5 Vendor Managed Inventory

Vendor Managed Inventory (VMI) is an approach to inventory management and order fulfilment which involves the collaboration between suppliers and their customers. It is also known as supplier-managed inventory or continuous replenishment process (Blatherwick, Vendor-managed inventory: fashion fad, 1998). The principle on the traditional order-delivery is that customers are the ones that take the initiative to define the amount and timing of deliveries of products from their suppliers. The suppliers thus fulfils their task as ordered by their customer (Kaipia R. H., 2002). However this system some inefficiencies with the supplier not having advance warning of customer demand thus forced to forecast about them. This kind of forecast mostly lead to the supplier carrying high level of stock that is unnecessary. In the traditional process, the supplier may sometimes be faced with unexpected short-term demands which leads to frequently change their production and distribution thus increase in cost. The end results is poor customer service due to higher level of stock-out. VMI is an alternative to traditional order process and is rendered more effective in the supply chain processes

(Christopher, 1998). Figure 2.1 shows the comparison between the traditional ordering process and the VMI model.

It is an initiative that encourages cooperation between buyers and suppliers within the supply chain (Daugherty, 1999). These are processes that are as a result of interpretation of inventory demand and supply is scheduled to meet the demand. In VMI the inventory or stock that is at buyers possession is still owned by the supplier. The buyer will make payments once the products in stock resold. Its goal is to accomplish a deeper collaboration between members of the supply chain for the purpose of coping with the always decreasing product time window and service fulfilment and also the requirements for improving operation efficiency. The benefit of adopting the VMI systems includes faster inventory turns, reduced inventory levels, reduced ordering and administration cost, zero obsolescence, improved cash flow management and reduced out-of-stock (Angulo, 2004).

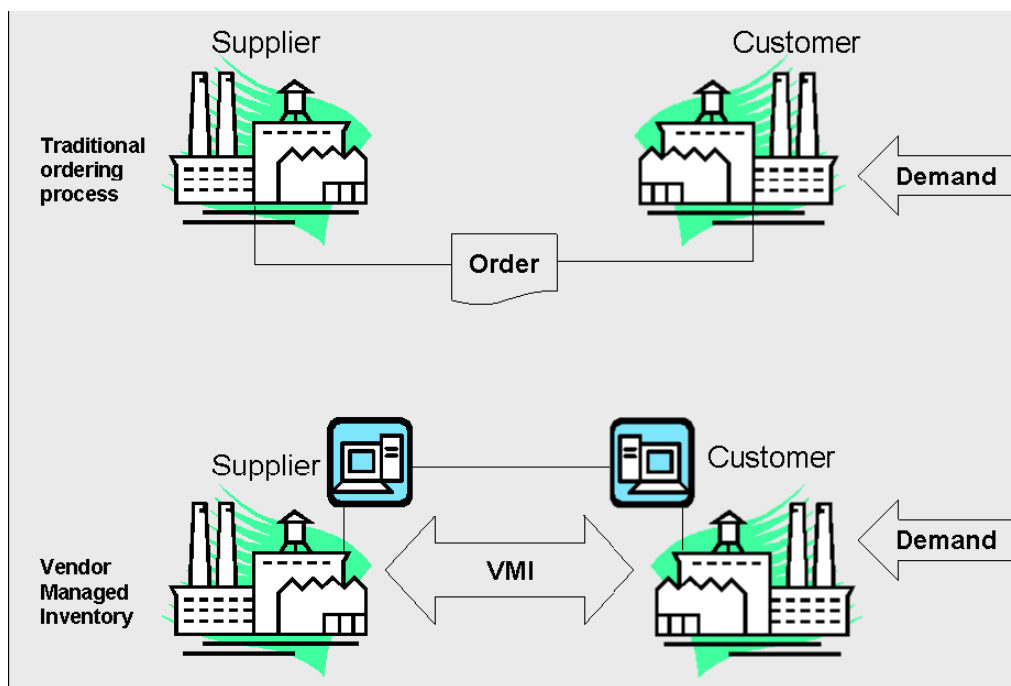


Figure 2.1 The Traditional Ordering Process vs VMI.

In a VMI partnership, the supplier but sometimes can be a reseller or distributor take the responsibility to make inventory replenishing decisions for their customer. This implies that the supplier monitors levels of inventory (electronic messaging or physically) and make decisions regarding order quantities, shipping and timing for re-supply. Transaction that are normally initiated by a buyer, such as orders in the VMI system are initiated by the supplier. The purchase order acknowledgement from a supplier is the first indication a transaction

underway with advance shipping notice that informs the buyer of products being in transit. In this kind of partnership the buyers give the supplier control over re-supply decisions and even sometimes supplier takes financial responsibility for the inventory (Waller, Johnson, & Davis, 1999).

According to Cetinkaya and Lee (2000) VMI system greatly reduces stock problems and inventory transportation cost while it offers the ability to synchronize decisions on both inventory and transportation. The advantage of VMI includes reduced uncertainty on demand, improved customer service and reduced cost (Fox, 1996). The reduction of stock-out not only saves the suppliers but also allows them to receive more information on the demand patterns of their customers which helps them to plan better on their inventories. Being able to plan better on inventories has a major advantage to members using the VMI (Jain, 1994). An analytic model developed by Chaouch (2001) calculated the inventory levels and delivery rates that was used by small suppliers which so reduction in cost. One of the major findings deduced from the study was reduced amount variability and timing of demand which increased the benefits of having lowered prices. Blatherwick (1998) additionally had the view that VMI was an exceptional tool for ordering policies of the downstream members of the supply chain which were less erratic and sophisticated. Therefore VMI is considered as a promising solution to supply-demand mismatch (Lapide, 2002).

2.6 VMI and Performance of SMEs

There is evidence that VMI is of benefit to both the buyer and the supplier. The buyers benefit from VMI model is straightforward whereas those of suppliers are more controversial (Dong & Xu, 2002). The buyer enjoys solid profit gain through adjustments under VMI while there is less evident of supplier's financial gain. The reduction of the bullwhip effect is one of the main consequences of implementing VMI. This reduction can be from two possible sources. First, it is through the elimination of buyers decision making layer with the re-supply decision is now only left to the supplier. Secondly, the delay in the information flow between buyer and supplier has been eliminated.

VMI has surely helped to increase visibility in the supply chain that allows more accurate and rapidly availability of demand information (Smaros, Lehtonen, Appelqvist, & Holmstrom, 2003). Since the supplier seem to do more task in the VMI model than the traditional process, cost redistribution in the buyer-supplier relation is visible. However with VMI means that the overall cost of the entire buyer-supplier relation reduced due to the increase in visibility. According to Mattson (2002), Waller et al. (1999) VMI increased the frequency

of replenishment from monthly to weekly resulting to the supplier having a much smoother demand signal. Therefore it helps to reduce the peaks and valley in production which then allows smaller levels of capacity and inventory. When we look it from customer perspective, service is usually measured based on availability of a product .i.e. customer service. This is because when a customer wants a certain product and it is not available a more logical option is that the customer will seek it from another supplier thus a sale is lost. But with VMI model the supplier can coordinate the replenishment orders and deliveries from several buyers which improves the level of service. The supplier is able to balance their customers' needs while paying attention to those with most critical needs. In the supply chain, the most attractive projects are those that helps to improve both inventory cost and level of customer service. VIM is one of these projects (Waller, Johnson, & Davis, 1999).

The research by Waller et al. (1999) indicates that VMI allows suppliers to achieve high production efficiency and reduce excess capacity without having to increase inventory or limiting order fulfilment to their customers (retailers). Mattson (2002) is in agreement and claims that the manufacturing process has become more flexible and with the increased flexibility, opportunities are created to better the suppliers' capacity use and thus reducing the production cost. Sufficient information about customers' needs and good planning creates opportunities to reduce set up times during production through improved coordinated production processes. This in the end leads to reduced suppliers' cost of production. To realize the benefits of VMI can only be realized through financial and time investment and significant managerial commitment (Ellinger & Taylor, 1999).

2.7 Smart Stock Management Control

Smart Stock Management System involves the use of an Android smartphone to track inventory based on Radio-frequency identification (RFID). It has more than two types of barcodes that are available in the market. The type of the barcodes that exist are 1D barcode, 2D barcode and so on. According to Flipse (2011), the use of barcode increases the database system productivity but it has a limitation in that not all systems are compatible with the 1D or 2D barcode. The main role of the database section in a Smart Stock Management Control is to do reporting for both the warehouse and manufacturing department for the purpose of analysing the materials arriving for the warehouse and the materials used in the manufacturing process (Krishna et al., 2016).

The database of the Android smartphone and the computer is kept up to date from time to time via wireless connection. The Smart Stock Management System is already in the market

but there are a number of limitation to the system such as database synchronization via wireless connection between the Android device database and the computer database (Krishna et al., 2016). The system allows users to synchronize data manually or to set the system to auto synchronize every 1 minute. This ensures that the database is kept up to date and in a consistent state. It also ensures that good reporting will be done on the database for both the warehouse and manufacturing department. Smart Stock Management System make the tracking and reporting of inventory to be efficient and simple to understand by the users (Krishna et al., 2016).

2.8 Barcode System

A barcode is an optical machine readable representation of information about the object it is attached to. Barcodes are used for identification, retrieval, handling, and storage of goods in stores and warehouses. This technology is implemented in many applications. Individual inventory items or unitized packages have affixed barcode that can be read by a barcode scanner attached to a computer system. A barcode is assigned to a particular inventory item to show its identity during storage, retrieval and dispatch. Barcodes are further used for communication of dispatched items for the preparation of bills by accounts departments and making periodic reports on inventory status and sales. Barcodes facilitate the tracking of specific items in the warehouse during inventory audit or material pick up. They are also assist in tracking consignment during transportation and inspection at the customer end.

The information that is generally required relates to the country code, name of manufacturer, date of manufacture, product details, material content, and so on. The details are needed at the users end for the purpose of managing inventory. They are machine readable codes in the form of bars and spaces (Sople, 2010). Optimized use of barcodes in supermarkets has helped inventory managers to identify their products with ease, serve customers faster and efficiently while reducing the time and expenses of stocking at the end of every financial year.

2.9 Mobile Technologies in Business

The number of businesses that have adopted the mobile technology is not significant despite the huge campaign for mobile technologies a few years ago. This is mostly contributed by business owners who are in a position to decide whether to adopt the mobile technology not having the tools and concepts to determine the benefit of introducing such new technology (Deibert & Rothlauf, 2007). Moreover, the benefit of a business processes is often only measured at the end of the project, that is after the new technology has been implemented. It is

more useful for possible benefit of the mobile technology to be determined as is it being introduced. This will assist business owners in making decision of adopting new technologies. A prior studies will allow designing of new business processes using the mobile technology that will maximize the benefit of the enterprise (Deibert & Rothlauf, 2007). According to Basole (2004) and Rahul (2005) the adoption of mobile technologies in business processes generates a measurable benefit for the business and the users respectively.

The implementation of mobile technologies benefit and influence the performance of businesses. There are various indicators that can be used to gauge the benefit of adoption mobile technologies in today's businesses. Indicators that considers the characteristics of the mobile technologies and applications need to be introduced (Shaw, 2004). The indicators include: throughput time, error rate, automation of task steps, and access to information, costs and robustness.

One of the most important indicators is the change of throughput time. Throughput time is normally one of the main reasons for introducing mobile technology in business. By automating the tasks steps the throughput time greatly reduced because there will be few steps compared to the previous manual process steps. High automation of processes reduces the error rate of the business processes. This increases the effectiveness and efficiency of the business process such as inventory management. The design of the mobile application influences the error rate (Deibert & Rothlauf, 2007) . Therefore, it is recommended that processes that support mobile technology should be designed to fault tolerant from input data and restriction imposed on the input data from the user.

The adoption of mobile technology in business also improves access to information by the end-user. With mobile application and technologies information is available anywhere and at any time. The ways of accessing the business information affects the business processes. Mobile technology provide better access to information which results to increased flexibility. Furthermore, users and business process waiting time will be reduced due to easy access of business information anywhere and anytime. The mobile applications can connect to the backend-system from anywhere because of it mobility nature. Connectivity to the backend-system is essential in order to make periodical updates and to always have the available data in real time on mobile client. A low quality connection can significantly reduce the benefits that comes with adopting mobile technology (Deibert & Rothlauf, 2007) .

Mobile technologies can have a great impact on the robustness of business processes. Robustness can be increased through better access to information and also it can be decreased as tasks performed by the business becomes dependent on the mobile technology. Using mobile

technology in business come at a cost. Costs is incurred as a result of acquiring new technology, changing existing business processes, the integration of mobile technology in the business and also the maintenance of the applications. The costs of using mobile technologies is important for the overall benefit it comes with (Deibert & Rothlauf, 2007).

2.10 Related Solutions

2.10.1 MYOB

Mind Your Own Business is one of the computerized accounting system in the market today. It is a subscription based and an online accounting system. Based on the purchased module of the system MYOB caters for the monitoring of: sales invoices and payment receipts, accounts payable and receivable processing, payments and money receipts processing, automated bank reconciliations, payroll services inventory management, fixed assets management and production of financial and management accounting requirements. It requires a certain level of accounting knowledge and is recommend to SMEs with more experienced staff. Using MYBO is time consuming but for an experienced bookkeeper with adequate training is a good solution for most small enterprises.

2.10.2 GOIS

Goods Order Inventory Management System Standalone is an earlier version of inventory management application. It is accessible from mobile platform such as tablets, Android smartphone, Apple iPhone and iPad. It is a device dependent application whereby all transactions information are stored in the device storage for tracking and works in offline mode. GOIS Standalone inventory management system useful for small businesses that face various problems while managing their inventory. GOIS Standalone has useful features that the recording, updating and tracking of inventory/stock records. Using this inventory management system you can easily view and track product in stock, purchases, sales and all other inventory records more efficiently on a compatible device. It can be downloaded from Apple and Android app stores (MetaOption, 2016). GOIS Standalone is being used by retail businesses across the globe.



Figure 2.2 GOIS Standalone (MetaOption, 2016)

2.10.3 On Shelf

On Shelf is another inventory system that is used by businesses to manage their inventory. It allows the user to see the items in stock and the items need to be ordered. With on shelf, invoices can be customized with one own image at the top. The sales can be entered quickly using a barcode feature or by choosing from a list of products. It offers a current trends report that allows the user to see products with highest and lowest sales. It provides comparison of unit sales and revenues on daily, weekly and monthly basis. The user can also generate report with products with most revenue or profit estimates (Littletan, 2012).

It provides an inventory analysis report that recommends inventory levels for every product. These levels are based on the sales data for a particular period of time. The user can accept the recommendations or input their preferred levels. Inventory can be sorted by category, brand, colour or size. It uses graphs to show the sales trends for each product on weekly or monthly basis. A glance can tell the user if demand for a particular product is increasing or decreasing. It also allows the change of the time period for the viewing the graphs such as 12 days, weeks, or months (Littletan, 2012).

It shows inventory status for each supplier is summarized on the order screen. An order to the supplier can be placed in a click of a button. The order can be printed or sent directly to the supplier of the product. Not ready to send the order to your supplier? Save it as a pending order and come back to it later. It has a customer history screen that summarizes each customer's contact information. It also gives quick access to previous sales invoices and a summary of products that were purchased. Products are sorted on the basis of quantity or date of purchase. The sales invoices and product purchase history are available for the dates that

selected by the user. A separate report can be accessed that provides a list of customers who have purchased a specific product within the selected period of time (Littletan, 2012).

2.10.4 Inventory Now

Inventory Now is designed to help retailers to track their inventory through the life cycle of a product. It helps the retailers to view a snapshot of all of their available inventory. When the retailer buys new inventory, he or she needs to record it in the mobile application. The products are marked in the system as they are being sold, received and delivered. This allows the retailer to see an overview of their inventory and the number of products that are in a particular status. This means that you can track your sales, what has been sold in the past and what products need to be purchased based on the inventory level. It provide a summary of the sales and purchases and track profits and profit margin with ease (IpartyMobile, 2012).

2.11 Gaps and Limitations

Most of the current system for accounting and inventory control in the market are standalone system. The may either be an accounting system or an inventory management system. GOIS is one of the inventory systems which only perform inventory control but does not include accounting. MYOB is one of the few applications that perform both accounting and inventory control. It requires a certain level of accounting knowledge that a small kiosk owner may find it complex.

The limitation of the current solutions is that they have not implemented the VMI model which the research is trying to implement for its efficiency and effectiveness in inventory management. The supplier has only been involved through the raising of invoices unlike the VMI model which is a kind of partnership where the buyers give the supplier control over re-supply decisions The benefit of adopting the VMI systems includes faster inventory turns, reduced inventory levels, reduced ordering and administration cost, zero obsolescence, improved cash flow management and reduced out-of-stock (Angulo, 2004)

2.12 Conceptual Framework

The Figure 2.3 shows how the proposed model will work. The proposed model will have two modules that for the retailer and supplier. The retailer who runs the business will make sales of the products in stock. The sale of each products reduces the stock level and updated the accounting records. The supplier monitors the current level of stock that is with the retailer. When the level goes below the set threshold he supplier more products to the retailer. This updated the inventory and the accounts. This is a continuous cycle in the business.

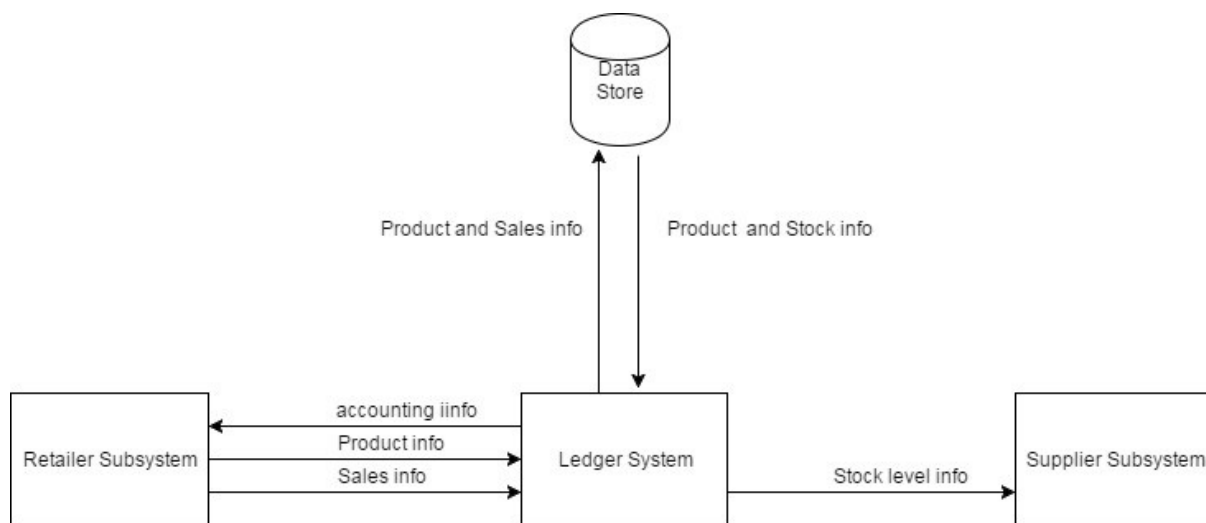


Figure 2.3 Conceptual Framework

2.13 Summary

Proper bookkeeping and good inventory management mechanism plays an important role in the growth and profitability of SMEs. Record keeping is essential to effectively manage a business. VMI system greatly reduces stock problems and inventory transportation cost while it offers the ability to synchronise decisions on both inventory and transportation. The use of mobile technologies in business today has a great benefit and influence the business in terms of increased throughput time, robustness of business processes and information access. The next chapter has discussed the methodologies that was used to achieve the proposed solution.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

In the previous chapter, the study has discussed the importance of proper bookkeeping in the growth and profitability of SMEs. The study also looked into Vendor Managed Inventory model that over the years has reduced cost and improved the management of inventory with the supply making the decision regarding inventory re-supply. In this chapter the study has described the design and the research methodology that was used to implement the proposed accounting system. It also outlined the development, data modelling, testing and validation methodologies together with the tools and the technologies that were used.

3.2 Agile Software Development

Agile System Development Life Cycle was used in the development of the mobile application. The steps of development are illustrated in Figure 3.1 below.

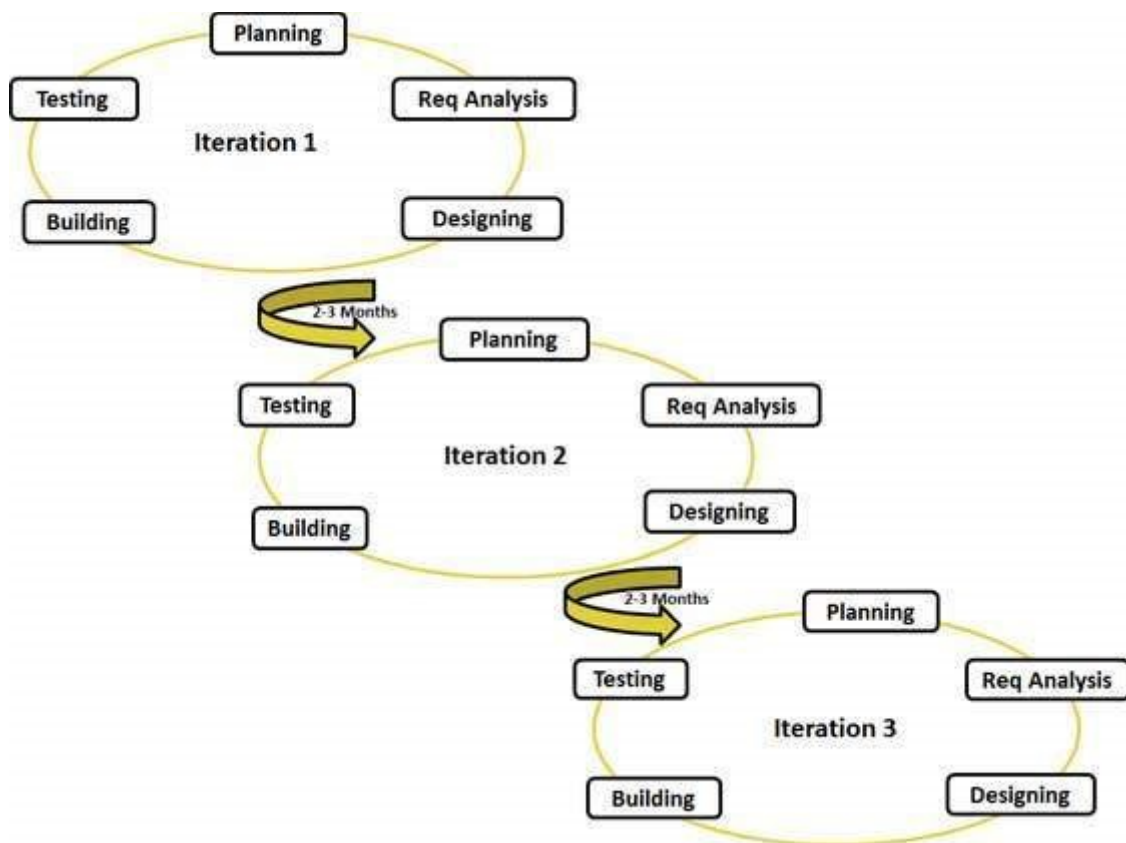


Figure 3.1 Agile Development Methodology (Tutorialpoint, 2017)

The research development followed the agile development life cycle which began by gathering requirements for the system through interacting with various small scale retailers. The requirement analysis phase is critical to the success of the software project. The

requirements were later analysed and used during the designing of the proposed mobile application. The development followed through all the steps as show in Figure 3.1.

3.2.1 Planning Phase

The planning phase is the first phase in agile development life cycle. It is at this phase that activities that were carried out when building the solution were clearly defined and the resources required were identified. Planning provides a blue print of how the entire process of system development will be carried out.

3.2.2 Requirement Analysis

Requirement analysis involved analysing the requirements of the system. This includes what the system is expected to do in order to meet users' requirements. This requirements provided information on how the system was be developed. The analysis helped to determine exactly what the client wanted. This phase involved data collection from small scale retailers via questionnaires and interviews. A target population was specified and sample size determined from this population.

3.2.2.1 Target Population

The research targeted small scale retailers that were operating near residential areas. The retailers that are close residential areas experience more business traffic in a daily basis. This group of persons are the best to provide information that will guide the research. The research also targeted small scale retailers within Nairobi county and specifically Kasarani town. The number of kiosks (small scale retail shops) in Kasarani town is approximately 300.

3.2.2.2 Sampling Strategies

The Sampling technique that was employed is probability sampling which involved randomly selecting each participant of the sample on the basis of equal chance. With this technique the result from the selected sample was generalized for the whole population. The information gathered from diverse small scale retailers was used to generalize the findings for all kiosks in Kenya.

3.2.2.3 Sample Size

The research selected ninety six kiosks within the Nairobi environ randomly for the purpose for this research. In this study, the sample size was determined by using a formula described by Frerichs (2013).

It is a function of the target population that is relevant to the study. The Equation below is used to determine the sample.

$$n = \frac{NZ^2 * 0.25}{[d^2 * (N - 1)] + (Z^2 * 0.25)}$$

n = Sample size

d = Precision level (mostly 0.10 or 0.5)

N = Total population

Z = Statistic for a level of confidence (for example 1.96 for 95% confidence level)

The equation above shows the formulae that was applied to get the sample population meaning every person got an equivalent chance to be part of the sample population.

$$n = \frac{300 * 1.96^2 * 0.25}{[0.1^2 * (300 - 1)] + (1.96^2 * 0.25)}$$

$$n = 96.04$$

The questionnaires were distributed to 96 respondents.

3.2.2.4 Data Collection

Data collection was conducted through interviews and questionnaires. The sampled retailers were interviewed to find out the challenges they faced while using the current methods of accounting and inventory control. A set of questionnaires similar to that in Appendix A were prepared and distributed among the sampled retailers. The questionnaires were delivered to the randomly chosen 96 retailers.

3.2.3 System Design Phase

This involved defining the architecture, modules, interfaces and data for the proposed system. The designs included user interaction design which was represented as mock ups, database design which was represented by entity relationship diagram and use case diagrams that was showed all the actors and their interaction with the various system modules. The designs from this phase guided the implementation of the system in the next phase. The following Unified Modelling Language (UML) diagrams were used in the design included uses case diagram, design class diagram, entity relationship diagram and sequence diagram.

Use case diagrams was used to identify the different actors in the system and how they interact with the system. The class diagram was used to show objects in the system, their attributes or characteristics and their behaviour or functions. It also showed how these objects are related to each other and with what cardinality value. The entity relation diagram showed

various entities and their attributes of the system and how these entities relate together with their cardinalities. The sequence diagram was used to show interaction of the system objects.

3.2.4 Building or Implementation Phase

The designs from the design stage were implemented in this stage of software development. This includes the mock-ups for interface implementation and the entity relationship diagram (ERD) for system database. The proposed system was developed in two modules: retailers and supplier module. The two modules were then integrated in order for suppliers to interact with the retailers. This formed the mobile implementation part of the system. The mobile application interacted with a database in the cloud by sending requests the online database server. For the purpose of administration, a web system was developed that is used to oversee the operations of the mobile solution.

Prototype Development

The mobile application was developed using Android programming language and interacted with MySQL database in the cloud. The mobile application was developed in two modules: the retailer and supplier modules. The retailer and supplier have an interface that is suited for their function in the system. The backend system was implemented using PHP, HTML5, CSS 3 and Java Script.

3.2.5 Testing Phase

The purpose of testing is to ensure that the developed solution will have fully meet the specified requirements and can successfully operate in the anticipated environment with the required security and usability. The proposed solution underwent both functional and non-functional testing.

3.2.5.1 Prototype Testing

Various tests were conducted to ensure the prototypes meet the specified requirements and does what it was intended to do. The prototype will undergo some of the tests.

i. Usability Testing

This was done to determine the usability of the application being developed. This helped determine whether the application was easy to use or what challenges the users might experience. To achieve this, 20 respondents were sampled to test the application and give their feedback on the same. The 20 respondents were sampled from the 96 who took part in the survey. This was done by giving the prototype to the users and observing whether they can easily use it or experience some difficulties.

ii. Unit Testing

This involves testing the independent functionality of both the retailer and supplier modules.

iii. Integration Testing

This involves testing the functionality of all the modules ensure that there are no integration issues.

iv. Functional Testing

This was done to test the entire system functionality.

v. Validation

To validate if the developed mobile application was a solution for the challenges of the current methods used by small scale retailers to account and manage inventory, 12 respondents were selected randomly from the sample population of 96 who participated in the survey during collection of requirements and usability testing. Their feedback assisted to determine if the proposed system would counter the challenges in accounting and management of inventory by small scale retailers.

3.3 Reasons for Using Agile Methodology

The benefit of using agile methodology is that it provides opportunities to assess the direction of project throughout the development process. This provides flexibility in re-working some parts of the system in response to feedback from the retailers. This methodology is also effective as it greatly reduces the cost of development of software can begin at the same time as requirement gathering is taking place. This makes agile methodology to be research best choice for the development process.

3.4 System Development Tools and Technologies

The mobile application was developed for Android OS environment and Android Studio IDE was used. The web system was implemented using Laravel PHP Framework. MYSQL database server was used to host and manage the database for the proposed system.

3.5 Ethical Measures

To adhere to ethical codes of conduct, all data collected from this research was maintained and treated with very high confidentiality. The consent of retailers was requested prior to any data collection. The right to participate is solely at any of the respondents.

3.6 Conclusions

This chapter has highlighted the development methodology intended to be employed in this research. It describes how system analysis, design implementation and testing were conducted throughout the development stages. In this light, the natures of the target population and data collection methods have also been briefly outlined. The data collected was analysed and conclusions drawn in line with the research objectives of this study

CHAPTER 4: REQUIREMENT ANALYSIS

4.1 Introduction

This chapter includes the results from the survey that was carried out to determine the system requirements. The results captured in this chapter are based on the user requirement questionnaire in Appendix A. It covers the various requirements collected from the interaction with the small scale retailers who are the potential users.

4.2 Requirement Analysis

The researcher discusses the results from the research conducted via interviews and questionnaires. The results obtained from the research were used to answer some of the research questions outlined in section 1.4. The responses were used during system design of the proposed system. The questionnaire is attached to Appendix A.

The sample size was 96 respondents. The sample size was arrived at using Frerichs (2013) formula in section 3.2.2.3. The number of small scale retailers who took part in the survey were 96 with only 80 completing then survey making and 83.33% response rate.

4.2.1 Functional Requirements

Function requirements defines the main functions and capabilities of the system that must perform successfully.

i. Create Account

All users must be able create account by filling the required account details that include email and password that will be used to access the system

ii. Login

All users must be able to login by supplying their email and password in order to access the system.

iii. Manage Products

The retailers must be able to add, edit and delete products. They should be also be able to update and monitor product stock level. The supplier should be able to monitor the stock level of the products they supply.

iv. Process Sale

The retailer must be able to perform a sale of products bought successfully. The system should capture sales details such as the product name, quantity and the cost of the item being sold. For every product sold the system updates the stock value for easier stock tracking.

v. ***Sales and Expenses Analysis***

The retailer must be able to view the sales and expenses transaction records based on the date transacted. The system should provide an analysis of all the sales processed in the system which include daily, weekly, monthly and yearly sales analysis.

vi. ***Post Expense***

The retailer should be able to update the system with the expenses of the business. These information will assist the retailers to analyses the expenses of the business. The system should capture the business expenses such as cost of reordering product and other business operation cost such as licenses and electricity.

vii. ***Manage Users***

The System Administrator must be able to add, edit and delete users of the web system.

4.2.2 Non-Functional Requirements

These are requirements that supplement the main function and capabilities of the system.

- i. **Usability** - The system should be user friendly will interfaces that are easy to use.
- ii. **Security**- Only authorized users should be allowed to access the system.
- iii. **Reliability and availability**- The system should be reliable and available at all times to the users.
- iv. **Integrity**- The system should ensure that system data is not altered or corrupted.
- v. **Performance**- It should have an acceptable response time when performing its functions.

4.3 Current Method of Accounting and Managing Inventory

The respondents were asked to specify the methods they use in accounting and managing their inventory. 75% of the respondents indicated that they use the paper-based bookkeeping method while only 17% use the computerized system. 8% used other methods that includes daily count using a calculator. The Figure 4.1 shows a graphical representation of the various methods used by small scale retailers to account and manage inventory.

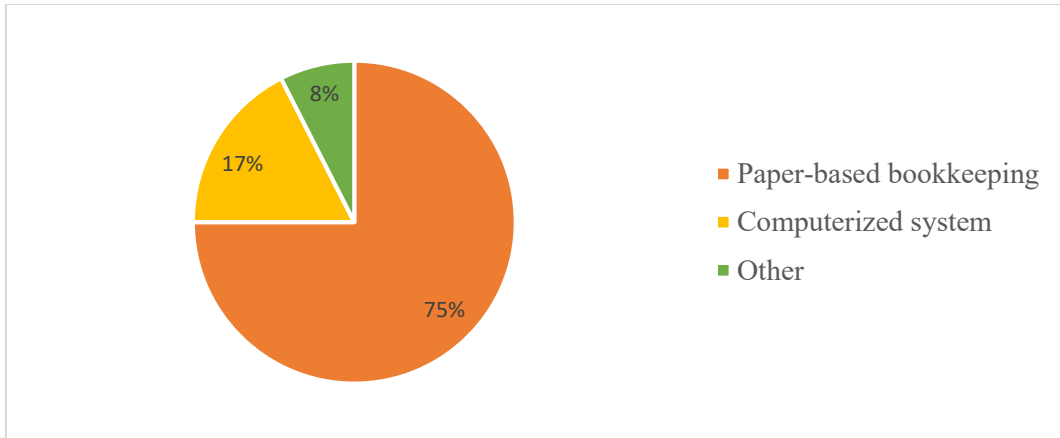


Figure 4.1 Current Methods of Accounting and Managing Inventory

4.4 Smart Phone Ownership

The proposed solutions requires that the users should own a smart phone. The respondents were asked to indicate whether they owned a smart phone. 92% of the respondents owned a smart phone. Figure 4.2 show respondents that owned a smart phone.

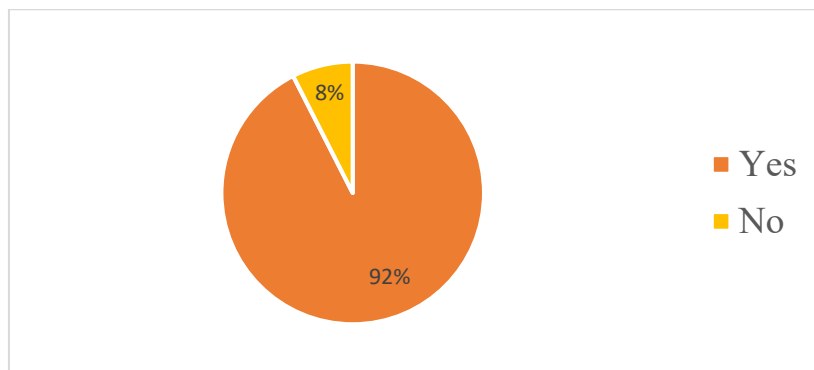


Figure 4.2 Smart Phone Ownership

4.5 Use of Mobile Applications

The respondents were asked to indicate whether they have used other mobile application other than calling or messaging applications. 65% of the respondents indicated to have used other mobile applications other than those for calling and messaging with WhatsApp being one of the mostly used. Figure 4.3 shows the respondents who use other applications on their phones.

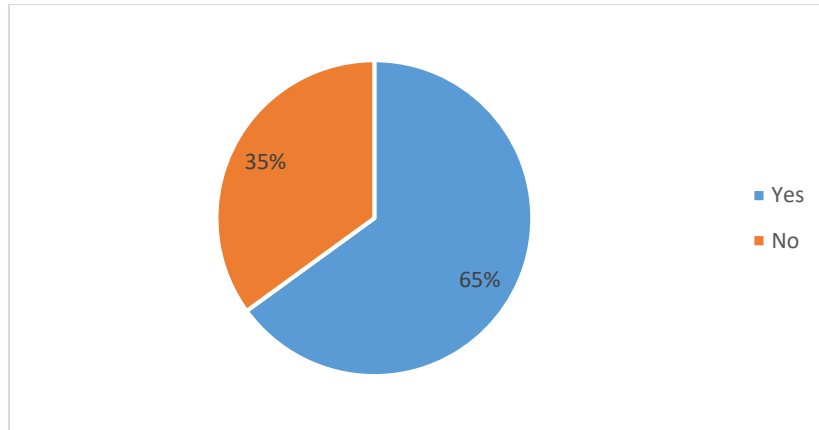


Figure 4.3 Mobile Applications Usage

4.6 Mobile Device Operating System

The respondents were asked to indicate the operating system of their smart phone which helped to determine which operating system the proposed solution should be based on. 86% of the respondents had Android mobile phones, 14% Windows phone while there was no one with BlackBerry or Apple phones. Figure 4.4 shows the respondents mobile phone operating systems.

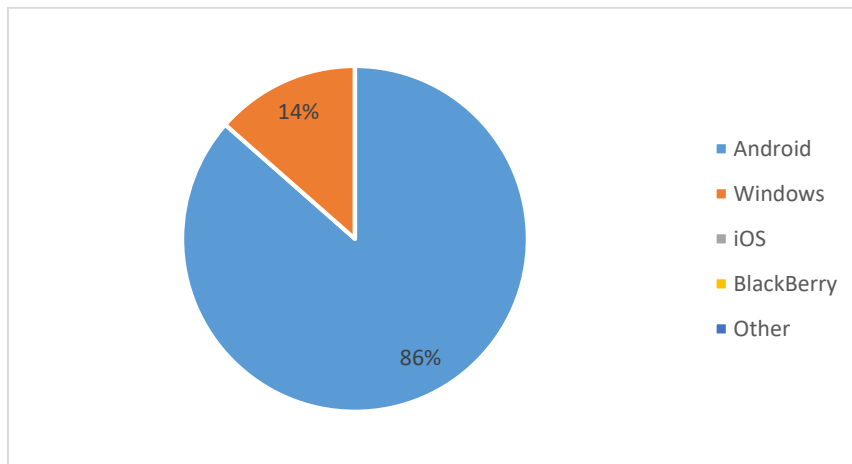


Figure 4.4 Mobile Phone Operating System

4.7 Challenges in the Current Methods of Inventory Management

The respondents were asked to indicate if they had any challenges with the current methods of inventory management and if there was to specify. 76% of the respondents indicated that they experienced some challenges with their current methods of inventory management with majority of them have been using the paper-based method. Figure 4.5 shows the respondents response to challenges with the current methods.

The respondents indicated that the challenges they faced was mostly related to the accuracy of the records they keep and the amount of time it takes to reconcile all the business transactions. Some of the products may stay longer in the show without being bought and sometime the fast moving products would get finished early thus causing them to lose business to another shop.

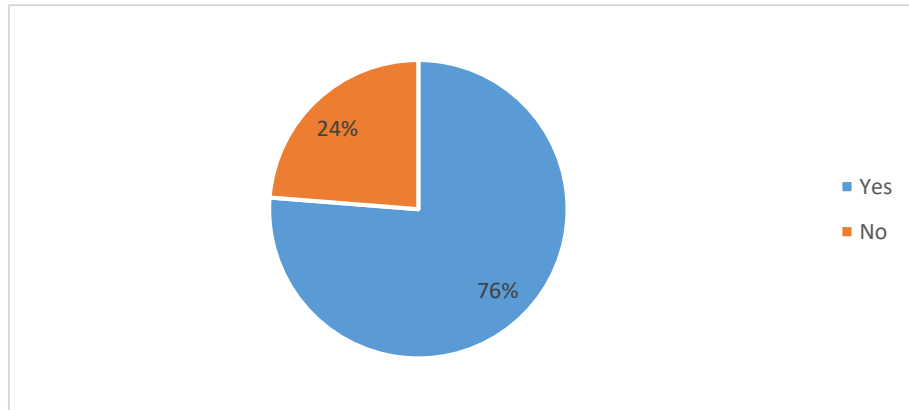


Figure 4.5 Challenges Experienced in Current Methods of Inventory Management

4.8 Suitability of a Mobile Application for Accounting and Managing Inventory

The respondents were asked whether they thought a mobile application was suitable for accounting and managing the business inventory. 87% of the respondents thought a mobile application would be suitable for accounting and managing their business inventory. The figure below shows the respondents response in regard to the suitability of a mobile application in the accounting and management of inventory.

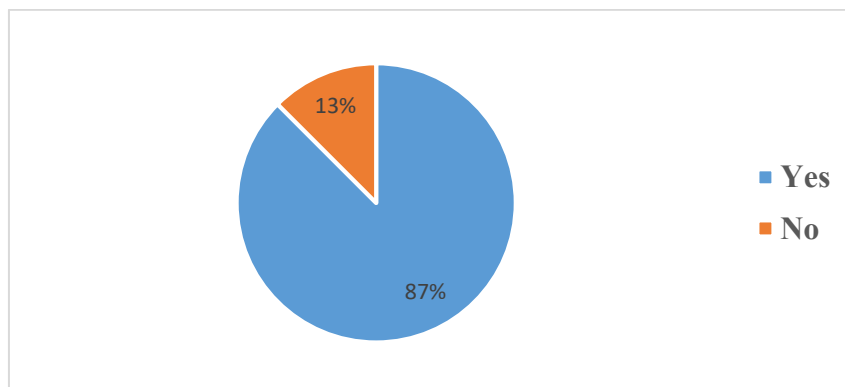


Figure 4.6 Suitability of a Mobile Application for Accounting and Managing Inventory

4.9 Conclusions

The analysis from the survey that was conducted showed that most of the small scale retailers are still using paper-based bookkeeping method. Majority of our targeted users owns a smart running Android Operating System which is a requirement to be able to use the proposed system. The respondents were able to indicate the challenges they experienced with the current methods of inventory management and accounting.

CHAPTER 5: SYSTEM DESIGN AND ARCHITECTURE

5.1 Introduction

This chapter covers the design structure of the system. It includes the design diagrams that were drawn using the Unified Modelling Language. Sequence diagram, Entity Relationship diagram, Use Case diagram and Partial Domain diagram are among the design diagrams that were draw to illustrate the design of the system.

5.2 System Architecture

The application adopted the Client-Server model which as a distributed system with clients sending requests to the server and server processing the request return result to the client. In this architecture the client is the mobile application that is used by the retailer and the supplier. The retailers interact with the application by using the mobile application to add products, process sale update product stock and view sales report. Each of the request sent to the server is processed and the appropriate response returned the user. When a product is added successfully the server sends a success message to notify the user of the success. The server is accessed over the internet thus all data is stored online for the purpose of data security and also to allow suppliers to monitor stock levels of the product they supply. System administrators are also able to access data analytics of all the sales and registered retailers and suppliers. Figure 5.1 show the system architecture

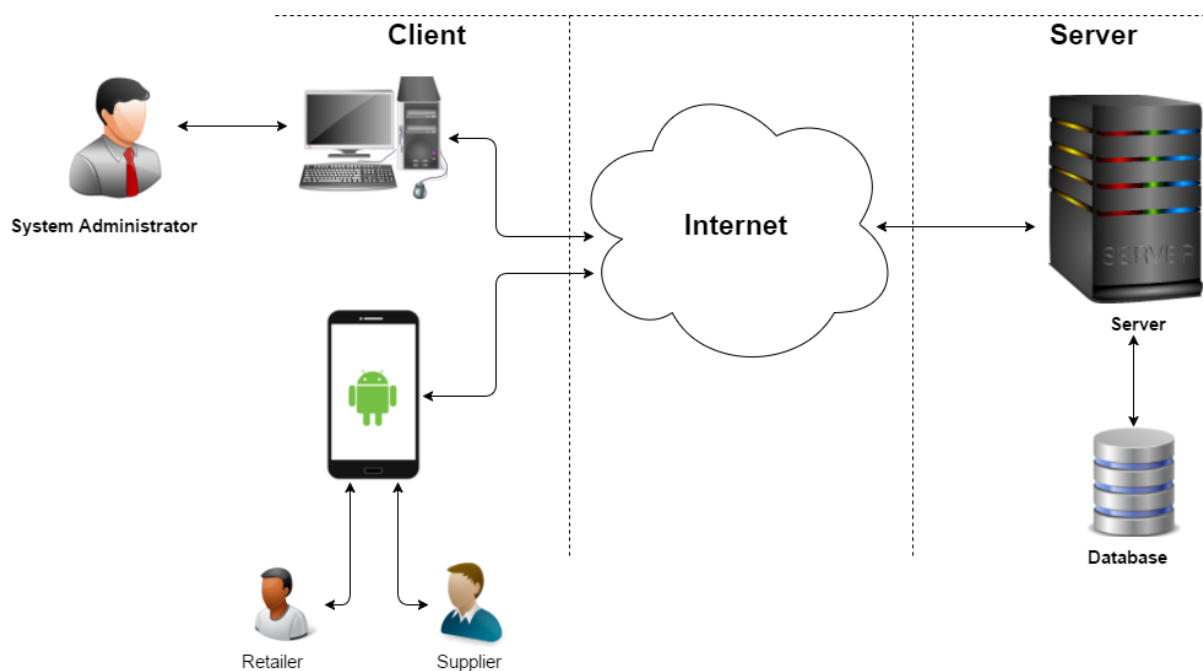


Figure 5.1 System Architecture

5.3 System Design

This section focuses on the design structure of the proposed application that shows how the different modules of the system interacts and work together to accomplish the desired objectives. The diagrams captured in this section include use case diagrams, entity relationship diagrams, sequence diagrams and class diagrams.

5.3.1 Use Case Diagram

The Use Case diagram shows the functionalities of the system in terms of the actors and their objectives represented as use cases. Figure 5.2 show the proposed application use case diagram.

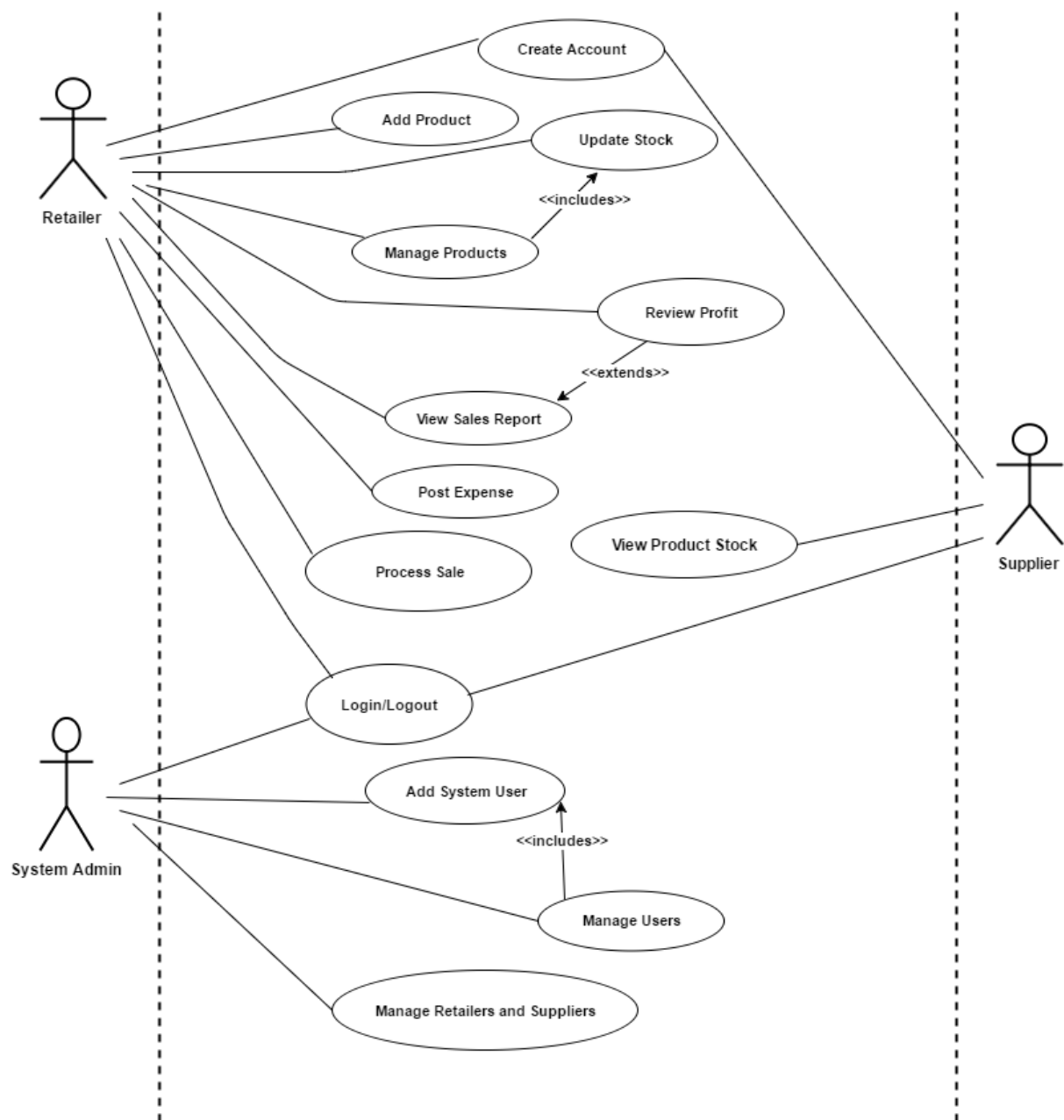


Figure 5.2 Use Case Diagram

The system has three actors: retailer, supplier and system administrator. The use case shows the actions that are performed in the system by the three actors.

Use Case Description

This describes the various use case by displaying the primary actors, the stakeholders, precondition, post condition and the main success scenario.

Use Case: Create Account	
Primary Actors:	Retailer, Supplier
Stakeholders:	System Administrator
Precondition:	Need to manage products, stock or make sale.
Post condition	Account details submitted
Main success scenario	
Actor	System
Fills all required details to create account and submit details	The system posts the details into the database and return a success message

Figure 5.3 Create Account Use Case

Use Case: Login	
Primary Actors:	Retailer, Supplier, System Administrator
Stakeholders:	
Precondition:	Need to access the system.
Post condition	Access granted and able to use the system.
Main success scenario	
Actor	System
Enters username and password and clicks the login button.	Checks the username and password against those stored in the database and grant access when there is a match.

Figure 5.4 Login Use Case

Use Case: Logout	
Primary Actors:	Retailer, Supplier, System Administrator
Stakeholders:	
Precondition:	Need to exit from the system
Post condition	Prompted to login to access the system.
Main success scenario	
Actor	System
Clicks the logout button.	Exits user from the system and calls the login use case

Figure 5.5 Logout Use Case

Use Case: Add Product	
Primary Actors:	Retailer
Stakeholders:	Supplier
Precondition:	User is logged in.
Post condition	Product is available for sale.
Main success scenario	
Actor	System
Enters and submits product details.	Adds the product into the database and return a success message.

Figure 5.6 Add Product Use Case

Use Case: Process Sale	
Primary Actors:	Retailer
Stakeholders:	
Precondition:	Customer request to buy a product.
Post condition	Product Stock updated and sale recorded.
Main success scenario	
Actor	System
Perform a sale function	Updates the database with the sale record

Figure 5.7 Process Sale Use Case

Use Case: Update Stock	
Primary Actors:	Retailer
Stakeholders:	Supplier
Precondition:	Arrival of new stock from supplier.
Post condition	Product Stock updated.
Main success scenario	
Actor	System
Enter new stock value and submits	Updates product stock value and returns a success message.

Figure 5.8 Update Stock

Use Case: Post Expense	
Primary Actors:	Retailer
Stakeholders:	
Precondition:	New Stock has been bought.
Post condition	Profit review.
Main success scenario	
Actor	System
Enter expense incurred on stock purchase	Adds expense record to the database

Figure 5.9 Post Expense Use Case

Use Case: Manage User	
Primary Actors:	System Administrator
Stakeholders:	
Precondition:	Need to remove, deactivate or activate user.
Post condition	Only current active users can log into the system.
Main success scenario	
Actor	System
Select a user and perform an action	Updates user details and status and return success message

Figure 5.10 Manage User Use Case

5.3.2 Sequence Diagram

The sequence diagram shows how the users interact with the system through the sending messages and receiving feedback. The sequence diagram in Figure 5.3 show the interaction between the users and the proposed system.

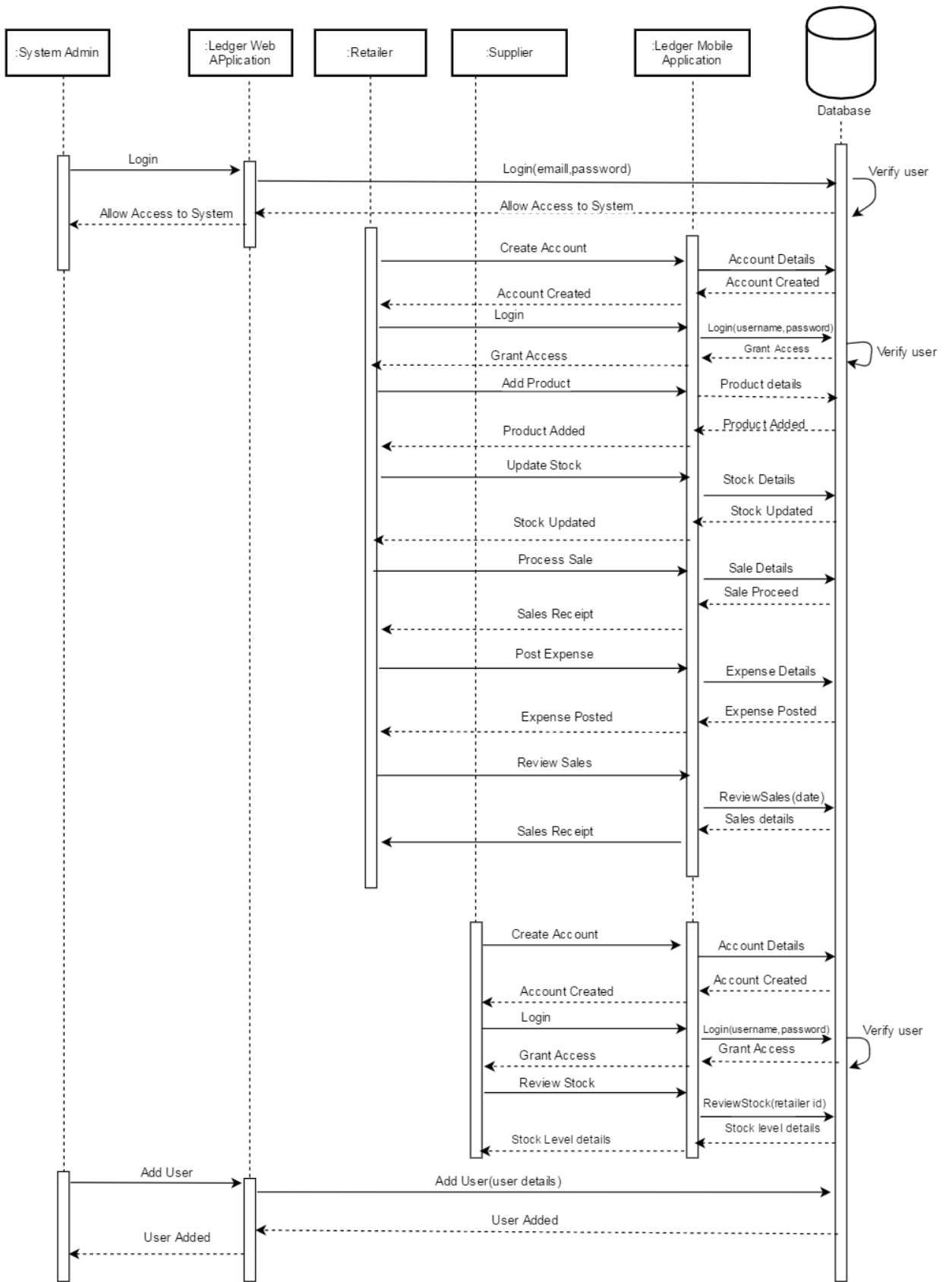


Figure 5.3 System Diagram

5.3.3 Partial Domain Diagram

The partial domain in Figure 5.4 shows the relationship between the entities of the system. It is a visual representation of conceptual classes in a domain.

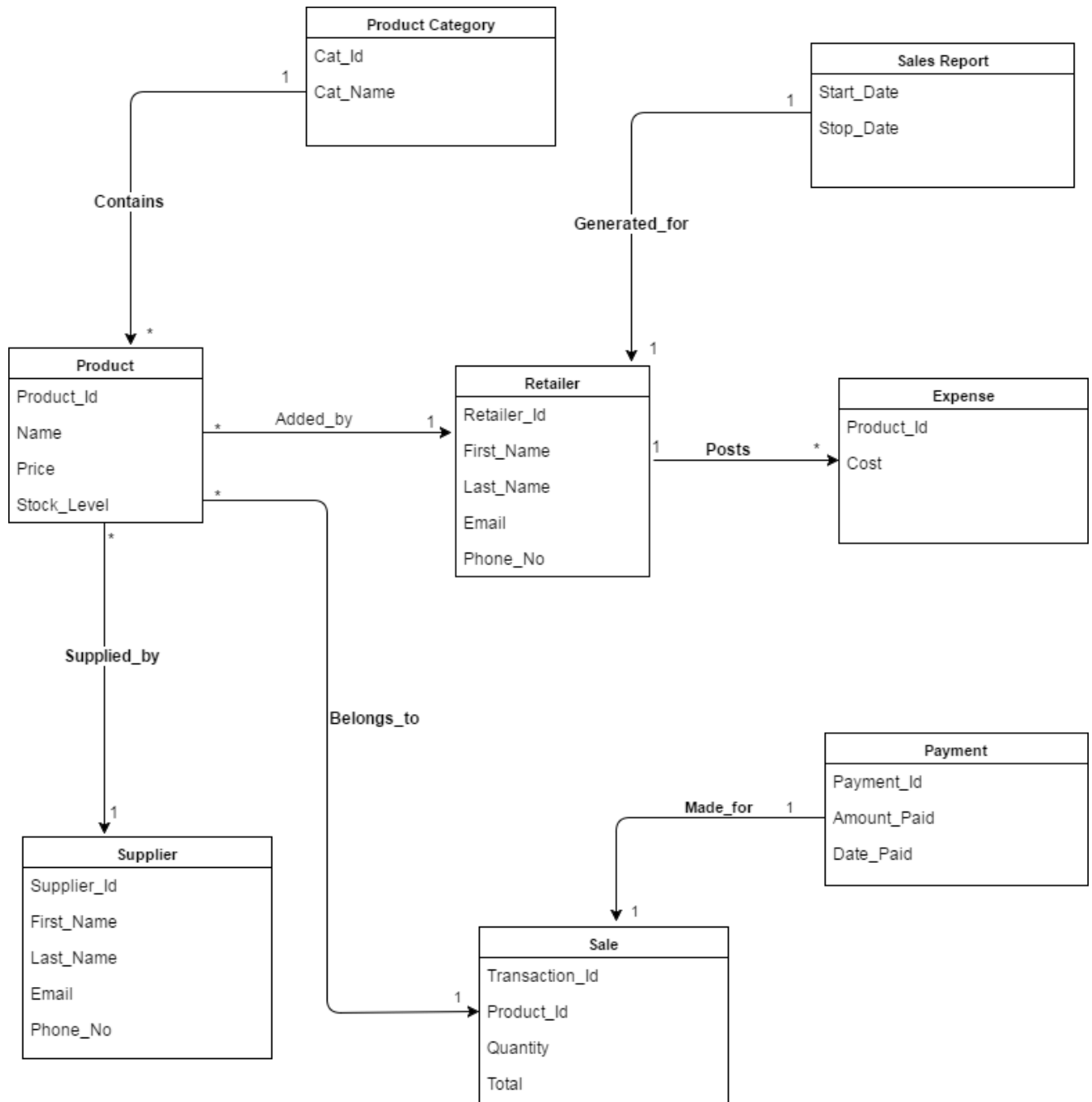


Figure 5.4 Partial Domain Model

5.3.4 Context Diagram

The context diagram in Figure 5.5 shows the flow of data from the entities to the application and vice versa. The main users of the system are the retailers who manages their shop, suppliers who monitor the stock level of their products and system administrators who perform the overall administration of the system. The context diagram shows what the entities inputs into the system and the output they receive from the system.

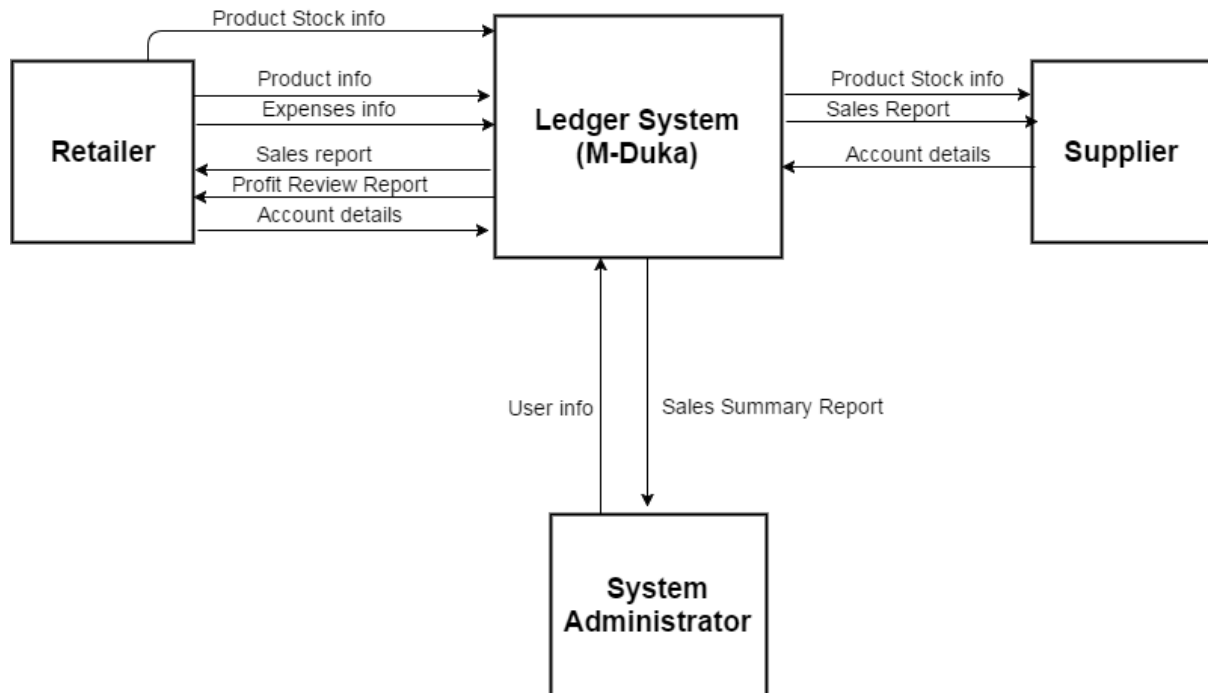


Figure 5.5 Context Diagram

5.3.5 Entity Relationship Diagram

An entity relationship diagram show the database tables and the relationships among them. Figure 5.6 shows an entity relationship diagram that was used to implement the system database.

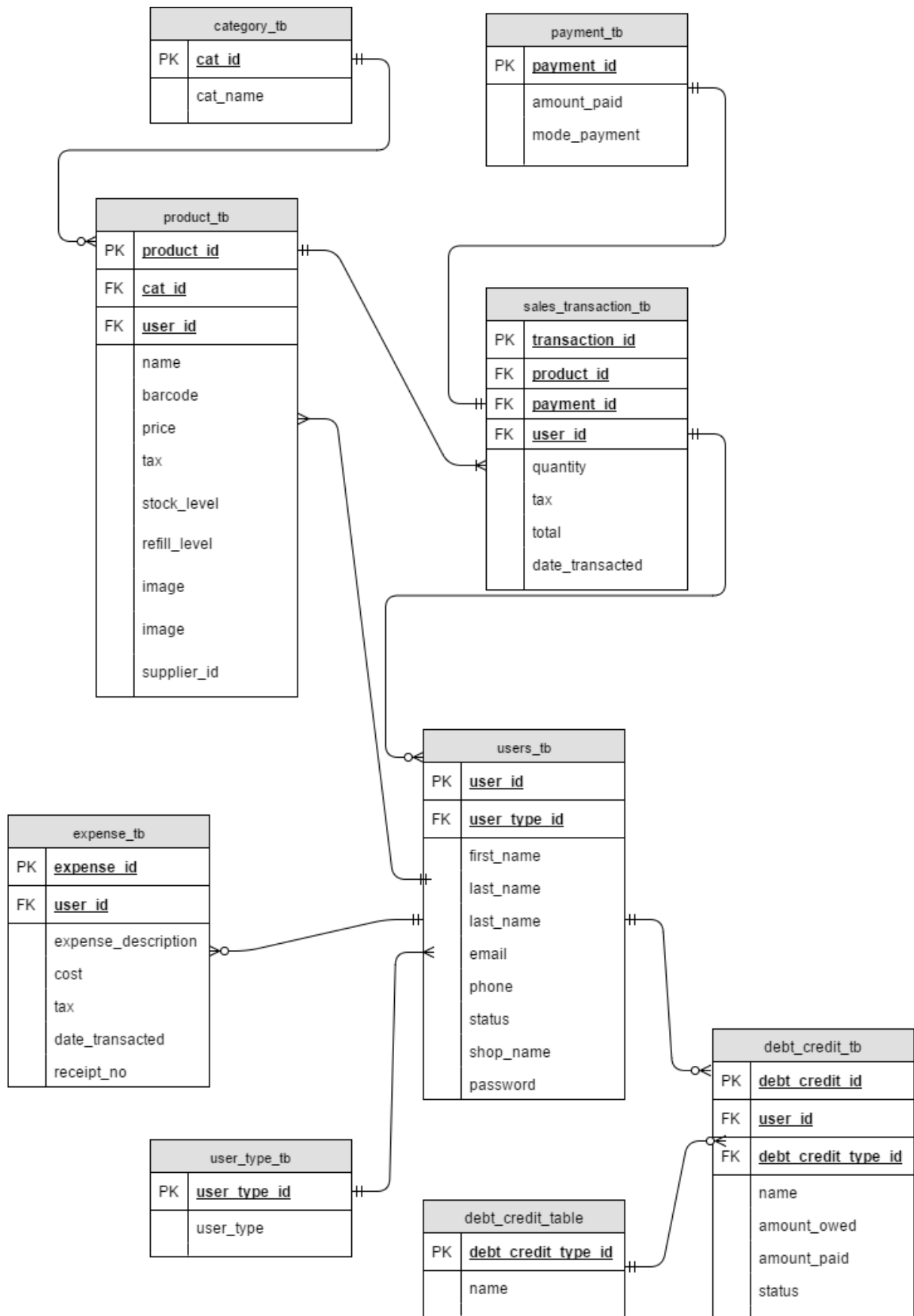


Figure 5.6 Entity Relationship Diagram

5.3.6 Database Schema

Table 5.1 Users Table

Column Name	Data Type	Index
user_id	Varchar(30)	Primary Key
user_type_id	Varchar(30)	Foreign Key
first_name	Varchar(30)	
last_name	Varchar(30)	
email	Varchar(255)	
phone_no	Varchar(30)	
password	Varchar(255)	
shop_name	Varchar(255)	

Table 5.2 User Type Table

Column Name	Data Type	Index
user_type_id	Varchar(30)	Primary Key
user_type	Varchar(30)	

Table 5.3 Products Table

Column Name	Data Type	Index
product_id	Varchar(30)	Primary Key
user_id	Varchar(30)	Foreign Key
cat_id	Varchar(30)	Foreign Key
name	Varchar(30)	
barcode	Varchar(30)	
price	Double	
tax	Boolean	
stock_level	int(30)	
refill_level	int(30)	
image	Varchar(255)	
supplier_id	Varchar(30)	

Table 5.4 Product Category Table

Column Name	Data Type	Index
cat_id	Varchar(30)	Primary Key
cat_name	Varchar(30)	

Table 5.5 Sales Transactions Table

Column Name	Data Type	Index
transaction_id	Varchar(30)	Primary Key
user_id	Varchar(30)	Foreign Key
product_id	Varchar(30)	Foreign Key
payment_id	Varchar(30)	Foreign Key
quantity	int(30)	
tax	Double	
amount	Double	
total	Double	
date_transacted	datetime	

Table 5.6 Expense Table

Column Name	Data Type	Index
expense_id	Varchar(30)	Primary Key
user_id	Varchar(30)	Foreign Key
product_id	Varchar(30)	Foreign Key
date_transacted	datetime	
cost	Double	
tax	Double	
receipt_no	Varchar(30)	

Table 5.7 Payment Table

Column Name	Data Type	Index
Payment_id	Varchar(30)	Primary Key
cost	Double	
amount_paid	Double	
mode_payment	Varchar(30)	
date_transacted	Date	

Table 5.8 Debt & Credit Table

Column Name	Data Type	Index
debt_credit_id	Varchar(30)	Primary Key
user_id	Varchar(30)	Foreign Key
debt_credit_type_id	Varchar(30)	Foreign Key
name	Varchar(30)	
amount_owed	Double	
amount_paid	Double	
Status	Varchar(30)	

Table 5.9 Debt & Credit Type Table

Column Name	Data Type	Index
debt_credit_type_id	Varchar(30)	Primary Key
name	Varchar(30)	

5.3.7 User Interface Flow Diagrams

This sections shows the screens that the user uses to interact with the system. The first screen that appears when the application is launched is the login screen. The user enters the login credentials and if successful logged in the dashboard screen loads. The dashboard screen acts as a central navigation point from which you can access the other main screen of the application. The retailer's dashboard is different from that of the supplier. From the dashboard the retailer can be able to access the product sale screen, product and stock screen, statistics screen, accounting screen, reports screen and the setting screen.

a) Mobile Application Wireframes

The figures below shows the mobile application screen design wireframes



Figure 5.7 Login Wireframe

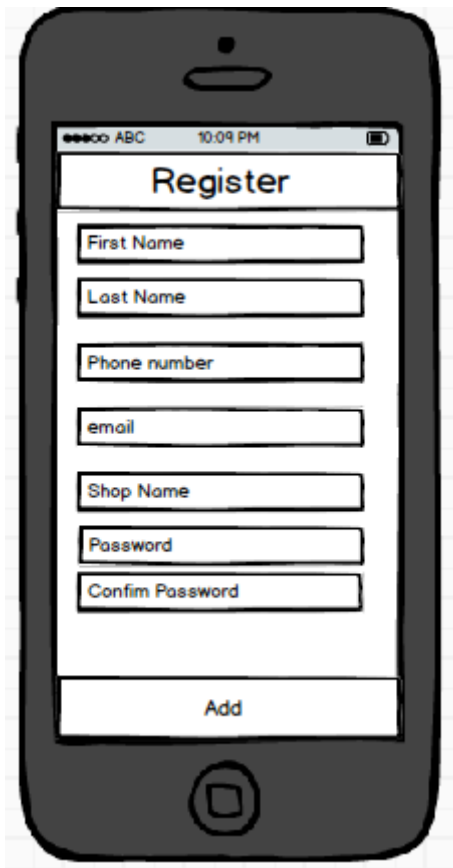


Figure 5.8 Register Wireframe



Figure 5.9 Dashboard (Retailer) Wireframe

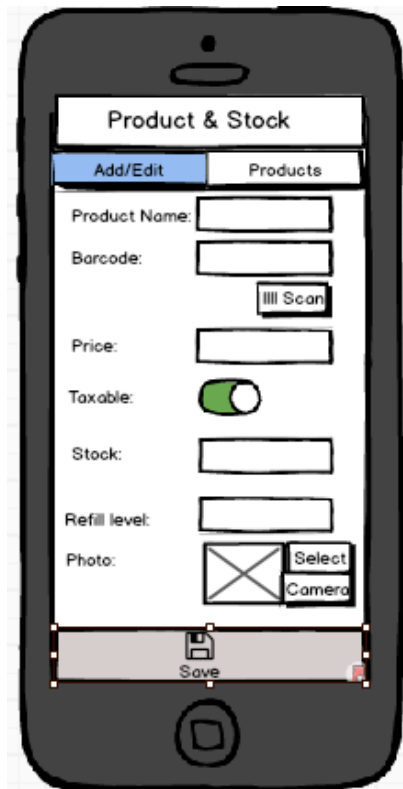


Figure 5.10 Add Product Wireframe



Figure 5.11 Product Stock Wireframe

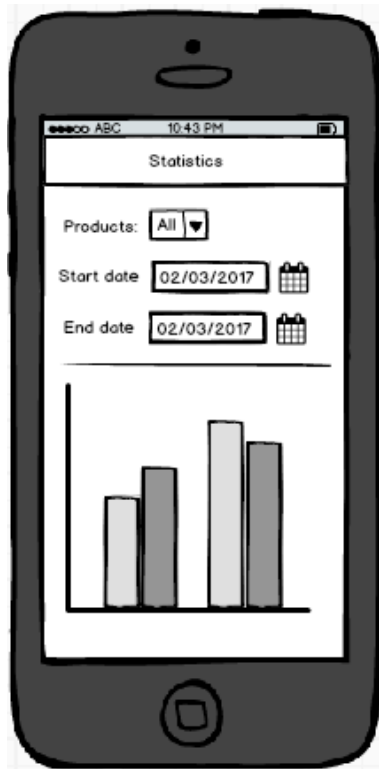


Figure 5.12 Statistics Wireframe



Figure 5.13 Product Sale Wireframe



Figure 5.14 List of Sale Products Wireframe

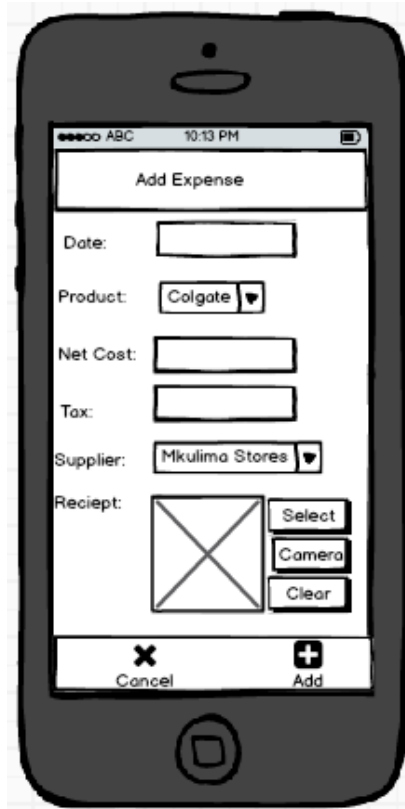


Figure 5.15 Add Expense Wireframe

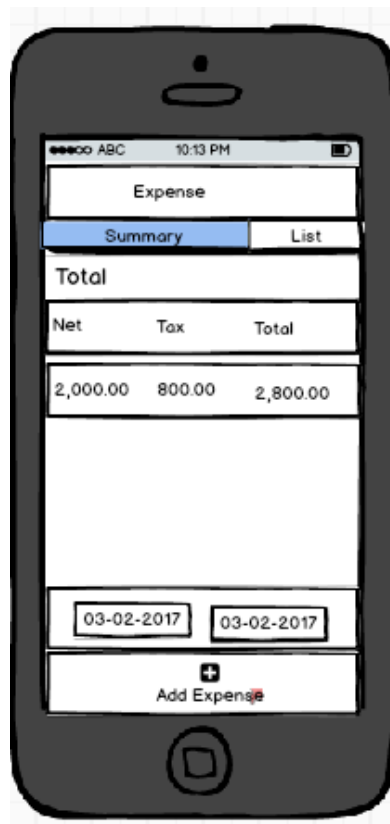


Figure 5.16 Expense List Wireframe



Figure 5.17 Sales Report Wireframe

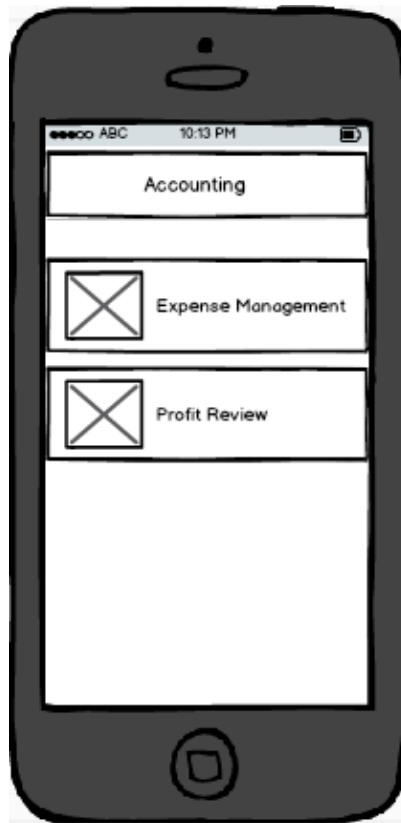


Figure 5.18 Accounting Wireframe

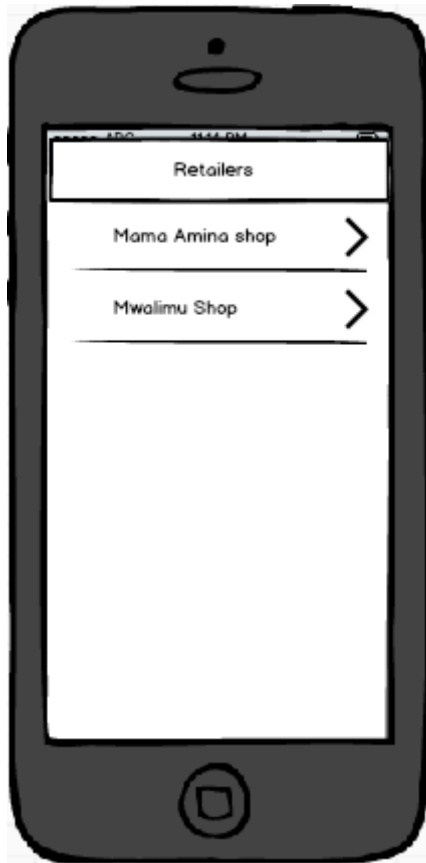


Figure 5.19 Retailer List Wireframe

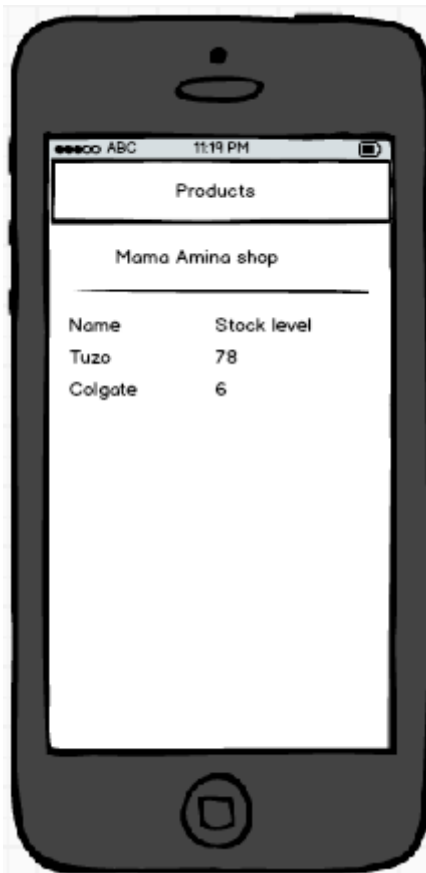


Figure 5.20 Product Stock Level Wireframe

b) Web Application Wireframes

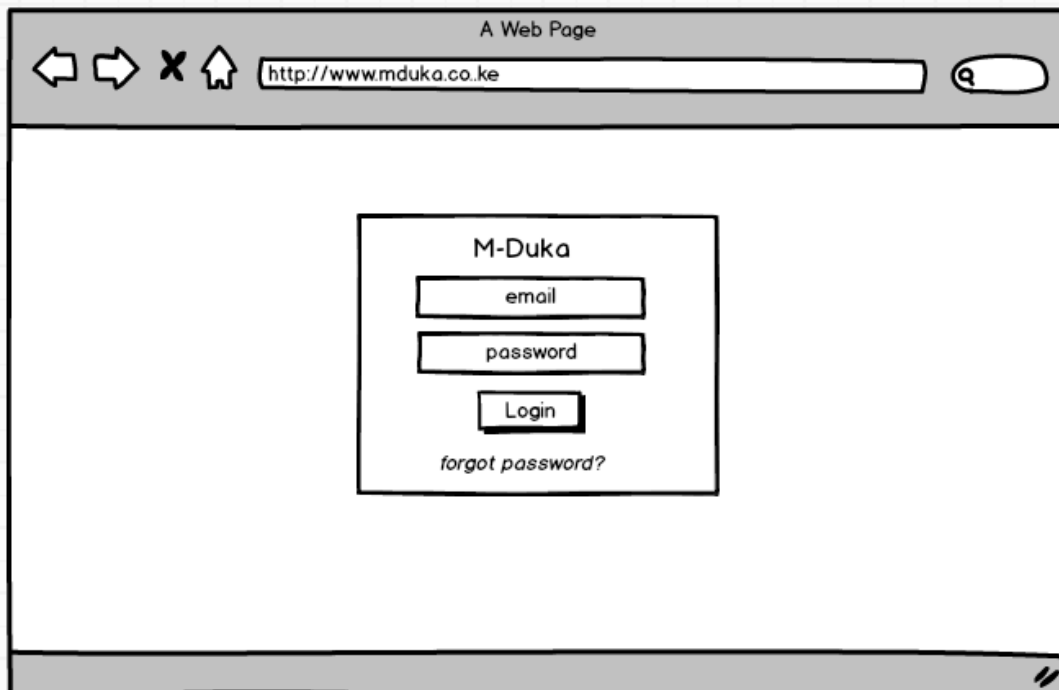


Figure 5.21 Login Wireframe

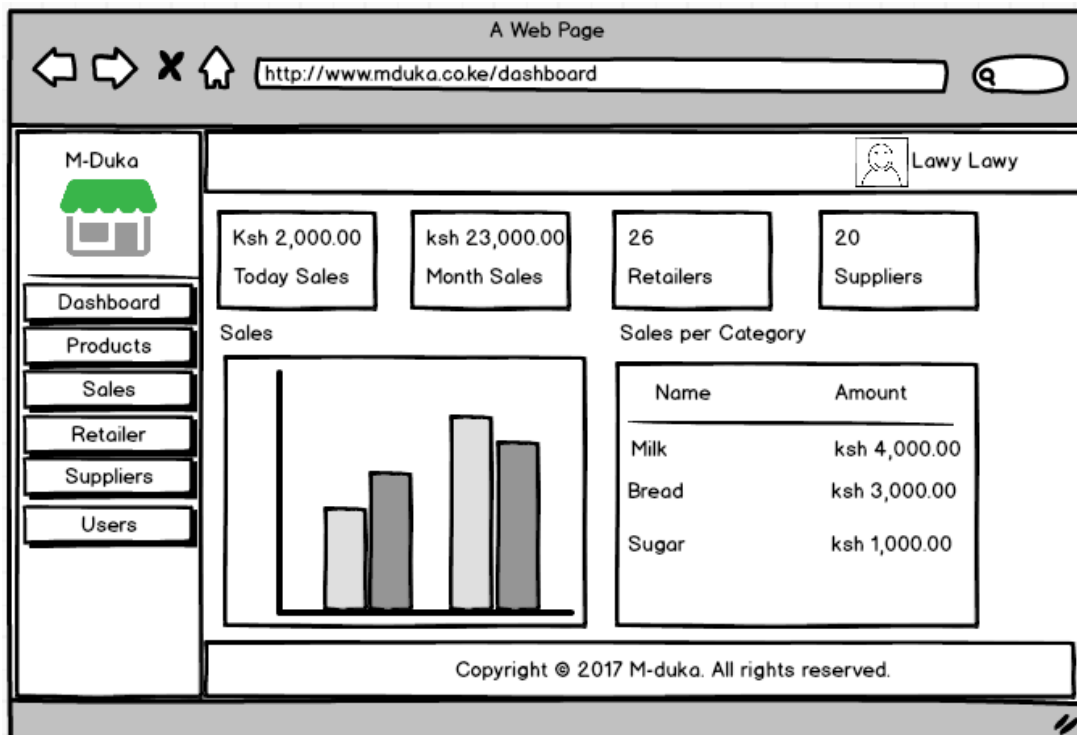


Figure 5.22 Dashboard Wireframe

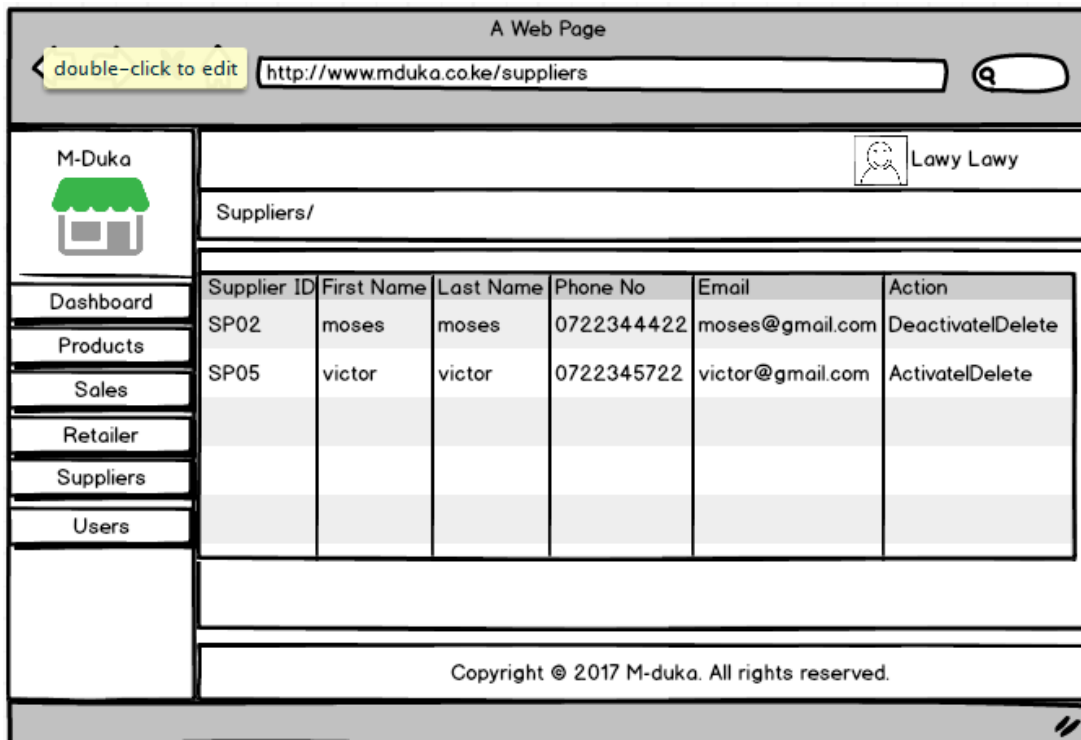


Figure 5.23 List of Supplier Wireframe

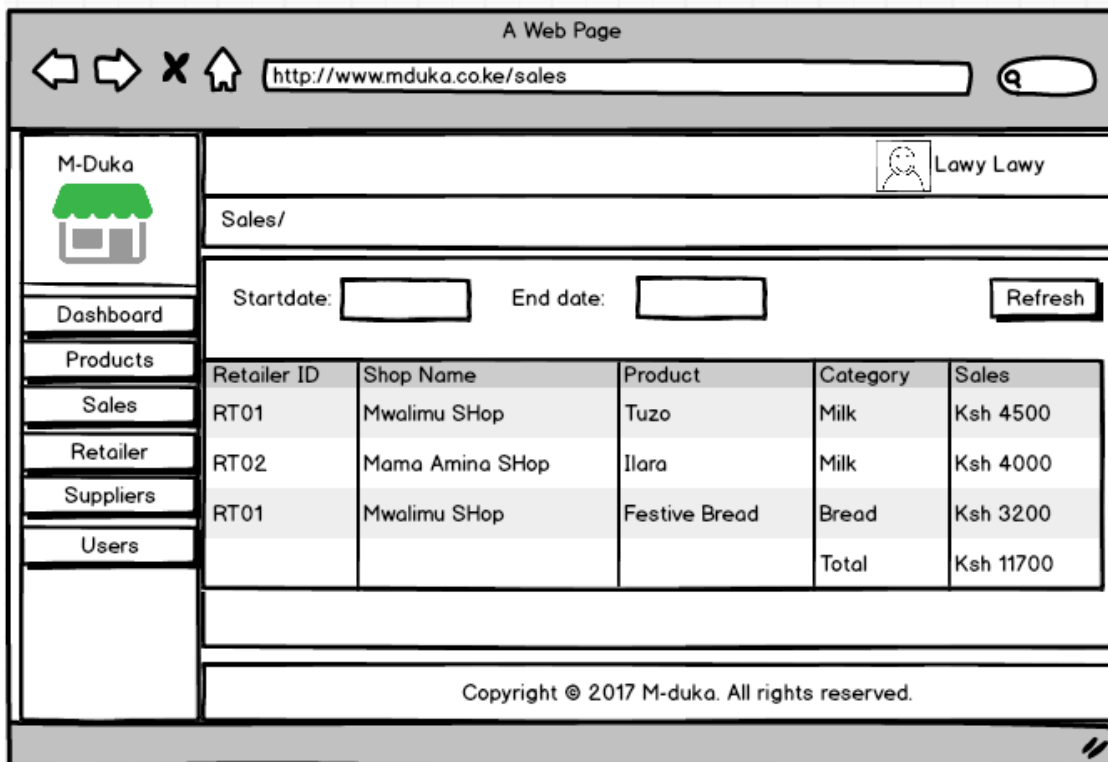


Figure 5.24 Sales Records Wireframe

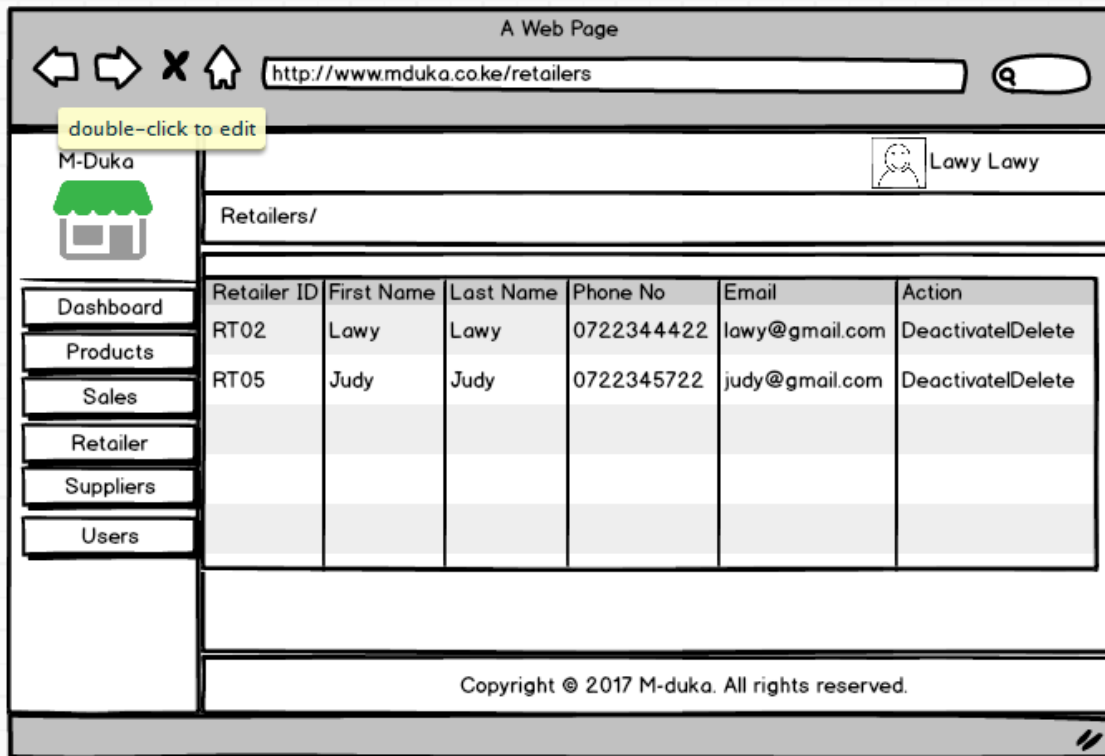


Figure 5. 25 List of Retailers Wireframe

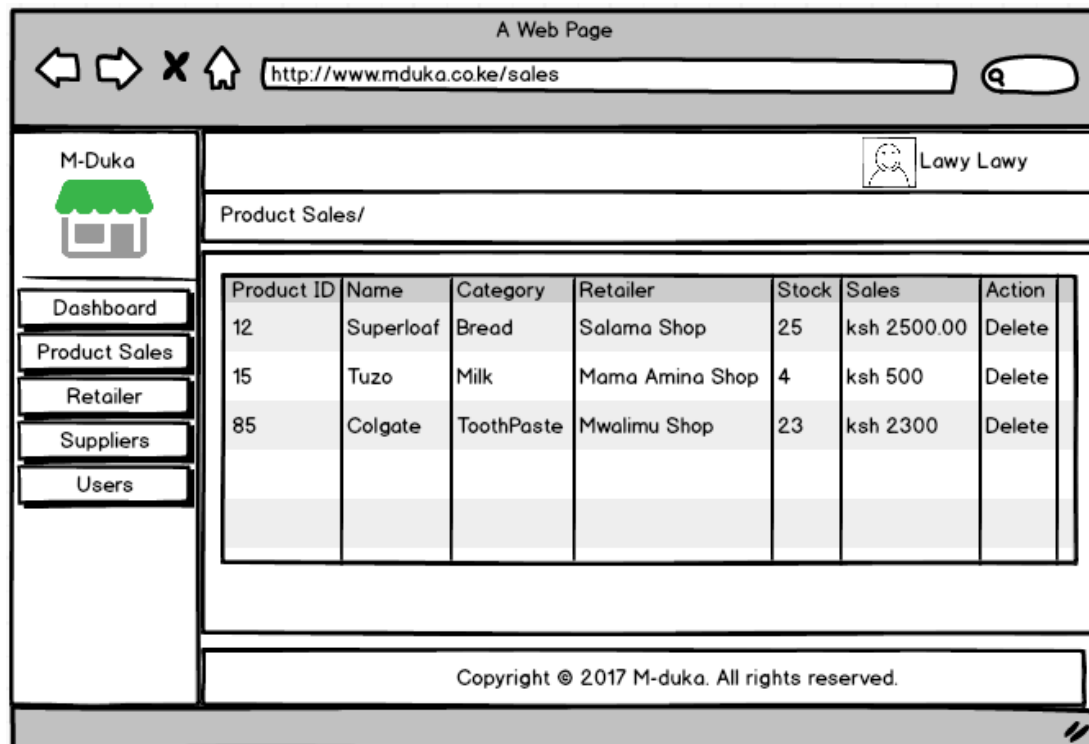


Figure 5.26 Product Sales Wireframe

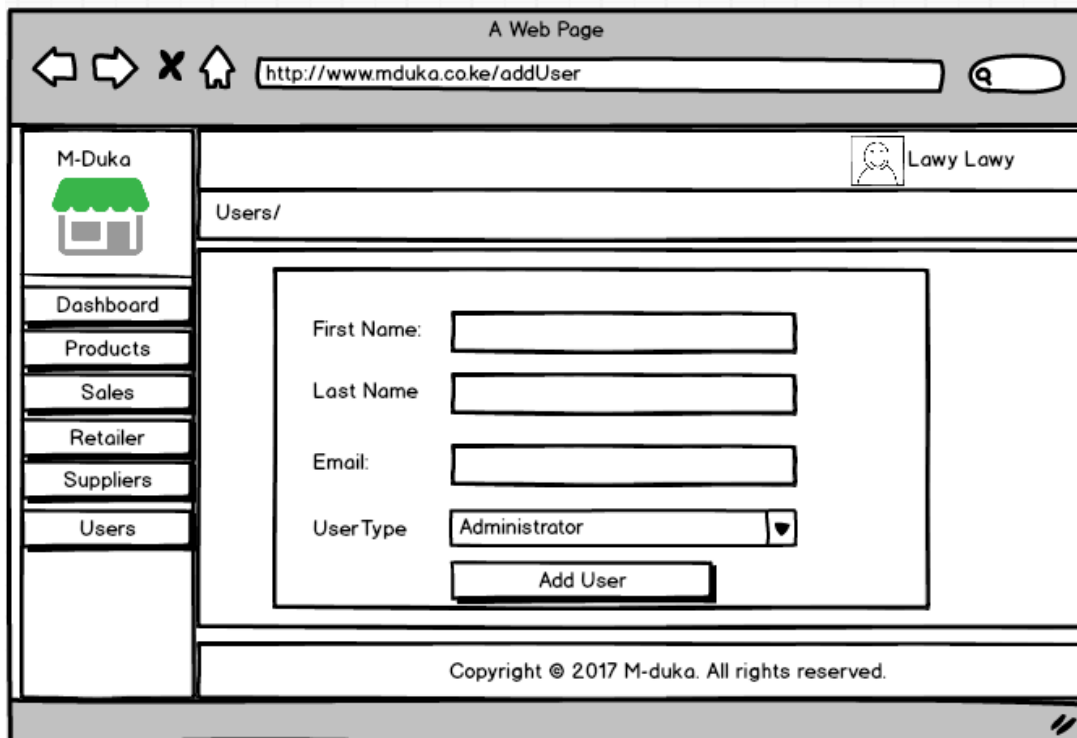


Figure 5.27 Add User Wireframe

5.4 Conclusions

The system analysis and design helped to understand the system requirements. The system diagrams were constructed using the UML notation. The diagrams captured in system design includes a use case diagram that showed actions of the different actors of the system, context diagram that showed how the different entities interact with the system, sequence diagram that showed the messages exchanged between the users and the system and the entity relationship diagram that showed the relationship between the system database tables. Wireframes were used to show the various screen designs used to interact with the system.

CHAPTER 6: PROTOTYPE BUILDING AND TESTING

6.1 Introduction

This chapter explains how the implementation and testing of the proposed solution was carried out. The major functionalities of the applications have been implemented, tested and clearly explained. The details of the implementation environment have also been explained in this chapter.

6.2 Functionality of the System

The proposed system comprises of a front end and a backend application. The front end was implemented as a mobile application and the backend as a web application. The mobile application is used by retailers to manage their shops and by suppliers to monitor product stock level. The web application is used by the system administrator who perform the overall administration of the system.

6.2.1 Mobile Application

i) Registration and Login

The implementation of the system requires that every user to create an account from which the email address and password submitted will be used during system login. The user can only access the system if they are registered in the system.

ii) Product Management

Product management comprises of adding, editing and removal of products in the system. When a retailers register as users in the system, they are able to login and add their shops product into the system. They are able to update information about the products such as stock value and even delete the product from the system if they no longer sell the product.

iii) Product Sale

When a customer requests to purchase a certain product, the retailer is able to process the sale in the system for easy accountability and reporting that is provided by the system. The sale is recorded in the system and used for analysis and statistics.

iv) Stock Management

The retailers are able to update newly bought stock into the system. The suppliers on the other hand are able to monitor the stock level of the product they suppliers so that they can know when to supply the next stock.

v) *Reports and Statistics*

The system provides reports and statistics of the sales transacted in the system. This assists the retailers to know the sales of a particular day, week or month and also which products has most sales. These information will assist them in making business decisions that will improve and make the business to grow.

6.2.2 Web Application

i) *User Management*

This comprise of adding, editing, activating and removal of users. The system administrator is able to add new users, edit information of current users, activate or deactivate users and also delete them form the system.

ii) *Data Analytics*

The data recorded in the system by mobile application users are analysed and presented as summaries in the web application. The analysed data provide the system administrator with statistics of the users of the system and also the product sales.

6.3 Implementation Environment

The mobile application was implemented an Android mobile phone. The source code was written using Android programming language that utilizes Java classes and XML designs. The application is optimized for Android version 5.1 with compatibility with Android devices on minimum version 4.0.1. The mobile application was able to receive data from the database via JSON. An Android application client was used because it has a flexible SDK, easily available Android Development Tools (ADT) and most of our target users own an Android phone.

The web application of the system was developed using Laravel 5.4 PHP framework. The application was hosted on an online Apache HTTP Server. Laravel PHP framework was used to implement the web application because of the following reasons: it is open source; it has multilayer security; it is supported by most web servers and database.

MYSQL database was used to develop the database of the system. It is open source, fully compatible with PHP which was the base of the web application.

6.4 System Modules

The system is composed of a mobile application designed on Android Platform and web application on Laravel PHP framework.

6.4.1 Mobile Application

The following are the main system components of the mobile application.

i) Create Account and Login

The users are required to create an account before they can use the system. They fill the required details as shown in Figure 6.2 and clicks the create account button. On successful registration they should now be able to login into the system using the correct email and password they specified during registration. Figure 6.1 shows the login screen.

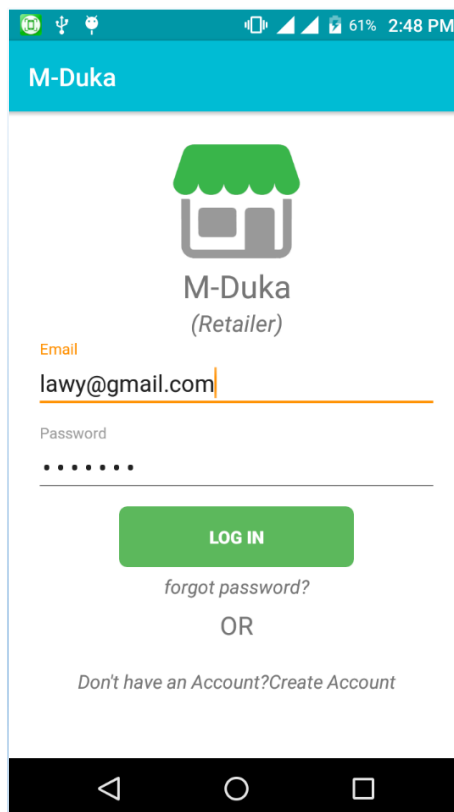


Figure 6.1 Login Screen

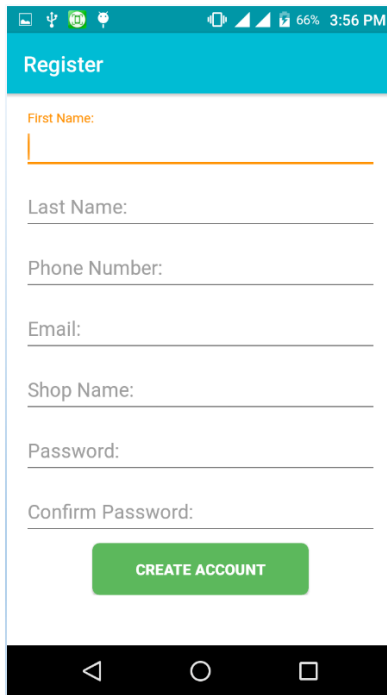


Figure 6.2 Account Creation Screen

ii) Dashboard

Figure 6.3 is the main page of the mobile application. It is from this screen that the user can navigate to the different section of the system.

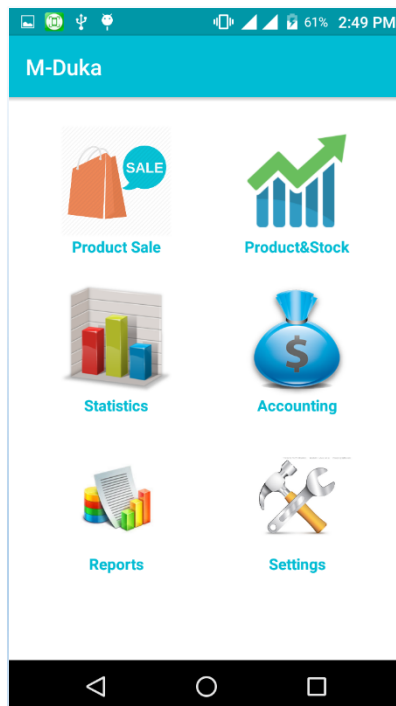


Figure 6.3 Dashboard Screen

iii) Product Management

The user is able to add products into the system by filling the details about the product as shown in Figure 6.4. The scan button launches a screen as shown in Figure 6.6 that is used to capture the product barcode. Figure 6.5 shows a list of products that are currently in the system.

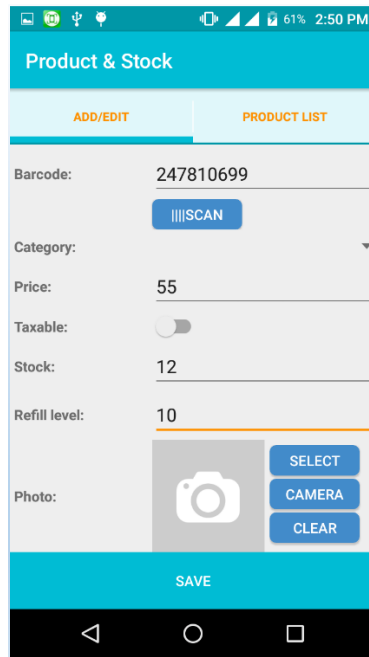


Figure 6.4 Add Product Screen

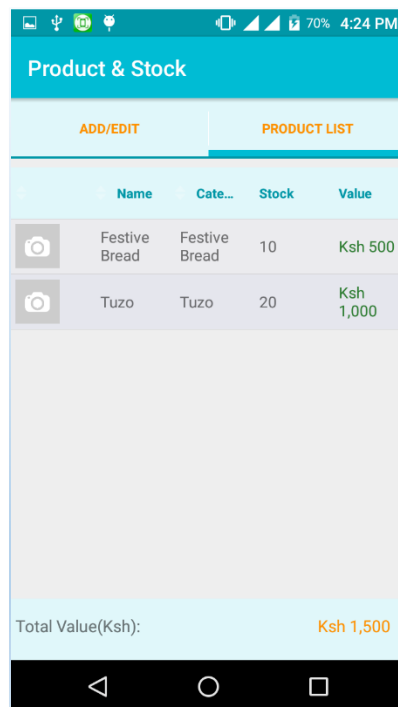


Figure 6.5 Product List Screen

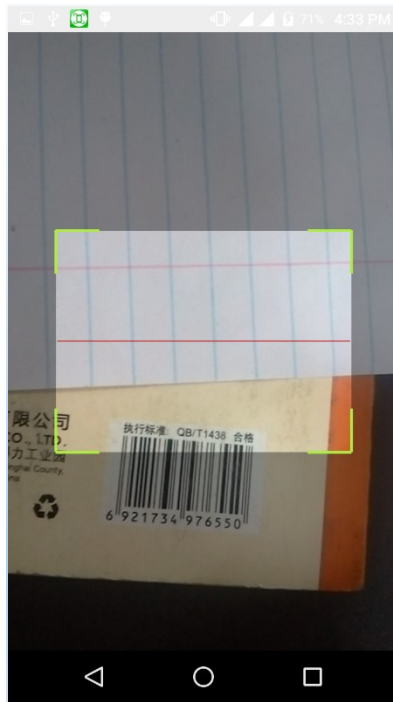


Figure 6.6 Barcode Reader Screen

iv) Stock Management

The supplier is able to monitor the stock level of their products in order to know when to supply the next stock. They have access to the stock level of all the retailers that they supply to. Figure 6.7 shows a list of products supplied to one of the retailers. The green status signifies that the stock level is above the refill level while the red status indicates that the stock is below the refill level and thus they need to supply more stock.

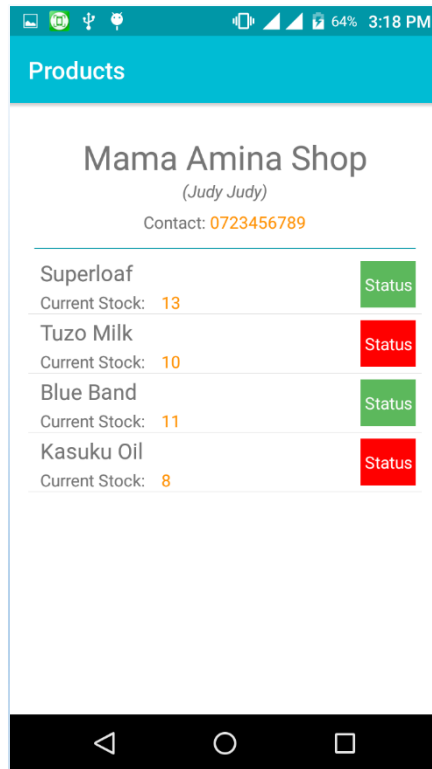


Figure 6.7 Products Screen

v) Product Sale

The Product sale screen as shown in Figure 6.8 is where the retailer processes the sale of a particular product so that it can update the stock value and add the sale record.

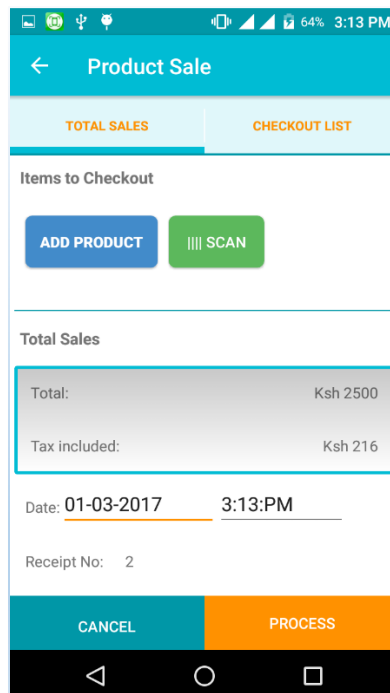


Figure 6.8 Product Sale Screen

vi) Reports and Statistics

The system generates analysis of the sales transaction performed by the retailer. Figure 5.9 shows a bar chart that compares the sales of various products.

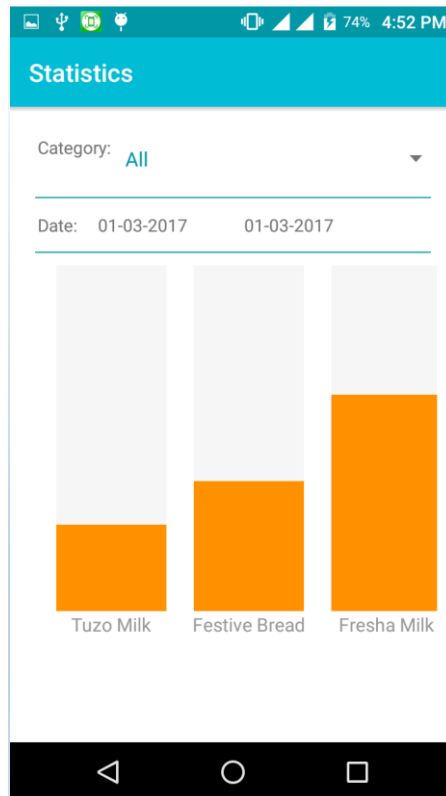


Figure 6.9 Sales Statistics Screen

6.4.2 Web Application

The following shows some of the components of the web application.

i) Registered Retailers

Figure 6.10 shows a list of all the currently registered retailers.

M-Duka							Admin			
MAIN NAVIGATION							Retailers			
Retailer ID	First Name	Last Name	Phone	Email	Shop Name					
1	Lawy	Lawy	0734003021	lawy@gmail.com	Mwalimu Shop	Edit	Deactivate	Delete		
3	Judy	Judy	0724043021	judy@gmail.com	Mama Amina	Edit	Deactivate	Delete		
4	John	John	0723456789	john@gmail.com	Duka Bora	Edit	Deactivate	Delete		
Retailer ID	First Name	Last Name	Phone	Email	Shop Name					

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Figure 6.10 List of Retailer

ii) List of Suppliers

Figure 6.11 shows a list of all the currently registered suppliers.

M-Duka							Admin			
MAIN NAVIGATION							Suppliers			
Supplier ID	First Name	Last Name	Phone	Email	Store Name					
2	Moses	Moses	0704234512	mose@gmail.com	Maji Mazuri Stores	Edit	Deactivate	Delete		
5	Victor	Victor	0724043021	victor@gmail.com	SHandarana Store	Edit	Deactivate	Delete		
Supplier ID	First Name	Last Name	Phone	Email	Store Name					

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Figure 6.11 List of Suppliers

6.5 Testing

This sections describes the various forms of tests that were performed on both the mobile and web application. The tests were done against the Functional and Non-functional requirements.

6.5.1 Usability Testing

Usability testing was carried out to confirm the user friendliness of the system and how a new user interacts with the system; whether they experience ease of use or not. The Table 5.1 below shows the usability tests performed.

Table 6.1 Usability Test

Test Case Name: Application Usability Test			
Test Description: Test for Usability of the Application.			
Pre-Condition: Application launched successfully.			
Post- Condition: Ease of use of the application by the system.			
Step	Actions	Expected Response	Result
a)	Users can access the Menu items and interact with them seamlessly.	Menu items should be visible, clickable and functional.	Pass
b)	Users can navigate on the application with ease.	An appealing user interface with the components well in place.	Pass

6.5.2 Functional Testing

The accounting application was developed to assist retailers to easily manage and account for the business inventory. Functional testing was performed in order to determine whether the applications meets the prior defined requirements. The following functional tests were carried out.

Table 6.2 Account Creation Test

Test Case Name: Creating Account		Test Case: 1	
Brief Description: Users create their accounts by filling all the required details press the create account button. Successful submission result to account being created.			
Pre-condition: The user should have installed the application and have access to the internet.			
Step	Action	Expected results	Pass/Fail
1.	User runs the application.	The application loads the login page.	Pass
2.	User taps on the create account link to create an account in the system.	The application loads the registration screen.	Pass
3	The user fills all the required registration details and taps on the create Account button.	The application returns a success message and redirects the user to the login page.	Pass
Post condition: User can now login and access the system.			

Table 6.3 Login and Logout Test

Test Case Name: Login and Logout Test		Test Case: 2	
Brief Description: Users login to the system using their email addresses and passwords and logout to exit the system.			
Pre-condition: The user should have created an account.			
Step	Action	Expected results	Pass/Fail
1.	User starts the application.	The application loads the login page.	Pass
2.	User enters the login credentials and presses the login button.	The application authenticates and loads the dashboard screen.	Pass
3	The user logout of the system once to exit from the system.	The application redirects the user back to the login screen.	Pass
Post condition: User can now utilise the system's services.			

Table 6.4 Adding Product Test Case

Test Case Name: Adding Product Test		Test Case: 3	
Brief Description: Users fills the required details of a product and clicks the saved button to add the product into the system.			
Pre-condition: The user should be logged in to the system.			
Step	Action	Expected results	Pass/Fail
1.	User logs into the application.	The application loads the dashboard screen.	Pass
2.	User taps on the product/stock menu.	The application loads a form with fields for entering product details.	Pass
3	The user clicks on save button after filling the form.	The product is added into the system and a message pops up to show product was added successfully.	Pass
Post condition: User can process a sale containing that product.			

Table 6.5 Sales Processing Test Case

Test Case Name: Sale Processing Test Case		Test Case: 4	
Brief Description: Once the user is logged in he/she can order an investigation report and recommend the treatment option after assessment of the patient's details.			
Pre-condition: The user should be logged in to the system.			
Step	Action	Expected results	Pass/Fail
1.	User logs into the application.	The application loads the dashboard screen.	Pass
2.	User taps on the process sale menu	The application loads the process sale screen	Pass
3	The user clicks on add product button or scan button to scan an item product in order to add product to a sale.	The product is added to the current sale ready for processing.	Pass
4	The user clicks on process button to complete the sale process.	A success message is returned to the user and the product stock value is reduced by the quantity of the product sold.	Pass
Post condition: The sale details can be used for product and sales analysis			

Table 6 6 Post Expense Test Case

Test Case Name: Post Expense Test Case		Test Case: 5	
Brief Description: The user enter the details of the expense incurred in purchasing certain product stock and clicks the save button.			
Pre-condition: The user should be logged in to the system.			
Step	Action	Expected results	Pass/Fail
1.	User logs into the application.	The application loads the dashboard screen.	Pass
2.	User taps on expense management menu.	The application loads expenses screen that shows the summary of all the expenses.	Pass
3	The user taps the add expense button to load the screen with expense details form.	The system loads the expense form screen.	Pass
4	The user fills the expense form and clicks the save button.	The system returns a success message and the expense summary details is updated.	Pass
Post condition: The expense record can be used for expense and profit analysis.			

Table 6.7 View Sales Analysis Test Case

Test Case Name: Sales Analysis Test Case		Test Case: 6	
Brief Description: The user views the sales statistics of the products in the system.			
Pre-condition: The user should be logged in to the system.			
Step	Action	Expected results	Pass/Fail
1.	User logs into the application.	The application loads dashboard screen.	Pass
2.	User taps on statistics menu to view the sales statistics.	The application loads the statistics screen showing a chart representing the sales statistics.	Pass
3	The user selects a category from the spinner.	The chart is updated to show the statistics of only the products of the selected category.	Pass
Post condition: The sales can be analysed based on the processed date.			

6.5.3 Compatibility Testing

Compatibility testing was done to ensure that both the mobile and web application are compatible with the existing platforms. Mobile application was tested on the existing Android versions while the web application was tested on the all the major web browsers. Android Platform Testing is specified in Appendix C. Table 6.8 shows the web browser testing.

Table 6.8 Web Browser Testing

Web Browser	Compatibility
Internet Explorer – Version 4 and above	Yes
Mozilla Firefox – Version 4 and above	Yes
Chrome – all versions	Yes

6.5.4 Security Testing

Security testing was carried out to ensure that there the system perform authentication and authorisation and also to ensure that input validation is properly implemented into the system. Table 6.9 shows the test case carried out.

Table 6.9 Security Test Case

Test Case Name: Security of the Application			
Test Description: Test for Security of the Application			
Step	Action	Expected Response	Result
a)	User Authentication	Login credentials are checked against what is in the database to find a match between the two. The password is then encrypted before it is stored in the database.	Pass
b)	Input Validation	User's input is checked to see if it is of the correct format and whether it meets the requirements.	Pass

6.5.5 Integrity Testing

This was done by combining the different modules of the application and then tested as a single unit. This type of test is used to verify the different modules and units of the system are able to work together as a unit to achieve the overall objective of the system.

6.5.6 User Testing

The end users were directly involved in usability testing. 20 respondents took part in the user testing and provided feedback that was used to refine the mobile application. The tests that were conducted were as follows:

i) User Friendliness

70% of the respondents indicated that the mobile application was easy to use and learn while 20% rated the user friendliness as average. The remaining 10% found the user interface to be difficult to use. Figure 6.12 show a representation user friendliness feedback.

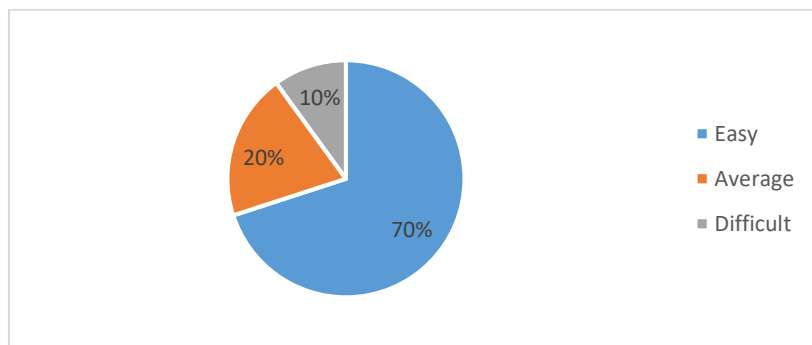


Figure 6.12 User Friendliness Feedback

ii) Functionality

The respondents were asked to whether the application functionalities solved the challenges of the current methods of accounting and inventory control. Figure 6.13 show a representation of the response of the users with 80% indicating the functionalities of the system solved most of the challenges.

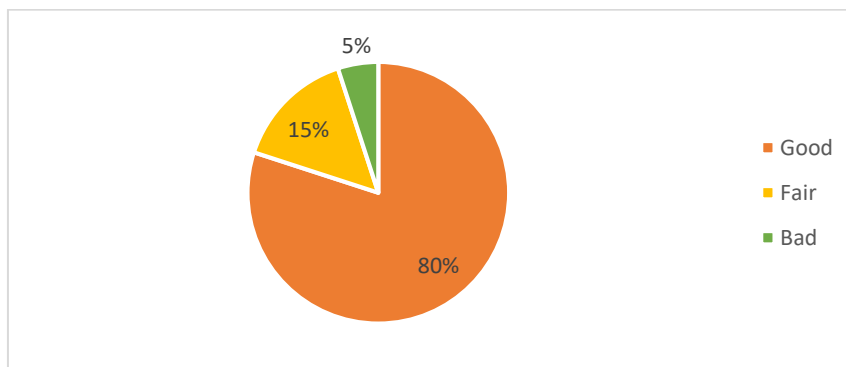


Figure 6.13 Functionality Test

iii) Acceptability

The respondents were asked whether they would use application in their business and 81% indicated that they would use the application to account and manage their business inventory. Figure 6.14 shows the acceptability feedback.

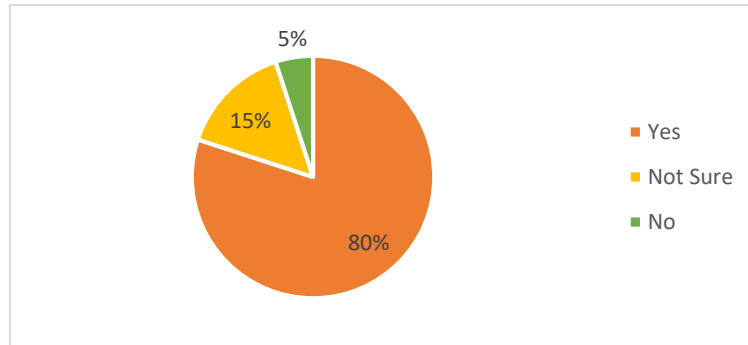


Figure 6.14 Acceptability Feedback

6.6 Conclusions

The system was implemented based on the requirements that were formulated during the requirement gathering and analysis. The system design in chapter 5 provided the details that were used in the implementation stage. Various testing were carried out to ensure that the system met the functional and functional requirements.

CHAPTER 7: DISCUSSIONS

7.1 Introduction

In the previous chapter the application was implemented and tested. This chapter sought to determine if the objectives were met and to see how the developed application maps with the current paper-based system that is used by majority of retailers to manage and account for their inventory. The advantages of the developed application are outlined in this chapter and also how the objectives have been accomplished.

7.2 Findings and Achievements

A review of the literature showed the bookkeeping plays a crucial role in the success of a business. The benefit of having a comprehensive record keeping mechanism is that business owners are able to timely and accurately develop financial reports that informs the progress and condition of the business. These reports serves as a reference point when making decisions pertaining the business. Inventory management has a significant influence in the profitability of a business and therefore the strategies of inventory management should be included in the business plan. The introduction of the Vender Managed Inventory system as a replacement of the traditional ordering process has greatly reduced stock problems while it promotes collaboration between the suppliers and the retailers. The VMI system allows the suppliers to make decisions regarding the stock to be supplied which result to the reduction of stock-out and also allows them to receive information on the demand patterns of their customers that helps them to plan better their inventories.

The study issued questionnaires to small scale retailers that assisted to determine the challenges that they face during accounting and management of inventory. The response from the respondents was able to justify the need of the system and if the system was feasible. From the findings the respondents showed that the current paper based system that is being used by majority of them was inefficient since the level of accuracy if the records was in question. The traditional paper based system was prone to errors as the records were as accurate as the bookkeeper. The retailers could easily make business decisions based on inaccurate information that may significantly affect their business. The questions in the questionnaire were designed in way that were able to answer the research questions in Section 1.4 and to meet the objectives of the study in Section 1.3.

7.3 Discussions

This sections explains how the study was able to meet the research objectives specified in Section 1.3. The first objective was to investigate the challenges of the current methods used by small scale retailers to account and manage inventory. The study shows the challenges that SMEs experienced when using the current paper based method of accounting and managing in Section 2.3. According to the research that was conducted, 76% of respondents from the sample size indicated that they had challenges with their current methods as shown in Figure 4.5. 75% of respondents used paper based system as indicated in Figure 4.1. Section 4.6 outlines the challenges that the respondents face with the current methods of accounting and managing inventory. It is due to these challenges that a need to develop the application was justified.

The second objective was to review the current models that provide accounting and management of inventory. 75% of small scale retailers are using the paper based system and only 17% used computer based systems as show in Figure 4.1. The paper based bookkeeping system inefficient for it is easily prone to errors and consume a lot of time to do the reconciliation of the records. VMI system of managing of inventory was found to be a better option of managing the inventory of the business over the traditional ordering process where the retailer defined the amount and timing of delivery of products from their suppliers as indicated in Section 2.5. Section 2.6 was able to explain in details the benefits of the VMI system to SMEs as it encourages collaboration between the retailers and their suppliers with the suppliers given the mandated to make decisions regarding the supply of inventory.

The third objective was to design, develop and test a mobile application that enhances accounting and inventory management by small scale retailers. The objective was achieved through the design, implementation and the testing of the mobile and web applications. The mobile application was developed for Android phones since 86% of potential end users owned an Android Phone as shown in Figure 4.4. The web application was developed using Laravel PHP framework. Various tests were carried to ensure that the system met the functional and non-functional requirements. The test carried out include: usability testing, functional testing, security testing, integration testing and compatibility testing. The mobile application was tested against the various Android platform and the web application against the various web browsers as indicated in Appendix C and Table 6.8 respectively.

The final objective was to validate the mobile application was a solution for the challenges of the current methods used by small scale retailers to account and manage inventory. The objective was achieved through getting feedback from 20 respondents who assessed the system and gave feedback based on the questionnaire in Appendix B. The feedback showed that 70% of the respondents found the application to be easy to learn and use while 80% were satisfied with the functionality of the system since it met their requirements. In general the feedback showed that 80% of the respondents were willing to use the application in their business to assist them in accounting and managing their inventory.

7.4 Limitations of the Application

The application developed have certain limitations. The users of the application are required to have a smart phone running Android Operating system. The application requires internet connectivity for suppliers to be able to monitor inventory. Currently it does not provide the ability to generate barcodes.

CHAPTER 8: CONCLUSIONS AND RECOMMENDATIONS

8.1 Summary

The current methods used by small scale retailers to account and manage their inventory were reviewed. A sample of small scale retailers were provided with questionnaires which they filled and the collected information was analysed. The analyses helped to determine the challenges that the small scale retailer encountered while running their businesses. This resulted to the development of a mobile application that was used by the retailers to manage and account for their inventory and allow the suppliers to monitor the stock level. The application provided efficiency in the way inventory is managed with good and easy accounting mechanism. This solved the challenges that were there with the current paper-based system that is being used by most of the small scale retailers. The system underwent various tests such as security, usability, functionality and the end users provided feedback on the look and feel, user friendliness and functionality of the application.

8.2 Recommendations

Inventory management plays an important role in a business and should be conducted in the best way possible. Poor inventory management methods may contribute to the failure of the business. I recommend that the application should be adopted by the small scale retailers who are experiencing challenges with how they manage their inventory. The system provide efficiency and is an effective tool for managing the business inventory.

8.3 Suggestions for Future Studies

The study suggests that future studies should be carried out on the research. The application should be developed for other mobile platform to cater for those who do not have Android smart phones. The application should be able provide a model for generating barcodes.

APPENDICES

Appendix A: User Requirements Questionnaire

Dear Respondent,

I am a Masters Student in the faculty of IT, Strathmore University am conducting a research on Mobile application for accounting and management of inventory by small scale retailers' .You have been selected to form part of this study. I kindly request you to complete the questionnaire below. The information requested is needed for academic purposes only and will be treated in strict confidence.

Thank you.

Kind Regards,

Lawrence Magerer.

*Required

Section A: Respondent Details

A1. Do you own a smart mobile phone? (Choose ONE)

- Yes
- No

A2. On a scale of 1-5 with 5 being the highest and 1 lowest, rate your experience in use of a smart mobile phone? (Choose ONE)

- 5
- 4
- 3
- 2
- 1

A3. Do you use your smart mobile phone to manage the business operations? (Choose ONE)

- Yes
- No

Section B: Current methods for accounting and managing inventory

B1. How do you manage and account for the business inventory? (Multiple Selection Allowed)

- Paper-based bookkeeping (Counter book)
- Computerized system

Other

B2. Do you have any challenges in managing the business inventory?

- Yes
- No

B3. If Yes, What are the challenges in managing the business inventory?

Section C: Design, develop and implement an Android mobile application for accounting and managing inventory

C1. What operating system does your smart mobile phone operate on? (Choose ONE)

- Android
- iOS
- Windows
- BlackBerry
- Other

Other.....

C2. Do you use other mobile applications apart from calling and messaging (Choose ONE)

- Yes
- No

C3. If yes, provide examples.

C4. What features would you like to see for accounting and managing inventory?

C5. Do you think a mobile application would be necessary to assist in managing and accounting for inventory? (Choose ONE)

- Yes
- No

Thank you for your time, I highly appreciate

Appendix B: User Testing Questionnaire

Dear Respondent,

I am a Masters Student in the faculty of IT, Strathmore University am conducting a research on Mobile application for accounting and management of inventory by small scale retailers' .You have been selected to form part of this study. I kindly request you to complete the questionnaire below. The information requested is needed for academic purposes only and will be treated in strict confidence.

Thank you.

Kind Regards,

Lawrence Magerer

*Required

Section A: Respondent Details

A1. How do you find the user interface of the mobile application based on its look and feel? (Choose ONE)

- Attractive
- Average
- Not Attractive

A2. Rate the mobile application based on whether the application was easy to learn and use as a first time user? (Choose ONE)

- Easy
- Average
- Difficult

A3. Do the system functionalities solves the challenges of the current methods of accounting and inventory control? (Choose ONE)

- Yes
- No

A4. Would you use the mobile application to manage and account your business inventory? (Choose ONE)

- Yes
- Not Sure
- No

Thank you for your time, I highly appreciate.

Appendix C: Android Platform Test

Android Platform	Compatible
Android 10 – 2.3.3	Yes
Android 11 – 3.0	Yes
Android 12 – 3.1	Yes
Android 13 – 3.2	Yes
Android 14 – 3.0	Yes
Android 15 – 4.0	Yes
Android 16 – 4.0.3	Yes
Android 17 – 4.1	Yes
Android 18 – 4.2	Yes
Android 19 – 4.3	Yes
Android 20 – 4.4	Yes
Android 21 – 4.4W	Yes
Android 22 – 5.0	Yes
Android 23 – 5.1	Yes
Android 24 – 6.0	Yes

Appendix D: Turnitin Report

A Mobile Based Accounting and Sales Management System for Small Retail Shops

Lawrence Kibet Magerer
Reg No: 091674

1
A Dissertation Submitted in Partial Fulfilment of the Requirements for the
Degree of Master of Science in Mobile Telecommunications and Innovation

Match Overview

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