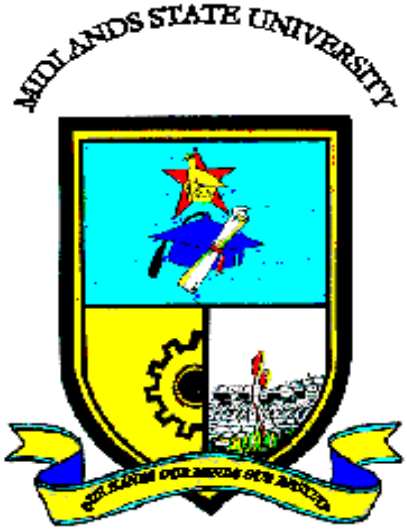
DECISION SUPPORT & FORECASTING SYSTEM



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DECISION SUPPORT & FORECASTING SYSTEM

By

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ABSTRACT

To begin with DSW didn't have a proper software to capture and report its daily activities expediently, the espousal of the M&E department in the organisation reviewed a high frequency of data discrepancies and anomalies in the company records, which then triggered the company to have an interest on investing in a more current, secure, fluid and comprehensible system that is partially intelligent to gear up the decision making process while being able to be associated with any of the existing business activities from selling, budgeting, human resource management and more which integrates every facet of the business into one capable environment. Data mining being a modern concept that seems to be helping many organisations in doing business, DSW will be using the data captured to influence decision making processes and any support that the business really needs. With the help of Java programming language and JavaFX framework the developer found it easy to integrate some of the user requirements into a single system that can forecast the product performance, do product time series analysis whilst monitoring the customer buying patterns and hopping to add some of or all the future user novel requirements to the system if possible. Interviews, observations and questionnaires gathered some of the key data needed to develop the system with the intention to understand how the business tackles their activities in terms of data capturing, reporting and other procedures. With the help of the feasibility analysis it was possible to determine the Storekeeper-DSS achievability. Alternatives were assessed and the development was to be done inhouse using organisational resources and the best changeover strategy was for the system to run alongside the existing system serving the same purpose in smaller groups to avoid losses in the event of a system failure. The proactive and reactive maintenance approaches were put in place to make sure that the system continue to run as required and to make sure that the additional requirements will be added to the new system.

DECLARATION

I, **Nigel Nyakudya,** hereby declare that I am the sole author of this dissertation. I authorize the **Midlands State University** to lend this dissertation to other institutions or individuals for the purpose of scholarly research.

Signature: ……. Date: …….....

APPROVAL

This dissertation, entitled **"DECISION SUPPORT & FORECASTING SYSTEM"** by **Nigel Nyakudya** meets the regulations governing the award of the degree of **BSc Honours Information Systems** of the **Midlands State University,** and is approved for its contribution to knowledge and literary presentation.

Supervisor's Signature: …….

Date: ……..

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Special thanks, to the Lord Almighty for his grace and guidance. I extend my sincere gratitude to Dr. M. Zhou for being patient, supportive and his greater leadership throughout to bring this dissertation to life. I want to thank Designer Statement Warehouse and Retailers for allowing and supporting me with all the relevant information needed. Not forgetting my lovely family who made the funds available all the times, the motivational support and encouragement received from the love of my life Shae and lastly, I would like to thank Stake over flow for their support and quick responses to programming issues I had.

I thank you all and God bless you.

DEDICATION

For my lovely mom, Shae, brother and sister

Table of Contents

LIST OF ACRONYMS

DB	Database
DFD	Data Flow Diagram
DSW	Designer Statement Warehouse
EER	Enhanced Entity Relationship
ER	Entity Relationship
GUI	Graphical User Interface
HDD	Hard Drive
ICT	Information Communication Technology
IDE	Integrated Development Environment
IPS	Internet Service Provider
JRE	Java Runtime Environment
OS	Operating System
ROI	Return On investment
SQL	Standard Query Language
UI	User Interface
UML	Unified Modelling Language
UPS	Uninterrupted Power Supply
VPN	Virtual Private Network

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

CHAPTER 1: INTRODUCTION

1.1 Introduction

Big data analytics is now one of the leading techniques being used in the industry from e-commerce, social media, transport and from small to medium and large companies like Apple, Facebook, and Google at a much greater scale. Decision Support, Warehouse Monitoring and Forecasting System (Storekeeper-DSS), is a JavaFX based system tailored to provide comprehensive Data analytics, Sales projections, forecasting, and Business management with an intelligent pattern recognition to trends, and associations mining, which primarily covers customer buying habits, product complementarity, and substitution effects. Storekeeper-DSS permits the management and users to accurately track all data with regards to sales, customers, orders, and purchases for better forecasting and aided decision making. This system was designed for Designer Statement Warehouse and Retailers (DSW) to capture and analyse its data pertaining to all the activities that have anything to do with its stores and warehouses including all other additional aspects of the business, therefore uses this information to aid decision makers after deducing complex relationships within the data captured. In addition, Storekeeper-DSS have a robust reporting module that allows users to run various automated reports, create and save customized report templates that can be run at any interval. It allows the management to carry out Just In Time (JIT) stock management, cash in and outflow monitoring, budgeting as well as Human and Resource Management all incorporated. This chapter encompasses the underpinning details of the study and illustrates the motive behind this project. It seeks to give a summary of the business in line with the need for a new system. It also enlightens on the organisation's background, structure, mission statement, and vision, with a clear definition of the problems being faced which led to the birth of this project and coming up with proper objectives, software development tools and information gathering techniques used and justification for the system clearly stated.

1.2 Background of Study

Storekeeper-DSS presents the most recent technic of Big Data analytics, inspired by Google, Facebook and other big firms adopting the same tech, denoting how good these companies are becoming by using each and every bit of information they have at hand to their benefit as well as users'. DSW as one of the growing companies in Zimbabwe with subsidiaries in a different business, they needed the same technology that the developer managed to offer in order for them

to gain a competitive advantage in the market. The system was inspired also by the business to IT alignment as our economy is now ICT driven as a result of the continual increase in smart tech and smart devices usage in the business environment. Decision making, setting, managing and achieving targets being the most difficult tasks for the management, Storekeeper-DSS is going to be the backbone of DSW in terms of many processes and make it easier through the use of mathematical algorithms to determine complex relationships within the data captured then advocate the best possible ways and solutions to business problems. Though the management will have room to improvise the suggested solutions, which will make it easier for variance analysis and to determine the efficiency of the system.

1.2.1 Background of The Organisation

Designer Statement Warehouse and Retailers are trend specialty retailers renowned for having the most discerning edit from the world's top designers in 2014, including women's and men's ready-to-wear, accessories and shoes. DSW's signature sense of wit and style is manifested in its creative advertising campaigns and celebrated window displays.

DSW eponymous apparel company represents one facet of a business empire that ranks the company as the trendiest in Africa. From head to toe, DSW sells attitude and image. Effortless style, authenticity, and easy-going living are at the heart of the brand's philosophy.

These positive values shine through at every level, from the laid-back tailoring to the made-to-last quality, use of natural materials and responsible marketing. DSW's aspiration is to be the best casual fashion brand with an outstanding price-value proposition: Capturing market trends and newness in colour, quality fabrics, and shapes, and expressing them in the effortless, relaxed and comfortable DSW style. For every garment, DSW pays maximum attention to fabric selection, fitting and perfect quality. The company's "esprit de corps" reflects a positive and caring attitude towards life that celebrates real people and togetherness according to the brand promise: "FOR IMAGE AND ATTITUDE".

The company's rise in the business world was exceptionally quick and boundless in scope and the company was an expression of the personality and vision of its founder, and, as such, the history of the company's founder was one part of the story of DSW's remarkable rise in the business world during late 2010. Which was obtained from DSW company profile.

1.2.2 Vision

Company's vision demonstrations its significant primary objectives and communicates these objectives to all employees and management in brief. This is a concept that shows the company's underlying future direction (Gandlin, 2014). Caminiti (1990) also argued that vision on its own either contribute positively or negatively to employee motivation.

DSW vision is: "To be a leading business empire in the provision of designer wear in Southern Africa by 2025".

1.2.3 Mission

Raymond (2003, p.23), states that "A business is defined by its mission, it defines how the business is going to offer its products and services to customers". Stapleton (2003) also argued that it helps to align the employees with business objectives.

DSW mission states that "to be the best supplier and known for a good repetition".

1.2.4 Organisational Structure

Stapleton (2003, p.10) stated that, "a structure is an entity (such as an organisation) made up of elements or parts (such as people, resource, market trends, levels of competence, rewarding system, departmental mandates, and so on) that impact each other by the relationship they form. A structural relationship is one in which the various parts act upon each other, and consequently generate particular types of behaviour". Caminiti (1990, p.9) also argued that "a carefully designed structure is very essential for success in a competitive business environment and without a practical management system that can establish and disseminate all the information, the structure loses its full effectiveness. There are different types of structures including flat and tall organisation. In the case, the business implemented the fat structure with few middle managers between the executives and other workers". The following organisational structure shows how authority is passed in the organisation in order to accomplish is objectives:

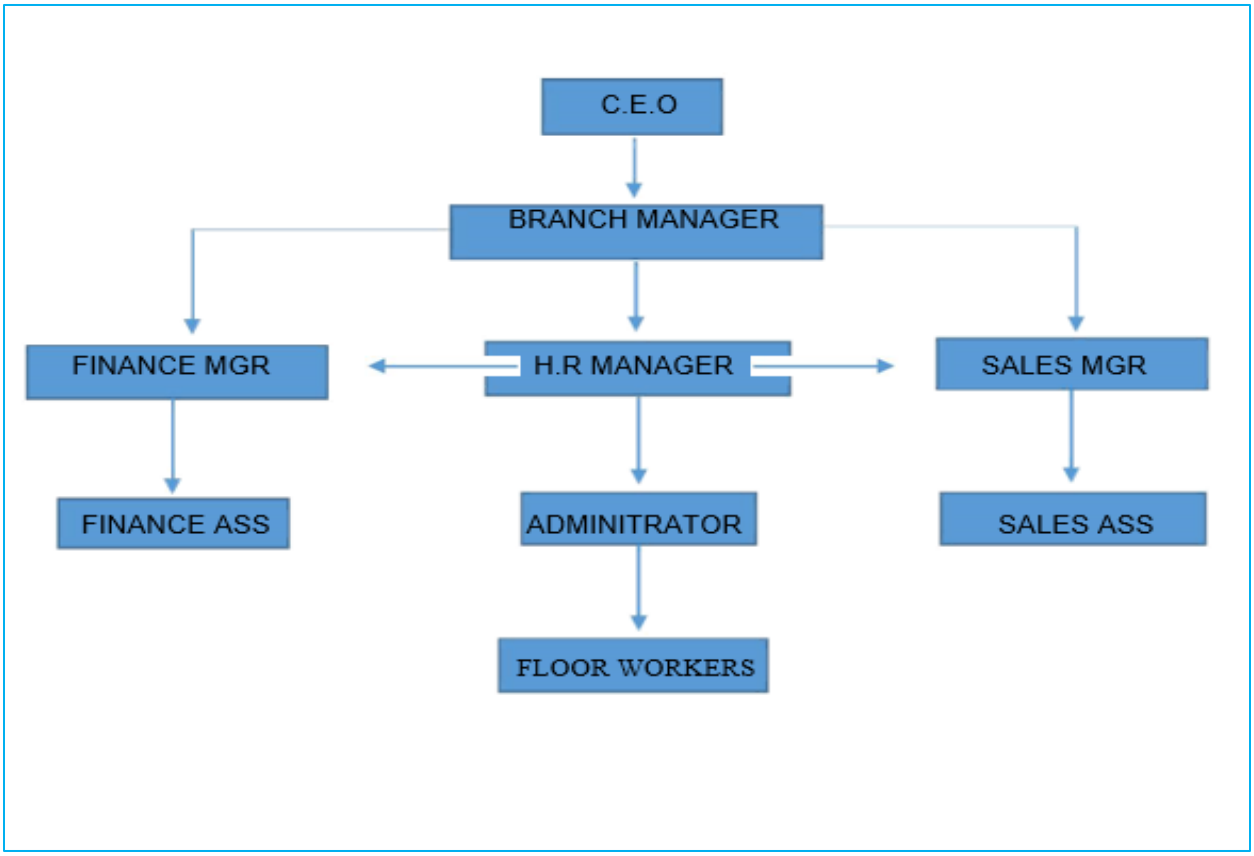


Figure 1. 1 Organisational Structure

1.3 Problems Definition

DSW is currently capturing its data on excel sheets which is cumbersome and time-consuming, most of the times leading to data losses, alterations and it's hard to analyse the data for decision making. The research showed that data distortion is mainly due to slight changes in excel formulas mostly happens without users noticing it while working. The analysis done by the researcher and the complaint by some brunch managers proved that some users were constantly changing or fabricating the figures without being monitored and mostly for cover-up which needed to be addressed with an immediate effect. The business world is now computerised with the Zimbabwean government making the economy ICT driven. So, for DSW to perform better in the industry it needs to be efficient in reducing losses caused by poor decision making, fewer sales, and other factors. Gathering and integration of data from all its subsidiaries for analysis were taking

more time than needed leading to fabrication of fake reports and misleading information which becomes a cost to the business.

1.4 Aim

Gandlin (2014), stated that an aim of the system shows its determination or purpose and its desired goals. Aim shows what the system seeks to achieve in the long run mainly for the benefit of the organisation. The project aimed at developing an organisational friendly desktop system for the purposes of easy data integration, analysis, decision support, and forecasting. Above all this, being used to manage each and every aspect of the business that one can think of, that is to integrate all aspects of the organisational activities.

1.5 Objectives of Research

According to (Borrington, 2013), An objective/(s) is what the system seeks to achieve both in the long and short run of its use. Every new system to be developed/developed has to have a set of goals that it has to accomplish. This directs the developer towards the main goal of the system and where to put more focus on during and after the development. The system developed will attain the following specific objects, namely:

To detect fast and slow-moving products as per specified time of the year (time series analysis).

To provide sales projection and forecasting to aid BCP preparation.

To Provide data with regards to customer buying habits.

To provide budgeting information for decision supporting.

To allow management to carry out cash in and outflows controls.

1.6 Instruments and Methods

In order to develop Storekeeper-DSS, the researcher uses different instruments and methods which were referred to as the tools and techniques by Kumar (2014). These played an important role in extracting and reviewing relevant data, developing, debugging, testing and implementation of, Storekeeper-DSS.

1.6.1 Methods

The researcher used quite a few methods in data gathering, this was necessary to determine all the relevant information needed during the development process. Kumar (2014), highlighted that data gathering and evaluation is necessary for any software project. The researcher went on to use questionnaires and interviews with observations carried out from other companies in the same field to gather all the required information and to note if there was by any chance the developer could integrate the data from the old to the new system.

1.6.2 Instruments

To further perfect the program, the researcher went on to research more about data analytics with Java, JavaFX, Python, R and Julia as a way to find a better technique to use in problem-solving. Instruments relates to all software tools that were used in software development. Kumar (2014), argued that instruments are any application or software program that was used during the development process. After carrying out a tiresome research the developer then went to use JavaFX programming language and other instruments listed below:

MySQL.

Java 8.

NetBeans 8.2.

IntelliJ IDEA

Inno Setup Compiler.

NotePad++.

Scene Builder.

Hamachi Pro VPN.

According to Oracle (2018), MySQL is an open-source relational database management system that the developer used with JavaFX and Java 8 a free runtime environment developed by oracle. The developer used a free IntelliJ IDEA developed by JetBrains and NetBeans 8.2 for code editing compiling and debugging. According to Gluon (2018), Scene builder is a free JavaFX FMXL builder developed by java and now maintained Gluon, that the developer used in the development.

Inno Setup Compiler was used to compile the jar into executable windows application with NotePad++ also for code editing and the system needs a secure connection which Hamachi VPN takes care of.

1.7 Justification

Stapleton (2003), Argued that to justify a system means to clarify or to clearly show or present enough facts as to why there was a need for the development of a new system. System justification seeks to reveal the probable worth or why it is of utmost importance to caring out that particular project as the system owners has to be satisfied in order to support the project with funding and other resources. In this circumstance, it safeguarded the essentiality of developing the new system for DSW. Apart from the inconveniences with regards to the current system, in order for DSW to take an edge in the industry, it essentially needed to be more aligned with the current tech to help in carrying out its activities effectively and efficiently. Data being the cornerstone of DSW, it had to find a way to determine each and every opportunity to advance their current processes using findings from the data they currently have at hand and more to be captured. Finding the relationships in this data will help in strategy formulation and guided decision making. This can only be achieved with the adoption of a new system that will constantly monitor, production levels and aid decisions making on what to do at a different point in time with a proper DSS and data capturing system. DSW will be in a position to make the best quality decisions, leading to the success and new opportunities for the business. The company is in a financial crisis, facing high competition, technological backdated and ICT now being the driver for our economic recovery as well as fraud by other employees, ordering of wrong products just to quote a few. All the above problems were sufficient to justify the necessity to develop a new system which was then developed by the researcher.

1.8 Conclusion

With a proper citation of the most problems that were associated with the current system and the current business environment, it proved the necessity to develop Storekeeper-DSS. Both with a clear clarification of smart objectives and problem definition, instruments and methods used in data gathering, it all positively contributed to a more meaningful justification to why the system had to be developed which was clearly shown above. A clear statement of the organisational structure, vision, and mission gives a general overview of what the company intends to achieve in

the future aligning it to the objectives of the newly developed system. The next chapter focuses on a feasibility study of the development which proved if it was necessary or no to adopt.

CHAPTER 2: PLANNING PHASE

2.1 Introduction

The planning phase conveys a very crucial enlightenment regarding any possibilities, dangers/risks, costs associated with the new project, its success in line with stated objectives in chapter 1, how it will function and what is needed for it to operate. Thus, it helped the researcher and DSW top management team in decision making process, project planning and coming up with a better schedule for Storekeeper-DSS development. This chapter demands a full comprehensive feasibility study of the development indicating the co-operate values that may be brought about by the decision to implement Storekeeper-DSS. The analysis of feasibilities helps to determine if it is valuable or not to proceed with the development of any new system (Cohan, 2005). The feasibility study embraces economic, technical, operational, scheduled and, social feasibility which were important in determining the impact of the system to the business, its shareholders and third parties/ stakeholders.

2.3.1 Technical Feasibility

Roth (2012) et al argued that by carrying out technical analysis of the project, the main aim to gaining the overall understanding regarding the technical resources that the business has and wat they are capable of acquiring, the applicability of the available technical resources to cater for the expected needs for developing Storekeeper-DSS (funding and other resources). Technical feasibility assesses the hardware components (physical) of an organisation, software components (e.g. antiviruses, operating systems) and the workers to be involved in the project to see if they possess expertise required for the development. Any project is considered to be technically feasible only and only if there are adequate resources to support is needs and if the organisation is capable of acquiring the additional resources needed. This analysis verifies if the organisation has the necessary technical proficiency/know-how for the development and implementation processes. According to Havard (2013), technical feasibility should answer some of the following questions that the researcher found applicable:

> Is the required technology available? that's when the research had to find the most appropriate programming language for Storekeeper-DSS.
>
> Does the available technology and technical resources have the ability to sustain the solution?

Is Storekeeper-DSS feasible within the limits of the current resources and technology or if there is a way to upgrade the available resources to meet all its requirements?

How much will it cost if the business has to buy the addition required hardware and software programs for the development?

Table 2.1 shows the summarizes of hardware resources required for the development of Storekeeper-DSS:

Table 2. 1 Physical Components

Resources	Quantity	Resource Specifications	Status	Remarks
Computers	3	-At least intel core i5 4th generation processor. -At least 4GB DDR3 RAM. -Resolution of 1366*768 (recommend), but for better experience, 1920*1080 will be perfect.	Available	There was no need to purchase because the organisation has at least three laptops per brunch with a resolution of 1366*768 which is good.
Server	1	At least Dell desktop, 1 terabyte, 16GB DDR3 RAM with intel core i7 8th	Not Available	DSW will need at least one computer to work as central DB server.
External hard drive (HDD)	1	At least 1 terabyte	Available	No need to purchase
Network devices and ISP.	1	At least 10MB/S band width.	Not Available	DSW had to make sure that they have an IPS with the required the specs. (ZOL)
UPS	1	2Kilo Volts	Not Available	DSW needed a power back-up for its server to keep running.
Fire Wall	1	Any	Not Available	The business had to purchase one

Despite hardware components, the developer needed some software resources for the development, operational, implementation and system testing. The following table summarizes all these resources, showing the type of resources required, quantity, specifications, and its status in the organisation

Table 2. 2 Software Resources

Software Name	Specifications	Status
Windows OS For development and any OS for implementation	Windows 7, 8 or 10. 32 or 64 bit all compatible.	Windows 10 was available
IDE	NetBeans 8.2, and Intellij IDEA	Free download, purchased
Antivirus	Kaspersky's Internet security 2018	Purchased
Java JDK	Version 8 specific	Free download
JRE	Version 8 specific	
Text editor	Latest version	Free download
Xampp	Latest version	Free download
Scene Builder	8.3	Free download
MySQL	Any	Free download
Hamachi PRO VPN	Any	Purchased

The analysis to determining whether there were enough employees with the required skills to operate the new system efficiently was done under technical expertise and this answered the following questions:

Is there any need to carry out an additional training to enhance the performance of the human resource?

Is there enough human resource needed for the development?

Does the human resource possess the required expertise operate the system?

Is there need to outsource additional human resources?

Table 2.3 below shows a summarized human resource analysis done during the research and it shows the type of stakeholders targeted, their status, company's perspective, and comments.

Table 2. 3 Technical Expertise Analysis

Stakeholder	Current Status	Company's Perspective	Comments
Users	Computer literate	The business was willing to fund any additional hardware or training needed.	The developer had to carry out a short training process to familiarize users with the new system.
Developer	Computer literate	The business was willing to aid the developer in any way.	The developer needed to acquire more knowledge on consumer basket analysis with apiary algorithm and to know more about big data analytics.
Management	Computer literate	The business was willing to fund any additional hardware or training needed.	Since the management were the ones mainly targeted by the system, they needed a detailed understanding on how the new system works.

The analysis fully answered the questions that needed attention and efficiently tackled. The researcher did the analysis effectively, and that clearly proved that the project was technically feasible. However, for the development to commence the develop needed also to evaluate other feasibilities like operational and social just to mention a few as they were also valid in considering if the project was appropriate to continue with. This led to the next subtopic which focuses on the analysis of project's economic feasibility.

2.2 Business Value

Business value defines all the current and future benefits of an entity, in this case, the values are those future benefits to the entire organisation that are to be realized as a product of employing Storekeeper-DSS, sited by Kriedt (2002). Sward and David (2006) also argued that these benefits embrace all forms of value to outline the suitability and well-being of the business in the long and short run. According to (Borrington, 2013), business value expends the idea of value, of the

enterprise beyond economic benefit and profit, to include other/additional forms of value which may comprise: managerial, employee, customer, supplier and societal values. It maybe in forms of the reduction in the operational cost, an increase in the customer base, revenue, security, managerial values and elimination of the business from high competition. These values will be enjoyed by DSW and its stakeholders, and these can be quantified by carrying out a variance analysis but many of these cannot be measured directly in monetary terms since they embrace an intangible value such as employee motivation and improved relationships within the organisation.

Storekeeper-DSS brought about managerial, users and customers values with it, and these include:

Quality decision making by management, through computer guided decision making.

Easy data integration through the use of central server, between the business and its subsidiaries leading to easy access to the relevant information.

Improved data security so the users will now use the system with confidents without fearing that some will temper around with their work.

Provision for better forecasting and hidden patterns recognition which will help in business future planning and creation of business continuity plan by the management.

Customers will receive quick services through the enhance customer service module attached to Storekeeper-DSS.

Guided pricing strategy for the management will help deduce the substitution and complementarity effect if the price changes. This will help in making the decision that maximizes the profits for the business.

Easy monitoring and controlling of business stocks, identification of seasonal products and suggest when to order those products, and in what quantities. This will help distributing business funds so that no funds will remain idle or funding the wrong product in the wrong season.

Users are able to work in comfort of their home that is if there is need to, and management can also continue work or run reports from anywhere that is if there is internet connectivity. This will make sure that system user can updates their work even from home.

Consumer basket analysis will help the management in product arrangements, determination of visiting days and hours thus allowing the management to do a proper planning and know which products to promote and when.

Cash in and out flow monitoring and liquidity track so that the managers will keep up to date to what is currently happening, this will lead to maintained liquidity so that the business will be able to meet their obligation when needed.

Reduction in work load for both the employees and management due to the implementation of the system will lead to increased moral in the organisation and users do have to wait for the day time to complete their work if they are permitted to work from home.

The likelihood of the system leading to increased profits is very high if all goes as planned chill will also going to be one of the most important value to the business.

The above listed are some and not all the benefits or values that the system will bring about, instead the developer aimed at developing a business-friendly application which will cater for every aspect of DSW from planning to managing everything.

2.3 Feasibility Study

Feasibility study is an oriented activity for management, it is a business evaluation and analysis instrument also well-defined as a controlled process for identifying the potential of a business idea including citation of problems and opportunities. Determining business objectives, assessment of costs and benefits, to determine the success rate of the idea. Hoagland and Williamson (2000) argued that feasibility study of the business idea is also based on an extensive examination and explorations, that may be utilized to fund the decision-making process in proving if it is worth or not to proceed with the proposed idea. Therefore, in this case, it assesses the operational, technical, organisational and economic merits for the development of Storekeeper-DSS which was a best way that aided the project team to safeguard the wastage of the company's resources so that it doesn't invest in an unprofitable project. The feasibility study carried out by the developer was intended to be a preliminary review of the project's facts to see if it was viable or not. From the system analysis perspective, this study contains recommendations and limitation whether to proceed to the nest phase, or re-establishment of the facts or to discontinue the project, as cited by Thompson (2003) and Havard (2013).

2.3.2 Economic Feasibility

Brown (2008), argued that economic feasibility is an evaluation and analysis of the project in terms of economic fitness and potentials based upon the extensive examination of different opportunities and research, as to determine the monetary benefits and budgets to show whether the project is feasible or not. This assessment aimed at determining the positive economic benefits and savings to the organisation that the Storekeeper-DSS will going to deliver equating them to the total cost of development and implementation. Economic feasibility typically involves the cost benefit analysis and the return on investment since these are the most commonly used technique for evaluating the effectiveness of any business ideas. Ness (2016) stated that it indicates all the economic benefits of a project and used determine the net benefits of a project by subtract the overall benefits form overall cost. If the benefits outweigh the costs it will be considered as Cohn (2014), also argued that there is a need to compute return on investment (ROI) and payback period based on the cost benefit analysis in order to fully determine the economic feasibility of Storekeeper-DSS.

Costs

Costs are the actual expenditure incurred or attributed to a particular activity (Borrington, 2013) and these can be divided into operational, set up and developmental costs. Operational costs result from the use of the daily use of the system and developmental are those cost incurred in coming up with the system for example labour, additional resources needed and training costs (Brown, 2008). Set up costs are those costs incurred when the system is being installed including the arrangement of hardware, and putting everything on position including cabling stated by (Matson, 2000). All these costs were used to determine if DSW financial department was able to fund the project to completion and to prepare financial budgets so as to know if there was a need to outsource additional funds.

Developmental Cost

These are the total cost incurred during the development of Storekeeper-DSS, from labour, training, and procurement of resources. A full detailed table below shows the total developmental costs incurred to completion of the project.

Table 2. 4 Developmental Costs

Item	Quantity	Unit costs	Total cost
Labour	1	$ 4260	$ 4260
Server	1	$ 2190	$ 2190
Software	1	$ 720	$ 720
Total cost			**$ 7,170**

Table 2. 5 Operational Costs

Description	Cost (2018)	Cost (2019)	Cost (2020)
Hardware maintenance	$ 500	$ 570	$ 870
Software maintenance	$ 300	$ 300	$ 350
Total	**$ 800**	**$ 870**	**$ 1,220**

Table 2. 6 Setup Costs

Item	Quantity	Unit costs	Total cost
Labour	1	$ 700	$ 700
Hardware (UPS, Fire-Wall, Network devices, HDD)	1	$ 3800	$ 3800
Software (VPN, Antivirus, Intellij IDEA)	1	$ 366	$ 366
ISP	1	$150	$150
Total cost			**$ 5,016**

Benefits

This refers to any value addition to the business as a product of employing a new system (Chen, 1998). These benefits are classified into tangible and intangible as explained below.

Tangible Benefits

Randal (1996) stated that tangible benefits relate to those benefits expressed in monetary terms like income. These are a type of remuneration may include any kind of income, a reduction in costs e.g., labour costs and other related costs. The table below shows estimated benefits expected from the new system in the next 2 years.

Table 2. 7 Tangible Benefits

Description	2018 Benefits	2019 Benefits	2020 Benefits
Reduction in labour costs	$ 500	$ 2000	$ 550
Estimated decrease in other expenses	$ 700	$ 1000	$ 900
Estimated increase in profit	$ 10000	$ 25,000	$ 40,000
Total	**$ 11,200**	**$ 28,000**	**$ 41,450**

Non-Tangible Benefits

These are benefits without monetary value for example job satisfaction and worker motivation. Intangible benefits include non-physical items which makes it difficult for one to express it in monetary value (Pettinger, 2014). Some of these includes:

Improved employee's job satisfaction resulting in motivated employees with high morale, thereby increasing the company's productivity.

Time saving for both the customer and employees through the elimination of some time-consuming processes.

Improved data integrity and data security and accessibility.

Cost Benefit Analysis

Raider (2002) states that CBA is an analysis of the costs and benefits to the business for a particular activity to be carried out, those benefits will be used to out-weigh the costs associated with the development of the system. The results will then be expressed as payback period and will be used in financially viable.

Table 2. 8 Cost Benefit Analysis

Description	2018	2019	2020
Estimated Benefits			
Tangible benefits	$ 11,200	$ 28,000	$ 41,450
Total	**$ 11,200**	**$ 28,000**	**$ 41,450**
Estimated Costs			
Development	$ 7,170	-	-
Operational	$ 800	$ 870	$ 1,220
Setup	$ 5,016	-	-
Total	**($ 12,986)**	**($ 870)**	**$ 1,220**
Profit or (Loss)	**($ 1,786)**	**$ 27,130**	**$ 40,230**

According to the table 2.8 above, DWS is likely to make a loss in the first year, the profit will start to increase to $27 130 in 2019. The above data was then used to calculate the ROI and payback period of the project.

Return on Investment (ROI)

It is also known as the accounting rate of return, Matson (2000) defined ROI as a way of equating the net profitability to the investment at hand. ROI is obtained by abstracting total costs from total benefits of an investment then divide by the total costs of development.

ROI = (average annual profit/total investment) *100

Average annual profit = net profit/number of years

= **((1786) +27130+40230)/2**

= **$32787**

ROI = **(32787/12,986) *100**

= **252.42%**

The above calculations showed that the return on capital is high though the business made a loss in the first year. This also indicates that the business will be viable and was better off to invest in this project.

Payback Period

Payback period is the amount of time it takes for an investment to breakeven or payback (Havard, 2013). The main aim of payback period was to determine when the initial investment of $**12,986** will be paid back by the income from the project.

Payback = ($1786/$27130) * 12

=**1 year 8 months**

The project needs only 1 year 8 months to pay its initial investment which is favourable for the organisation as it will start to enjoy the benefits of the project in the short period of time.

2.3.3 Social Feasibility

Matson (2000), argued that social feasibility study is used to determine the response of all stakeholders of DSW, this will determine the social impact of Storekeeper-DSS to the community. The system has less impact to the society since it will be for managers and users, customers will have less impact other than improved services and will not result in a high labour turnover. Management and other employees accepted the system there for the system was considered socially feasible and the developer had to continue to operational feasibility.

2.3.4 Operational Feasibility

According to Bentley and Whitten (2007), defined operational feasibility as the study used to determine how well the new system solved business problems, make use of the opportunities identified requirements analysis phase of the system. Borrington (2013) argued that operational feasibility is a measure of how well the system is going to support all the daily operations and the degree to how much it will affect the existing operations of the business. Storekeeper will help the employees with a reduction in work load and increased service provision to clients, help in managing and controlling the business. It mainly answers some of the following questions:

How the system is going to improve the exist operations?

How the new system satisfies the requirements of the project?

How the system is going to operate after development?

Operational Feasibility helped in identifying some of the user's requirements and to determine what was more important. The analysis of all the feasibilities, fully reviled that the developer had to do this project since they showed a positive result towards the development and was supported by the management and stakeholders.

2.4 Risk Analysis

Risk analysis was defined by **(**Cohn, 2014**)** as a procedure that generally includes, "risk assessment, risk characterization, risk communication, and risk management". Generally, it is process which include risk identification, evaluation and solving (which include the total elimination of the risk, or lessening the probability of the risk occurrence, or even the impact of the risk when it occurs). Risk analysis fulfils the following:

Risk identification.

Risk analysis (analysing the possibilities of occurrence).

Risk evaluation (analysing the risk likely impact to the business).

Risk planning (planning for the risk in the event that it occurs).

The following table is a summary Storekeeper-DSS potential risks, occurrence probability, impact rate, and possible counter measure.

Table 2. 9 Risk Analysis

Potential Risks	Probability	Risk Impact	Counter Measure
Failure to achieve all objectives.	Minimum	System failure.	System redesigning and objective analysis.
Unclear objectives	Low	System failure.	Objective communication and agree.
Resistance to change	Low	Failure to implement.	Share and stake holder involvement in all the levels of production.
Lack of unanticipated variables.	Minimum	Late delivery.	Provision of research team on standby to cater for those extra needs.
Failure to meet the deadline.	High	Late delivery and increase in costs	Scheduling of activities and Gantt chart preparation. Allowing extra times for delayed stages.
Data theft.	Very High	Losing information and data theft. Data distortion.	Data encryption, securing the block with surveillance devices.
Losing data	Very High	Losing information and Data distortion.	Data backup and antivirus

With all the potential risks being identified on table 2.9 including the citation of the countermeasures. It showed that the developer was well prepare and planned for all the above risks.

2.5 Stakeholder Analysis

This analysis focusses mainly on identifying the affected parties and how much will be impact by the new system and it focusses on the following:

Identification of the stakeholders.

How is the new system going to affect them (either negative of positive)?

What can stakeholders do?

Cohn (2014) states this analysis ensures that all the affected parties will be considered their interest risk and reaction to the effect. This will help a lot, let's take for instance if other business funders are being affected negatively, they may choose to stop.

Table 2. 10 Stakeholders Analysis

Stakeholders	Interests	Risks	Reaction
Customers	An increase in convenience and service provision.	Losing loyal customers.	The customers will have about 46% increase in service provision and convenience so the customers will be happy.
Employees	Reduction in work load, easiness of doing their job.	Demotivation	Involvement of the employees in the development so that they get motivated and this will increase motivation and eagerness to use the new system.
management	Reduction in work load, easiness of doing their job, better decision making and managing the business	Resistance to the use of the new system	Involvement of the management in the development so that they get motivated and this will increase motivation as their work will be reduced.

2.6 Schedule feasibility

This is a measure of how reasonable the project time table is or the deadline are reasonable or not and the developments system must meet the deadlines of each stage (Bentley and Whitten, 2007).

Water Fall Model

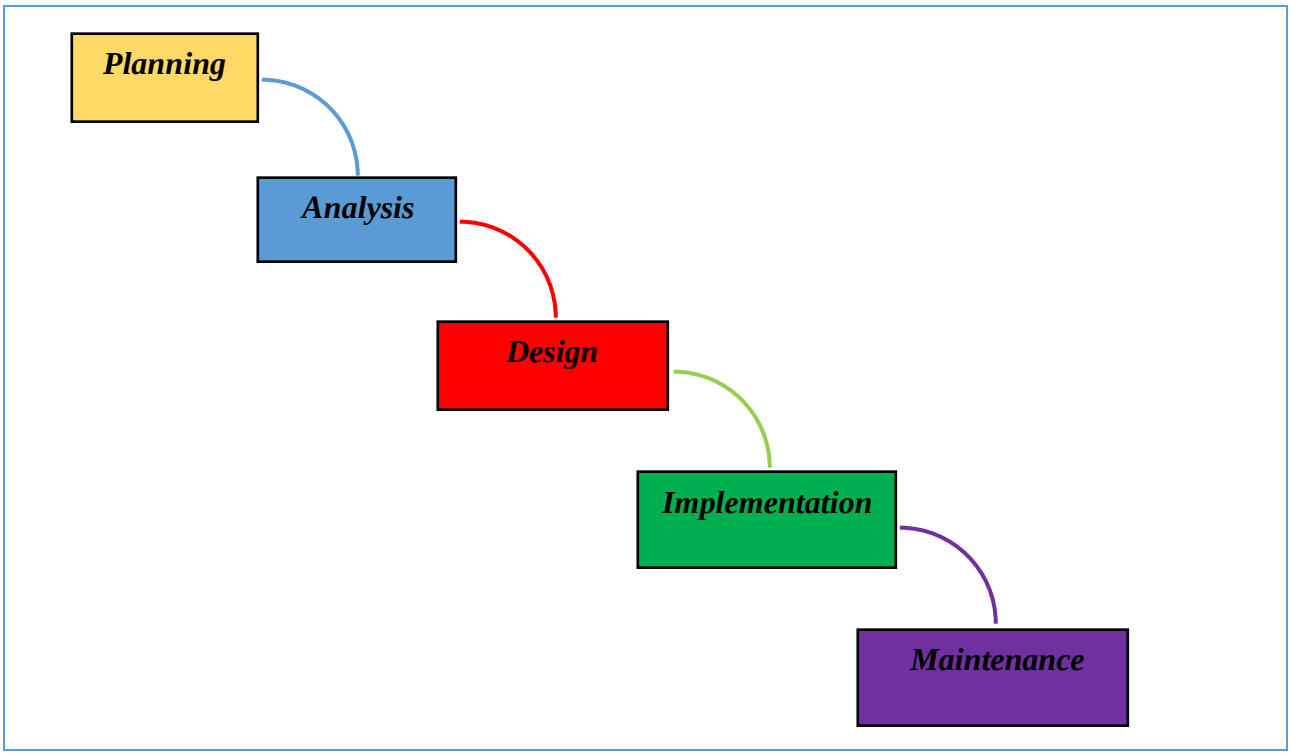


Figure 2. 1 Water Fall Model

The development of a new system commenced through a series of stages highlighted above. Planning stage involved gathering of all the necessary data which was needed and planning on how to carry out the project, the analysis stage was when the data gathered was being evaluated for relevance in line with the project objectives. The design stage involved the actual coding and lastly, the implementation involved the setting up of the system which then led to the final stage which is the maintenance stage.

2.7 Work Plan

The designing of a work plan was done soon after carrying out a schedule feasibility, Horine (2012) defines it as the "measure of how rational the project time is, given technical expertise and all other resources. If focusses on the practicality and realistic of the project dead line".

Figure 2. 2 Time Schedule

Activity	Description	Duration (weeks)	Deliverables
Project proposal	Problem definition and objective formulation.	1	A well Justified proposal.
Planning	Planning for the development.	1	A complete and well communicated project plan.
Analysis	Project analysis which included risk analysis all listed above.	2	Analysis report.
Design	System and database designing	3	New system design and database
Implementation	New system installation and testing	1	System and all the functionalities.
Maintenance	maintenance and evaluation	continuous	Review reports and system logs

Gantt Chart

stage	Wk1	Wk2	Wk3	Wk4	Wk5	Wk6	Wk7	Wk8	Wk9
Proposal									
Planning									
Design									
Coding									
Implementing									
Maintaining									
Documentation									

Figure 2. 3 Gantt Chart

New system maintenance, evaluation, and documentation is a lifetime task for as long as the system still running.

2.8 Conclusion

The planning phase further elaborated the highlights of chapter 1 there by carrying out a feasibility study, analysis of the potential risks associated with the development, listing of the business value in line with the stated objectives, stakeholder analysis, and work plan scheduling, the developer concluded that it was worth to continue with the development to the next stage and the bases for this conclusion was clearly shown by all the favourable outcomes of this chapter. The next chapter focuses on the designing phase of the new system.

CHAPTER 3: ANALYSIS PHASE

3.1 Introduction

After carrying out all the required feasibilities for the development of Storekeeper-DSS, the planning phase concluded that the development is worth carrying out and the developer proceeded to the analysis phase which this chapter tries to shade more light on. According to Dennis and Roberta (2012), the analysis phase of a system development is the process of examining how the old system really works through the use of an activity diagram, context diagram including a data flow diagram for more emphasis on its functionality. The analysis phase of software development stresses the enhancement of the current system's weaknesses by trying to fix all the loopholes identified in the introduction phase of Storekeeper-DSS development. In order for the developer to carry out this analysis, there was a need for information gathering to have all the required information for the project through the use of different methodologies, evaluation of possible alternatives and system requirement analysis.

3.2 Information Gathering Methodologies

According to Foster (2014), methodologies refers to any technique that may be accustomed getting all the mandatory information and data for a specific use and in this case, the developer required all the relevant information in order develop Storekeeper-DSS. After gathering data from and other related businesses, the development turned to have a positive result which captured the interest of the management. The data was gathered with the help of interviews, observations and questionnaires to provide a comprehensive report on the shortcomings of the old system and any possibilities of improvising it to work any better.

3.2.1 Interviews

An interview is a communication between two people, the interviewer and their interviewee, this technique facilitates a two-way communication from one to more people where the interviewer queries a set of questions that the interviewee has to respond to (Manual, 2012). In this case, the researcher prepared a set of question that he asked face to face to different people at DSW and different customers with the hope of better understating the current system and to hear the suggestions of the stakeholders. An interview comprises of the structured and unstructured questions (Kvale, 2000). The researcher interviewed only the group representatives which were the one airing the views of the group with regards to the current system, problems being faced, and

possible solutions, including expectations on how the new system was supposed to ease their respective areas. This was done during working hours for 2 days because the developer was also interested in seeing the old system in practice for better understanding it and to gather enough information on its strengths and weaknesses.

Advantages

The interview allowed the researcher to further emphases on the subject matter to get the interviewee to completely understand the questions before they responded which allowed the responded to respond with the required information.

The researcher was able to better understand the interviewee whenever they lacked the technical jargon through the use of non-verbal cues such as the gestures and facial expressions.

The information that was obtained will be first-hand information from both the business customers and the old system users.

Instant feedback associated with interviews resulted in quick decision making by the researcher and enabled them to be flexible on which questions to asking and sometimes gives out the answers to the questions that the researcher didn't think/ intent to asking.

Disadvantages

Interview was time-consuming and they made the people being interviewed reschedule their work plans so as to have time to cater for those interviews.

Some stakeholders didn't free to answer what they really wanted to say, let's take for instance their comments about the old system were untruthful.

Some stakeholders were just not good at interviews in general, so putting them in that scenario wasn't so good for them to really express all their views and comments.

The questions interviewed at DWS are attached to the appendices of this document, and the conclusion of this interview shows that the business was lacking behind in terms of tech and users needed a more intelligent system to help them carry out the day to day operations of the business and to cater for the increased demand and to speed up different processes.

3.2.2 Questionnaires

Manual (2012) states that a questionnaire is an instrument involving of a series of queries and alternative prompts used by developers when gathering any kind data from a targeted cluster for the different purposes that may include; like in this case system development and other instances like system upgrading and more. Questionnaires offer a series of straightforward queries with blank fields for the respondent's ticks. The questions used were closed based, for instance, fill within the space, affirmative and ranking scales. The questionnaires were submitted to DSW management by the researcher so that willing employees and customers get the prospect to attend to or to attempt the questions freely without anyone hurrying them and after that, the answer scripted were then sent to the researcher for analysis.

Merits

Operations of the business were disturbed since the employees were to answer them during their free time.

Produce a more reliable response since there was no pressure and fear of being interviewed by the respondent.

Questionnaires less expensive as compared to the interviews which resulted in cost saving.

They provided privacy to the responded and enabled them to be truthful which allowed the researcher to acquire some of the information he couldn't get with an interview.

Demerits

They lacked clarity because of the use of technical jargon so some information was biased.

Some of the questions were left unanswered because of failure to understand the question by the respondent, which resulted in biased results.

Few customers managed to return the answered scripts which made the information a bit biased than if most of the customers had attempted the questions.

To conclude, the analysis of questioners reviewed that most of DSW stakeholders were in support of the new system development. A sample of the used questionnaire is attached on the appendices of this documentation.

3.2.3 Observations

Rosenblatt (2014) states that observation is a process derived from the connotative meaning of observing itself, where the researcher was watching the various stakeholders as they were carrying out their daily activities at DWS and other companies like J&J warehousing and distributors in the same line of business for reference. Observation involves noticing and perceiving on how the stakeholders carry out their daily duties and how they use the system so as to have a personalized opinion on the system and get to notice areas of improvement.

Advantages

The researcher was able to collect first-hand information and gets to have a personalized view about the current system processes that happen at DSW.

The information collected was more relevant because the data was being collected as the activities were happening rather than second-hand information.

Observations made it easy for the developer to notice most of the areas of improvement that the interviews and questioners were not able to determine.

Observations do not conflict with the business operations.

Disadvantages

The researcher knew that observations sometimes produces biased data in the case that used or customers notice that there are being monitored they change their behaviour and it depends on the day and mood for doing work.

Observations reviewed most of the necessary information on how the customers approach the business, get served and leave. How quick were they being served the problems they face and what time do they visit most? All this gave the developer an insight on what needed to be improved on the current system and the countermeasures.

3.3 Analysis of The Old System

DSW have both single and bulk buying clients, single/few product buyers visit different branches for different products they want, they select the products they want and get served by the sales rep then leave the premises. Bulk buying clients and other business have to make an order using order note which they intern send to DSW. Upon receiving the order gets processed and verified once

approved the customer is alerted to pay or given at credit after that the client will receive the products. All capturing and recording are done on the excel and no proper reporting system. The data is disaggregated for different activities and processes which makes data extraction for analysis, planning, and decision making difficult

Inputs

According to Bentley and Whitten (2007), any system requires inputs which are any raw data to be entered into the system get processed to produce output in form of information like reports and forecasting data. These inputs include the following:

Product details

Customer details

Order details

Cash payment and credit information

Employee data

Salary data

Processes

According to Roth et al (2015), a process is any activity that is responsible for converting/ turning the above-stated input into the output of useful information that can be used by DSW management and employees in carrying out their daily activities, and these include the following:

Oder processing and verification.

Quotation preparations.

Reporting.

Forecasting.

Pricing decisions.

Product relationship monitoring.

Decision support.

Output

Output refers to the results obtained when inputs are processed (Tomsho, 2016), this is the useful part or product of the above-mentioned processes and the output impacts on the following in the business:

Decision making.

Pricing.

Require products.

Quotations.

Reports.

Predictions.

3.4 Process Analysis

Rosenblatt and Tilley (2016), argued that process analysis presents diagrammatically the sequential order of activities in a system and is used to identify and analyse scientifically how the old system works. The main idea is to help improve the performance of the old system by determining how its activities are interlinked before developing a new system and the methods used included a data flow diagram (DFD) and the activity diagram Donald (2004).

3.4.1 Activity Diagram

This diagram shows a dynamic characteristic of the new system, and in this case, it is a chat that represents the flow of activities in the old system and how they intertwine one another to produce a functional system. One can easily depict how the system works by just looking at its activity diagram.

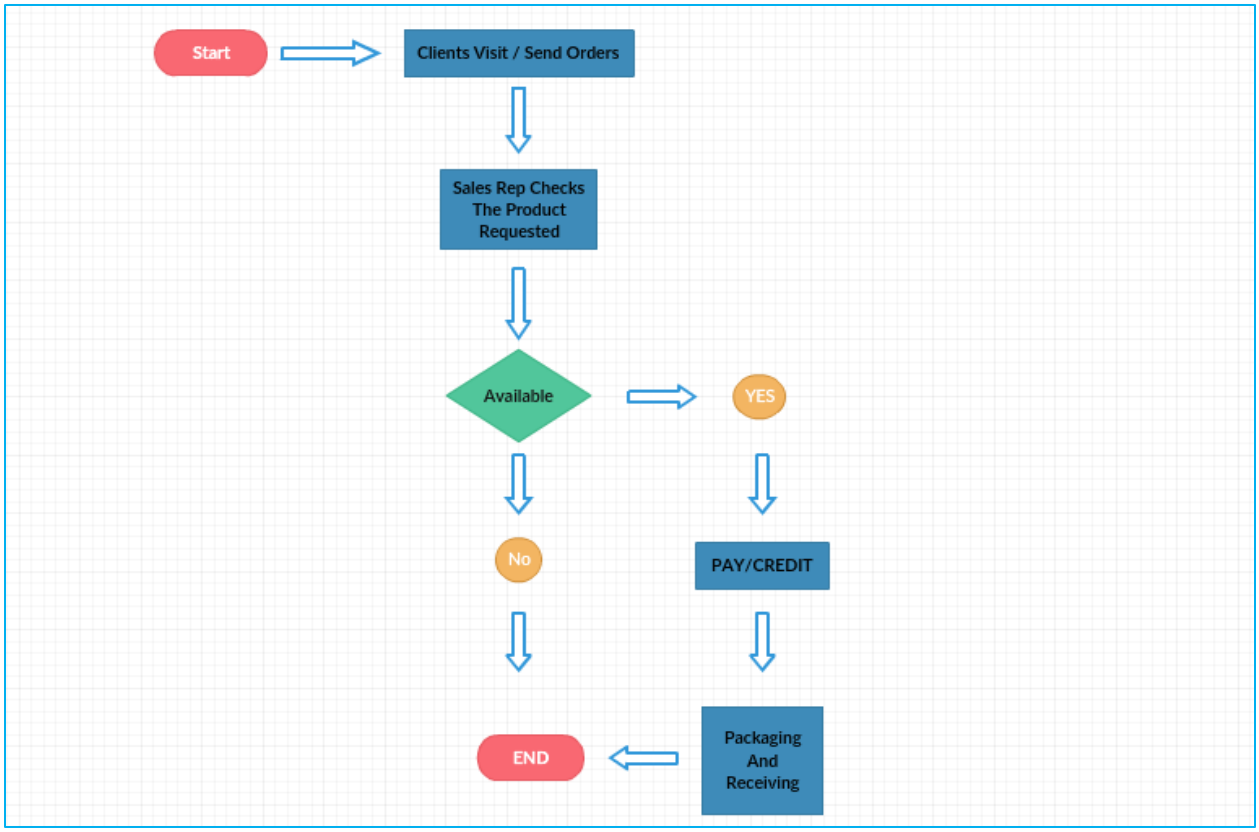
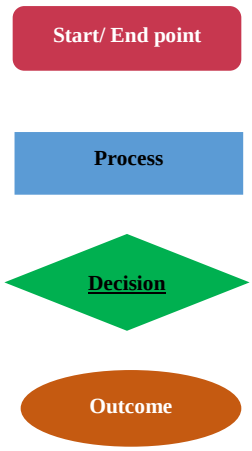


Figure 3. 1 Activity Diagram

KEY



3.5 Data Analysis

This is an assessment of all data gathered using critical, rational, and systematic reasoning to assess each and every component of the data received for DSW (Baltzan and Phillips, 2015). A DFD and

a context diagram was used to analyse the old system data gathered by the researcher. Both the DFD and context diagrams were used to show the entities, processes, data flows and data stores available to clearly show how the system works.

3.5.1 Context Diagram

It describes the relationship between a system and its surroundings, showing the all the entities, that work along with the present system (Phillips et al, 2015). Context diagram structure contains the system of interest at the central while all other entities are connected to it either by inputting data or retrieving data from the system.

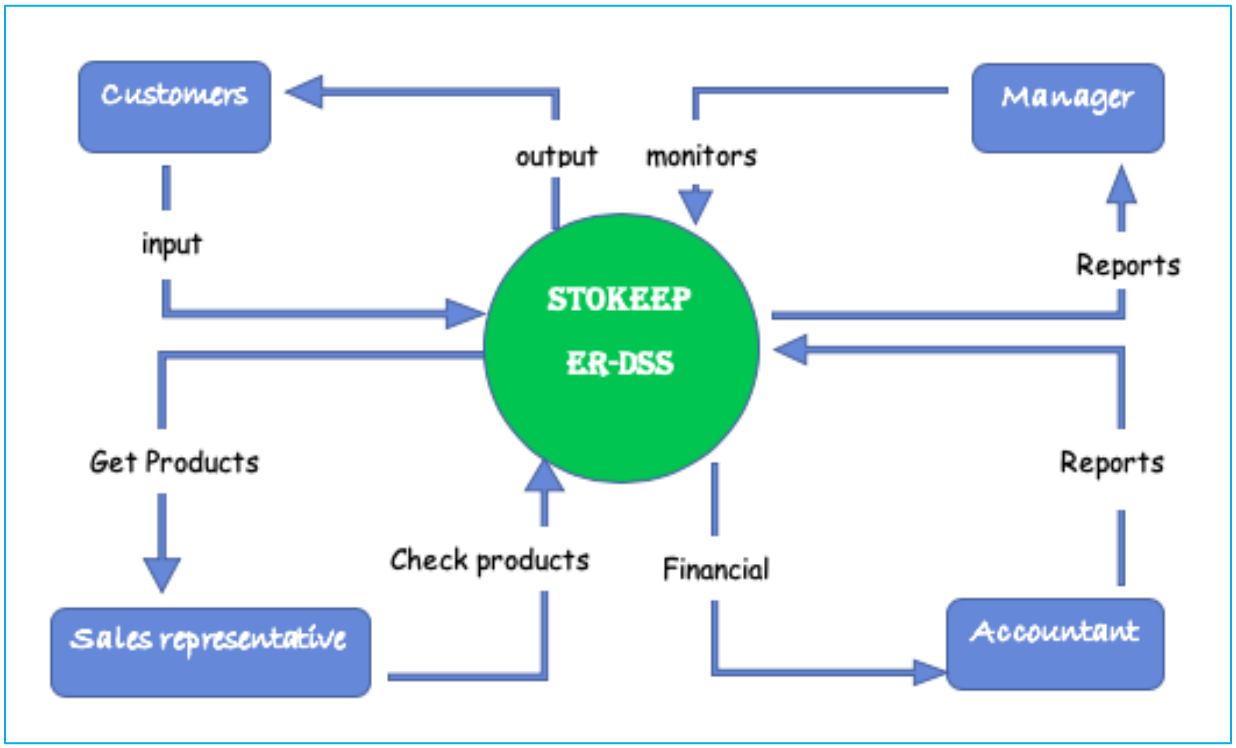
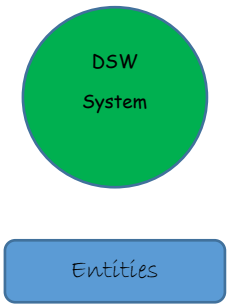


Figure 3. 2 Context Diagram

KEY



Dataflows

3.5.2 Data Flow Diagram

This concept demonstrates and show the interaction of different components of the system. DFD is a vital technique in a system modelling or development (Rosenblatt, 2014) when examining the previous system, the developer was able to construct its DFD by analysing different entities involved, processes and data stores.

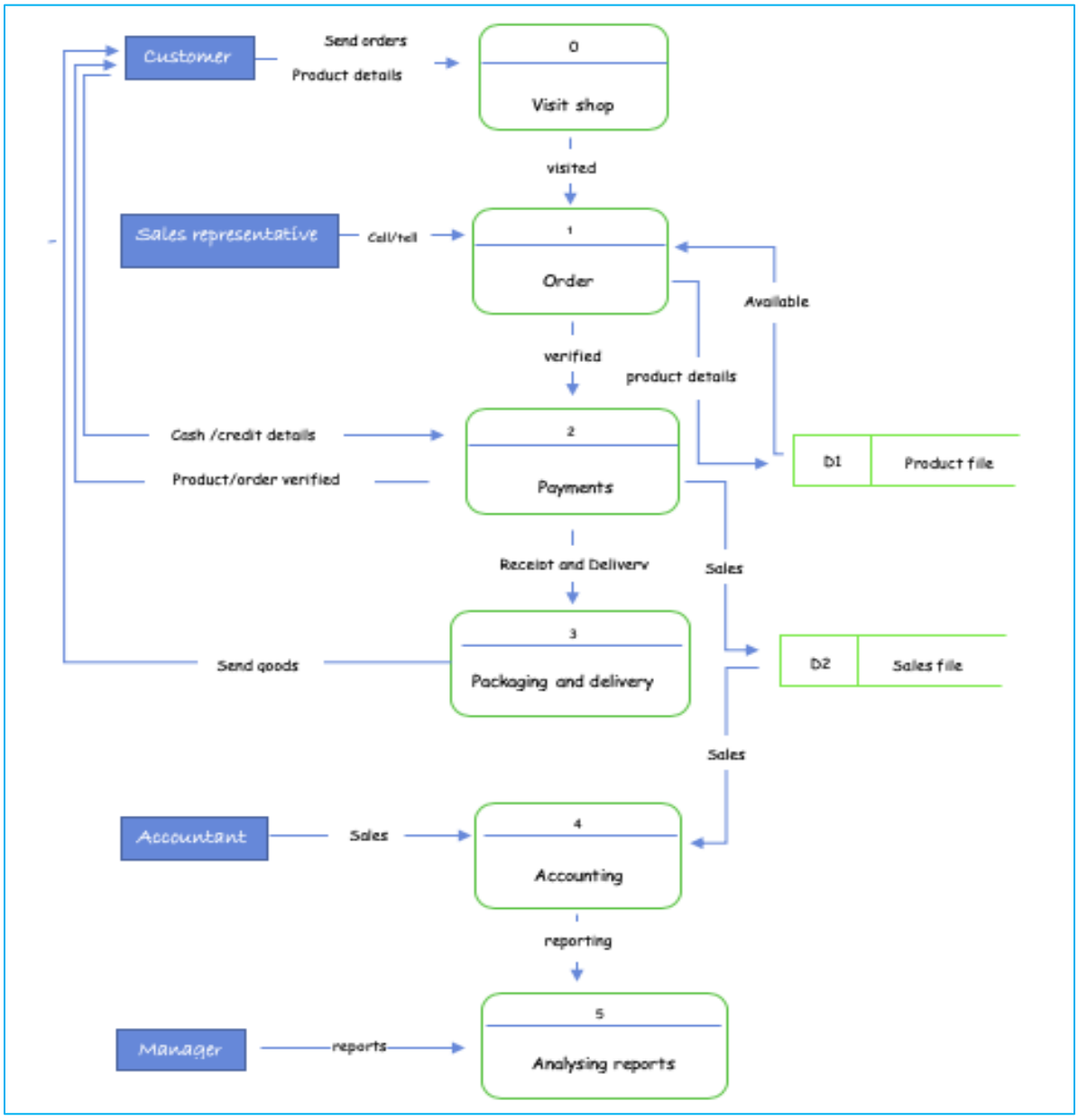


Figure 3. 3 Data Flow Diagram (Existing System)

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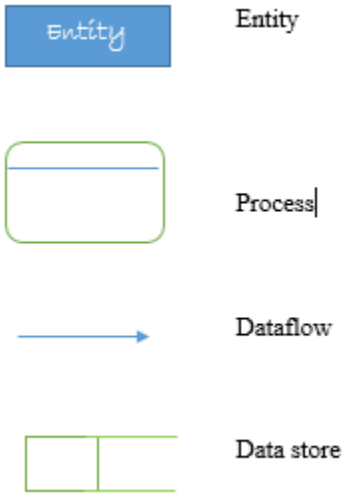

3.6 Weaknesses of The Old System

Henry (2004) argued that weaknesses are the shortcomings of any system after the researcher gathered and analysed the old system data the report produced the following results.

The current system is now falling short of the demand.

Data integration, manipulation, and processing for decision making is taking ages which delays critical decision making.

Lack of data integrity and enough access permissions at different level compromises data security.

Lack of data sharing between branches which leads to biased decisions.

Poor reporting system.

Poor data capturing interfaces.

3.7 Evaluation of Alternatives

At this stage, the researcher had to evaluate or to carry out an assessment of different alternatives as to how the new system should be delivered. The evaluation tries to find the best way to carry out the development and implementation of the new system (Rosenblatt and Tilley, 2016). The alternatives to software development include insourcing or in-house development (which is the development of the system using the available resources within the organisation), outsourcing (is

whereby the business contracts the external developers to develop the system) and defacto sourcing which was defined by (Dennis, Wixom and Roth, 2015) as the improvement of the current system where it lacks behind sometimes known as upgrading. The researcher had to carefully choose the most appropriate alternative by looking at the advantages and disadvantages.

3.7.1 Outsourcing

Sommerville (2004) argued that outsourcing is the process whereby the business outsources the system and documentation from other company or individual developers. For example, when eco-cash outsourced the eco-cash program from India. This has its own pros and cons and the developer may or may not choose to outsource every component of the system.

Advantages

The new system may require a certain expertise that the developer/ developers don't possess and require a long time to learn. In this case, the developer needed to learn more about big data analytics which may take long before the system development.

Outsourcing has a repetition in quick delivery of software programs than in-house development.

High-quality system delivery because of the employee competitive programmer which are good at their job and possess different skill sets.

Mostly outsourcing results in reduced costs for development.

Disadvantages

Insourcing is usually cheaper than outsourcing and the developer noticed that outsourcing is costlier by an excess of **$4,000** more from **$7,170.**

3.7.2 Improvement / Upgrading

Koumpis (2012) state that upgrading is a process of modifying and patching of the current system to meet the required standards of performance and to produce the required results and to attain the expected performance, as well improving the efficiencies and effectiveness of the existing system. In this case, there is a need to develop the real application for the business to stop using Excel for data capturing and reporting. The developer looked into making the available system better but with the current tech and available activities, the business needs something automated to better

solve the problems that the business is currently facing and to reduce the level of competition in the industry.

3.7.3 Development

Stephanidis (2003) argued that development also known as the insourcing or in-house development whereby the developer uses the available resources in the organisation to come up with the new system. With some of the resources available, the developer came up with a list of other resources which are not available within the organisation and needed to be purchased.

Advantages

It returns the copyright within the company than if the application is outsourced.

The cost of development is mostly cheaper than outsourcing and the organisation is in the financial crisis.

In-house development proved to be cheaper than outsourcing.

Returns the security of the system and its confidential information with the business.

Easy editing of the source code and documentation of the system than to always communicate with the provider.

Results in a high-quality software system which solves all the problems identified since the application will be developed with the ones who are already familiar with the system.

Disadvantages

It is time-consuming because the developers needed to get familiar with big data analytics and get trained.

It increases the workload of the DSW ICT department and sometimes leads to demotivation of workers.

Since most of the users are involved in the development it is difficult for them to come to an agreement because some of the requested functions will not be easily implemented.

in-house development has many positive facts than all other alternatives and the developer went on to use this for development as this alternative is cost effective and can benefit the business in numerous ways.

3.8 Requirements Analysis

After choosing the alternative, it was up to the developer now to identify and analyse the functional and non-functional requirements of the new system. Koumpis (2012), argued that this analysis is a way used in determining different user expectations to the new system. Information gathering techniques made it easy for the developer to identify and classify all these requirements.

3.8.1 Functional Requirements

According to Stephanidis (2003), a functional requirement focus on the system's functionality features and postulates its behaviour in order to show how it really works. These requirements are completed from the fall backs of the old system and all its weaknesses and they include the following:

To provide proper authentication.

Concurrency access to the system.

Sharing of the same resources between branches.

To aid decision making.

To provide detailed reports.

Proper pricing suggestions.

Case diagram

Csis.pace.edu defined case diagram as "A case of a use of the system/product that describes the system's actions from the point of view of a user and sells a story, a sequence of events involving interactions of a user with the system and specifies one aspect of the behaviour of a system".

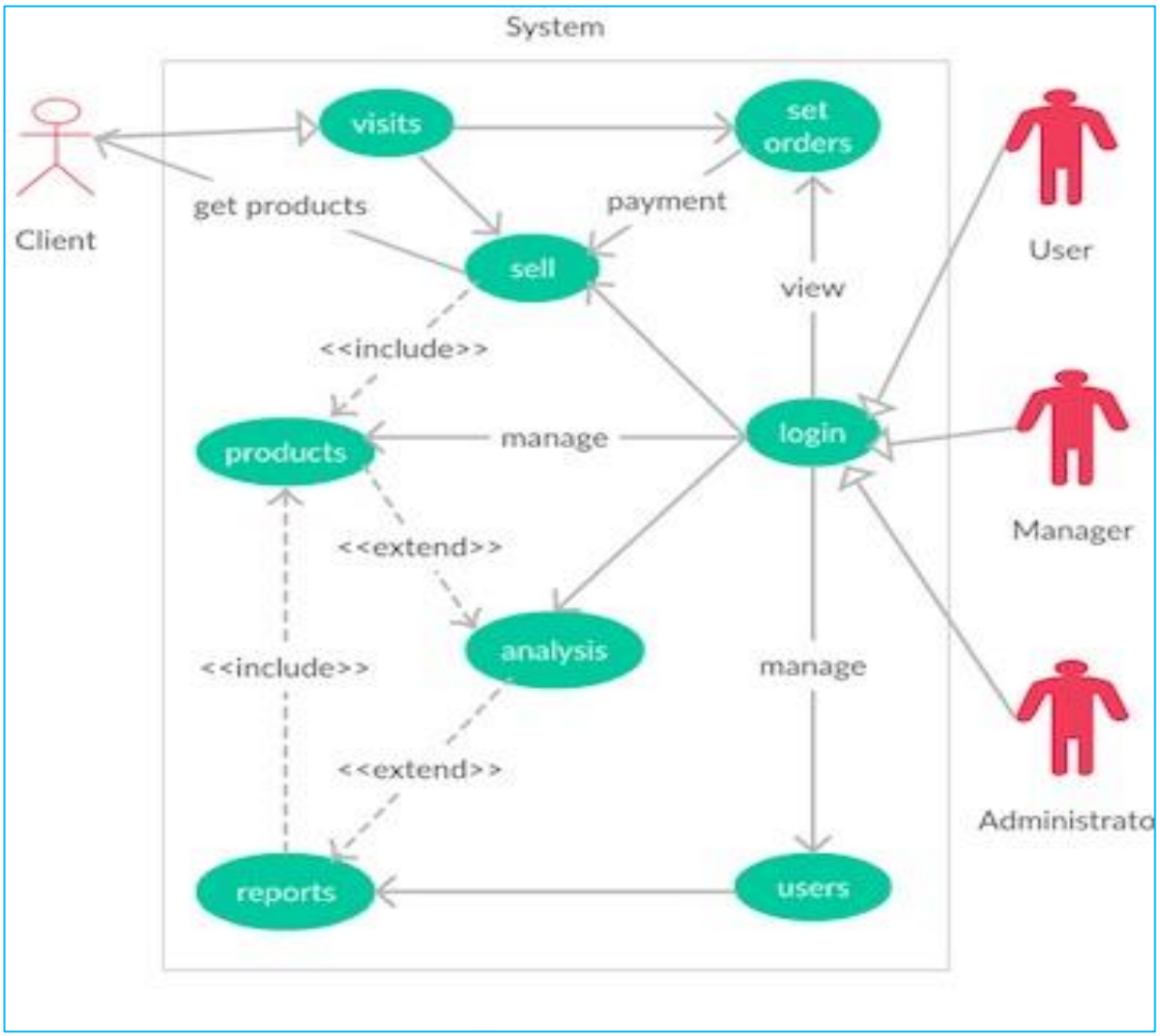

Figure 3. 4 Case Diagram

KEY

3.8.2 Non-Functional Requirements

Rosenblatt (2014) stated that non-functional requirements specify a criterion used to verify the operation of a Storekeeper-DSS rather than its exact performances or actions. In this case, they represent the quality attributes of the new system.

Compatibility requirements, tells us that the system should be compatible with the system it should work on.

Maintainability requirement, states that the system should be easy to maintain and well documented.

User-friendly is mainly concerned with the easiness of use and to understand by the users.

Secure or security requirement focuses on new system authenticity and data safety.

Reliability is one of the most important requirements.

Timely responses focus on the effectiveness and efficiency of the new system.

3.9 Conclusion

At this juncture all methods used for data gathering, analysis and evaluation showed completely how the current system works, its weakness and strengths. Which shade light to the developer before starting the design of the new system. A proper identification of requirements was necessary for the developer to not what exactly required by the business and stakeholders and there for the developer have to proceed to the system design phase where they will be concentrating on the creation of models and templets.

CHAPTER 4: DESIGN PHASE

4.1 Introduction

System design in project development concentrates primarily on the formation, modelling and system delivery procedures for the new system (Date, 2012). The design phase outlines the system's framework, consisting of the program interfaces, pseudo codes and the database architectural design showing all its tables, normalized relationships with the help of an enhanced ER diagram. The DFD which is the extension of the context diagram in this chapter shows how Storekeeper-DSS will be operating so as to help with mapping of the identified requirements into an architecture that illustrates how the system operates. The architecture also consists of the functional and non-functional requirements implementation, the system's physical design (Interact between the system and the hardware it operates on), and program design (sequence diagram, packages, class and how they interact) (Rosenblatt, 2014).

4.2 System Design

System design shows or present a physical appearance of how the new system will look like before developing it (model) Donald (2004). It relates to the actual translation of DSW's need to produce a designation mechanism (definition of modules, procedures, components, interfaces that satisfies the need of the system). The diagrammatical presentation of the processes in form of DFD and the context diagrams illustrates how the information/data flow within the system between different entities that are involved with the system. This aids the developer in keep up with the procedures required in developing Storekeeper, a system that is maintainable (ability to maintain), flexible (able accommodate any future changes), reliable (available when needed), portable (easy to move), secure and cross-platform (able to work on any OS). Abstraction (the general understanding) and apportioning (making sub systems) were the methods used to come up with the new system design. It illustrates system functionality in terms of network infrastructure and validating it to meet its objectives.

Description of the New System

Storekeeper-DSS is a partially intelligent system that was developed targeting all the day-to-day process (operations) at DSW mainly for the management, so as to assist in decision making, by making all the necessary information readily available (comprehensive reports, chart, predictions, suggestions etc.) wherever and whenever needed. For the system to work it was necessary to first

integrate all the activities on the capable infrastructure since the organisation didn't have one, but the research focuses on the data analysis part of the system. Storekeeper-DSS works on both central and local server architecture whereby the data from the brunch (s) will be securely captured and stored. Once the data is safely stored the system will then craw the database identifying the relationship(s) between the data captured, and then us this information to aid the decision-making process for the management and other different uses that includes employee management.

4.2.1 Context Diagram

Raymond (2003), defined a context diagram as a single top-level process, and it show its relationship to other internal and external entities available which are (data stores, entities, users and stakeholders). The interaction between entities is represented diagrammatically with less details but enough to represent/show the entire functionality of the system at a glance.

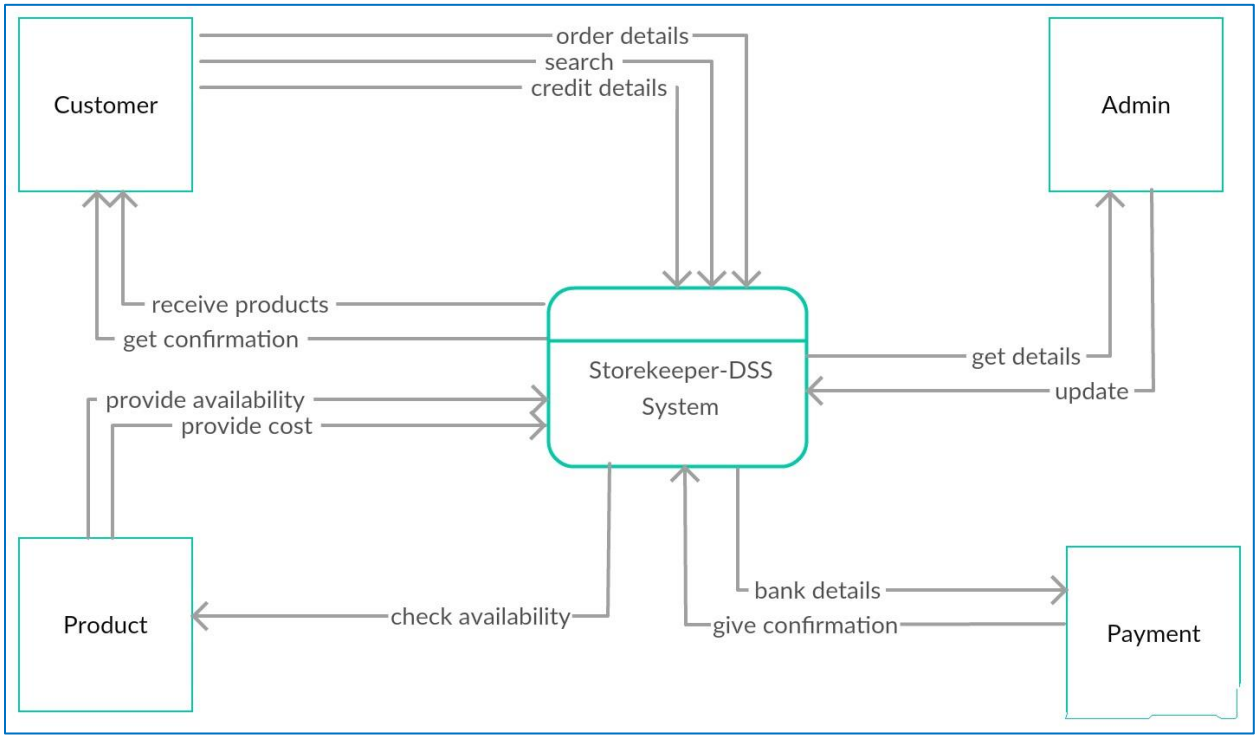

Figure 4. 1 Context Table

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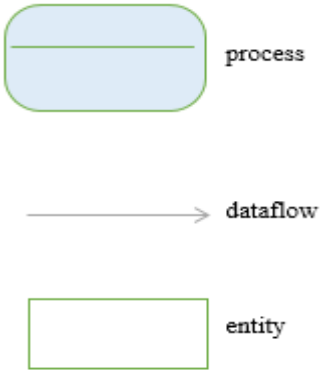


4.2.2 Data Flow Diagram

Rosenblatt (2014), viewed the DFD as a graphical representation of all the data movements known as data flows throughout the entire system. A DFD is comprised of four main elements (the processes, different entities, data storages, and flow directions), the movements of data around the system so that one can easily comprehends the enterer system by just looking at its DFD if it is well crafted. (Diaz et al, 2013) argued that, it presents a relationship between different system elements as it shows the how data inputs are converted into different kind of output as data moves in and out of each and every process before it is finally stored in different data stores available in the system (e.g. data base, HDD). In other words, a DFD advances the context diagram of the system and go further to show different relations between system components that were left in the context diagram to show the complete relationship or the completeness of the system.

DSW Storekeeper Data Flow Diagram

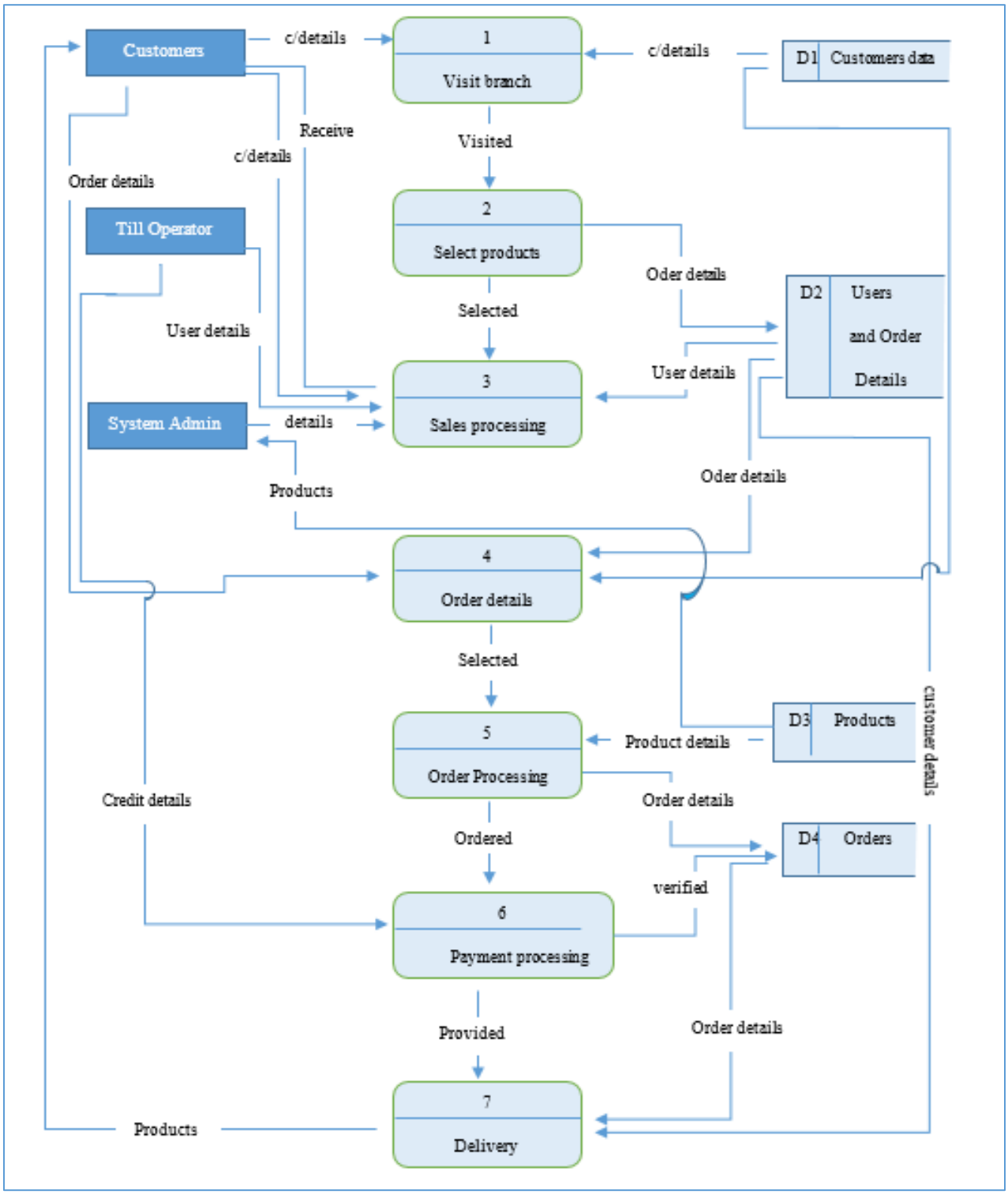
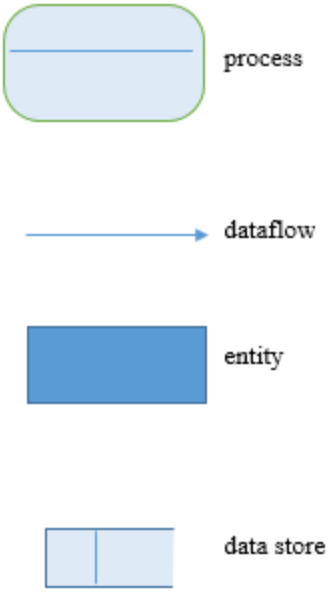


Figure 4. 2 Data Flow Diagram

Key



4.3 Architectural Design

According to Norman et al (2011), project's architectural design demonstrates how the system is going to reside within its official infrastructure that is the (hardware, software, and the network). It went on further to describe how different components will be integrated to communicate and to share data without any barriers. Roth et al (2012) had a view that this design process prepares a suitable integration environment for the developed system and its different components. Figure 4.3 illustrates the design for Storekeeper-DSS.

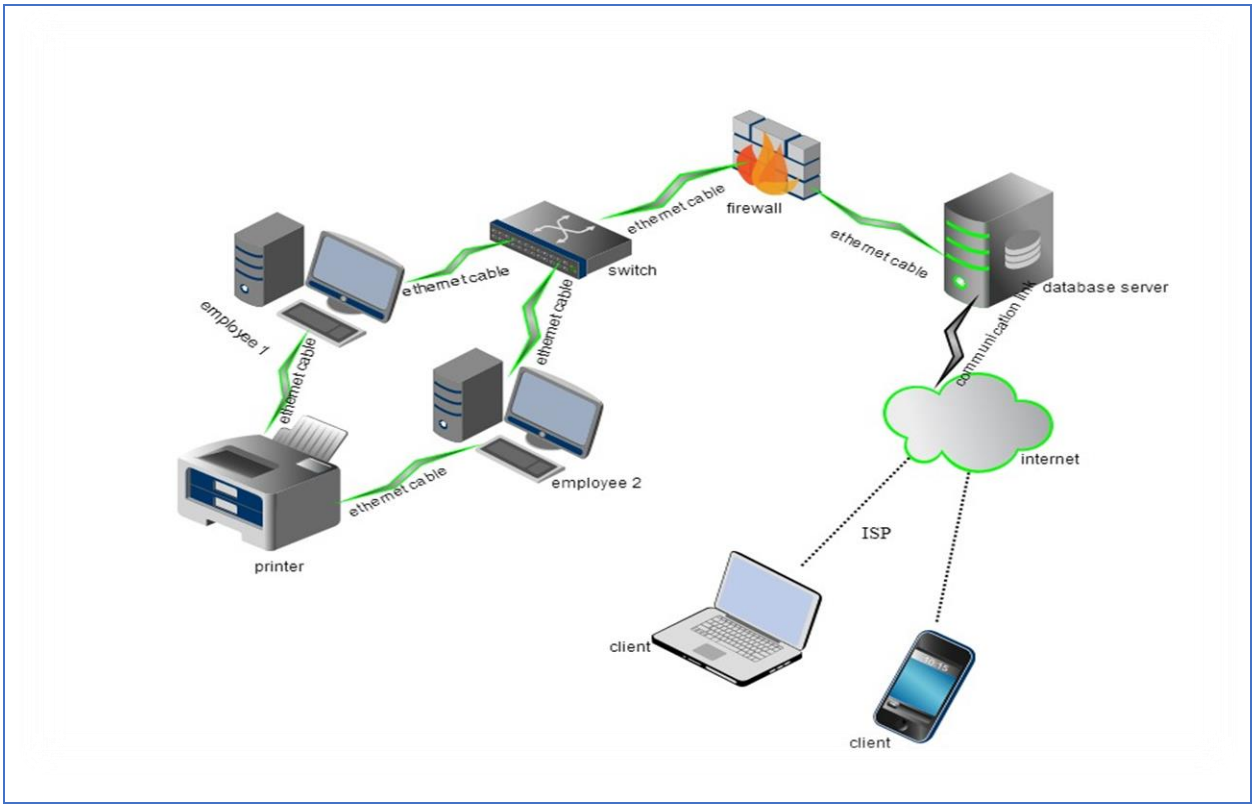


Figure 4. 3 Architectural Design for Storekeeper-DSS

The above picture shows that the system will sometimes send the DB requests over the public internet if the database is not internally hosted therefore there was a need to develop a system in such a way that it will be able to run over that infrastructure securely, so the use of Hamachi Virtual Private Network (VPN) came into place to secure the clients requests when the clients are on the public network and to have access to a centralized server hosted off the premises.

4.3.1 Client Server Approach

According to Brown (2008), the developer used a CSA architectural design for DSW in order to cater for different clients (employees and management) in order for them to have access to database resources from the server. A server is the one responsible for processing different database query and transactional services from clients. Rosenblatt (2014) reviewed the server in a client server network as only the DBMS, where the clients are the applications being serviced by the DBMS. Storekeeper-DSS is running on MySQL server were by User Programs (UP) are running on the client side. Interface called Java Database Connectivity (JDBC) provides an Application program interface (API) allow client-side programs to query the DBMS both in centralized and client server

approaches. Centralized server DBMS, combines everything into single system including, DBMS software, hardware, application programs, and user interface processing software.

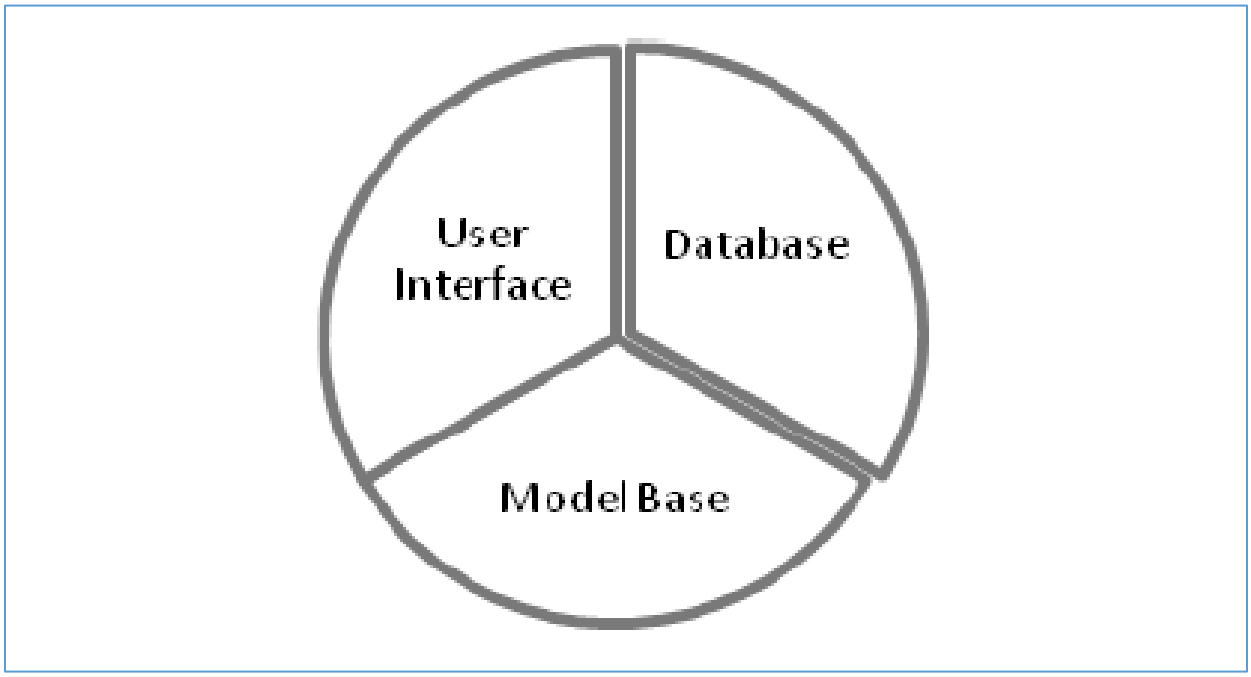


Figure 4. 4 Client Server Model

The above diagram shows the basic components of a client server architecture which can be further expanded into a more comprehensive network model that shows how the system works to serve the clients.

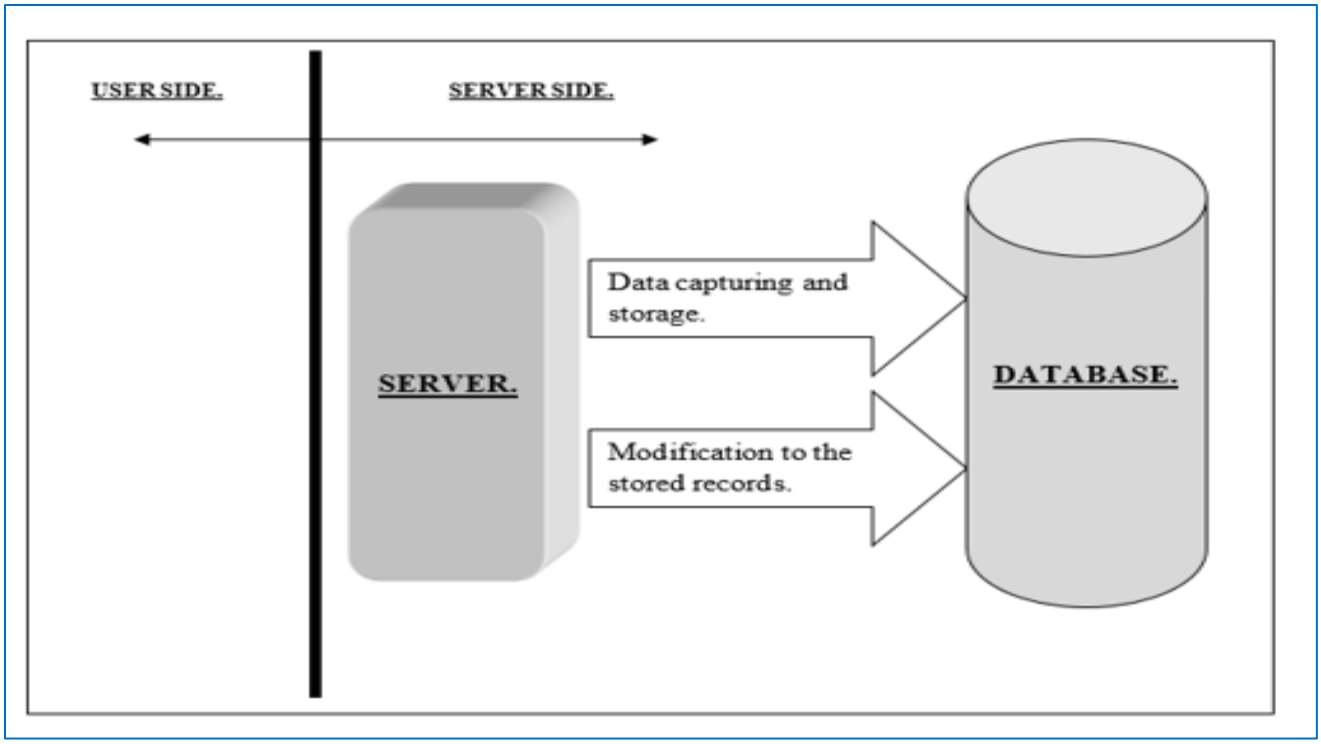


Figure 4. 5 Client Server Approach

4.4 Physical Design

Physical design represents a real model layout of components resulting from changing a logical model into a real technical model, and include: hardware, software, and users of the new system (Doan, 2011). The design gives a general overview regarding the communications within the system. Barua et al (2008) also argued that a physical design results from the transformation of a logical model/rational model into arrangement of components that make up a system. Physical design shows how software, system users and hardware will be integrated to work together in the new system.

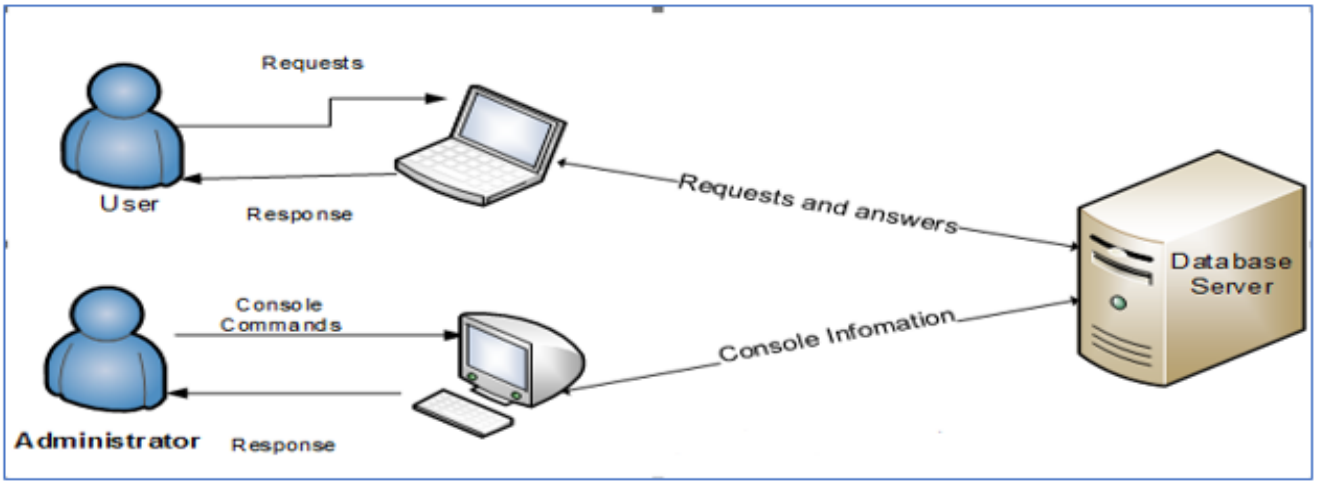


Figure 4. 6 Physical Design for Local Users

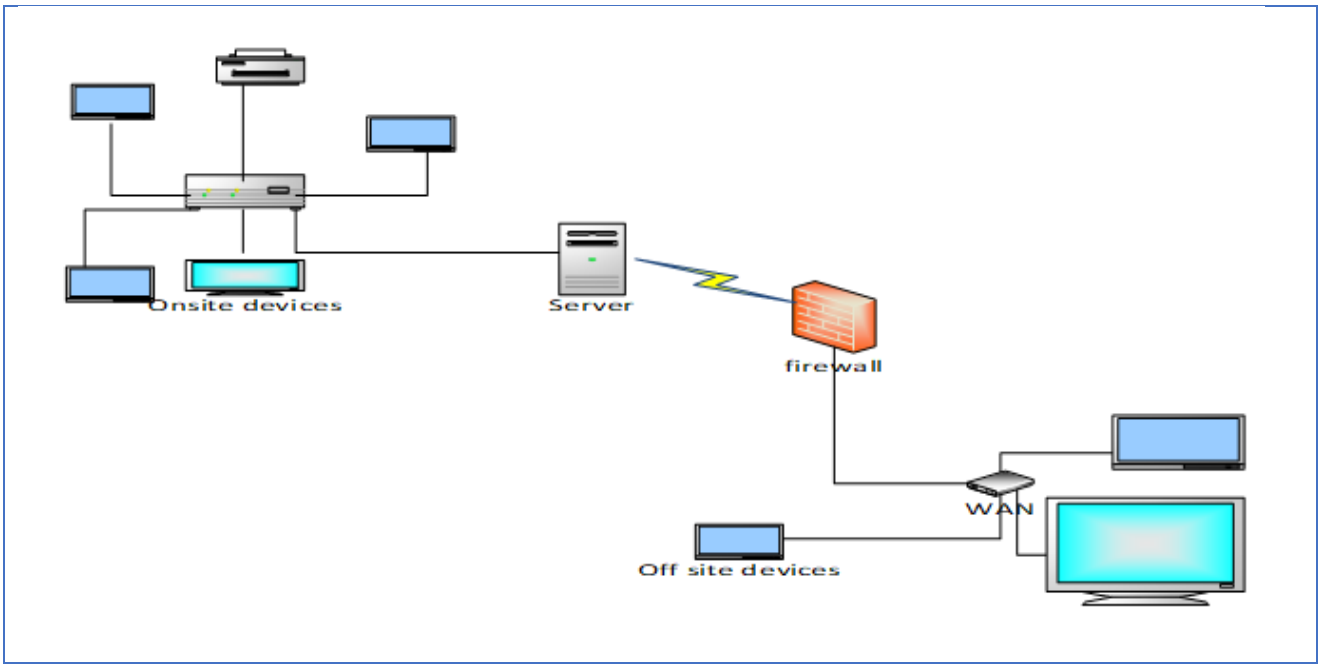


Figure 4. 7 Physical Design for External Users

Because of the need to access a centralized DB the new system design has to physical designs, local users will use the internal private network which is secure to query the DB and for the external clients there is need for a VPN, SSL and a firewall to fully secure the connections to the DB and to prevent the intruders.

4.5 Database Design

According to Amber (2004), database design refers to the creation of comprehensive data models. And the model embraces the required logical and physical design choices including physical storage parameters necessary to generate a suitable design in DDL.

4.5.1 Database Tables

Table 4. 1 Access Permissions

Column	Type	Null	Default	Links to	Comments	MIME
id *(Primary)*	int(11)	No				
Add_Product	tinyint(1)	No	0			
Add_Supplier	tinyint(1)	No	0			
Add_Brand	tinyint(1)	No	0			
Add_Catagory	tinyint(1)	No	0			
Add_Unit	tinyint(1)	No	0			
Add_Customer	tinyint(1)	No	0			
Update_Product	tinyint(1)	No	0			
Update_Supplier	tinyint(1)	No	0			
Update_Brand	tinyint(1)	No	0			
Update_Catagory	tinyint(1)	No	0			
Update_Unit	tinyint(1)	No	0			
Update_Customer	tinyint(1)	No	0			
Manage_RMA	tinyint(1)	No	0			
Sale_Product	tinyint(1)	No	0			
Provide_Discount	tinyint(1)	No	0			
Manage_Employee	tinyint(1)	No	0			
Manage_Org_Infor	tinyint(1)	No	0			
Change_Own_Pass	tinyint(1)	No	0			
date_created	date	No				
time_created	time	No				
date_modified	datetime	No				
user_id	int(11)	No		users_logger => id		
creator_id	int(11)	No		all_users => id		
modified_by	int(11)	No		all_users => id		

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null
PRIMARY	BTREE	Yes	No	id	0	A	No
Id	BTREE	Yes	No	id	0	A	No
user_id	BTREE	No	No	user_id	0	A	No
creator_id	BTREE	No	No	creator_id	0	A	No
modified_by	BTREE	No	No	modified_by	0	A	No

Table 4. 2 All Addresses

Column	Type	Null	Default	Links to	Comments	MIME
id *(Primary)*	int(11)	No				
location_id	int(11)	No		all_locations => id		
address	varchar(100)	No				
creator_id	int(11)	No				
date_created	date	No				
time_created	time	No				
date_modified	datetime	No				
modified_by	int(11)	No				

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null
PRIMARY	BTREE	Yes	No	id	0	A	No
id	BTREE	Yes	No	id	0	A	No
location_id	BTREE	No	No	location_id	0	A	No

Table 4. 3 All Brands

Column	Type	Null	Default	Links to	Comments	MIME
Id *(Primary)*	int(11)	No				
BrandName	varchar(70)	Yes	*NULL*			
Description	text	Yes	*NULL*			
creator_id	int(11)	No		all_users => id		
date_created	date	No				
time_created	time	No				
date_modified	datetime	No				
modified_by	int(11)	No		all_users => id		

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null
PRIMARY	BTREE	Yes	No	Id	5	A	No
Id	BTREE	Yes	No	Id	5	A	No
creator_id	BTREE	No	No	creator_id	2	A	No
modified_by	BTREE	No	No	modified_by	2	A	No

Table 4. 4 All Categories

Column	Type	Null	Default	Links to	Comments	MIME
Id *(Primary)*	int(11)	No				
CatagoryName	varchar(70)	Yes	*NULL*			
CatagoryDescription	text	Yes	*NULL*			
creator_id	int(11)	No		all_users => id		
date_created	date	No				
time_created	time	No				
date_modified	datetime	No				
modified_by	int(11)	No		all_users => id		

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null
PRIMARY	BTREE	Yes	No	Id	2	A	No
Id	BTREE	Yes	No	Id	2	A	No
creator_id	BTREE	No	No	creator_id	2	A	No
modified_by	BTREE	No	No	modified_by	2	A	No

Table 4. 5 All Cities

Column	Type	Null	Default	Links to	Comments	MIME
id *(Primary)*	int(11)	No				
city_name	varchar(100)	No				
creator_id	int(11)	No				
date_created	date	No				
time_created	time	No				
date_modified	datetime	No				
modified_by	int(11)	No				

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null
PRIMARY	BTREE	Yes	No	id	0	A	No
id	BTREE	Yes	No	id	0	A	No

Table 4. 6 All Colours

Column	Type	Null	Default	Links to	Comments	MIME
Id *(Primary)*	int(11)	No				
ColorName	varchar (70)	Yes	*NULL*			
Description	text	Yes	*NULL*			
creator_id	int(11)	No		all_users => id		
date_created	date	No				
time_created	time	No				
date_modified	datetime	No				
modified_by	int(11)	No		all_users => id		

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null
PRIMARY	BTREE	Yes	No	Id	2	A	No
Id	BTREE	Yes	No	Id	2	A	No
creator_id	BTREE	No	No	creator_id	2	A	No
modified_by	BTREE	No	No	modified_by	2	A	No

Table 4. 7 All Contacts

Column	Type	Null	Default	Links to	Comments	MIME
id *(Primary)*	int(11)	No				
contact	varchar(100)	Yes	*NULL*			
email	varchar(100)	Yes	*NULL*			
creator_id	int(11)	No				
date_created	date	No				
time_created	time	No				
date_modified	datetime	No				
modified_by	int(11)	No				

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null
PRIMARY	BTREE	Yes	No	id	0	A	No
id	BTREE	Yes	No	id	0	A	No

Table 4. 8 Contract Types

Column	Type	Null	Default	Links to	Comments	MIME
id *(Primary)*	int(11)	No				
cnt_name	varchar(100)	No				
cnt_title	varchar(100)	No				
cnt_renewable	varchar(100)	No				
cnt_description	varchar(100)	Yes	*NULL*			
creator_id	int(11)	No				
date_created	date	No				
time_created	time	No				
date_modified	datetime	No				
modified_by	int(11)	No				

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null
PRIMARY	BTREE	Yes	No	id	0	A	No
id	BTREE	Yes	No	id	0	A	No

Table 4. 9 All Contracts

Column	Type	Null	Default	Links to	Comments	MIME
id *(Primary)*	int(11)	No				
cnt_type	int(11)	No		all_contract_types => id		
cnt_grade	int(11)	No		contract_grades => id		
expiry_date	date	No				
creator_id	int(11)	No				
date_created	date	No				
time_created	time	No				
date_modified	datetime	No				
modified_by	int(11)	No				

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null
PRIMARY	BTREE	Yes	No	id	0	A	No
id	BTREE	Yes	No	id	0	A	No
cnt_type	BTREE	No	No	cnt_type	0	A	No
cnt_grade	BTREE	No	No	cnt_grade	0	A	No

Table 4. 10 All Customers

Column	Type	Null	Default	Links to	Comments	MIME
id *(Primary)*	int(11)	No				
address_id	int(11)	Yes	*NULL*	all_addresses => id		
contact_id	int(11)	Yes	*NULL*	all_contacts => id		
first_name	varchar(100)	No				
last_name	varchar(100)	No				
gender	varchar(100)	No				
creator_id	int(11)	No		all_users => id		
date_created	date	No				
time_created	time	No				
date_modified	datetime	No				
modified_by	int(11)	No		all_users => id		

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null
PRIMARY	BTREE	Yes	No	id	0	A	No
id	BTREE	Yes	No	id	0	A	No
creator_id	BTREE	No	No	creator_id	0	A	No
modified_by	BTREE	No	No	modified_by	0	A	No
address_id	BTREE	No	No	address_id	0	A	Yes
contact_id	BTREE	No	No	contact_id	0	A	Yes

Table 4. 11 All Departments

Column	Type	Null	Default	Links to	Comments	MIME
id *(Primary)*	int(11)	No				
dpt_name	varchar(100)	No				
dpt_title	varchar(100)	No				
dpt_description	varchar(100)	Yes	*NULL*			
creator_id	int(11)	No				
date_created	date	No				
time_created	time	No				
date_modified	datetime	No				

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null
PRIMARY	BTREE	Yes	No	id	2	A	No
id	BTREE	Yes	No	id	2	A	No

Table 4. 12 All Jobs

Column	Type	Null	Default	Links to	Comments
id *(Primary)*	int(11)	No			
department_id	int(11)	No		all_departments => id	
job_name	varchar(100)	No			
job_title	varchar(100)	No			
job_description	varchar(100)	Yes	*NULL*		
creator_id	int(11)	No			
date_created	date	No			
time_created	time	No			
date_modified	datetime	No			
modified_by	int(11)	No			

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null
PRIMARY	BTREE	Yes	No	id	0	A	No
id	BTREE	Yes	No	id	0	A	No
department_id	BTREE	No	No	department_id	0	A	No

Table 4. 13 All Locations

Column	Type	Null	Default	Links to	Comments	MIME
id *(Primary)*	int(11)	No				
city_id	int(11)	No		all_cities => id		
location_name	varchar(100)	No				
creator_id	int(11)	No				
date_created	date	No				
time_created	time	No				
date_modified	datetime	No				
modified_by	int(11)	No				

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null
PRIMARY	BTREE	Yes	No	id	0	A	No
id	BTREE	Yes	No	id	0	A	No
city_id	BTREE	No	No	city_id	0	A	No

Table 4. 14 All Products

Column	Type	Null	Default	Links to	Comments	MIME
id	int(11)	No				
pid *(Primary)*	varchar(20)	No				
pName	varchar(40)	No				
pExpdate	date	Yes	*NULL*			
pOqty	int(11)	No				
pRqty	int(11)	No				
pUcost	decimal(13,2)	No	0.00			
pMarkup	varchar(10)	No				
pPrice	decimal(13,2)	No	0.00			
pDisco_a	varchar(10)	No				
pU_cogs	decimal(13,2)	No	0.00			
pT_cogs	decimal(13,2)	No	0.00			
pU_bte_cogs	decimal(13,2)	No	0.00			
pT_bte_cogs	decimal(13,2)	No	0.00			
pVat	varchar(10)	No				
pDty	decimal(13,2)	No	0.00			
pTp	decimal(13,2)	No	0.00			
pOexp	decimal(13,2)	No	0.00			
pDisco_r	varchar(10)	No				
pUexp	decimal(13,2)	No	0.00			
pTexp	decimal(13,2)	No	0.00			
pU_income	decimal(13,2)	No	0.00			
pT_income	decimal(13,2)	No	0.00			
pSupplier_id	int(11)	No		all_suppliers => Id		
pUnit_id	int(11)	No		all_units => Id		
pBrand_id	int(11)	No		all_brands => Id		
pCategory_id	int(11)	No		all_catagories => Id		
pRma_id	int(11)	No		rma => Id		

pColor_id	int(11)	No		all_colors => Id		
pOdate	date	No				
pRdate	date	No				
pDescrip	varchar(255)	No				
pBarcode	varchar(20)	No				
pOStock	int(11)	No				
pRbEP	varchar(11)	No				
pRbEF	varchar(11)	No				
pRbAR	varchar(11)	No				
pRbEN	varchar(11)	No				
pRbEPR	varchar(11)	No				
pRbEG	varchar(11)	No				
pRbEC	varchar(11)	No				
pRbES	varchar(11)	No				
creator_id	int(11)	No		all_users => id		
date_created	date	No				
time_created	time	No				
date_modified	datetime	No				
modified_by	int(11)	No		all_users => id		

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null
PRIMARY	BTREE	Yes	No	pid	3	A	No
id	BTREE	Yes	No	id	3	A	No
creator_id	BTREE	No	No	creator_id	3	A	No
modified_by	BTREE	No	No	modified_by	3	A	No
pSupplier_id	BTREE	No	No	pSupplier_id	3	A	No
pBrand_id	BTREE	No	No	pBrand_id	3	A	No
pCategory_id	BTREE	No	No	pCategory_id	3	A	No
pUnit_id	BTREE	No	No	pUnit_id	3	A	No
pRma_id	BTREE	No	No	pRma_id	3	A	No
pColor_id	BTREE	No	No	pColor_id	3	A	No

Table 4. 15 All Sales

Column	Type	Null	Default	Links to	Comments	MIME
id *(Primary)*	int(11)	No				
s_id	int(11)	No				
c_id	int(11)	No		all_customers => id		
p_id	varchar(20)	No		all_products => pid		
p_cost	decimal(13,2)	No	0.00			
p_price	decimal(13,2)	No	0.00			
p_disco_a	varchar(20)	No				
p_qty	int(11)	No				
p_total	decimal(13,2)	No	0.00			
p_rma	date	No				
user_id	int(11)	No		all_users => id		
date_sold	date	No				
time_sold	time	No				

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null
PRIMARY	BTREE	Yes	No	id	0	A	No
id	BTREE	Yes	No	id	0	A	No
user_id	BTREE	No	No	user_id	0	A	No
p_id	BTREE	No	No	p_id	0	A	No
c_id	BTREE	No	No	c_id	0	A	No

Table 4. 16 All Staff

Column	Type	Null	Default	Links to	Comments	MIME
id *(Primary)*	int(11)	No				
contract_id	int(11)	No		all_contracts => id		
job_id	int(11)	No		all_jobs => id		
address_id	int(11)	No		all_addresses => id		
contact_id	int(11)	No		all_contacts => id		
first_name	varchar(100)	No				
middle_name	varchar(100)	No				
last_name	varchar(100)	No				
gender	varchar(100)	No				
title	varchar(100)	No				
status	varchar(100)	No				
dob	varchar(100)	No				
nationalId	varchar(100)	No				
nationality	varchar(100)	No				
creator_id	int(11)	No				
date_created	date	No				
time_created	time	No				
date_modified	datetime	No				
modified_by	int(11)	No				

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null
PRIMARY	BTREE	Yes	No	id	0	A	No
id	BTREE	Yes	No	id	0	A	No
job_id	BTREE	No	No	job_id	0	A	No
contract_id	BTREE	No	No	contract_id	0	A	No
address_id	BTREE	No	No	address_id	0	A	No
contact_id	BTREE	No	No	contact_id	0	A	No

4.5.2 Enhanced Entity Relationship Diagram

EER is an extension of the ER model which shows all the features that where not on the ER model which shows the completeness, disjointness constraints, subtypes, and supertype relationships representation (Harrington, 2002)

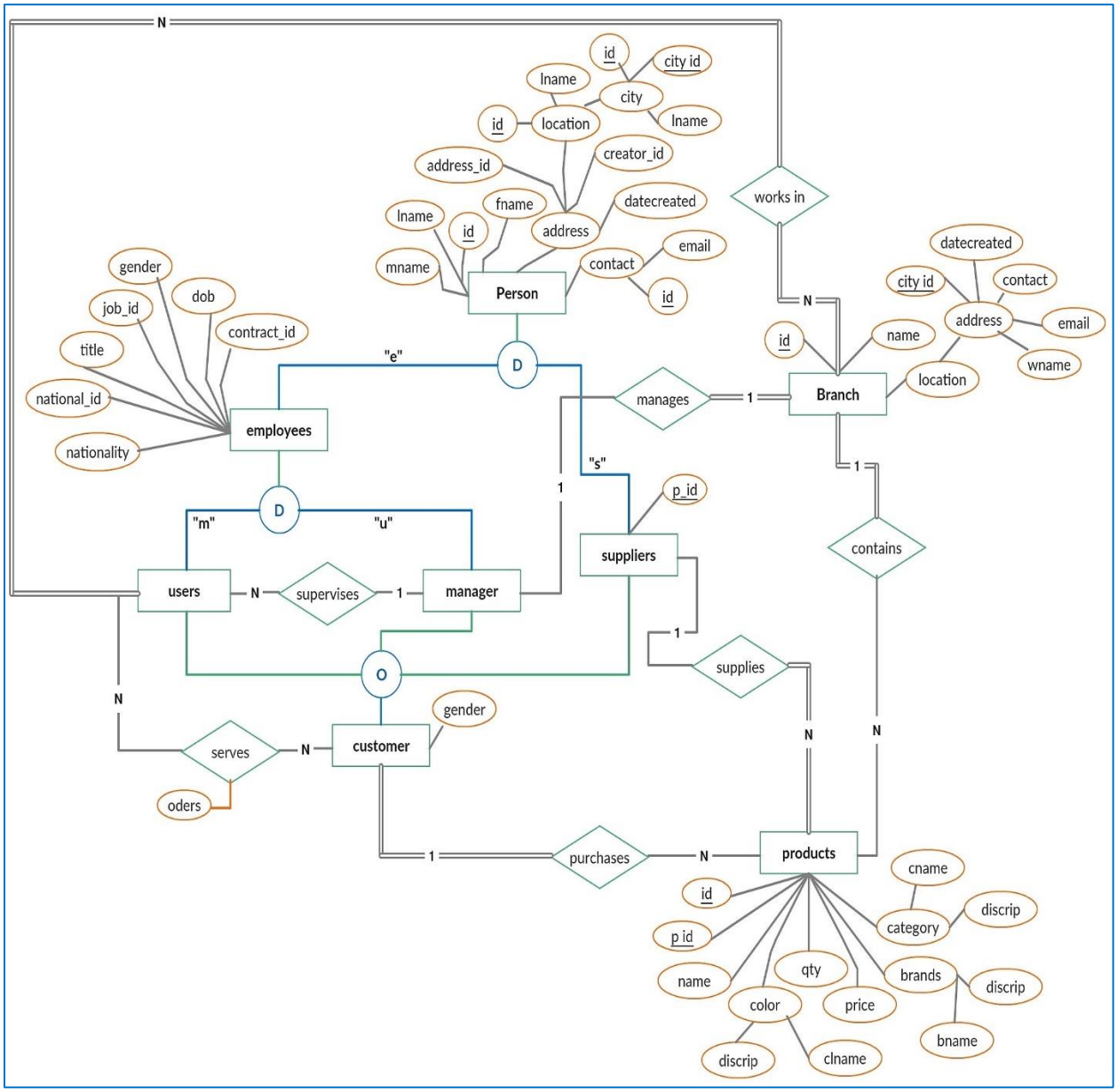


Figure 4. 8 EER Diagram

4.6 Program Design

Program design is one of the many techniques that the developer adopted which is used for the creation and designing of the new system modules. Its main function is to provide a self-descriptive and comprehensive model that shows the interaction between various system modules, showing their relationships and cardinality to another in order to produce a functional system, through the use of class, sequence and package diagrams with the help of UML (Saleh, 2009).

4.6.1 Class Diagram

As mentioned above a class diagram shows the number of different integrated module in the new system as shown below.

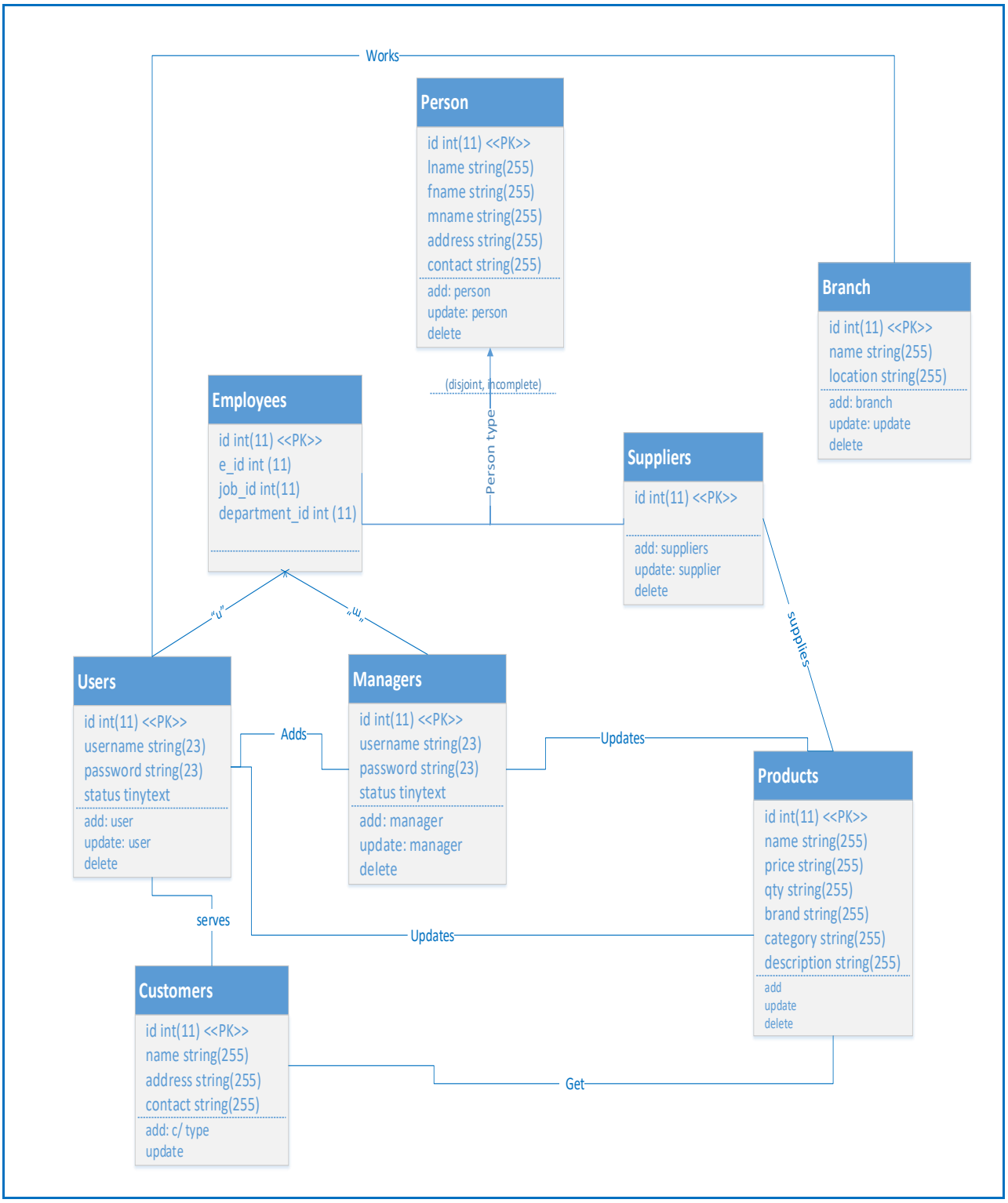


Figure 4. 9 Class Diagram

4.6.2 Package diagram

According to Saleh (2009), this diagram shows modules of Storekeeper-DSS which are composed into different packages. The following are the key modules of the new system and the interaction between its packages.

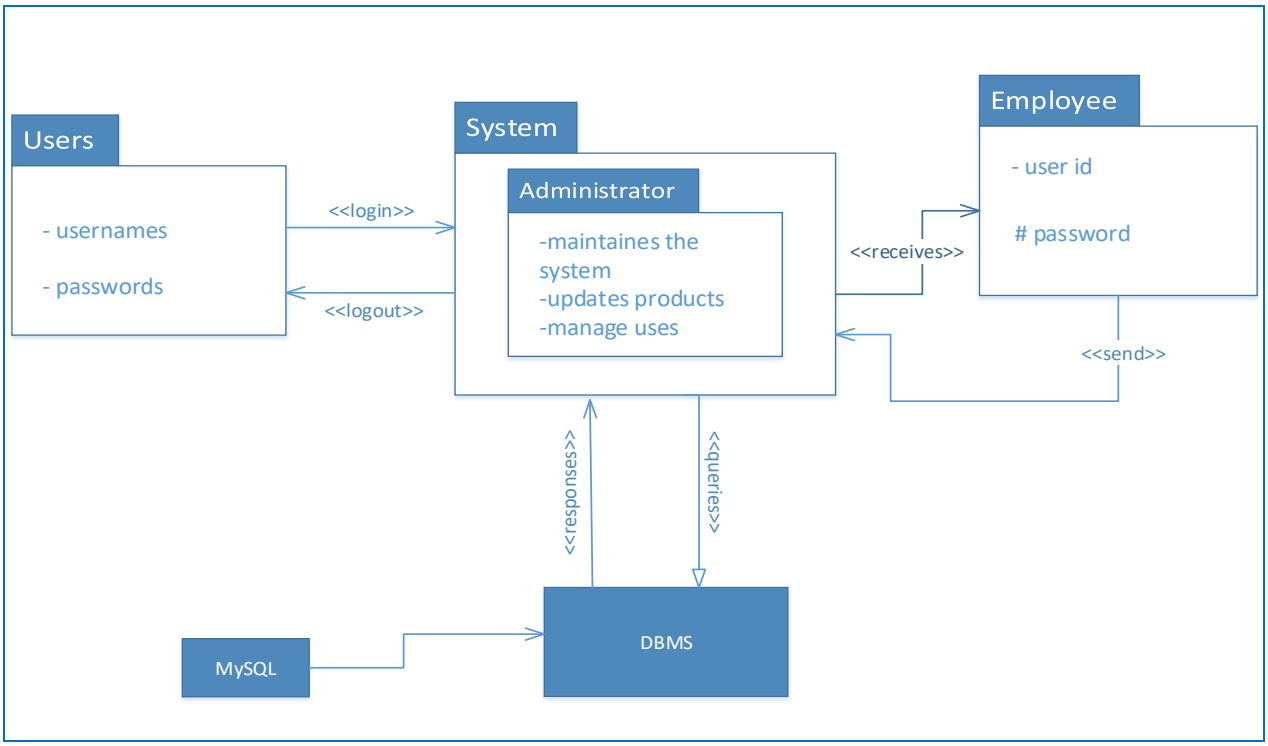


Figure 4. 10 Package Diagram

Key

Protected attributes

- Private attributes

<< >> Dependencies

4.6.3 Sequence Diagram

It determines the sequential order of different activities in a system and how they interact with each other specifying the system object activities and how information is being passed from object to object (Roth et al, 2015).

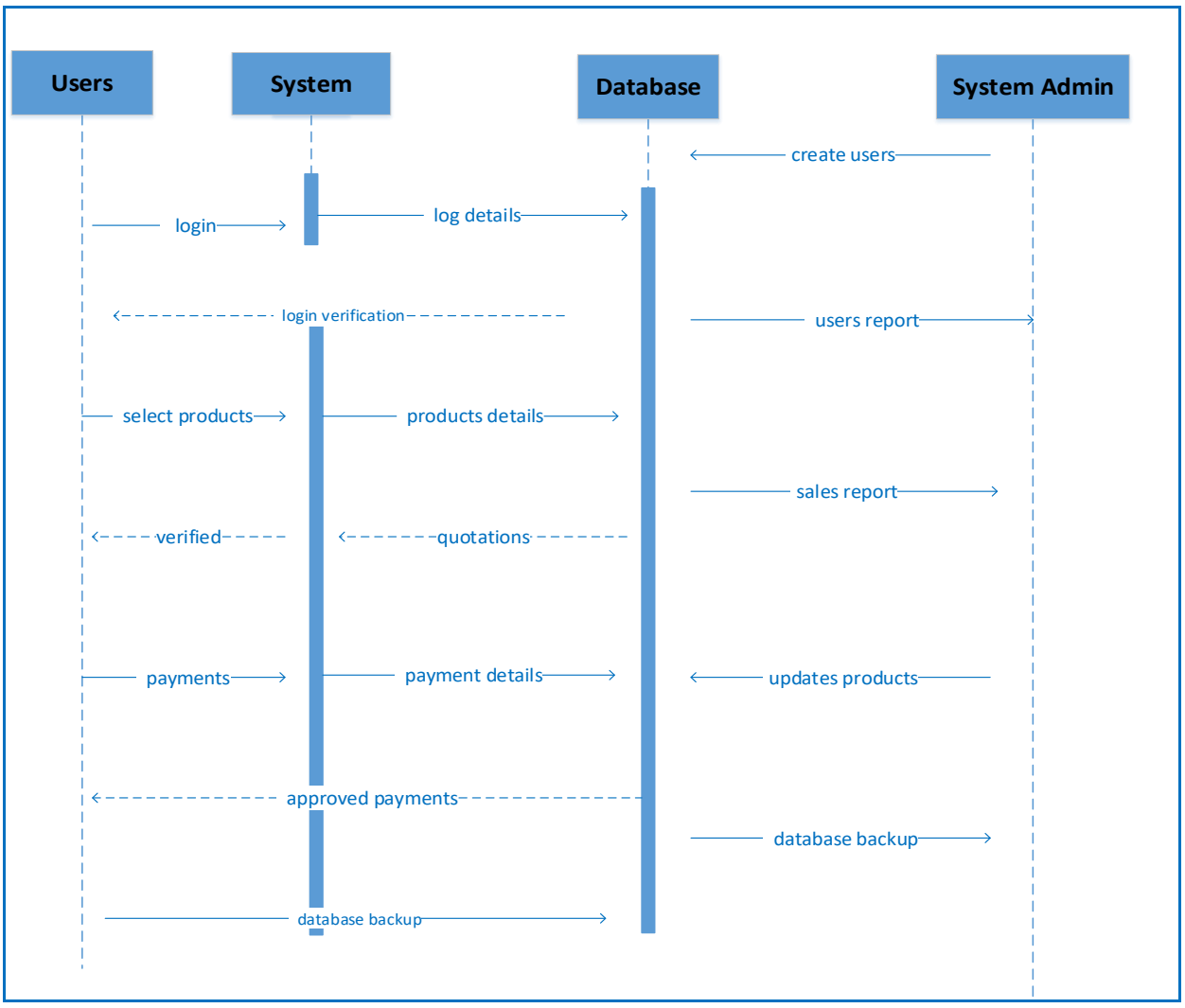


Figure 4. 11 Sequence Diagram

4.7 Interface Design

Jansh (2008), defined UI as the interaction between the user and the computer through the uses of interfaces and clicks to perform different tasks without the need to type in commands. According to Tiwari (2008), the introduction and use of GUI lead to interface designing which is the design of computers desktop and web applications, mobile applications and more which are user-based

programs that provides a simplified interaction, easy to use and attractive designs for a clear and much starter two-way communication between the user and the computer.

4.7.1 Menu Design

Program or application menu holds and groups system's main functions for easy navigation around. Dennis and Roberta (2012), main menu contains universal grouped function that are used as a source of navigation around the system.

Full menu **Minimized menu**

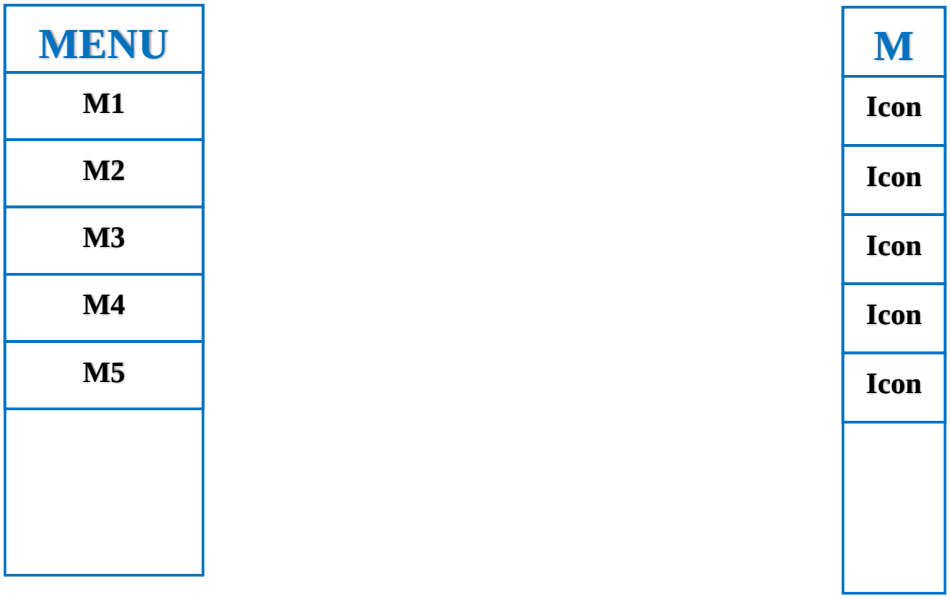


Figure 4. 12 Manu Designs

4.7.2 Input Design

Input fields are used to capture raw data into the system, validation queries and process results (Rouse, 2007). Storekeeper-DSS use input fields to capture products, login, account creation and more.

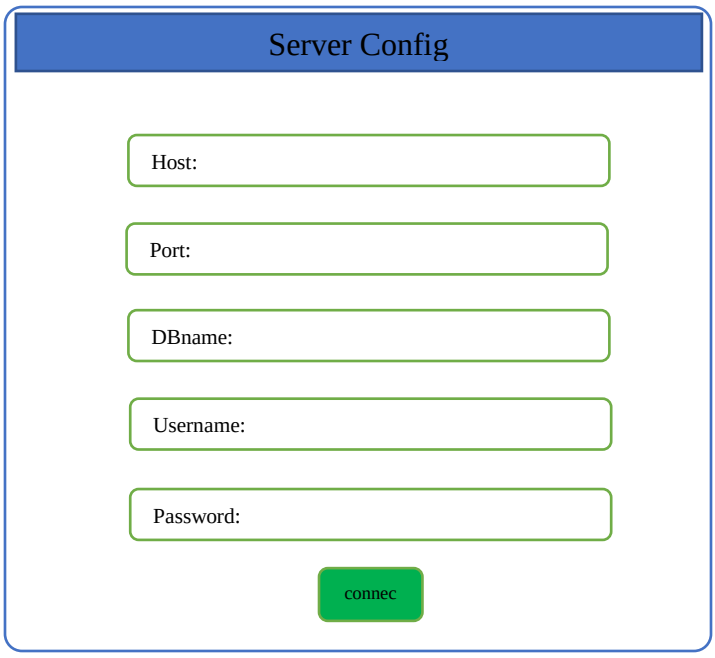


Figure 4. 13 Input Design One

Input form (Figure 4.13) is used for connecting to both local and remote server (e.g. centralized DB server). By inputting the host IP address, port number one can test if the server is up before connecting to it or entering other details like DB name, username and user password to initialize the connection and this comes first before able to login into the system. Below is the input form used for logging into the system by entering a case sensitive username with a minimum of 4 characters and password of not less than 6 characters.

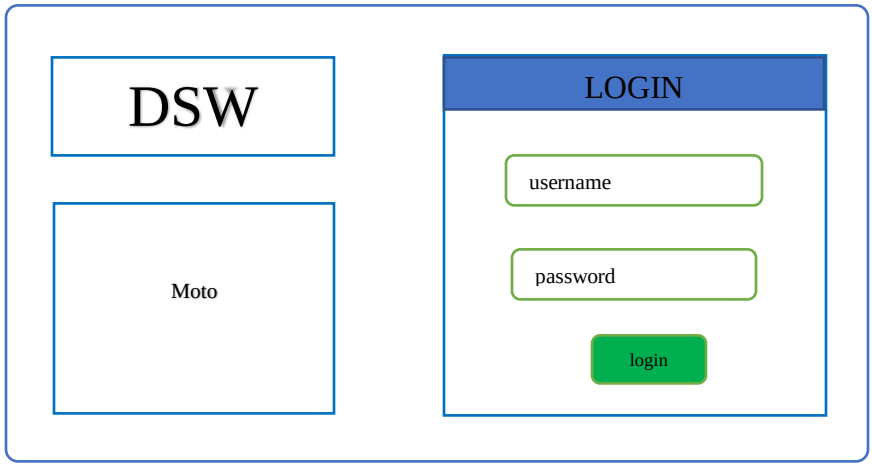


Figure 4. 14 Input Design Two

4.7.3 Output Design

Rouse (2007) describe system's output design as a way used to provide proper response on certain actions performed to the user as a way to facilitate two-way communication. The developer used different forms of output including the tables and chats. The following is a table that shows all the products captured.

Home page is the system's dashboard which shows the systems quick view.

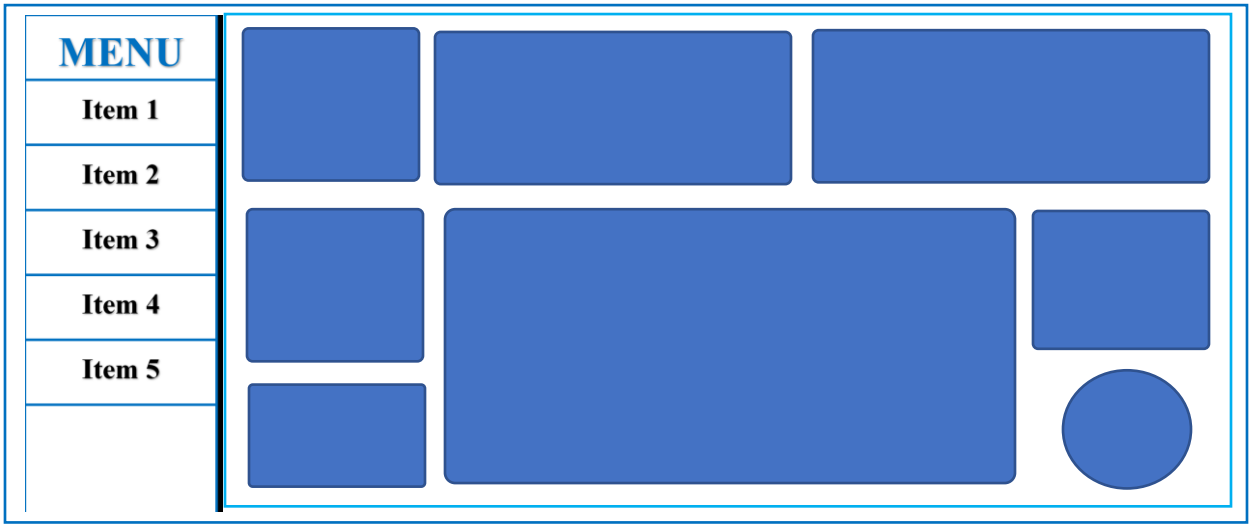


Figure 4. 15 Output Design One

Below is one of the output forms for the system to that will be used to display the products.

Id	Name	Price	Category	Qty	Unit
Pid-1	Pname	Pprice	Pcategory	Pqty	Punit
Pid-2	Pname	Pprice	Pcategory	Pqty	Punit
Pid-3	Pname	Pprice	Pcategory	Pqty	Punit
Pid-4	Pname	Pprice	Pcategory	Pqty	Punit
Pid-5	Pname	Pprice	Pcategory	Pqty	Punit
Pid-6	Pname	Pprice	Pcategory	Pqty	Punit

Figure 4. 16 Output Design Two

4.8 Pseudo Code

It the simplified version of programming or coding of any language in to simple English such that those familiar with programming or not can have a general understanding on how the code works (Braharu, 2017).

Login:

Input user details

If correct

    Successfully logged in

    Go to main menu

Else

Clear the fields and indicate the error message

New User Sign Up

Enter the user details

    Check the details

If correct

Save details

Print out note

Go to login

Else

Indicate the error

Do nothing

Saving Data to the Database

Check DB conn

If successful

Save the data

Show success note

Else

Set conn parameters

Connect to the DB

If failed

Show error note

Validate Login Forms

If blank

Change the field to red

Else

Save

Show a note success

4.9 Security Design

Security design is there to cater for all kinds of system fall backs and system threats and traits that my hinder the data integrity, consistence and its security which a bifurcated into physical, operational and network securities (Norman et al, 2011). According to Forouzan, (2012) security design is there to protect the system from any system intruders, it might be in form of viruses, people, natural disasters, fire, and trojan etc.

4.9.1 Physical Security

Form the contextual meaning of the word physical, this design are measures taken to protect the organisational computer infrastructure from physical harm, (Forouzan, 2012). These measures include protecting the org information system from fire through fire guards, fire alerts and smoke detectors, theft through the use of verification systems that includes cameras and fingerprint readers, flood and more.

Physical Security Layout

The use of Security guards, smoke detectors, air conditioning, and use of surveillance cameras and fingerprint authentication at the door way.

4.9.2 Network Security

According Hoffer (2009), this is an activity designed to protect the network resources and encompasses both hardware and software technologies. The purpose for this design is to come up with an effective network security controls measures to the organisational network in order to provide a secure and threats free network which is reliable and efficient. The security may be informed of a multi layers encryption whereby each network security layer implements its policies and controls to the network communication. This provides a proper user authentication so that they can have access to network resources whilst monitoring network malicious activities. DSW secured its network though the use of network access controls whereby the use of Kaspersky antivirus and a firewall keeps monitoring the network and network resources.

4.9.3 Operational Security

This meant to safeguard the access to Storekeeper-DSS (Norman et al, 2011). DSW operational security measures for the system is based on the application level through secure socket layer (SSL) and the users connect their computers via domain or active directory.

4.10 Conclusion

The conclusion to this chapter was drawn from on the bases of how the events took place during design phase which shows an overview of the system how the new system, its architectural, program, physical, interface, and database design were properly articulated and clarified in satisfactory way. This phase initiated the next chapter which focuses on system implementation and maintenance and shows if the system was successfully implemented or not due to certain reasons.

CHAPTER 5: IMPLEMENTATION PHASE

5.1 Introduction

After the completion of the system design, it was vital for the developer now to focus on the project coding, testing and debugging, installation and maintenance of the system. With the aim to verify whether or not the system work through testing while referring to the objectives listed at the beginning of the project (Sommervile, 2007). At his stage that's once each system developed are going to be tested as the simplest way to verify whether or not the system is meeting its purpose or not, system verification and validation to discover the errors that were created throughout the event is additionally done at this stage further because the coaching of system users if there's must. it incorporates configuration, integrations, installation, maintenance, and proposals. the foremost crucial issue during this chapter are the transition ways to be used throughout the transition stage.

5.2 Coding

Melmoth et al (2015**),** refer coding as an entire process done with the aim of converting pseudo code into compiler language (e.g. Java, PHP, HTML etc.) which then converts its language into computer understandable language (binary language), the developer's responsibility is to convert system requirements into code (programming language), debug and maintain the systems source code. For example, the developer used JavaFX and a bit of R in coding the new system in which Gupta (2008) viewed as the conversion of system requirements into any programming language to produce functional user interfaces.

5.3 Testing

According to Mahapatra (2016), system testing is a process of identifying and debug errors after system coding, the developer(s) mostly make several mistakes that can only be detected during the testing phase and mainly concentrate on identifying the system's imperfections or faults, verification, performance and its validation with the aim to note whether or not the system met all the objectives set in the introduction phase of the development. If not then try to debug and add or continue with the implementation of the system with some of its expected modules left out with the hopes of adding them up by applying future updates. The process includes the clients of DSW, system developer and company management. This test is meant to disclose the errors made during the development and find out if there is a way to solve them Mother (2000). Several techniques

and be adopted for this process by the developer chose the following; white-box, integration, black-box, unit, system and acceptance testing, validation, and verification.

White-Box Testing

It is the opposite of black box testing according to Hoffer (2009) and is used for verification processes which is also known as the structural or glass box testing. Black-Box and White-Box testing encompass integration, unit, and acceptance illustrated in figure 5.0.

Black-Box Testing

Hoffer (2009) argued that Black-Boxing technique only considers the output produced to the input entered in the system and ignoring the internal mechanism of the whole system. It is also acknowledged that its being used for functional (validation purposes) and both methods where used in the following tests.

Testing Processes for The New System

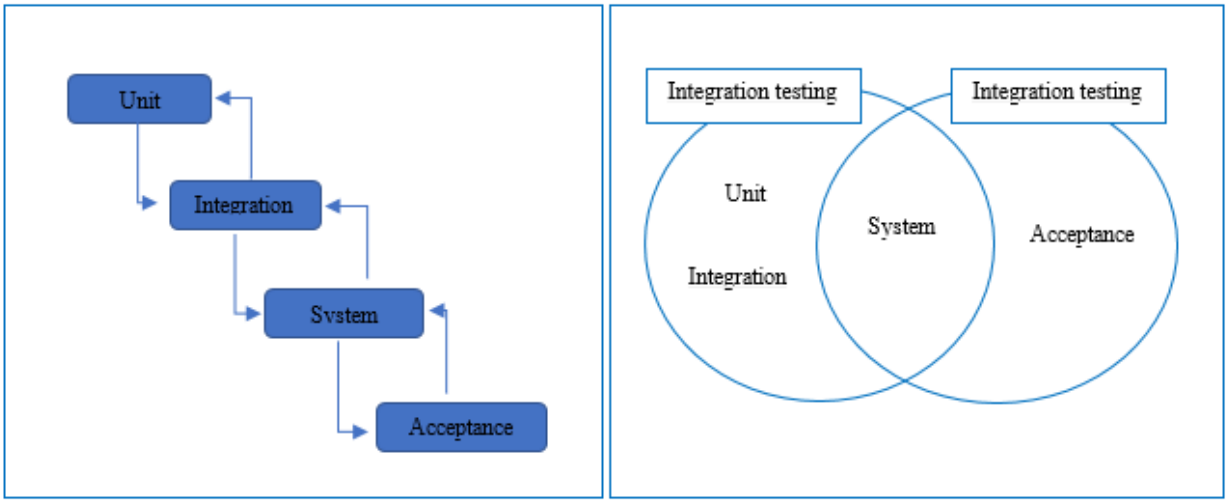


Figure 5. 1 Testing Processes (Adopted from: users.ece.cmu.edu)

5.3.1 Unit Testing

Bernal et al (2014), defined unit testing as a process that focuses on every smallest single unit of the new system one at time in targeting the errors and verify its performance and functionality in line with user requirements which is known as functional testing. The testing of individual modules

was done independently as a way to determine the modules with errors through the use of black and white box testing. The following is a registration form for the system admin being tested for validation.

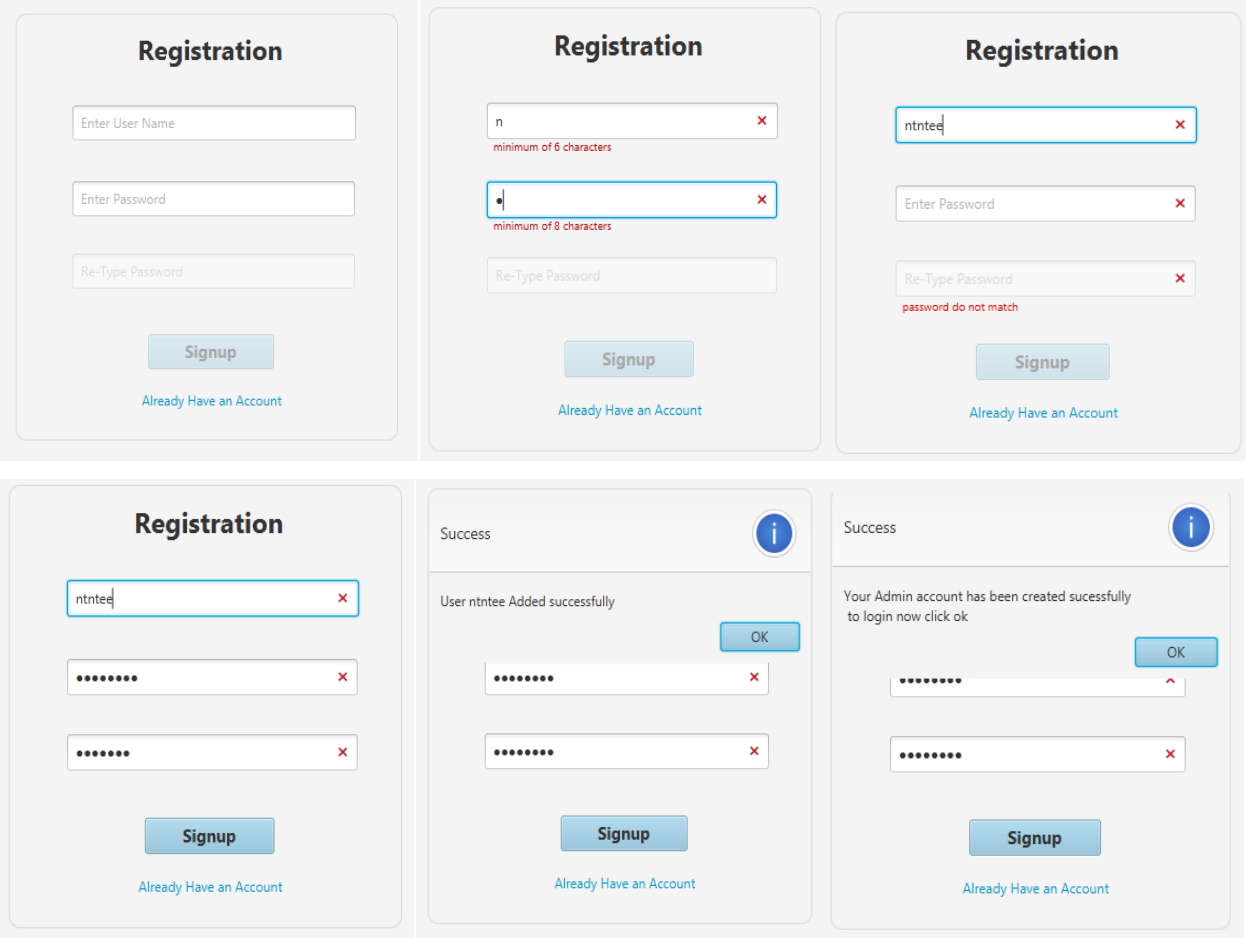


Figure 5. 2 Creating Account Testing

This module show in figure 5.2 was tested inorder confirm if it was capturing the required data and forbids the users from entering incorrect data. And the login verification was done soon after to see if the system fully authenticate the system users.

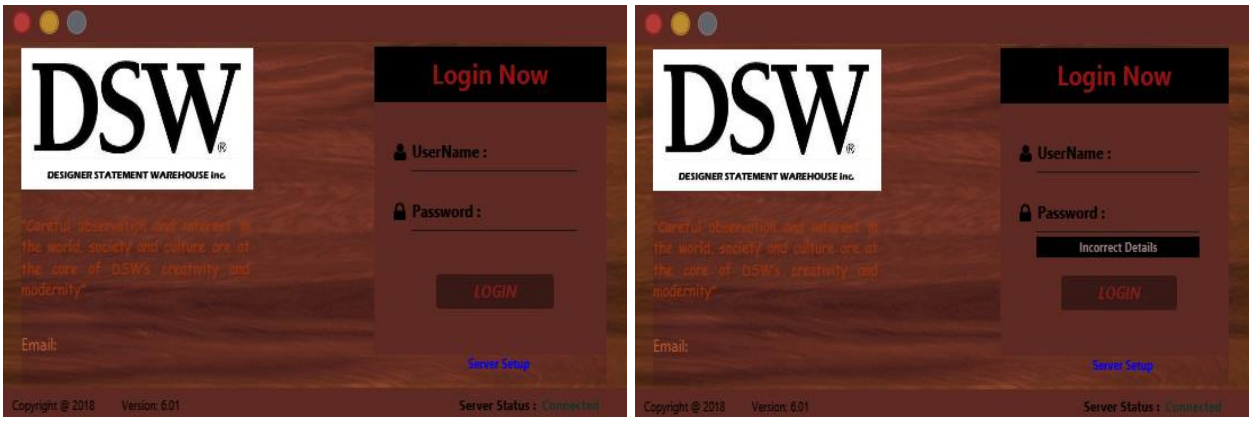


Figure 5. 3 Login Authentication Testing

This module focuses on authenticating the system users so that only those permitted can have access to the system and in future, this form will be integrated with biometrics authentication and a password to provide a two-way authentication system. In order to see if the system can be remotely accessed there was a need to test the server config unit to see if it can work on both local and remote servers which was shown in figure 5.4.

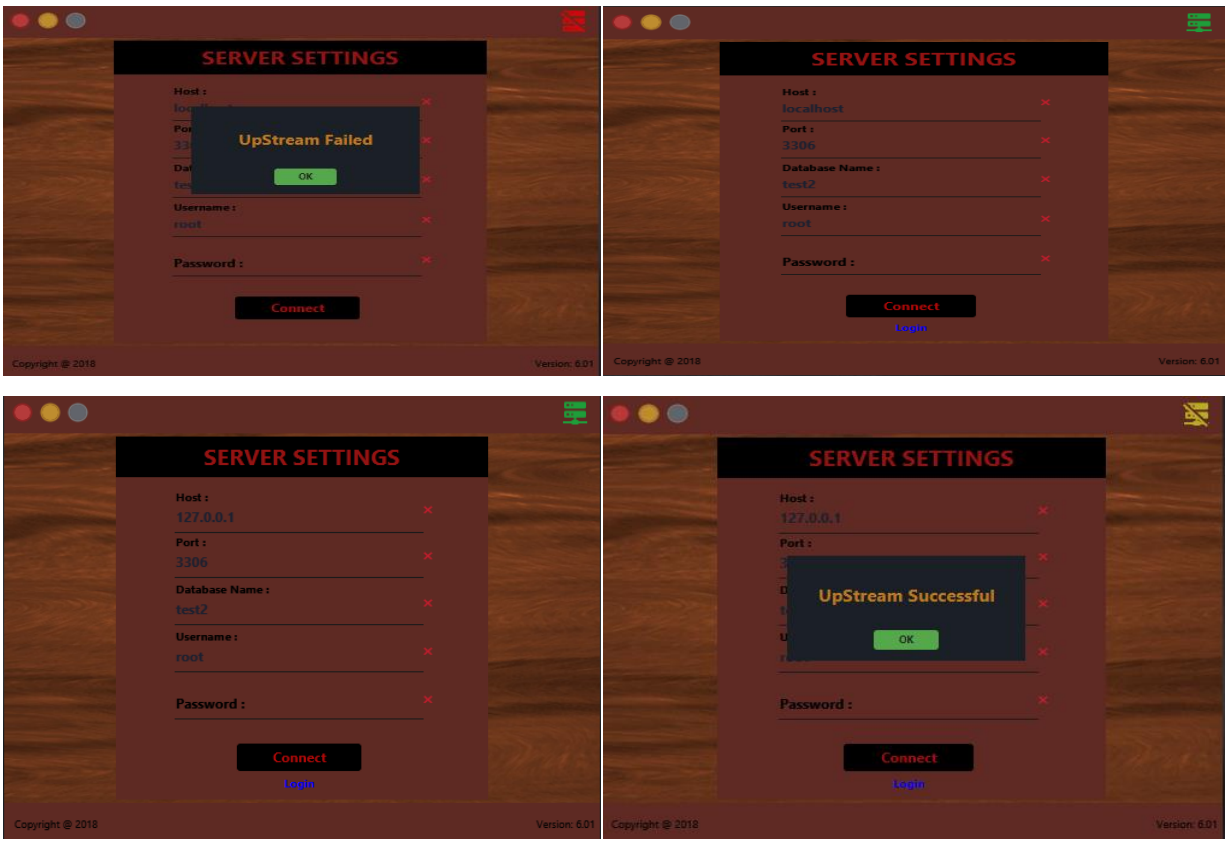


Figure 5. 4 Server Connection Testing

The test on the server config unit showed that the system was working perfectly on the Localhosts but on the centralized servers it proved to have been taking more time to fetch data for the DB in the event that the network was slow. So, the developer then tried to make a patch for that which is not the 100% fix at the moment but working or reduce the effects greatly.

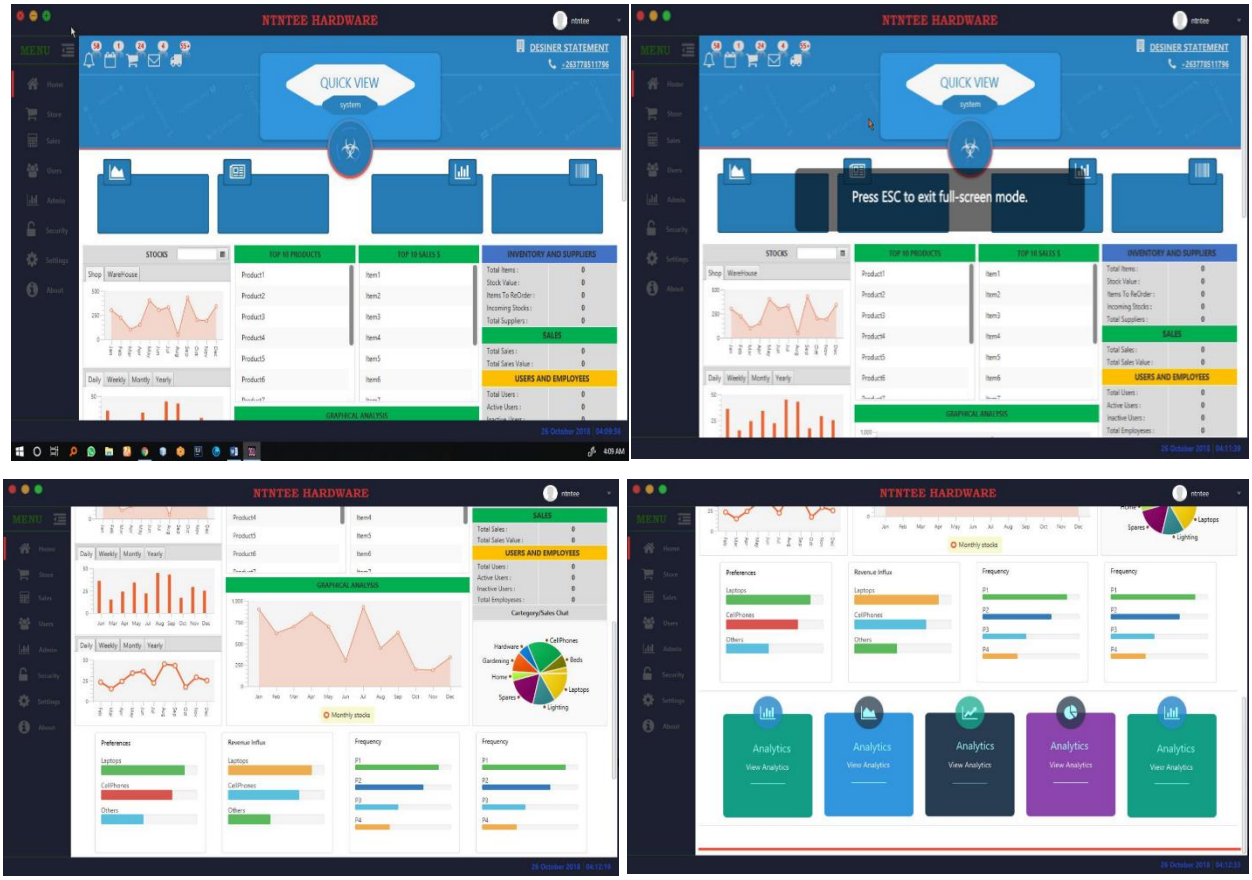


Figure 5. 5 Main Menu Testing

This module shows most of the system's statistics graphically which includes different kind of charts and graphs. The test results showed that, the module wasn't working 100%, due to some of the charts not working because there where not yet linked to the system's data during the system testing.

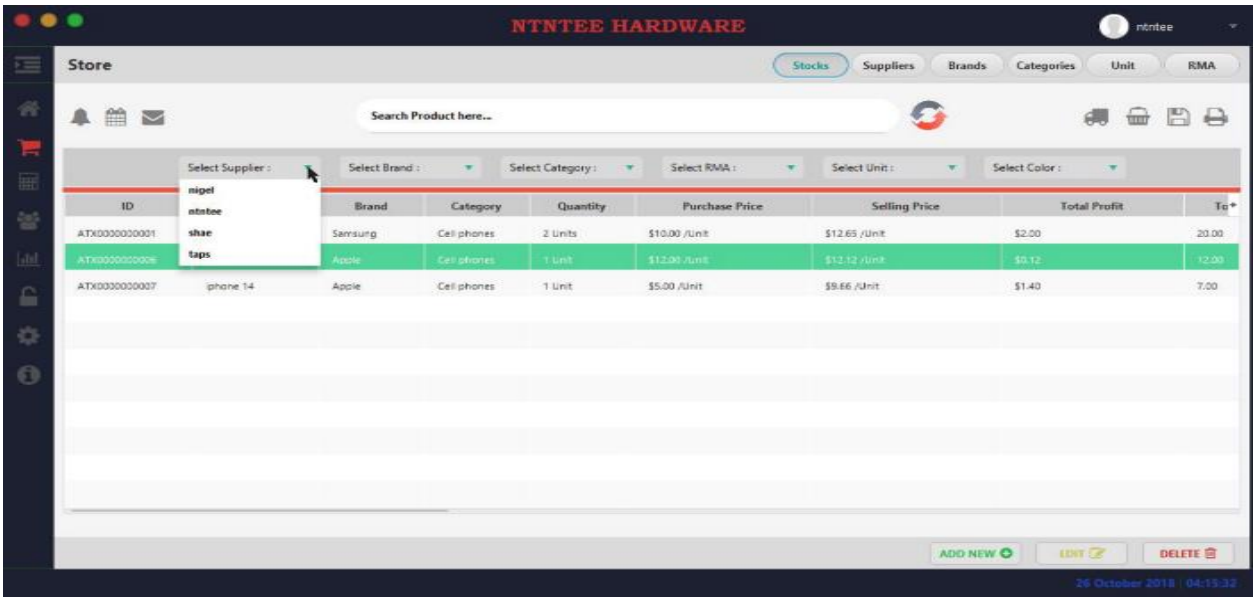


Figure 5. 6 Product Displaying Testing

With product displaying testing the motive was to syste if the system was able to display, filture, modify the view to see specified data which was possible and achived and there were no errors found. Proceeding to adding products, brands, categories, colors, editing, deleting and more, figure 5.7 shows that ththe units were working fine.

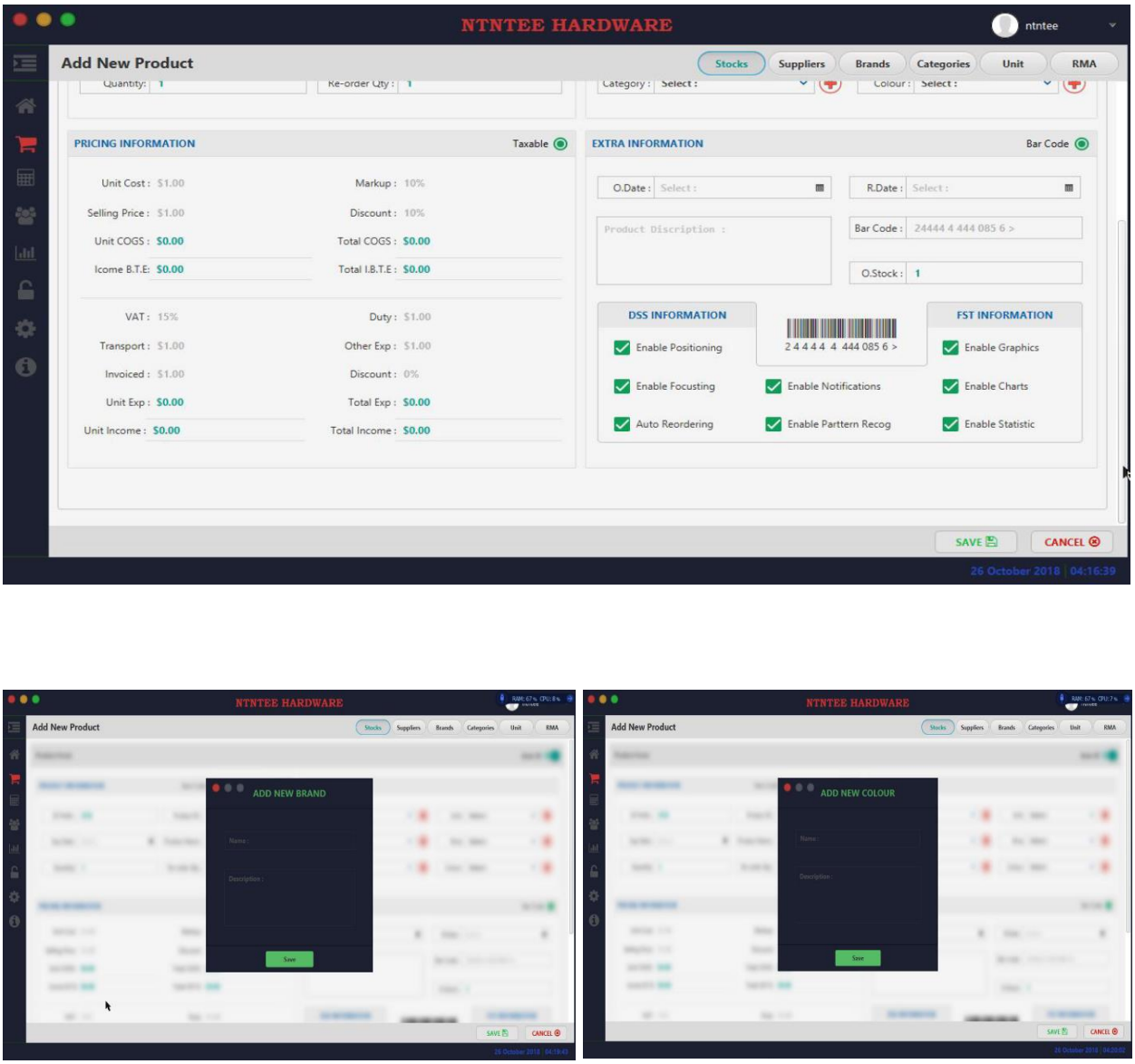


Figure 5. 7 Adding Products

5.3.2 Integration Testing

Limaye (2009) argued that integration is the process of putting together different sub components (Systems) of a project. When carrying out integration testing the developer was putting together different modules (subsystems) of the system from Server Config, Login, Account creation to the last unit of the system after carrying out unit testing and passed, shown at paragraph 5.3.1 and this technique was to see if the different units were capable of integrating and work together as one.

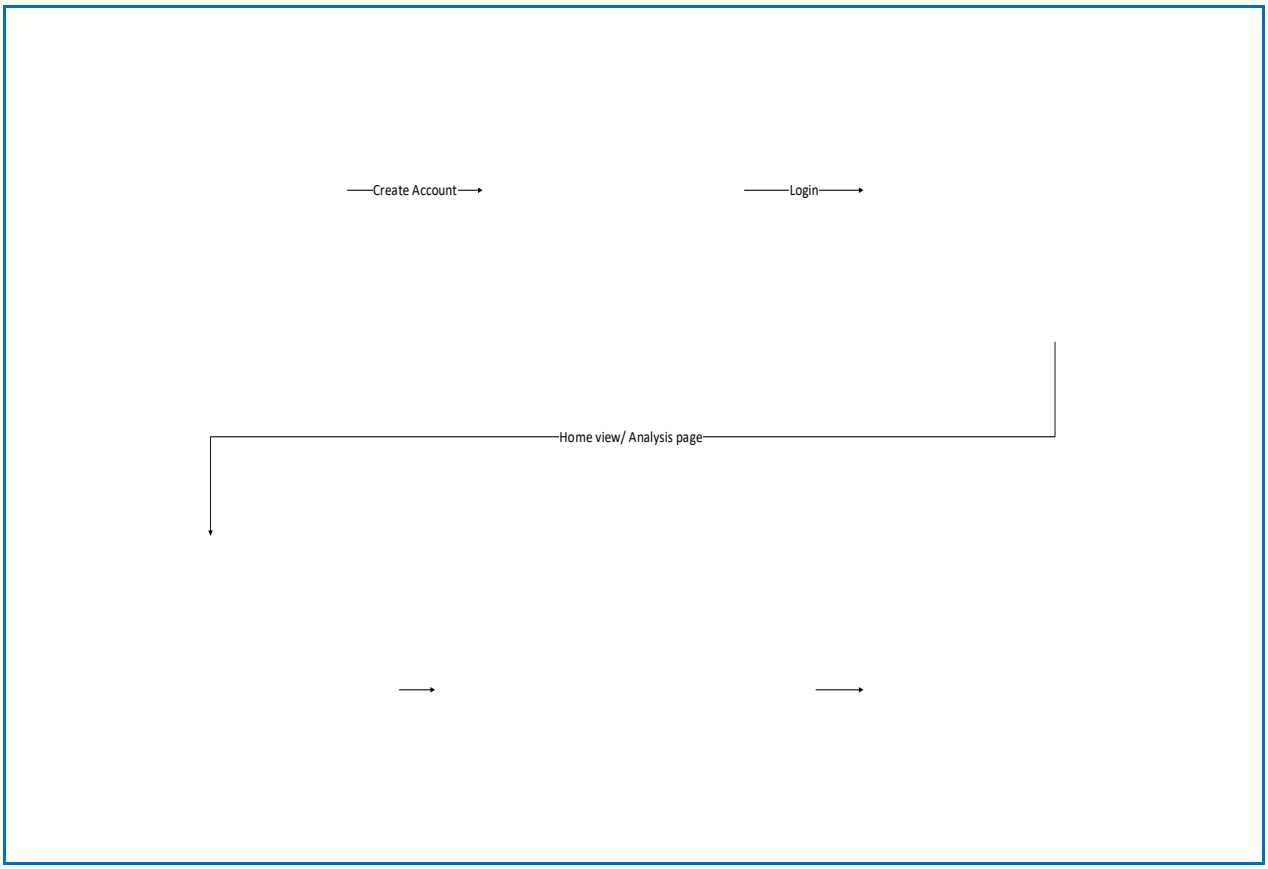


Figure 5. 8 Integration Illustration

Figure 5.8 illustrates how various modules integrate with each other to form a working system. It shows the system flow form when the user launches the system and how these modules work together in a system.

5.3.3 System Testing

According to Godfrey (1999), this test is done on the entire system (the whole system) which is purely Black-Box approach, just soon after unit, and integration testing with the aim to prove the workability of the system as a whole. System test is the last physical test on the system itself, which is meant to identify the bugs that were left out by any chance or that could not be identified during unit and integration tests. The test was done in different stages as follows using the Bottom up approach:

First stage: System Administration test

Second stage: User test

Third stage: Management test

The last stage: Developer Overall test

Few errors were identified and corrected at the end of the system test and users and managers were able to view the system differently even if it was a single system and provide a good user administration and tracking changes made on the system.

5.3.4 Acceptance Testing

After a successful application development and thorough testing, one more thing to worry about was (quality assurance) whether the employees/ users were going to accept the new system Limaye (2009). Acceptance test is an approach that was used to identify user reactions and their take regarding the adoption of the new to avoid resistance to change by the employees. This test proceeded fine because all the users and the top management were engaged in the development process since the start of the project. Every member was aware of and wanting the system to be developed so this test came up positive when all the users were asked to test the system quality.

5.4 Installation

According to Bernal et al (2014) system installation is the process done after all the system tests and approval. It is a process of placing the system in its operational space or environment which sometimes termed as system implementation. The system is to be installed on the domain of DWS and some on the individual computers considering the mentioned below changeover strategies in order for server clients to connect to the system. The installation will be done using the executable file created and the system was designed for easy installation, there is no need for creating the database as the system is the one responsible for that. The system admin has to input the server details (host, port, user and password) then gets to enter the desired name for the database and the system will create the database and the tables which makes the installation fast and easy. Star topology will to connect different nodes to the network to allow communication with the server.

Installation Process

Prerequisites

Java Runtime version at least version 1.8.0 installed.

Xampp at least version 7 installed.

Thumb drive or any storage device at least 1GB free space.

Hamachi VPN installed version latest available.

Java security policies installed in java runtime.

Step 1

Copy the system executable file into the above-mentioned storage device.

Plug it in on any the targeted server, personal computer or desktop running any version of (windows, Mac OS, or Linux).

Step 2

Double click the executable to install, if windows use .exe mac use .dmg Linux .deb and follow the prompts until done.

Final Step

Open the system using the system icon on desktop for windows and on the launch pad for mac and Linux

The first time of opening the system one will be prompted to enter server details after done proceed to create the admin account and the installation completes.

5.4.1 System Changeover Strategies

It is a technique used in adopting the new system in the organisation so as to avoid different inconveniences of the new system adoption. With this approach a newly developed system is to be put into work in a way that the users will welcome the change without any problems or interference to the business activities Sommerville (2015). There are three main strategies out there designed fully to cater of this, which include pilot, conversion parallel running, direct changeover etc.

Parallel Running

Tiwari (2008) State that with this procedure, the new system will be adopted to work together with the old system as a way to test the reliability of the new system up until it is proved to save the interest of the business. Both the systems will be competing in saving the same purpose after that they will be an assessment to compare their, reliability, effectiveness and efficiencies. Then come

a conclusion whether to fully implement the system of not. The following are the Pros and cons relating to this technique:

Pros

Users have the chance to acquaint or familiarize with the newly implemented system while the old system is operational

In the case, something goes wrong with the new system e.g. system failure, it is easy to revert to the old system.

Old system might be used for reference purpose

Provides an evaluation and feedback platform.

Cons

High operational costs will be witnessed.

It takes longer until the system id fully implemented.

Success of the system will depend on their attitude towards the system.

Direct Changeover

With Direct Changeover (direct shift) there is no need to test the system more, once the above tests are done the developer will went on to fully install/implement the system At DSW which is why its termed direct shift (Stephanidis, 2003). Bernal et al (2014 states that the Direct changeover is usually done when all the employees are on the holydays so when they come back, they will find the new system in place and working which is why he defined it as an immediate changeover.

Pros

Minimizes the disturbances during the working time.

The use of one system is favourable for the organisation.

Low conversion and less operational costs since the organisation will have to use one system.

Cons

Usually associated with resistance to change by employees.

Costly to the organisation in the event of system failure.

Pilot Conversion

According to Mahapatra (2016) pilot conversion a method of deploying a system first in pilot sites before the full implementation of the system. With this technique the developer can continue system testing and evaluation for better performance before full system role out for example what lager software companies like apple does by providing IOS better versions for system testing. The pilot site is responsible for providing feedback on the system performance the developer in turn use to debug the program and for evaluation purposes and presentation to the stakeholders.

Pros

Allows further system checking and evaluation before implementing to the entire organisation.

Pilot site can also act as the testing ground and will familiarize themselves more with the system helping to avoid user resistance to change.

Cons

Time consuming just like Parallel running.

The pilot site may provide biased information because it's a test on small numbers so on large numbers the system may behaves differently.

Recommendations

After a full assessment of all the changeover strategies the developer suggested it come to a time when the organisation had to choose one strategy depending on what they want considering their advantages and disadvantages. The developer recommended pilot conversion as a more stable and suitable technique since DSW will be using both the systems in selling its products the difference being that only the few users will be using the new system, they can capture the old systems data into the new system to test its relevant in terms of performance before a full implementation and for historical data analysis.

5.4.2 Data Migration

This is process of moving data from one data store to another (Michael, 2007**).** It's only possible when there was existing data that the new system can use in order to continue from where the old system left. In this case, DSW can decide to capture its existing data manually into the new system or continue using it from the old storage since the system doesn't cater for data migration.

5.4.3 User Training

Whenever the new system is developed there is a need for the system users to be equipped with necessary knowledge on how to navigate and explore the system (Mahapatra, 2016). At this point, only the pilot uses where taught in depth on how to use the new system and as they progress other users will also get to be familiar with the system until the system is finalized.

5.5 Maintenance

System maintenance is the process of keeping the system in an operational condition after fully implementation (Beichelt et al, 2012). The intention is to correcting performance issues and other improvement to be made and any efforts made to keep the system in place. System maintenance have several types of maintenance and they include corrective, adaptive, preventative and perfective.

5.5.1 Adaptive Maintenance

Sommerville (2004) states that system users will keep on having new additional features to be added to the system and the process of adding these features is known as adaptive maintenance, and these features may be in terms of hardware and software componence. With this the system and its environment can be alter to meet the ever-changing user and business requirements.

5.5.2 Perfective Maintenance

This is the implementation of supplementary or additional user requirements Tittmann et al (2012), with the concerns of enhancing the overall performance of the system and debugging. It helps improve the system's performance by making enrichments and changes to the system**.** As the users get more familiar with the system, they will start to notice so many ways to improve its performance so the process of adding those changes it's called perfective maintenance.

5.5.3 Corrective Maintenance

Corrective maintenance (debugging) refer to any reactive process that is meant to correct any errors to the new system (Kenneth and Kendell, 2011). During system development the developer(s) make lots of mistakes most of them can only be identified in the long run of the system use, after being identified this error requires attention by correcting or debugging them.

5.5.4 Preventive Maintenance

Stephanidis (2003) argued that proactive or preventative approach focuses on preventing or providing measure to cater for the system failure which involves system diagnosing and monitoring. This is a measure to reduce the impacts of new system failure to the organisation or the system it-self. For example, the use of antiviruses and fire wall rules to prevent viruses and intruders to the system.

5.6 Recommendations for Future Development

The system couldn't some of the user novel requirements which are to be accomplished hopefully during the next system upgrade this was because the developer was still researching on how to implement those objects to the new system and couldn't meet the dead lines. The system users have to keep noting down all the areas that needs improvements so that the developer or anyone responsible for system maintenance will find it easy to know what to begin with and how to deal will all the suggested improvements to be made to the system.

Recommendations to Users

Users are encouraged to keep a log of any possible changes to be made to the system, errors being faces and what they think is not working.

Participation of users in the future maintenance of the system.

To always the pessimistic that the system is there to help not to increase the work load

Recommendations to Managers

Keep a weekly report on the system performance.

To hold weekly meetings where all the stakeholders will be involved, to highlight all the problems being faced so that there will be monthly updates to the system.

Put in place a good maintenance team so that the system keeps working as enquired.

5.7 Conclusion

Now after all the process were done the development of Storekeeper-DSS was a success despite the fact that there were some expected user requirements and modules that the system couldn't meet as shown in the recommendation for future developments that there is a need to fulfil those expectations if the developer finds a way to adopted them to the new system. There is more to Storekeeper-DSS that the future developers can add to make it a highly intelligent system which cater for every aspect of the business.

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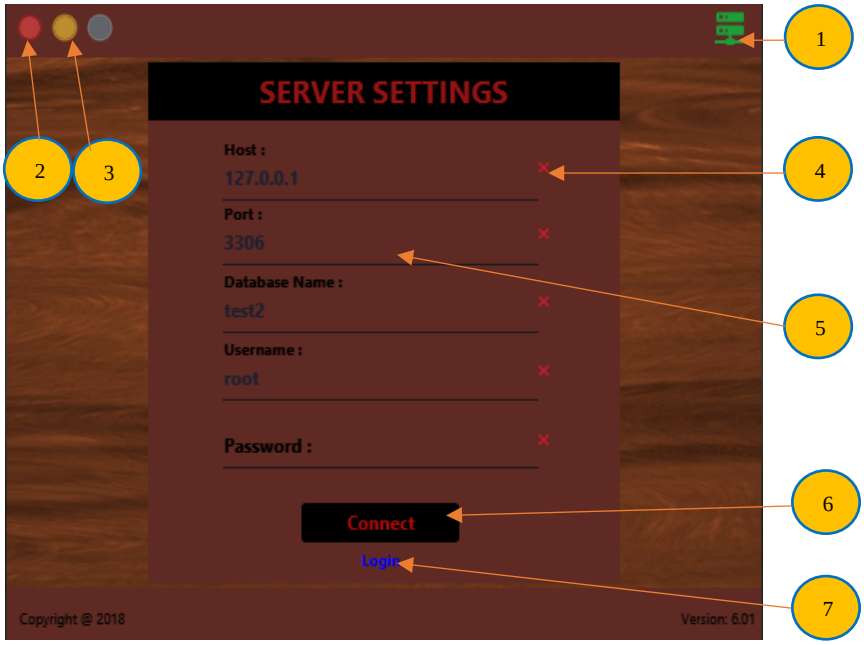
APPENDICES

Appendix A: User Manual

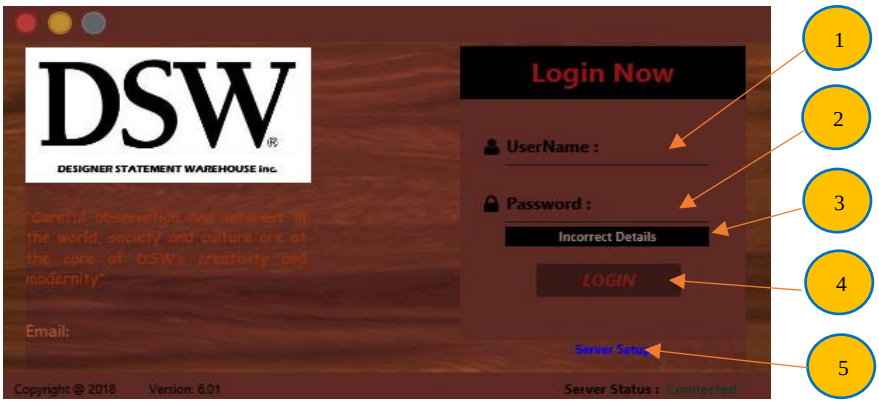
The following is a user manual for Storekeeper-DSS.

Sever Connection



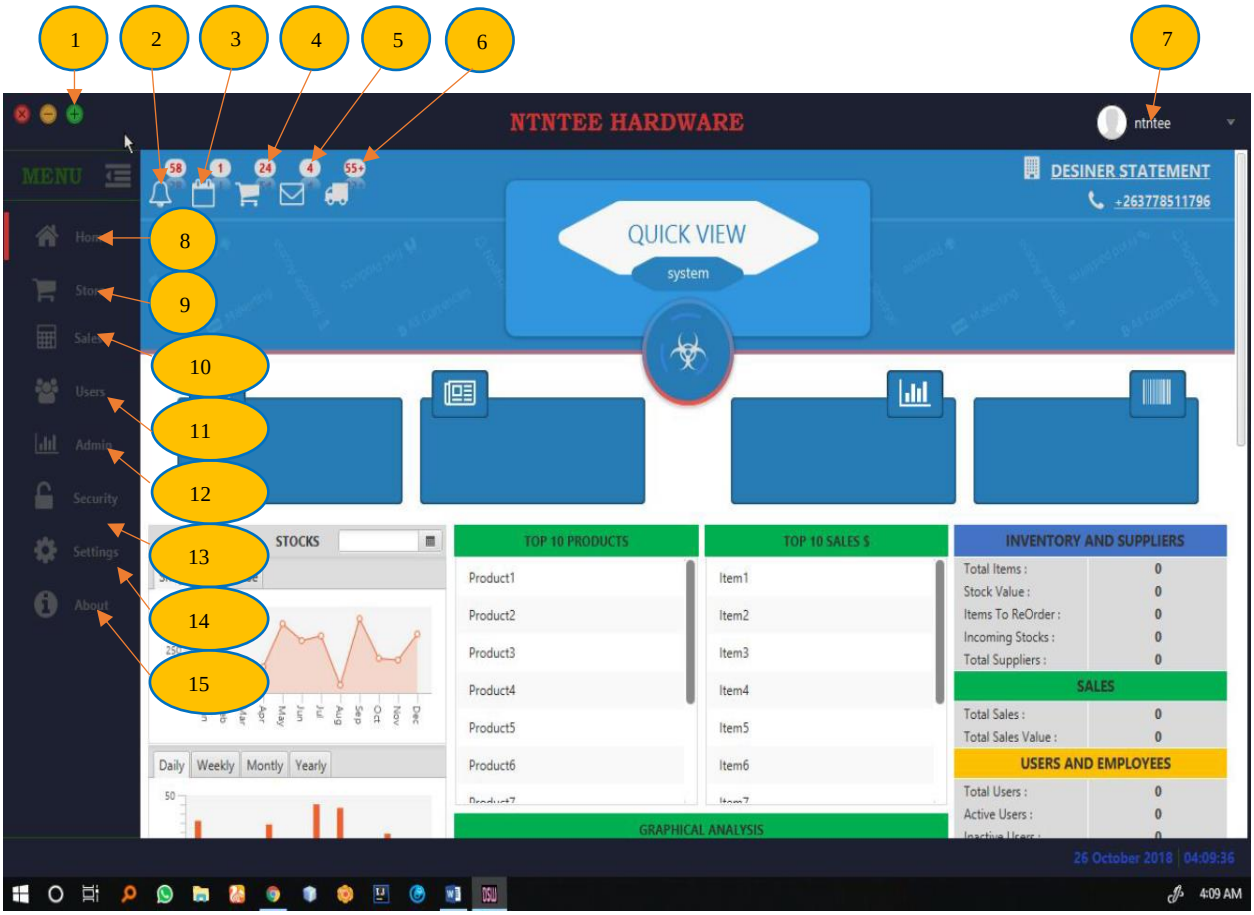
To connect to the server, fill in all the field represented by (5) having made a mistake use (4) to delete data in the fields. (2) and (3) are close and minimize buttons respectively. Once done filling all the server details click (6) to connect or to test the connection, the server indicator () will keep showing whether the server is up or down.

Login



To login into the system fill username (1) which is case sensitive and user password (2) once done click button (4) to login and if incorrect details are provided the user will be shown label (3)

Home Page

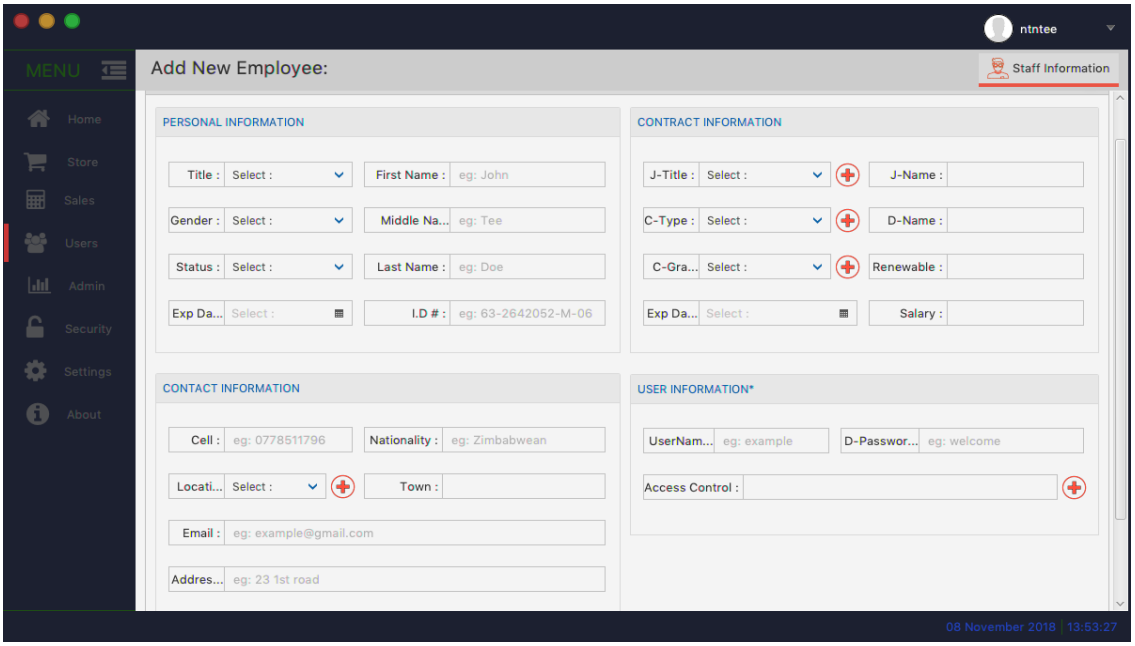


1	Maximize button	8	Home
2	Notifications	9	View store
3	Calendar	10	Make a Sell
4	Orders	11	Manage users
5	Emails	12	Administration
6	Deliveries	13	Settings
7	logout	14	About the Application

1	Top ten sells	8	Categories Chart
2	Bar Chart	9	Sales Chart
3	Stocks Line Chart	10	Trending
4	Product Line Chart	11	Trending
5	Users Data	12	Trending
6	Most profitable Deals	13	Trending
7	Sales information	14	

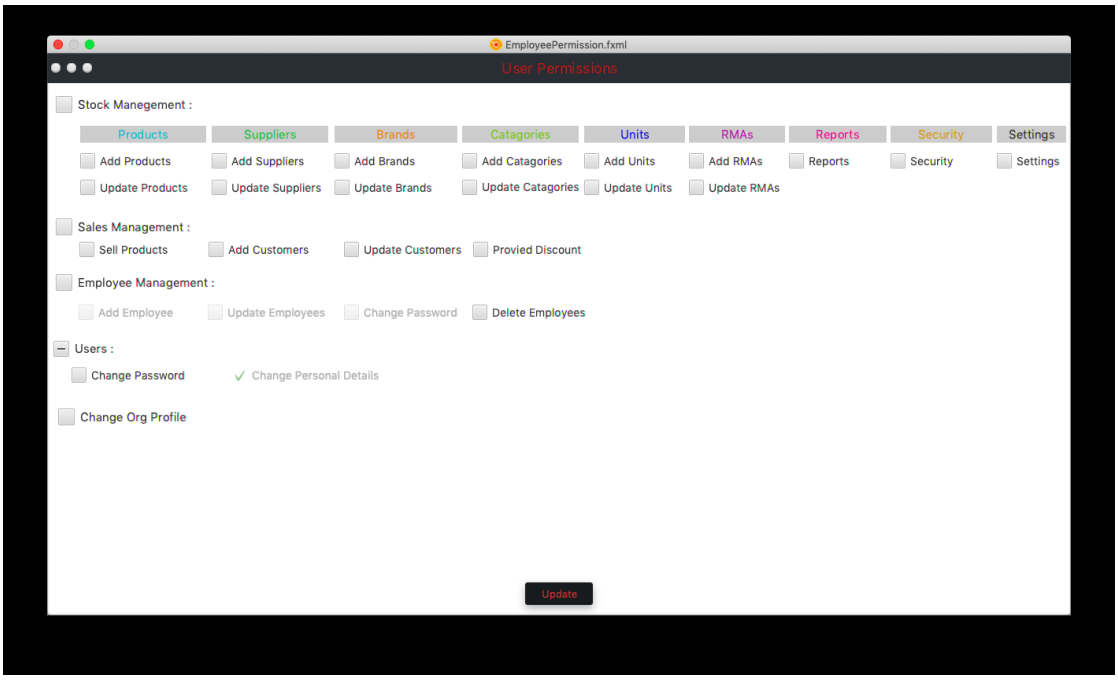
Add Users

In order to add new users, go to Users tab select and new user from the dropdown menu button and fill in the from below. Once done save button.

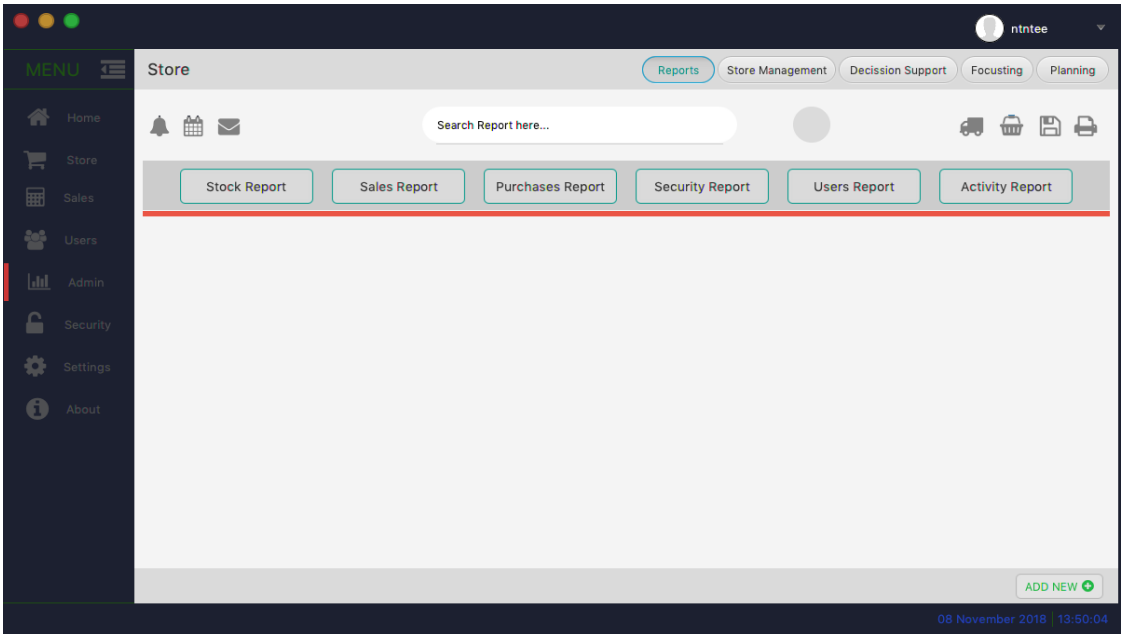


Assigning User Permissions

Upon creating a user name, one needs to assign user permissions or to adjust in future, this can be done in Users by selecting the user and click update permissions and use the below form to assign different permissions to different users and click update to save. By default, a user is created without any permission.

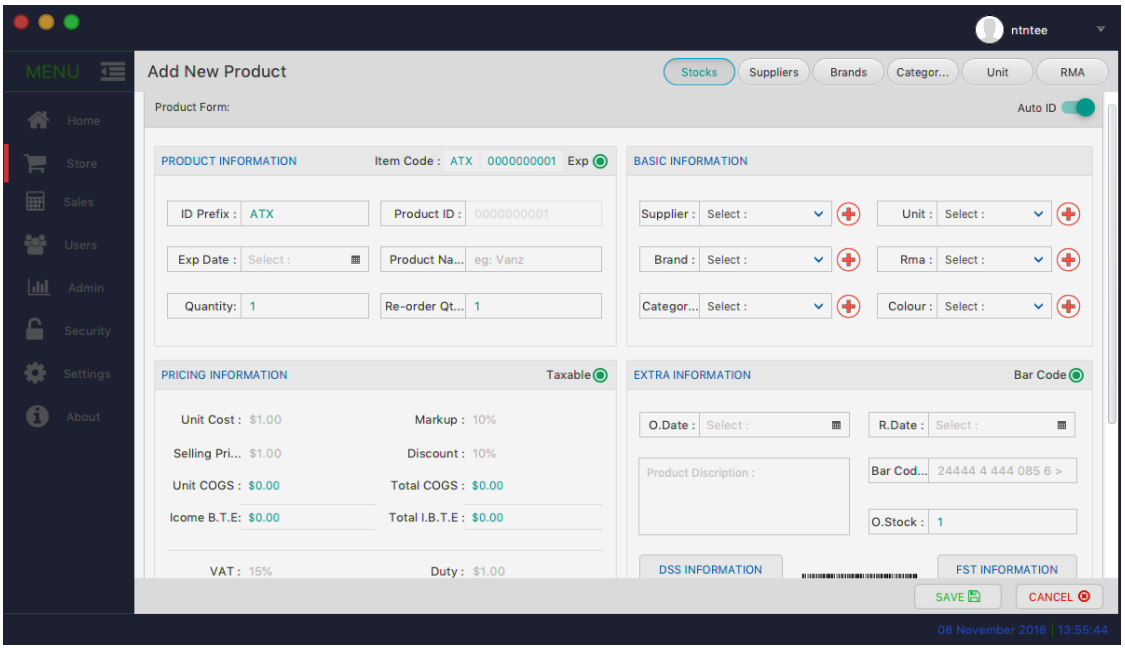


Reports



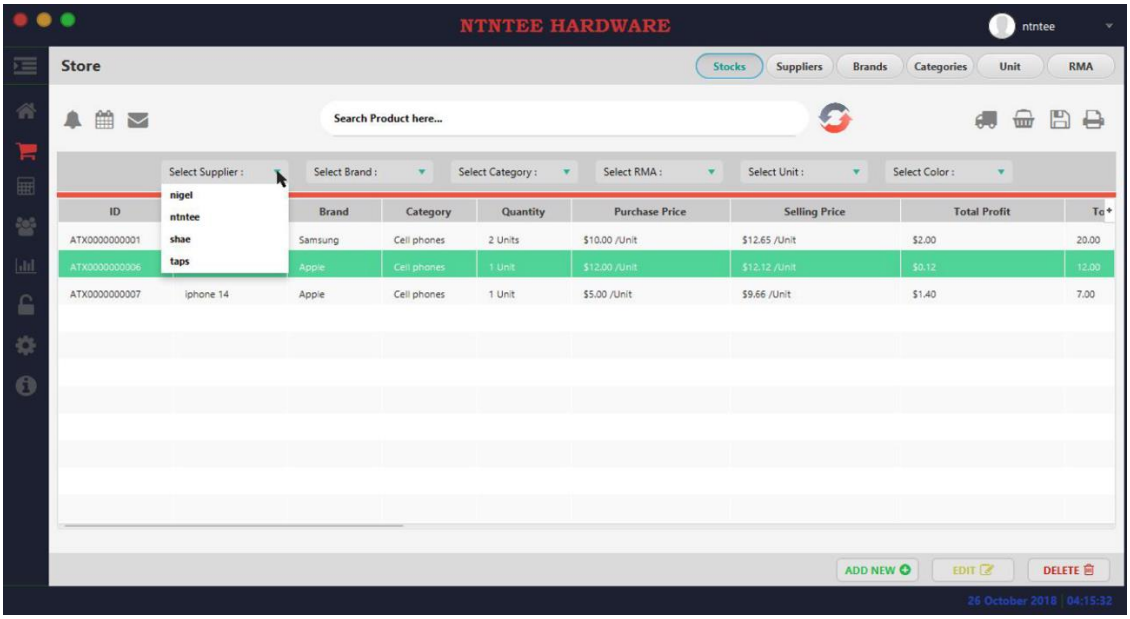
A detailed report can be generated by any users with proper permissions using the admin tab, select the type of report you want to generate and the system will generate everything for you.

Adding Products



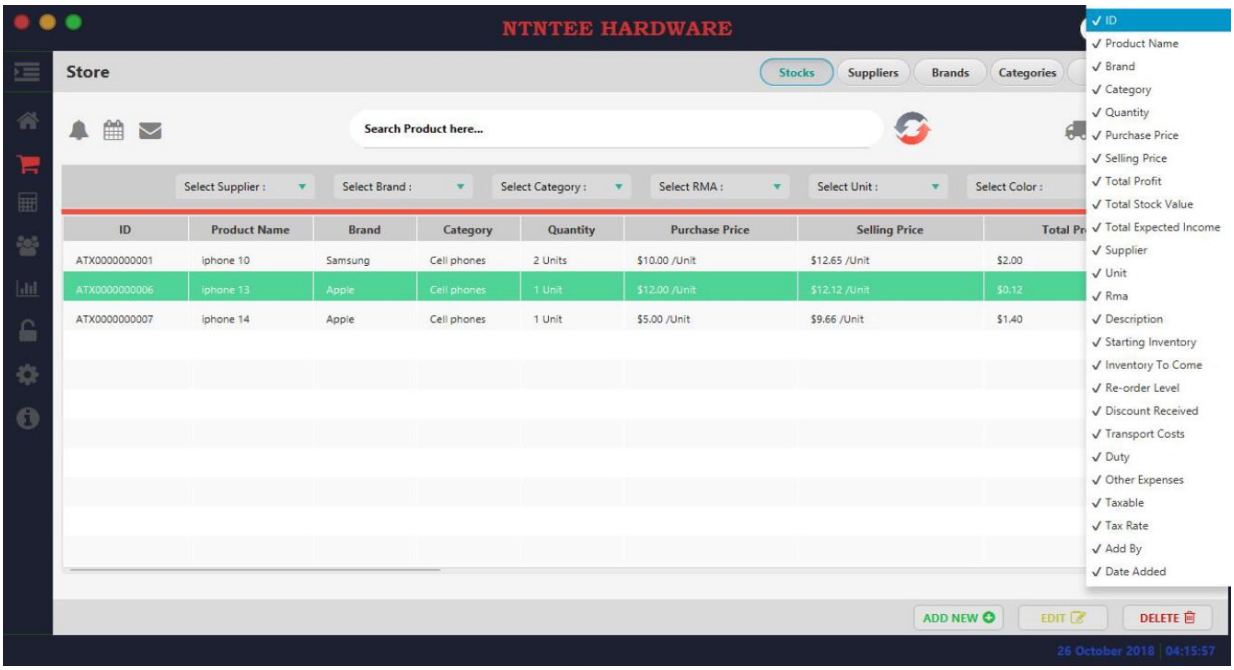
To add new products, go to Store then click add new button the fill the above form. If there are no brand names, category, rma, unit or supplier use the plus button to add.

View Products



To view products, it's all done in the Store tab, one can delete, edit or add new products.

Customise The view



This option allows the user to enable or disable specific columns or repositioning the columns to meet the user's preferences.

Appendix B: Interview Checklist

The sample questions that were asked and answered during the interview sessions.

Interviewer name……

Interviewee position……

Interviewee department…..…….

Questions

Q1. We understand a need for a new system development has risen, what are the contributing factors?

.....
.....
.....
.....

Q2. How does the current system work?

.....
.....
.....

Q3. What challenges you are currently facing?

……
……
……
……..

Q4. What can be done regarding the mentioned challenges?

……
……

……

……

Q5. What I you take pertaining this idea?

.....

.....

.....

Q6. If the idea is ideal what are your expectation, suggestions or requirements?

.....

.....

.....

Q7. Where should be focused first, or the area of relevance?

.....

.....

.....

Q8. When do you expect the new system?

.....

.....

.....

THANK YOU FOR YOUR COOPERATION

Appendix C: Questionnaire Checklist

Please answer all questions

1. Are you satisfied with the current system?

Yes ☐ No ☐

If not, what are your concerns and what do you think should be done? Are clients satisfied with the services offered?

Yes ☐ No ☐

What do you suggest or recommend?

……

……

……

3. Does the existing system store data efficiently and are the records easy to manipulate?

……

……

……

4. How long does it take you to save client's needs?

Less than 10 Minutes ☐ 10-20 Minutes ☐ More than 20 Minutes ☐

5. How do you rate the performance of the current system?

Excellent ☐ Average ☐ Bad ☐

What do you suggest or recommend?

……

……

……

6) what your take regarding the adoption of a new system?

……

……

……

DATE……

THANK YOU FOR YOUR COOPERATION

Appendix D: Observation Score Sheet

Date .....

Time .....

Department under observation .....

.....

.....

.....

.....

.....

.....

Conclusion .....

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.....

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Appendix E: Code Snippets

LOGIN

```
private void btnLogin(ActionEvent e){
        if (con.getCon_status()&&isValidCondition()){
            logninTask(tfUserName.getText().trim(),pfUserPassword.getText().trim());
        }
    }
private void logninTask(String user, String pass){
        btnLogin.setStyle("-fx-alignment:TOP_LEFT; -fx-background-color: #000000");
        btnLogin.setText("Loading...");
        loginloader.setVisible(true);
        final ScheduledExecutorService scheduler = Executors.newScheduledThreadPool(1);
        scheduler.scheduleAtFixedRate(() -> {
            userSession.INSTANCE.putId(query.userApi(user,pass));
            Platform.runLater(() -> {
                scheduler.shutdownNow();
                logger();
            });
        },1,1,TimeUnit.SECONDS);
    }
public String userApi(String username,String pass) {
        dbcon.db();
        try {
```

```
            String haxpass = DigestUtils.shaHex(pass);
            dbcon.res = dbcon.stat.executeQuery("SELECT user_id FROM "+dbName+".users_logger WHERE BINARY user_name='"+username+"' AND user_password='"+haxpass+"' LIMIT 1");
            if (dbcon.res.next()) {
              return dbcon.res.getString(1);
            }
        } catch (SQLException ex) {
            Logger.getLogger(SQL.class.getName()).log(Level.SEVERE, null, ex);
        }
        return null;
    }
private void logger(){
        if (userSession.INSTANCE.getId()!=null) {
            try {
                FXMLLoader loader = new FXMLLoader();
                loader.setLocation(getClass().getResource(nav.getMainApp()));
                loader.load();
                Parent parent = loader.getRoot();
                Scene appscene = new Scene(parent);
                Stage mainstage = new Stage();
                mainstage.setMaximized(false);
                mainstage.initStyle(StageStyle.TRANSPARENT);
```

```
            ApplicationController apControl = (ApplicationController) loader.getController();
            nav.stageDrag(mainstage, apControl.btnS);

            apControl.acMain.getStylesheets().add("/style/application.css");
            apControl.permission();
            apControl.viewDetails();

            mainstage.setScene(appscene);
            Stage stage3 = (Stage) btnLogin.getScene().getWindow();
            stage3.close();
            mainstage.getIcons().add(new Image(nav.getAppIcon()));
            mainstage.setTitle("name");
            mainstage.show();
        } catch (IOException ex) {
            Logger.getLogger(LoginController.class.getName()).log(Level.SEVERE, null, ex);
        }
    } else {
        loginloader.setVisible(false);
        btnLogin.setText("LOGIN");
        btnLogin.setStyle("-fx-alignment:CENTER; -fx-background-color: #000000");
        InvalidDetails.setVisible(true);
        tfUserName.clear();
```

```
            pfUserPassword.clear();
            btnUserNameTfClear.setVisible(false);
            btnPassFieldClear.setVisible(false);
        }
    }
```

Sever Processes

```
public class dbConnection {
    private final Properties properties=new Properties();
    private final String resourcePath = System.getProperty("user.home")+"/StoreKeeper";
    private final Path path = Paths.get(resourcePath);
    private boolean con_status=false;
    private boolean prop_file_status=false;
    private boolean server_status=false;
    private boolean policy_status=false;
    public Connection con;
    public ResultSet res;
    public Statement stat;
    private String driverName;
    private String jdbcUrl;
    private String user;
    private String password;
    private String serverName;
    private String port;
```

```
private final Navigation nav = new Navigation();
public void db(){
   try {
      properties.load(new FileInputStream(resourcePath+"/settings.properties"));
      prop_file_status=true;
      StrongTextEncryptor txtencry= new StrongTextEncryptor();
      String password2=properties.getProperty("*&y}[4?3");
      txtencry.setPassword(password2);
      try{
         driverName=txtencry.decrypt(properties.getProperty("5*+dr$%)"));
         jdbcUrl=txtencry.decrypt(properties.getProperty("^&*-%bc**"));
         user=txtencry.decrypt(properties.getProperty("&*>@u44r"));
         password=txtencry.decrypt(properties.getProperty("yiy33%%"));
         serverName=txtencry.decrypt(properties.getProperty("&%$-<<.."));
         port=txtencry.decrypt(properties.getProperty("2@7&*%$"));
         policy_status=true;
      }catch(Exception e){
         System.out.println("Install java decyription policy.");
      }
      try {
         if(driverName!=null&&jdbcUrl!=null&&port!=null&&serverName!=null){
            Class.forName(driverName);
```

```
            String unicode =
"?verifyServerCertificate=true&useSSL=true&useUnicode=yes&characterEncoding=UTF-8";
            con=DriverManager.getConnection(jdbcUrl+serverName+":"+port+"/"+ unicode,
user, password);
            stat=con.createStatement();
            con_status=true;
          }
        } catch (ClassNotFoundException | SQLException e) {
          con_status=false;
        }
      } catch (IOException e) {
        System.out.println("settings.properties file upStream failed.");
      }
    }
    public String dbName(){
      try {
        StrongTextEncryptor txtencry= new StrongTextEncryptor();
        properties.load(new FileInputStream(resourcePath+"/settings.properties"));
        String password2=properties.getProperty("*&y}[4?3");
        txtencry.setPassword(password2);
        try{
          return txtencry.decrypt(properties.getProperty("09%AHGA9"));
        }catch(Exception e){
```

```
            System.out.println("no policy.");
        }
    } catch (IOException e) {
        System.out.println("DataBase Name Acquisition Error.");
    }
    return "";
}
public boolean getCon_status(){
    return con_status;
}
public boolean getPro_file_status(){
    return prop_file_status;
}
public boolean getPro_policy_status(){
    return policy_status;
}

public void testConnection(String server, int port){
  if (!"".equals(server) && !"".equals(port)) {
      try {
          Socket socket = new Socket(server, port);
          server_status=true;
      } catch (IOException ex) {
```

```
            server_status=false;
            System.out.println("UpStream on \\"+server+":"+port+" failed.");
        }
     }
   }
   public boolean getServer_status(){
      return server_status;
   }
   public void dblogin(String server, String port, String database, String username, String password){
      if ("".equals(server)||"".equals(port)||"".equals(database)){
         Alert alert = new Alert(Alert.AlertType.WARNING);
         alert.setTitle("Warning");
         alert.setHeaderText(null);
         alert.setContentText("Please complete the server, port and database !!");
         alert.showAndWait();
      }else{
         try{
            StrongPasswordEncryptor passencry= new StrongPasswordEncryptor();
            String pdecry=passencry.encryptPassword(password);
            StrongTextEncryptor txtencry= new StrongTextEncryptor();
            txtencry.setPassword(pdecry);
            properties.setProperty("5*+dr$%)", txtencry.encrypt("com.mysql.jdbc.Driver"));
```

```
            properties.setProperty("^&*-%bc**",  txtencry.encrypt("jdbc:mysql://"));
            properties.setProperty("&*>@u44r", txtencry.encrypt(username));
            properties.setProperty("yiy33%%", txtencry.encrypt(password));
            properties.setProperty("*&y}[4?3", pdecry);
            properties.setProperty("&%$-<<..", txtencry.encrypt(server));
            properties.setProperty("2@7&*%$", txtencry.encrypt(port));
            properties.setProperty("09%AHGA9", txtencry.encrypt(database));
            policy_status=true;
        }catch(Exception e){
            nopolicy();
        }
        try{
            if(!Files.exists(path)) {
                Files.createDirectories(path);
                if (getPro_policy_status()) {
                    properties.store(new          FileOutputStream(resourcePath+"/settings.properties"),
"StoreKeeper Settings #");
                }
            }else {
                if (getPro_policy_status()) {
                    properties.store(new          FileOutputStream(resourcePath+"/settings.properties"),
"StoreKeeper Settings #");
                }
```

```
            }
        } catch (IOException e) {
            try {
                System.out.println("failed to save the settings file.");
                Parent root = FXMLLoader.load(getClass().getResource(nav.getSaving_settings()));
                Scene scene = new Scene(root);
                Stage nStage = new Stage();
                nStage.setScene(scene);
                nStage.initStyle(StageStyle.UNDECORATED);
                nStage.setTitle("Server Notification");
                nStage.getIcons().add(new Image(nav.getAppIcon()));
                nStage.showAndWait();
            } catch (IOException ex) {
                Logger.getLogger(dbConnection.class.getName()).log(Level.SEVERE, null, ex);
            }
        }
        db();
    }
}
public String dbServerName(){
    try {
        StrongTextEncryptor txtencry= new StrongTextEncryptor();
        properties.load(new FileInputStream(resourcePath+"/settings.properties"));
```

```
        String password2=properties.getProperty("*&y}[4?3");
        txtencry.setPassword(password2);
        try{
            return txtencry.decrypt(properties.getProperty("&%$-<<.."));
        }catch(Exception e){
            System.out.println("no policy.");
        }
    } catch (IOException e) {
        System.out.println("Server Name Acquisition Error.");
    }
    return "";
}
public String dbServerPort(){
    try {
        StrongTextEncryptor txtencry= new StrongTextEncryptor();
        properties.load(new FileInputStream(resourcePath+"/settings.properties"));
        String password2=properties.getProperty("*&y}[4?3");
        txtencry.setPassword(password2);
        try{
            return txtencry.decrypt(properties.getProperty("2@7&*%$"));
        }catch(Exception e){
            System.out.println("no policy.");
        }
```

```
    } catch (IOException e) {
        System.out.println("Server Port Acquisition Error.");
    }
    return "";
}
public String dbUserName(){
    try {
        StrongTextEncryptor txtencry= new StrongTextEncryptor();
        properties.load(new FileInputStream(resourcePath+"/settings.properties"));
        String password2=properties.getProperty("*&y}[4?3");
        txtencry.setPassword(password2);
        try{
            return txtencry.decrypt(properties.getProperty("&*>@u44r"));
        }catch(Exception e){
            System.out.println("no policy.");
        }
    } catch (IOException e) {
        System.out.println("User Name Acquisition Error.");
    }
    return "";
}
public String dbUserPass(){
    try {
```

```
        StrongTextEncryptor txtencry= new StrongTextEncryptor();
        properties.load(new FileInputStream(resourcePath+"/settings.properties"));
        String password2=properties.getProperty("*&y}[4?3");
        txtencry.setPassword(password2);
        try{
           return txtencry.decrypt(properties.getProperty("yiy33%%"));
        }catch(Exception e){
           System.out.println("no policy.");
        }
    } catch (IOException e) {
        System.out.println("Server Password Acquisition Error.");
    }
    return "";
}
public void nopolicy(){
  try {
      Parent root = FXMLLoader.load(getClass().getResource(nav.getNoPolicy()));
      Scene scene = new Scene(root);
      Stage nStage = new Stage();
      nStage.setScene(scene);
      nStage.initStyle(StageStyle.UNDECORATED);
      nStage.setTitle("Server Notification");
      nStage.getIcons().add(new Image(nav.getAppIcon()));
```

```
            nStage.showAndWait();
        } catch (IOException e) {
        }
    }
}
```