MOBILE DRUG AUTHENTICATION SYSTEM

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MOBILE DRUG AUTHENTICATION SYSTEM

BY

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ABSTRACT

Mobile Drug Authentication System was a system that allowed patients to verify drugs or medicines if they are original or fake through a sms. The purpose was to come up with a solution of a system that detects if a particular drug could be original or fake as well generating reports of barcodes that customers sent for verification. This was not possible with the use of a website in making alerts of fake drugs that were being sold to the members of the public as not all people were not accessing the website and also such alerts were removed before others knew about them as there was need to accommodate other notifications on the website. This also was difficulty for members of staff to generate reports of such cases. However, the planning phase was done at the beginning of the project defined the problems and justification for the development of the project. Information gathering tools which were used included questionnaires, interviews, observations and document reviews this helped in acquiring information about the project acceptability through strengths, challenges, opportunity and threats. Database which was used was xampp in efforts to store data in huge quantities and at the same time to minimize data redundancies. The development of the system was done in PHP and Dreamweaver. The system testing and implementation of the hardware and software was done to ensure that the functions and operations of the system were working as per to the objectives. The project was successfully implemented as that change proved very useful to the members of the community and management in making decisions. This resulted in the project team making recommendations to the organisation that included security of the system and backing up of system data after a complete success of the system implementation.

APPROVAL

This document "**Mobile Drug Authentication System**" by **Trevor K Chanaiwa** meets the guidelines leading to the award of the degree of BSc (Hons) Information Systems of the Midlands State University and was accepted for its contribution.

Supervisor……..

Date……

DECLARATION

I **Trevor K Chanaiwa** do hereby declare that I am the author of this document; I further authorize Midlands State University to lend this document anyone who may want to use it for research.

Signature……Date……

ACKNOWLEDGEMENTS

First and foremost it is by grace and I want to thank God for his favor he gave me. In undertaking this project I am deeply indebted to so many people who scarified their time and help in effort to assist me in the success of this project. I appreciate with gratitude to my supervisor Mr. P.S Mupfiga for assisting me throughout the project; I would not have been able to complete this project if it was not for him. My most gratitude goes to my family for their unwavering support, morally and financially may God bless.

To my one and only brother Kelvin Chanaiwa sisters Glenda, Rumbidzai, Faith, Tutsirai my friends Naison Mhlanga, Talent Dumba and Innocent January, Dickson Swatch, Joylne Swatch, Kudakwashe Matarise guys I salute you, words are not enough but only can thank you and God Bless you. I also extend my gratitude to my DPs Chipepera and mother Excellency for the support and prayers. Above all many thanks to Medicines Control Authority of Zimbabwe employees for their support and cooperation they gave me in doing this project.

DEDICATION

I dedicate this work to my parents B. Chanaiwa and D. Chanaiwa who worked tirelessly so that I can achieve the best in life by providing me with all necessities and my family as a whole for their ideas and guidance.

LIST OF ACRONYMS

MCAZ –Medicines Control Authority of Zimbabwe

PHP – Hypertext pre-processor

NPV –Net Present Value

ROI – Return on Investment

SQL –Structural Query Language

DCC - Drugs Control Council

ZRDCL - Zimbabwe Regional Drug Control Laboratory

MASCA -Medicines and Allied Substances Control Amendment Act

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CHAPTER ONE: INTRODUCTION

1.1 Introduction

The chapter focused more on the history of how Medicines Control Authority of Zimbabwe operates and difficulties they being faced by looking in detail as well as the hypothesis to whether they may consider building a new system either in-house or outsource.

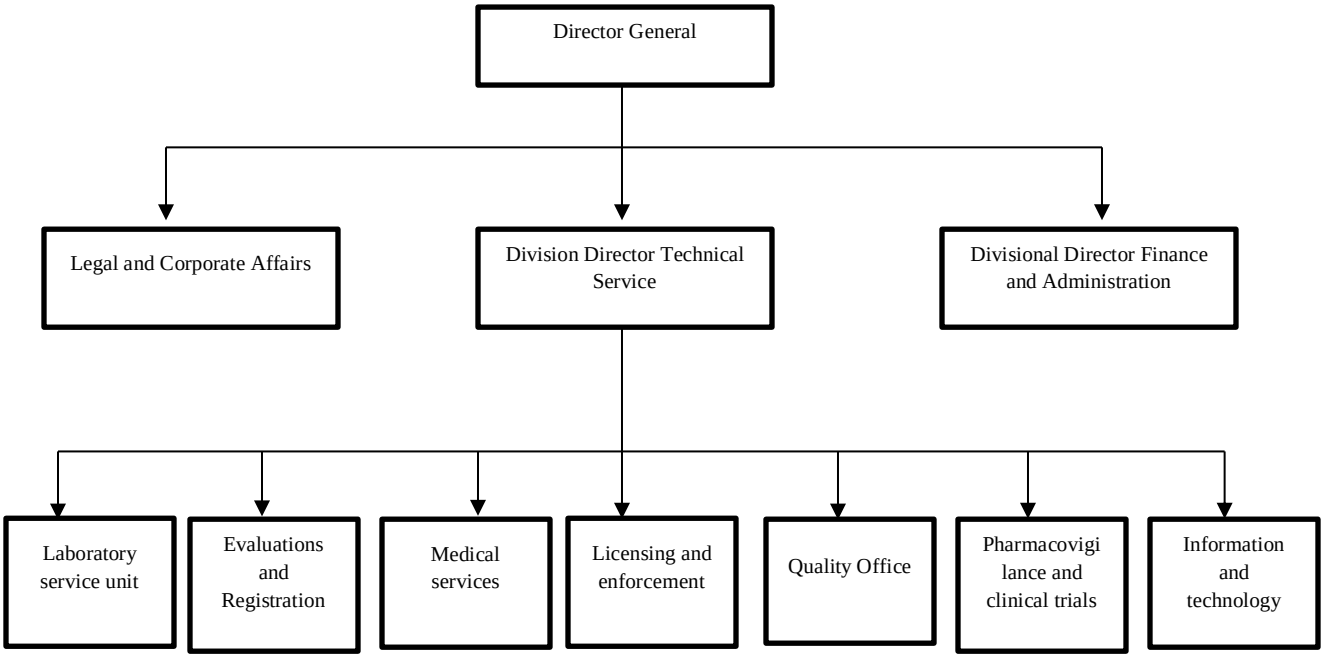
1.2 The Medicines Control Authority of Zimbabwe (MCAZ)

Year 1997 Medicines Control Authority of Zimbabwe (MCAZ), began to operate, after succeeding the authorities named Drugs Control Council (DCC) together with Zimbabwe Regional Drug Control Laboratory (ZRDCL). The body was formed by Medicines and Allied Substances Control Amendment Act (MASCA) of (No. 1 of 2006) that is [Chapter 15:03] with the aim to make the authority function as a business entity that can sustain financially and also be able to fulfill a statutory role. The responsibility of MCAZ is protecting health of the public in ensuring medical devices and medicines that are on the market are effective, are of good quality and above all safe. It can be attained by:

- All medicines to be tested and controlled
- There should be a Dangerous Drugs Act that can be effected representing Ministry of Health and Child Welfare
- Manufacturing, storage and distribution of medicines has to be controlled
- All medicines and allied substances should be evaluated then registered.

The Minister who oversee health must appoint authority members who work as committees are to serve for periods of up to five years which can be renewed when and if possible.The organization however, distributes its functions through the committees who have authority to make decisions and those decisions are verified by the organisation during meetings that are held on a quarterly basis. A member of MCAZ chairs the committee other members in the organisation are informed of roles each committee has to perform by reading of minutes. There are eight committees within the authority, which are: Executive, Licensing and Advertising, Finance, Registration, Legal, Adverse Drug Reactions and Medicines Review, Veterinary and Laboratory. Committee members are selected by the Authority on the basis of their expertise. MCAZ is located at 106 Baines Avenue in Harare. (mcaz.co.zw)

1.2.2 Organizational Structure



(mcaz.co.zw)

Fig 1 MCAZ Organizational Structure

1.2.3 Vision

Our vision is protecting people's right to quality medicines and medical devices. (mcaz.co.zw)

1.2.4 Mission Statement

Our mission is to be an effective medicines regulator in Zimbabwe. The mission being to protect public and animal health by ensuring that accessible medicines, allied substances and medical devices are safe, effective and of good quality through enforcement of adherence to standards by manufacturers and distributors. (mcaz.co.zw)

1.3 Problem Definition

Zimbabwe is experiencing a high volume of drugs that are circulating in different health facilities and pharmacies. However, in efforts to increase patients' health and cost effectiveness the writer has resolved to develop a mobile drug authentication system for Medicines Control Authority of Zimbabwe (MCAZ) that detects if a particular drug is original or fake. The drug verification and

authentication is carried out using mobile phones. Anyone can send a text message with the barcode of the drug that they suspect to be fake to dedicated number. Then the system at MCAZ to check if the drug is a fake or original drug using the system. This service is open to all mobile phone users, after a few minutes the user will receive a sms, stating genuineness of drug.

In general, manufacturers neglect good manufacturing practices either accidentally or deliberately, this drives the circulation of fake drugs. The products which fail to meet the requirements set by the regulatory authority like MCAZ or the manufacturer's dossier is deemed to be a fake drug for example drug that is made in a way that it does not dissolve properly or that is of incorrect hardness or concentration of a solution, usually has improper doses.

However MCAZ has been making alerts of counterfeit drugs through their website for example there is an alert of counterfeit ESB3 drug that is in the market and Dextropropoxyphene drug that has been withdrawn from Zimbabwe these have been placed on their website but the problem now is not all people have mobile phones that can access internet hence buy the use of this system it enables all mobile users even those that cannot access the internet to be well informed by the use of sending a SMS.

1.4 Aim

Aim was developing a system that sustains operation activities of drugs being manufactured and for customers to make use of sms platform to check for originality of drugs.

1.5 Objectives of the System

i. To develop an online system that gives pharmacies or patients an opportunity to verify if the drug they have bought is genuine and registered with Medicines Control Authority of Zimbabwe, this helps to flush out fake drugs that are being sold.

ii. To develop an online system that captures information of all drug manufacturers or pharmacies in the country.

iii. To develop an online system that allows manufacturers or suppliers send their drugs to Medicines Control Authority of Zimbabwe using their batch numbers and the system generates a barcode of those drugs that Medicines Control Authority of Zimbabwe test and approve.

iv. To develop an online system that gives a platform to top management make decisions or take measures of fake drugs that can be in circulation by the use of statistics reports generated by the system.

v. To develop an online system that allows pharmacies to view all approved manufacturers or suppliers of drugs this helps them to see the manufacturing and expiry dates of drugs

1.6 Hypothesis

Dreamweaver	This is a simple Rapid Application Development method which produces high quality Graphical User Interface
MySQL Database	A fast, easy to use open source database
Ozeki	A powerful sms platform linking to the database
PHP	A language designed for use on web development
Apache	A tool for the development of a web and for communicating with the database

Table 1 Hypothesis

1.7 Justification of the proposed System

Development of this system came after the realization that there are fake drugs that have become in circulation for example currently MCAZ made an alert of a counterfeit ESB3 drug that is on the market. Hence the system will help members of the public to find out if the drug they buy is not fake and if they find it fake they notify MCAZ so that they take action and by so doing this can save many people's lives.

Limitations

However there were constraints that were encountered during the development, implementation, operation and maintenance of the system these are:

- Printed labels can be peeled off from genuine products and be applied to fake drugs
- Counterfeiters can fake the code or sms response
- People can hack the database

1.8 Conclusion

In summary the chapter emphasis was mainly on the problem that was identified by organisation about circulation of fake drugs in the country and stating main objectives as reasons to develop a new system. These included limitations, the tools that can be used in undertaking the project and the structure of the organisation which helps to allocate roles a department or each person can play in achieving the aim of the project.

CHAPTER TWO: PLANNING PHASE

2.1 Introduction

The chapter main focus was to execute an investigation of business value with regard to the system under study, evaluating the alternatives and its functionality. However, there were analyses that were considered in the scheme of developing the new system.

2.2 Reasons for developing the system

In order to try flush out fake drugs that circulates in the country the reason was to design this system to help know and make decisions on measures that can be taken by simply sending a barcode of a drug to a dedicated number in which a response was given back stating the originality of the drug.

2.3 Business Value of the system

According to (techwell.com) it is the measuring of project success, that is comparing cost, time, and scope projections looking at how much value the project is going to deliver but the problem that remains is determining what value really is and how to measure it. However, business value refers to a level of quality that can be calculated to determine organisation estimation. The definition of business value institutes a degree of usefulness that can be used to regulate how worth is the business. (businessdictionary.com)

In marketing business value means a degree in which a product is appreciated by a customer fulfilling their necessity or requirements, determined by the customer's desire to pay for it.

2.4 Analysis Feasibility

According to (investopedia.com) feasibility study is used for assessing the use, practical and momentary advantages the system is to undertake. Hence feasibility study aim was to be a preparatory assessment to all information of the proposed project in order to discover the worthiness the project has before beginning the analysis phase. In order to make decision below data was used:

- Should the project start?
- If the end product going to satisfy end users and organization
- By taking into account the systems analyst view, this phase is the key instrument that recommends if it is worth begin the following stage else to cancel the project. Analysis is the capacity to accomplish the project well. Instead of getting into a

project with a hope having best results, this phase enables managers to explore possible negatives or positive end result of a project prior to spend too much time and money.

2.4.1 Technical Feasibility

This phase evaluate characteristics of how to supply a product for example, inputs, capital, technology needed, etc. (freetutes.com)

This was evaluated as a managerial plan stating the operation of a business in terms of production, delivery, storage of its goods. We can say in other words this method tracked how products move from the business until it reaches the target market.

Technical Expertise

MCAZ has an Information Technology department ensured that there was smooth running of the authority's information technology systems and implementing of current global IT developments. The MCAZ three laboratories covers Chemistry, Microbiology and Medical Devices. The role of these laboratories was to analyses and assesses the quality and efficiency of all medicines that are distributed on the Zimbabwean market. These laboratories were in need of new equipment in order to replace antiquated equipment and to keep pace with technological developments.

Hardware Requirements:

The below hardware specifications are recommended

ITEMS	NUMBER OF ITEMS
Computer Server	1
Desktop Computer	3
Antivirus	2
Switch	1
Printers	3

Table 2 Hardware Requirements

Database Server Requirements

UPS	
Hard Disk Drive	500GB
Processor	3.0GHz
Memory (RAM)	4GB
CD Rom Drive	52X
Network Card	10/100mb per sec

Table 3 Database Server Requirements

Workstation Requirements

COMPONENT	**SIZE**
Processor	3.0GHz
Hard Disk drive	1TB
Memory (Ram)	8GB
Connecting cables	UTP CAT 6
Network cards	10/100mb per sec
Switch	16 Port

Table 4 Workstation Requirements

Software Requirements

Microsoft Windows 7
Mozilla Firefox
Macromedia Dreamweaver

Table 5 Software Requirements

2.4.2 Economic Feasibility

Economic feasibility refers to if the system it to be built is it going to provide business value (Kendall and Kendall, 2002). In order to make an assessment on the effectiveness of the system that was developed this method proved to be the best. In economic feasibility expected from a proposed system then make comparison with costs. However, considerations were made that if

the benefits were more than costs; a decision was prepared for example developing the project. The following are questions that were used to help in this feasibility study these are:

- How effective the system could be in terms of costs?
- Are there more advantages than amounts needed to develop the system?
- What could be the cost of doing full system study
- Estimated amount required to purchase hardware and develop software

A business evaluated the cost of investing in the project before carrying out the entire system study.

Costs

These were grouped into two categories which are developmental cost and operational cost.

Developmental costs

This is the work taken into consideration when developing a new or existing product, (Wood and Sangster, 2005). The process was done before commencement of any operation. In short this was the amount of expenses that were used from the beginning of a project until it reached implementation.

Year	**2014**
Development cost	($)
Software Specifications	500
Hardware Specifications	2900
Training	500
Travelling	200
Labor	1200
Stationary	50
Work station specification	300
Photocopying and printing	20
Consumables	50
Total Development Costs	**5720**

Table 6 Developmental cost

Operational costs

(accountingtools.com) defines operating costs as a combination of job costing and estimation process. These were predictable expenses of successively managed business though they differ upon kind of trade. Various forms of operational costs were that of a business duty thinks through when budgeting. Roughly these operational costs were immovable, implying that individual cost was equal from month to month, such as rent. However, further operational costs were adjustable and could go up or down each month, such as utilities.

Year	**2014**	**2015**	**2016**	**Total**
Operational costs	($)	($)	($)	($)
Software Maintenance	400	600	700	**1700**
Hardware Maintenance	350	450	500	**1300**
Stationary	30	40	50	**120**
Total Operational costs	**780**	**1090**	**1250**	**2120**

Table 7 Operational cost

Benefits

Tangible Benefits

These kinds of benefits were considered as measurable. Hence the benefits were:

- The system was going to detect fake drugs that could be circulation
- The system however was going to assist the authority to fight crime by taking measures to avoid selling of fake drugs to patients
- The system was to be used by any person that has a mobile phone by the use of sending a sms to a dedicated number for verification
- The system gave patients information of any drug they buy after getting a response determining the originality of drugs

Year	2014	2015	2016	Total
Tangible Benefits	($)	($)	($)	($)
Reduction in stationary costs	600	850	900	**2350**
Reduction in manual labour costs	900	1400	1700	**4000**
Improved service	1200	1650	1900	**4750**
Total Benefits	**2700**	**3900**	**5700**	**11100**

Table 8 Tangible Benefits

Intangible Benefits

These were considered as benefits which were not measured easily with regard to monetary value.

- The system gave reports of drugs, manufactures and retailers of drugs
- The system improved decision making of management as they will be aware of what percentage of fake drugs that are in circulation hence will raise awareness to patients
- There was better customer service
- The system improved the performances of business operations

Year	2014	2015	2016	Total
Intangible Benefits	($)	($)	($)	($)
Goodwill	500	800	1100	**2400**
Shorter Service Time	200	500	800	**1500**
Moral Boost	300	600	800	**1700**
Total Intangible Benefits	**1000**	**1900**	**2700**	**5600**

Table 9 Intangible Benefits

Cost Benefit Analysis

It evaluated and gave a total corresponding value of remunerations and expenses of projects so to decide if it was meaningful to the business. Encyclopedia notes that a cost benefit analysis finds, quantifies, and adds all the positive factors. These are the benefits. Then it identifies, quantifies, and subtracts all the negatives, the costs. The difference between the two indicates whether the planned action was advisable.

Advantages of Cost Benefit Analysis

- The advantage was that many different outcomes were compared as long as the outcomes measures were valued in monetary units.

Disadvantages of Cost Benefit Analysis

- The disadvantage was that placing economic values on medical outcomes was not an easy task and there was no universal agreement on one standard method for accomplishing that.

Year	**2014**	**2015**	**2016**	**Total**
Total Tangible Benefits	2700	3900	4500	**11100**
Total Intangible Benefits	1000	1900	2700	**5600**
Total	**3700**	**5800**	**6200**	**16700**
Less costs:				
Development cost	5720	-	-	**5720**
Total operational costs	780	1090	1250	**3120**
Total	**6500**	**1090**	**1250**	**8840**
Net Benefits	**(2800)**	**4710**	**4950**	**2260**

Table 10 Cost Benefit Analysis

Return on Investment

This method seeks to express the average estimated yearly net inflows as a percentage of the net investment outlays. (Glautier and Underdown, 2001).

ROI = (Total Benefit – net benefit)/total cost *100%

(16700 – 8840)/8840 *100%

88.914

Advantages of Return on Investment

- It located weakness of a business
- It was a simple method

Disadvantages of Return on Investment

- It required a long period of time
- It only directed to a certain project not the whole company as a whole
- Discouraged managers to invest in projects

Payback Period

A project's payback period is time frame taken by a project outcome repaying its initial capital investment. Projects that have short payback periods are attractive propositions and are often chosen in preference to those with longer payback periods. (Baguley, 2008)

Advantages of Payback Period

- Simple and was easy-to-use method
- It was appropriate for low-cost projects

Disadvantages of Payback Period

- Could not be used on high-cost or long time span projects as it was assumed that cash flows after payback period were of no interest or that money did not changed in value as time passed
- Payback ignored time value of money
- Also did not take into consideration the cash flows that were behind payback period this resulted in ignoring profitability of a project

Year	Cash flow($)	Balance ($)
0	(5720)	(5720)
1	1920	(3900)
2	2810	(1090)
3	3250	2160

Table 11 Payback Period

1090/3250 * 12 = 4.02

2years 4 months

Net Present Value

This is the difference between the amounts invested and present value of future cash flows, (Sangster, 2004)

Advantages of Net Present Value

- The discounting rate that was used changed as the risk and conditions in financial markets changed
- Unlike using payback period technique or average return on investment the NPV correctly took into account the value of future earnings by calculating present values.

Disadvantages of Net Present Value

- The rate of discount that was used was critical in achieving what was and what was not profitable hence the higher the discount rate the fewer investment projects were likely to be profitable.
- When calculating, the discounted cash flow was the most complex of all other methods. This was not done easily as the other two methods; as such was rarely used by small businesses.

Year	Cash flow ($)	Discount Factor	Net Present Value ($)
0	(5720.000)	1.000	(5720.000)
1	1920.000	0.909	1745.280
2	2810.000	0.826	2321.060
3	3250.000	0.751	2440.750
Total NPV			**1408.91**

Table 12 Net Present Value

NPV = 1409/ (1+10%) ^3

1409/ (1.10) ^3

1409/1.331

$1058.602

$1059

Comment on NPV

The above investment project was viable since the present value of the net cash flow was ($1059) this can made the project to proceed.

2.4.3 Social Responsibility

The system as in the information technology was dependable in business distribution which was an environment that transformed quickly involving users and operations. Hence the new system brought plenty of advantages to the members of the community such as customers that had mobile phones as they could facilitate quality and efficient way of authenticating drugs.

Management: The system ensured that reports that were required by managers to make effective decisions to be shown. This enhanced manager's work as it was improved.

Information System Administrators: MCAZ had the support from trained database administrator within the organization. Database administrator dealt with problems arose concerning the database this meant the proposed system executed efficiently.

2.4.4 Operational Feasibility

This study was an instrument that evaluated the reduction of problems with regard to circulation of fake drugs taking an upper hand to chances recognized in the problem definition and the way the system will fulfill the specifications. In this phase it reviewed the willingness of the business in assisting the proposed system. This assisted in answering questions below:

- If the system to be developed, is going to be used?
- What are government regulations
- Does management support the project?
- Has the input of end users involved.
- Response of users towards the system to be developed

2.4.5 Risk Analysis

The risks are part of every project hence risk analysis was carried out in order to identify and analysis risks that were associated with the project. Risk was a threat and had drawbacks to the success of the project.

Stakeholder's Risks:

Management

The top management such as the board of directors was responsible for allocation of resources of the project. Therefore all stakeholders had to view the project objectively.

Users

Users major risk was resistance to change therefore it was very important to effectively communicate so as to restrict or reduce this risk.

Technical risks

The strategy to be put in place for this risk would be using the parallel changeover to carter for the risk of the system not meeting its objectives.

Economic risks

Due to the commitment that the management had given however the project was economically safe in terms of resources provision. All resources were available and fully functional.

2.5 Developing a work plan

Developing a work plan assisted in having a project scheduled to time, this helped reduce errors as steps of the development were followed accordingly. However the proposed project started from the 13 of August 2104 to 17 of October 2104. These helped to record and track all the tasks that were used in designing of the system. The development of the project used System Development Life Cycle (SDLC) so as to model the activities involved. Below were the expected time allocations of the project.

2.6 Work Plan

Project work plan served as a tool that helped in making plans, manage implementation of a project. This gave a time frame of phases that was taken in developing the project in this instance the project planning started on the 20th of August.

Project Schedule

Phase	Start	End	Duration (Days)
Proposal	13/08/2014	20/08/2014	7
Planning	20/08/2014	29/08/2014	9
Analysis	29/08/2014	10/09/2014	12
Design	10/09/2014	26/09/2014	16
Implementation	26/09/2014	15/10/2014	19
Maintenance	15/10/2014	24/10/2014	9
Documentation	13/08/2014	24/10/2014	72

Table 13 Project Schedule

Gantt chart

This is a type of scheduling chart named after Henry Gantt each phase shows the start to finish of a project, (Thomsett, 2009)

ACTIVITY	WK 1	WK 2	WK 3	WK 4	WK 5	WK 6	WK 7	WK 8	WK 9
Project proposal	■								
Planning		■							
Analysis			■	■					
Design					■	■			
Implementation							■	■	
Maintenance									■
Documentation	■	■	■	■	■	■	■	■	■

Fig 2 Gantt Chart

Key

■ One week

(gantt.inc)

2.7 Conclusion

In a nutshell we can conclude by saying the chapter assisted in outlining the activities that were taken into consideration in evaluating whether the outcome of implementing the project could be achieved and if this would benefit the organisation in return over a period of time. With the use of different feasibilities such as analysis feasibility assisted the organisation to decide whether it was necessary to start the project.

CHAPTER THREE: ANALYSIS PHASE

3.1 Introduction

This phase responded the question "What the system is going to do?" which meant it contained all specifications that the system tries to meet. In this stage it assisted in developing a system which works on limitations of current system. However basis of this study relied on specification records and specification collection of information which was a method that was repeated.

3.2 Information gathering methodologies

The main purpose of collecting data was to regulate the data requirements of an organization. To make resolutions of the system specifications information was gathered especially from the customer. This assisted in having a well-defined, complete and an accurate detail of how a business functions and the people involved. The problem though was usually information was omitted or misinterpreted in the whole process. However there were many methods that were used when gathering information depending on the type of information to be obtained as well individuals providing such information these included:

Interviews

An interview is a help gather vital facts about existing problems, such as a lack of quality control or insufficient security, and they also allow the analyst to involve people in possible changes, (Edwards, 1993). Interviews were done in three days and the people that were the staff of the organisation. Reasons why these people were interviewed was because from the management they offer support in term of financial support, administrators are responsible for the administration of the system such as the database and staff are the people who would use the system in terms of updating data. A face to face interview was done to management and administrators based on finding information of how they were making decisions using the current system whenever they come across about a fake drug being in circulation and mainly their financial support to the system. The staff interviews were done so as to collect their views on the functionality current system and how they felt it could be improved.

A total of ten questions were asked to each person this was done so as to acquire their awareness on fake drugs. The interviews were conducted at MCAZ boardroom on the 5th of September between 1400 and 1600hours. The reason for conducting interviews at MCAZ were because the

people who were interviewed where from within the organisation hence, finding a different venue would mean extra cost and use more time.

From the objective that is to develop a system that gives a platform to top management make decisions or take measures of fake drugs that can be in circulation by the use of reports generated by the system the researcher wanted to find information on how management and staff come up with reports of fake drugs which are in circulation if they are using the current system of using websites.

Conclusions from Interviews

- There was full support in the development of the new system from the management.
- Existing system was not giving information to everyone as there were people who did not had access to websites.
- This method allowed direct communication with the people who used the current system, thus helped the designer understood the problems associated with the current system.

Questionnaires

(ask.com) defines questionnaires as a research instrument that contains a variety or series of questions that are used for the purpose of collecting information. They may either be closed or open ended. This method was very useful in collection of statistical information.

Questionnaires were given to system users and organisation clients of the system so that they gave their input and views with regard to the current system and fake drugs that were circulating. This was done in Harare in different places such as Kuwadzana, Mufakose, Mbare, Chitungwiza and Hwedza mainly because there was higher population in such areas. The questionnaires were about ten questions which were divided in two that was five questions were directed to the system users and the other five were asked to the clients based on what they felt about the new system that was to be designed, whether it was going to be helpful to the community. This was done in a way that papers with questions and were distributed to people. Since this method provided anonymous it gave a platform for respondents to express their views openly.

The researcher mainly focused on the objective to develop a system that gives patients an opportunity to verify if the drug they have bought is genuine and registered with Medicines Control Authority of Zimbabwe, so to help flush out fake drugs that are being sold this helped in

finding information from the user about the system functionality and if this new system could be useful to them and if they would use it if it was to be implemented.

Conclusions from Questionnaires

- Current system was not effective in achieving all the requirements hence there was support in developing the new system from end users
- Allowed anonymous input giving respondents ability to answer freely

Observations

(cdc.gov) noted that observation is an approach of compiling data by viewing performance, events or noticing physical features in their original setting. This method was used so to compile information by viewing the performance of the current system, in order to gather data that was accurate about how a program runs especially the processes and using this technique seemed to be more useful in that regard.

During the research of developing the new system observations were used, and this process was carried three times that was from the 24th to 26th of September and was done after working hours from 7pm to 8.30pm the reason was to view how the existing system was behaving. Since the system was developed at MCAZ so the process took place at the organisation premises. This included documentation of reactions that were caused by fake drugs that people did not know, and some reports that were reported before.

The reason for this was to fully understand the functionality of the current system

Conclusions from Observations

- The strengths of the current system was incorporated into the new system
- There information of fake drugs was not being well communicated as the information did not reached all people especially those that had no access to internet

Document Reviews

To evaluate several present sources (for instance, documents, results, information files or any written data) with a goal of gathering self-sufficiently provable information, (siteresources.worldbank.org).

Document review was done at MCAZ on the 12th and 19th of September only twice. The permission was granted by the clerical staff so that the researcher had an opportunity to go through the documents of previously used projects these included agreements forms, minutes and memos of meetings that were held by the project team.

From this methodology the researcher was looking for information that was used before such as expense that were used in the development of the existing project.

Conclusions from Document Reviews

- Some of the documents that were used were out dated
- This led in having incomplete data in some areas

3.3 Analysis of existing system

The current system that was being used to make alerts of fake drugs to the members of the community was via the MCAZ website. For example there was a drug by the name Dextropropoxyphene that was withdrawn from use in Zimbabwe mainly because information that was gathered showed that the drug had high chances of causing serious toxicity to human heart. Hence such information can be shown on the website but the problem is some other areas in our country there is a problem of connectivity, also not everyone had a mobile phone that could access internet which meant information reached a few individuals.
This was carried out using the view of:

Input

Existing system worked in an input method that gave output as a result that input information originated from end users that used the system. Once data had been collected from other sources the organization interacted with such sources of data such as patients and pharmacies or doctors

Output

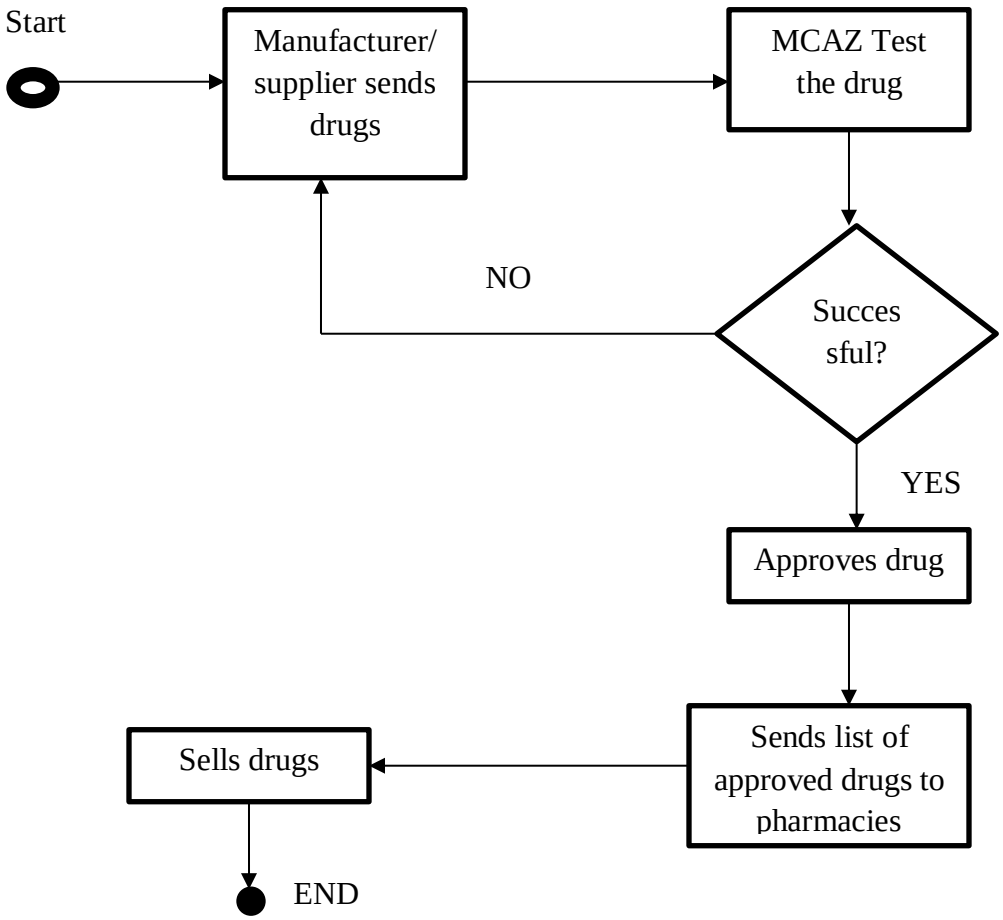
The current system outputs were those of data that was generated on the website.

3.4 Process analysis

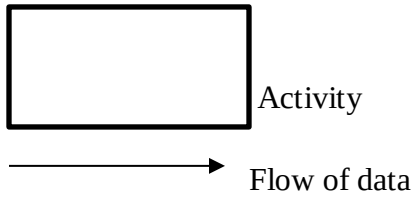
According to (Richard Nordquist, 2007) he refers this process to a method of paragraph or essay development by which a writer explains step by step how something is done or how to do something.

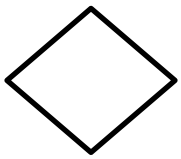
Process analysis script contained multiple methods for instance

- provides data about how something functions (informative)
- Explains something was done (directive).



Key





Decision

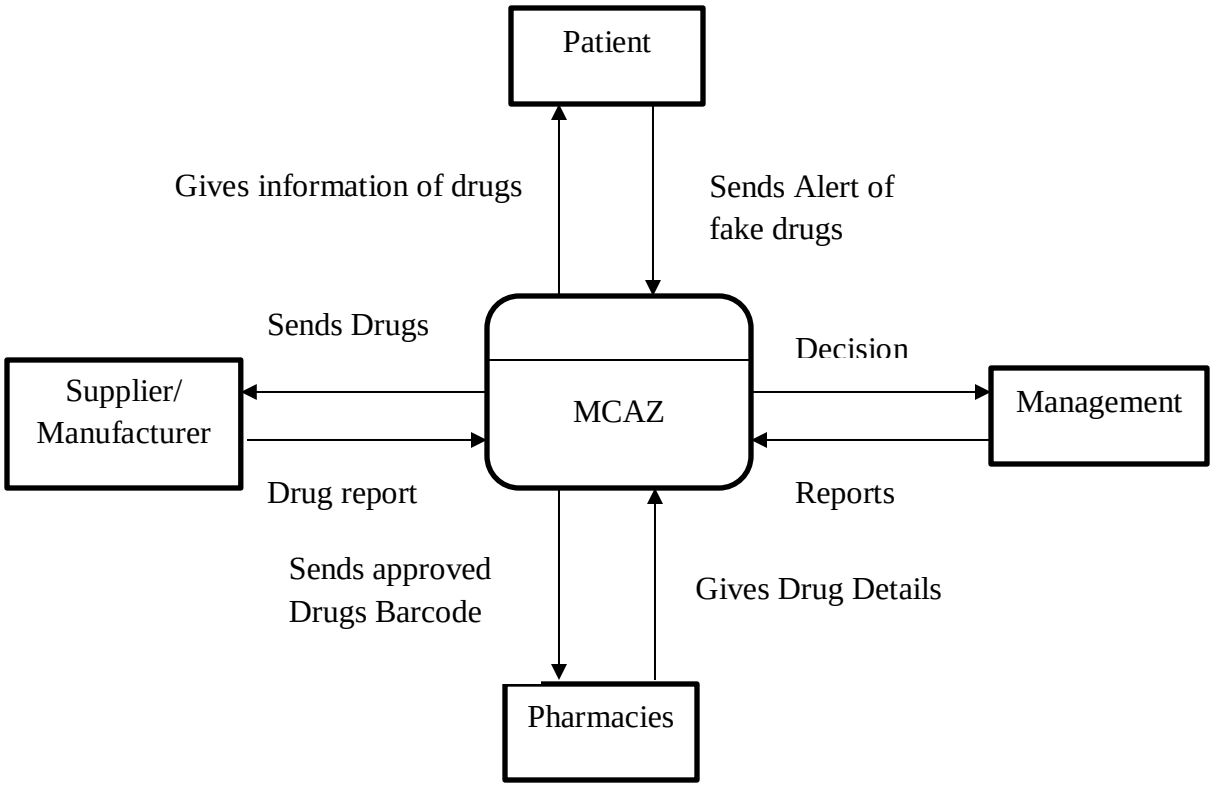
End Node

Start Node

Fig 3 Activity Diagram

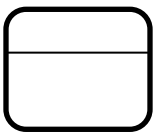
3.5 Data Analysis

A context diagram can be defined as topmost level data flow diagram which can also be referred to as level 0. It only comprises of one process node that simplifies the purpose of the whole system in association to external units, (smartdraw.com). A context diagram exhibited a whole picture of a system to be developed such as, players and in what way the players relate with the system hence showed the summary of the system. Used facts that were gathered these gave a perfect indication of the current system and the diagram below showed how the system worked.



Key

Entity



Process

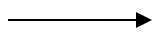
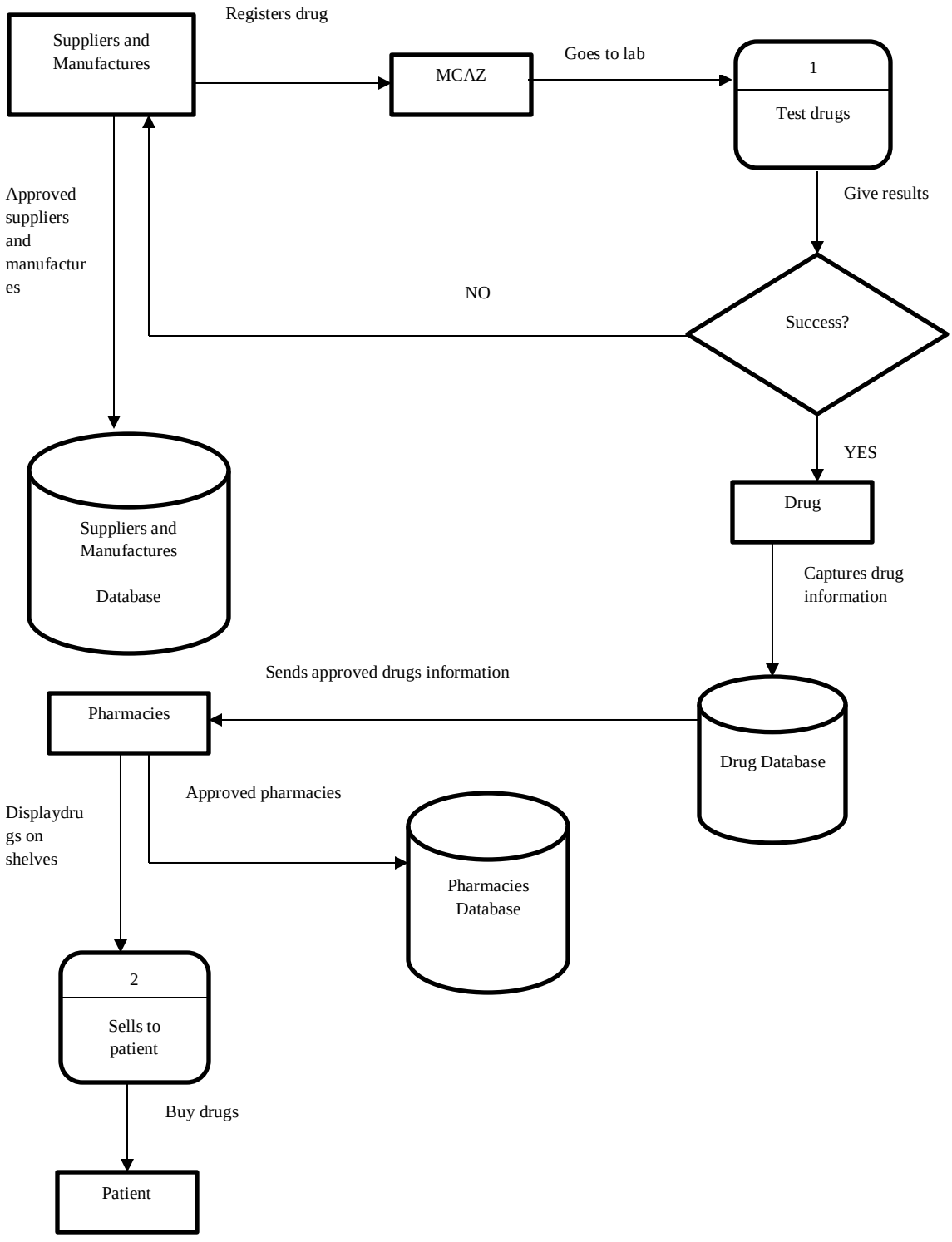


Fig 4 Context Diagram

This is a diagram that focuses on the data flowing into and out of the system and processing of the data. (Kendal, Kendal, 2002). Below was the DFD of the proposed system after had gathered information using interviews and observations.


Suppliers and Manufactures
Registers drug
MCAZ
Goes to lab
1
Test drugs
Give results
Approved suppliers and manufactures
NO
Success?
YES
Suppliers and Manufactures Database
Drug
Captures drug information
Sends approved drugs information
Pharmacies
Drug Database
Approved pharmacies
Displaydrugs on shelves
Pharmacies Database
2
Sells to patient
Buy drugs
Patient

Key

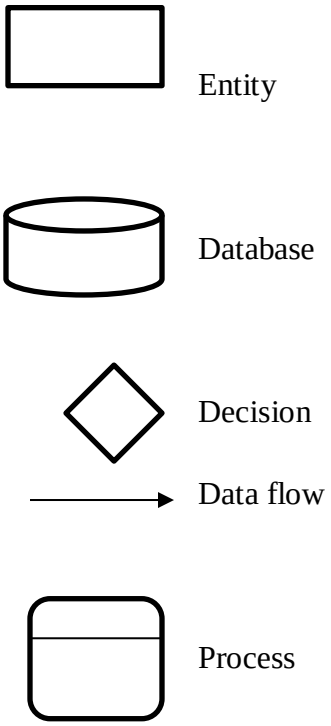


Fig 5 Data Flow Diagram

3.6 Weakness of current system

Main problem with the current system was not everyone accessed the internet to find information about anything to do with the drugs from the website

There was no evidence of previous records as new information about any fake drug or suspended drug was removed from the website to make way of other awareness information

Some areas had a problem of connectivity for example in rural areas hence even if the people who wanted to check the website frequently were not be able to do so

3.7 Evaluation of alternatives

After having gathered the user specifications, the analyst noted that it was of great importance to develop a new system. This will resulted to a conclusion on how the current system could be changed. Hence the designer decided to use the resulting changes of the existing system these were outsourcing, improvement and development.

3.7.1 Outsourcing

This involves the assigning of another company or person to do a certain function (sourcingmag.com). When a business requires services that they do not have in their organization, usually they try outsourcing to resolve their problems. This was the process of contracting an outward company to do the change of the system. Developing the system needed participation of user who controls the system, thus after development has been done software designer will device the system permitting chance to train users so they become aware of how to use the system. After all the necessities which were specified at the beginning of the study also adding those that were polished before its completion then this undertaking was deemed complete.

Advantages of outsourcing

- Concentrated on core process rather than the supporting ones
- Risk was shared
- Reduced operational and recruitment costs

Disadvantages of Outsourcing

- There were hidden cost
- There was risk of exposing confidential data
- Lacked customer focus

3.7.2 Improving the current system

The existing system involved showing of information about medicines through the website. This gave details of all necessary data of a drug if fake or reasons of suspension which gave the users a full understanding of reasons stated. However because of trying to reach a large number of people the existing system cannot be improved as not everyone has access to the website.

3.7.3 Development

The methodical use of scientific and procedural information to meet specific aims or desires, (businessdictionary.com)

Advantages of development

- The documentation was available at the end of development
- Organisation had complete control of resources

- There was boost of knowledge base

Disadvantages of development

- It required a lot of time
- There was a danger if the system did not perform to the expectations these results in the organisation falling behind.

3.8 Requirements Analysis

It involved tasks that determined the needs to meet a new system taking into consideration of possible conflicting requirements of various stakeholders for example users; it could be functional and non-functional. Definition from (Mylopoulos, 2004) says it is a careful assessment of the needs that a system is to fulfill.

3.8.1 Functional Requirements

- The desired functionality of the proposed system was that had to allow the administrator to enter a new drug that had been manufactured into the system
- To authenticate the drugs that users want to check for originality
- Data was secured and backed up every quarter hour.
- System operated 24 hours a day and accessible in real-time.
- Transactions were processed in less than one second.
- System was able to support many users at the same time.

Case

This highlighted the sequence of steps such as the interaction between the user and a complete set of use cases specified different ways of operating the system. The behavior expected of the system was defined without dealing with internal configuration of the system.

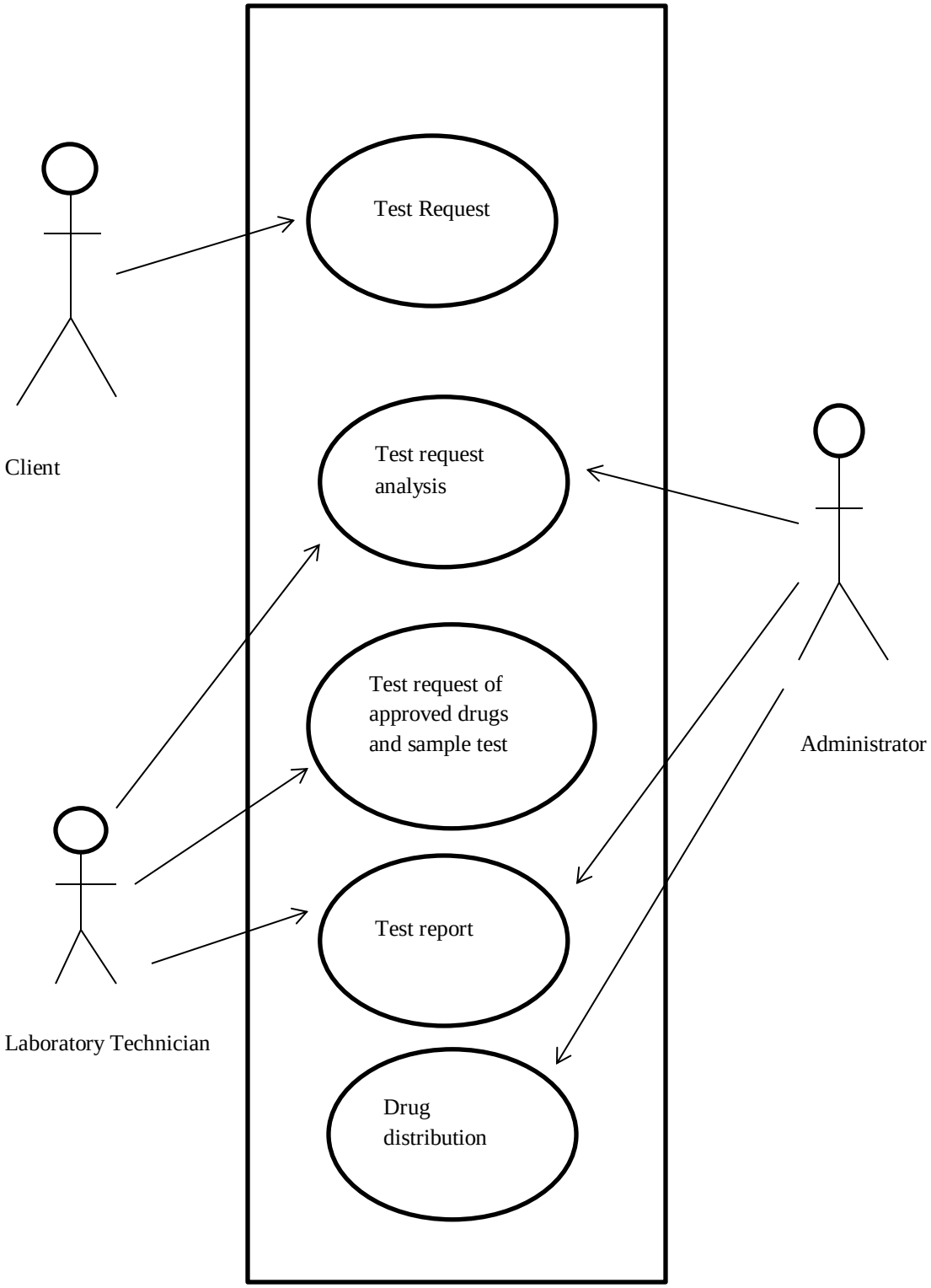
Actors

Client – a regular customer or user of the organisation product or service. He or she can view information that relates to their account.

Database –this was where all the information was stored this includes drug details, supplier or manufactures details and pharmacies details.

Administrator – a person that had total control over the functions, processes and action of the database.

Laboratory Specialist – a person that conducted tests on drugs to find out if they are manufactured according to approved standards.


Test Request
Client
Test request
analysis
Administrator
Test request of
approved drugs
and sample test
Test report
Laboratory Technician
Drug
distribution

Key

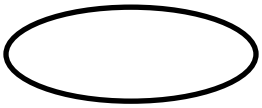
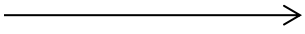
	Actor
	Use Case
	Communicator

Fig 6 Use Case

3.8.2 Non-functional requirements

The system had to allow quick means of sending information for processing. The system had not to be difficult to use such that there were reduction in cost for errors which could be produced. The system accepted submission of drug barcode so that it verified and validated the drug to the user. Only the administrator was guaranteed the authorization rules to delete records in the database. The system was allowed a room for expansion or adds new features in the future.

3.9 Conclusion

After having had used different techniques of information finding, analyzing the current system it gave the analyst an overview of how the system could be designed that is the processes, flow of data to be incorporated into the new system. In summary this meant the system planning phase was well articulated and had been analyzed which gave the confidence to proceed to the next stage design phase.

CHAPTER FOUR: DESIGN PHASE

4.1 Introduction

This part of the chapter outlined the design stages that a project was to undergo for instance; it explored the improvement of the new system by achieving analysis part as well as understanding entirely requirements of new system to be developed. Will look on the real structure on design of current system clarifying in what way the system is to function.

4.2 System Design

The aim of this step was forming procedural clarifications which fulfilled useful necessities to the project. During project lifecycle at that point there was a well-designed description transcribed in a commercial language, comprised a full explanation of the operational needs. This was a more like a preparation of the new system component specification hence constructed various system components. The system purpose and use was to authenticate drugs that were tested and were stored in the database through the use of sms.

Features that were incorporated in the design of the system were as follows:

Maintainability

In the case of developments or making changes the system was easy to maintain. Added features came up resulted in modification of external data; hence it was flexible to these changes.

Effectiveness

In order for the organisation to reduce cost it was easy to operate the system and gave some benefits as a result. However any person who was to operate the system had to be included during the process of making the new system in order to use the system efficiently.

Reliability

This meant the new system to be developed had to remain reliable that is if a sms was sent it had to give the sender a response in a very quick manner and not encounter problems in the process.

Below were the inputs, processes and output that were expected from the proposed system:

Inputs

- Supplier registration details
- Drug registration information
- System users

Process

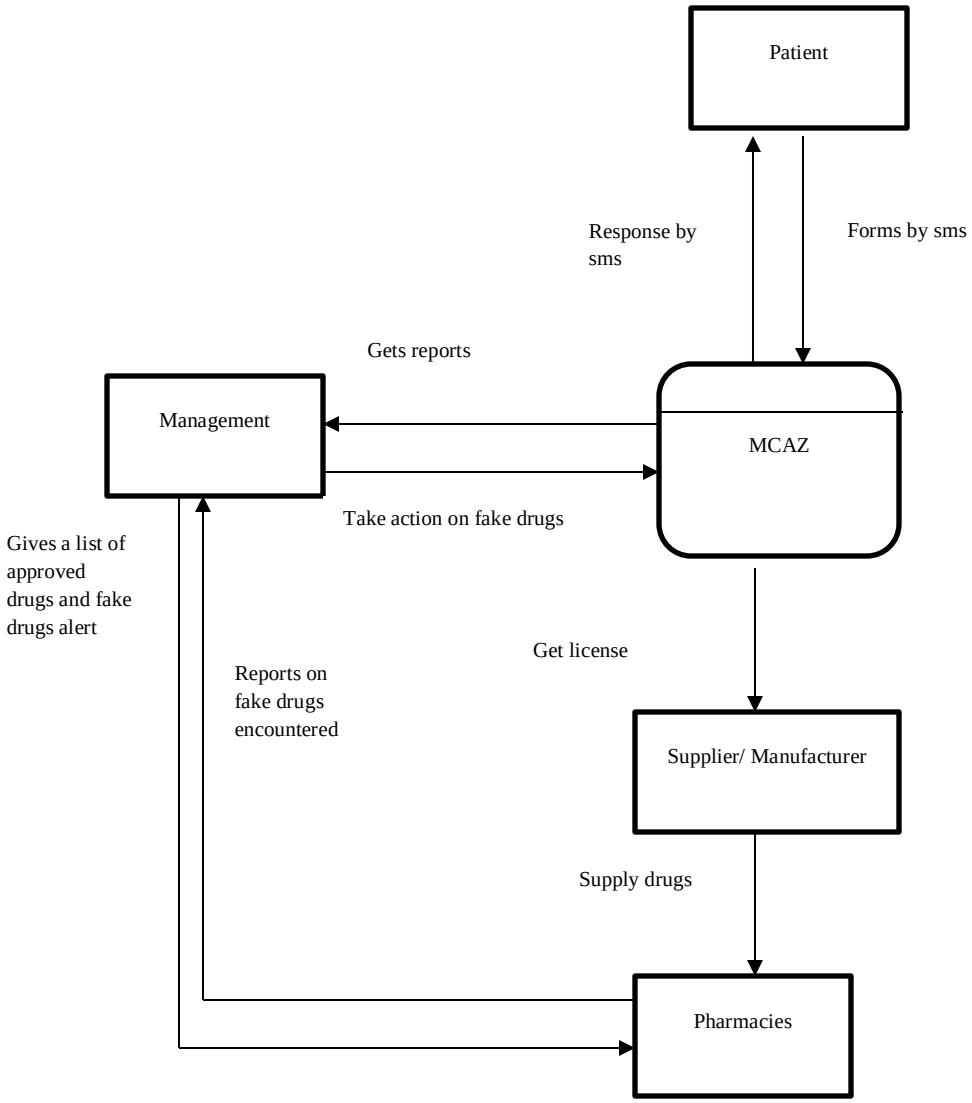
- Validation of tested drugs
- Updating of supplier list
- Updating of drugs

Output

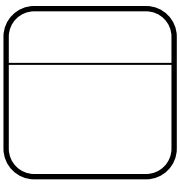
- Statistics of accepted and rejected sms
- Drug report
- Supplier report

4.2.1 Context Diagram

There was a difference in terms of context diagram of current system to that of the new system in the sense that there were additional entities added, this was to ensure that there was smooth flow of processes and was efficient.


Patient
Response by sms
Forms by sms
Gets reports
Management
MCAZ
Take action on fake drugs
Gives a list of approved drugs and fake drugs alert
Get license
Reports on fake drugs encountered
Supplier/ Manufacturer
Supply drugs
Pharmacies

Key



Process

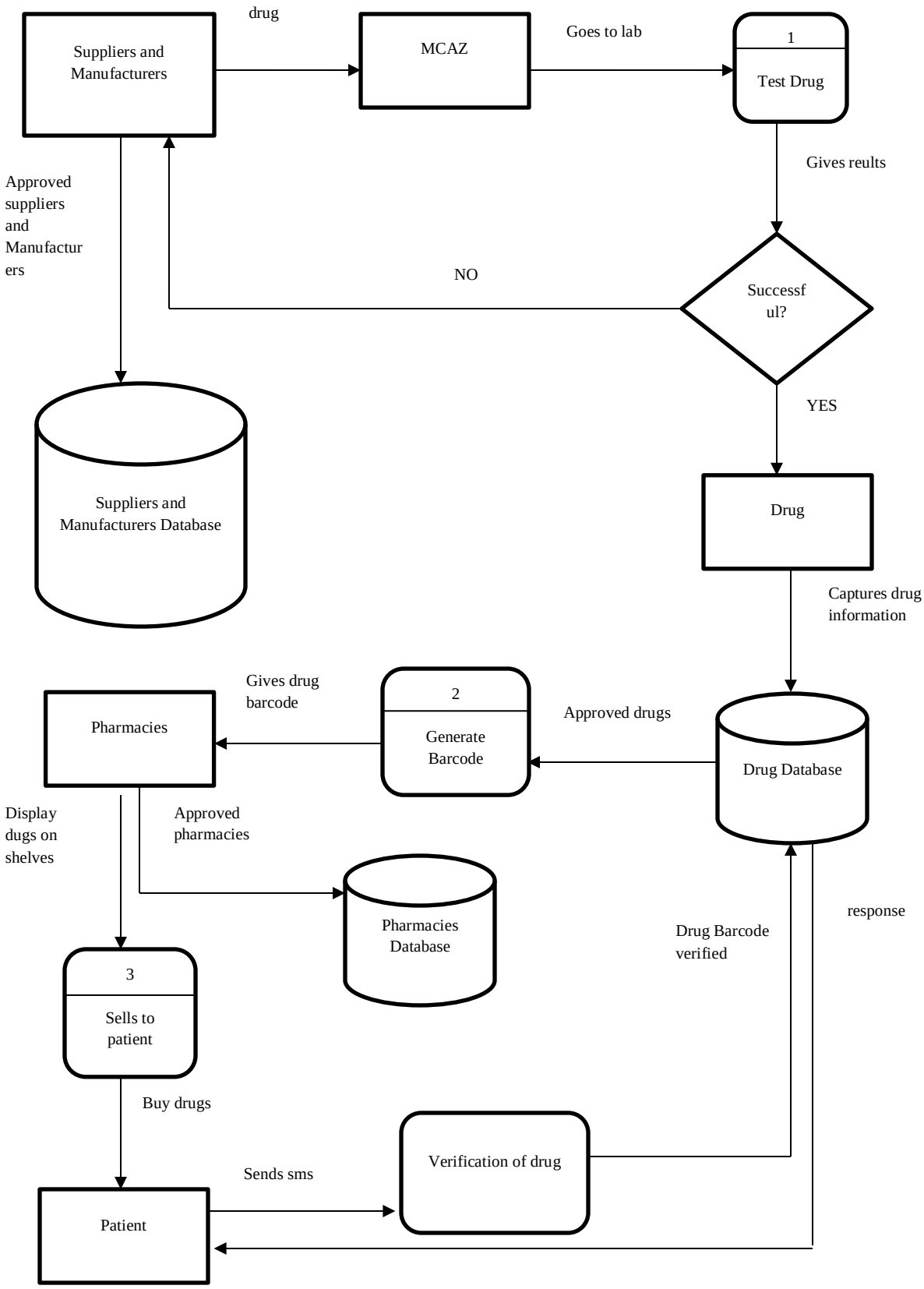
Entity

Data flow

Fig 7 Context Diagram

Data Flow Diagram

System development was easy to understand the flow of data hence this gives an improvement on the system efficiency also reduced data redundancy. Below was a representation of a data flow diagram


drug
Suppliers and Manufacturers
MCAZ
Goes to lab
1
Test Drug
Gives reults
Approved suppliers and Manufacturers
NO
Successful?
YES
Suppliers and Manufacturers Database
Drug
Captures drug information
Gives drug barcode
2
Generate Barcode
Approved drugs
Drug Database
Pharmacies
Display dugs on shelves
Approved pharmacies
Pharmacies Database
response
Drug Barcode verified
3
Sells to patient
Buy drugs
Verification of drug
Sends sms
Patient

Key

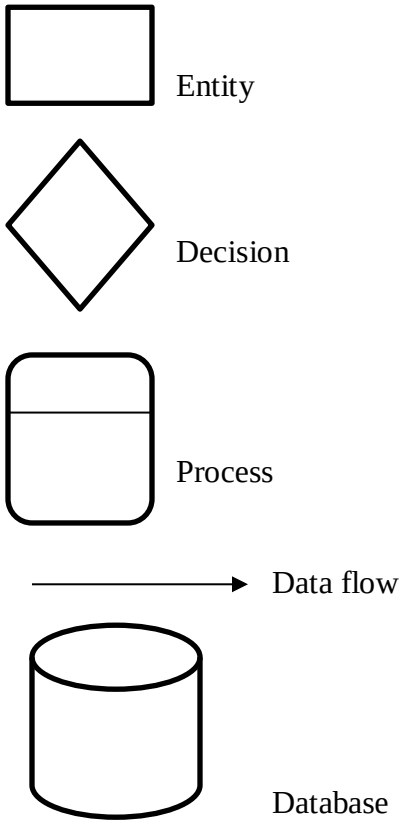


Fig 8 Data flow diagram

4.3 Architectural Design

As noted by (businessdictionary.com) as the concept that focuses on the components or elements of a structure and unifies them into a coherent and functional whole depending on particular method of achieving objectives. This aimed to recognize the system components that were used and included control and flow of data between those components and the functions they were to perform such as input and output of information. These design comprised of

Server – it was to collect and keep all the information that the organisation uses for storage. User requested web pages from the web server using a web browser. Hence the wamp web server searched the web page that had been demanded by the user then communicated with MySQL server. This resulted in bringing out the requested page to the user web browser. Mozilla Firefox was the default browser that was used.

Network cable- they were used to allow communication between Wide Area Network and Local Area Network links

Client Machine - a user machine which was connected to internet or a network and accessed another machine known as server requested different kind of resources in order save information. It was also used to run certain programs or perform certain functions. It is also known as requesting machine reason being it request data from the server.

Printers – printed out reports that were used for decision making by management

4.4 Physical design

In this phase the development team finalized on the technical blueprints for the new system centered on the implementation stage. Some issues that were not yet determined about the platform had to be resolved in this stage. This described the technical environment of the system to be developed that consisted of hardware used and how it was to be structured for example where the hardware was to be located such as servers and how they were to be interacted in a network. The manner in which hardware and software was to act together was very important as the system was incorporated in an infrastructure that was already there. Altogether, the database server was connected to user machines linked by 24 port switch and joined by UTP CAT 6E cables. In order to print out reports a printer was connected to the link.

Physical Design of the system to be developed

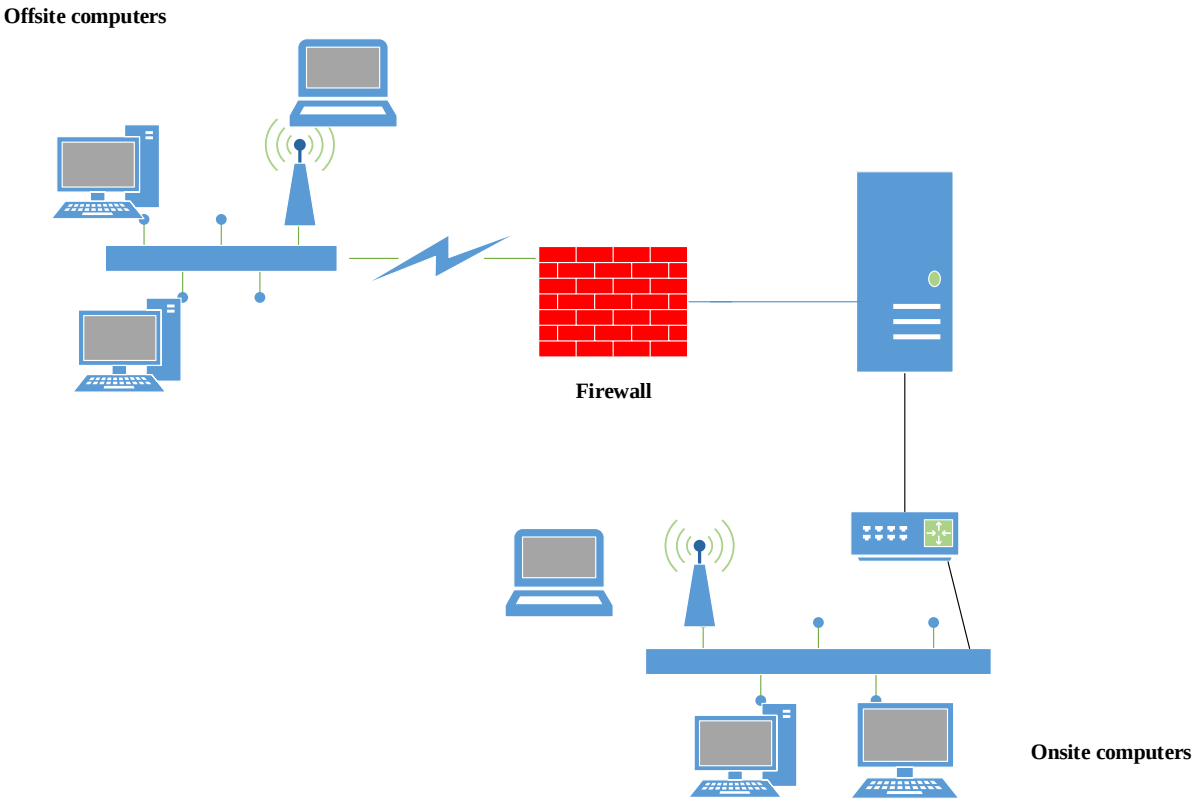


Fig 9 Physical design

4.5 Database Design

This was a technique of creating a complete data model or a whole database system of a database. This involved the logical data model that had all needed designs ranges such as physical and logical.

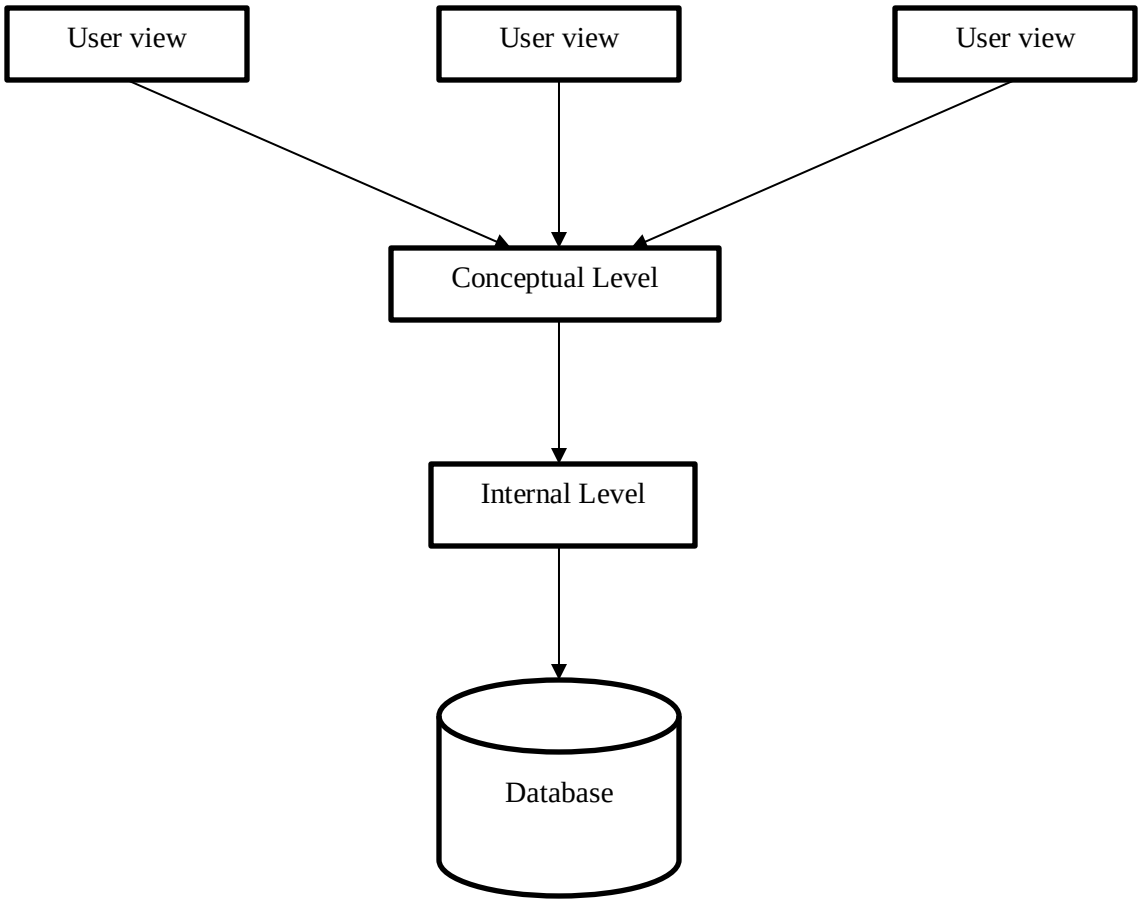


Fig 10 Database design

External Level

A given database generally had many external schemas each corresponded to the way in which a specific application program viewed the database. An external schema corresponded directly to a user view. A user view existed in the form of a chart drawn on paper.

Conceptual Level

Conceptual level described all the different types of data elements that were stored in the database and the relationships among them. All the external schemas were derivable from the conceptual schema. In effect the conceptual schema was a computerized representation of a logical data model.

Internal Level

This defined the actual data that was stored in the database. It was a computerized representation of the physical data structures that were used to implement a conceptual schema. Computerized descriptions of the physical data structures defined the data files that made up the database to both the database software and operating system software. How data was stored was described in this stage.

TABLE SHOWING USER DETAILS

Field Name	Format	Description
Username	Text[15]	Name of user
Userid	Text[15]	Specifies Id of user
Password	Text[10]	Unique user code
IsAdministrator	Yes/No	Ask is its admin or not
Date created	Shortdate	Uniquely creates date
IsActive	Yes/No	Specifies status of member

Table 14 User Details

ER Diagram

According to (webopedia.com) this was a graphical representation of entities and their relationships to each other typically used in computing in regard to the organisation. Entity relationship diagram was important for analyzing and diagramming. Often used for top – down planning of an organization's data requirements. It showed what business entities that were important to the enterprise and what relationship that existed among them.

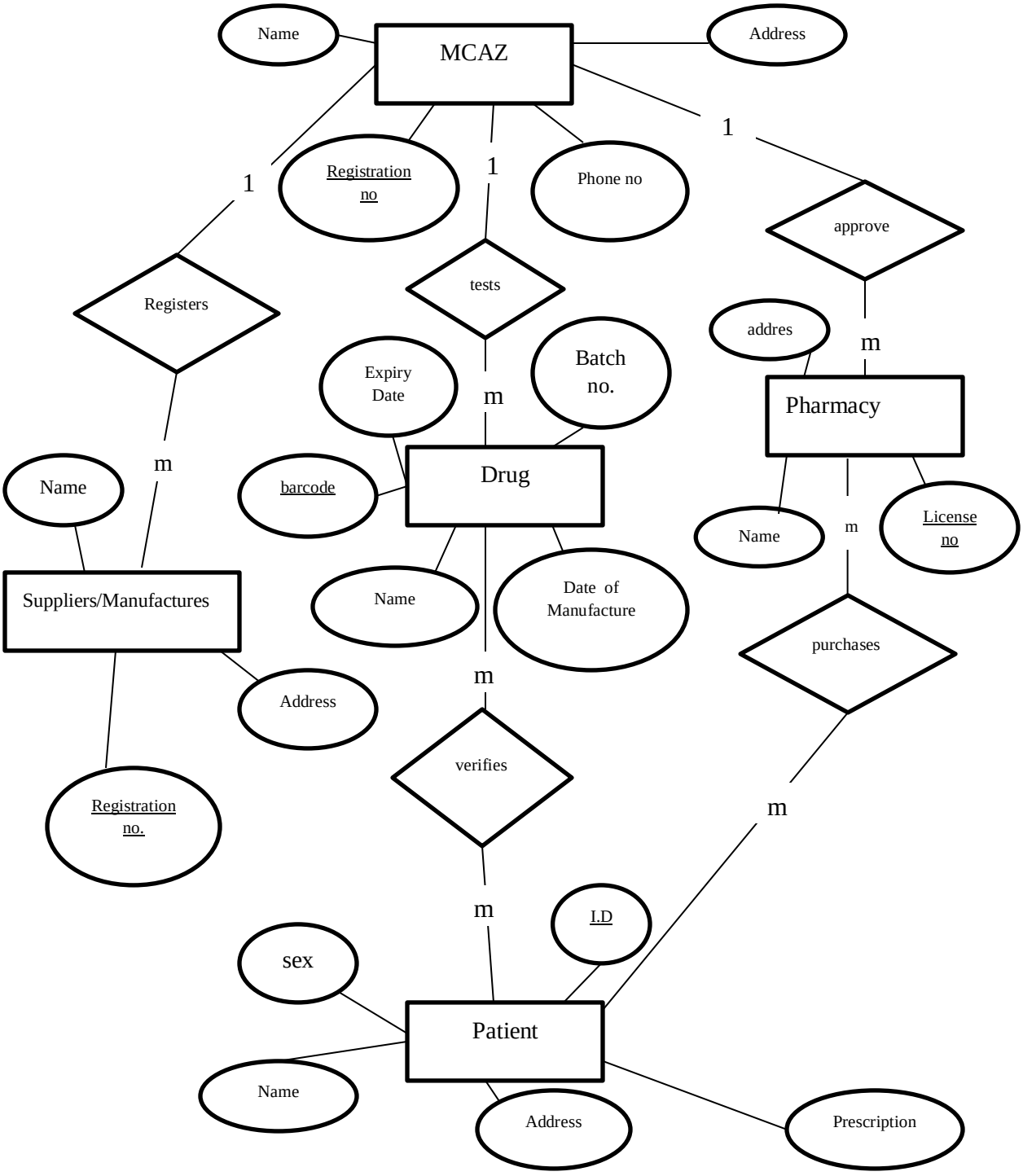


Fig 11 ER diagram

Enhanced Entity Relation Diagram (EERD)

This was a diagram that showed interrelationship between entities showing how they were related to each other.

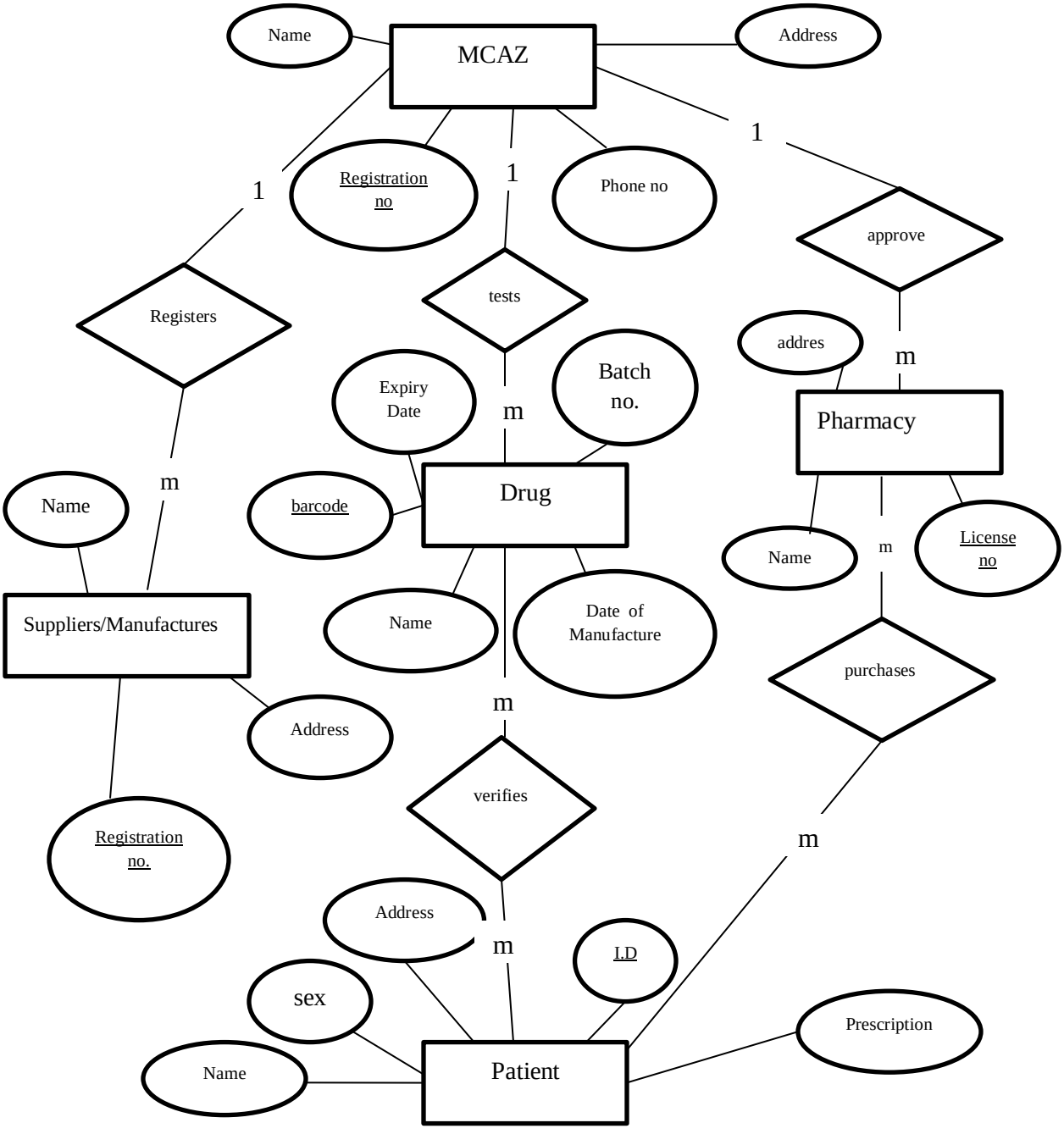


Fig 12 Enhanced Entity relation diagram

4.6 Program design

As noted by (encyclopedia.inc) it was the activity of processing from specification of some required program to a description of the program itself. Utmost this phase models the software life cycle identified program design as one of the phases. The input at this stage was a description of what the program was required to do. Through the process design judgment was prepared as to how the program met the expectations. The output was an explanation of the program in exact form that provided a suitable basis for a subsequent implementation.

4.6.1 Class diagram

It had information such as below:

- Class attributes
- The processes which were included in classes
- System modules

This was used to show the state and system behavior. The class diagram notation was a shape that was divided into three categories that is class, attributes and operations.

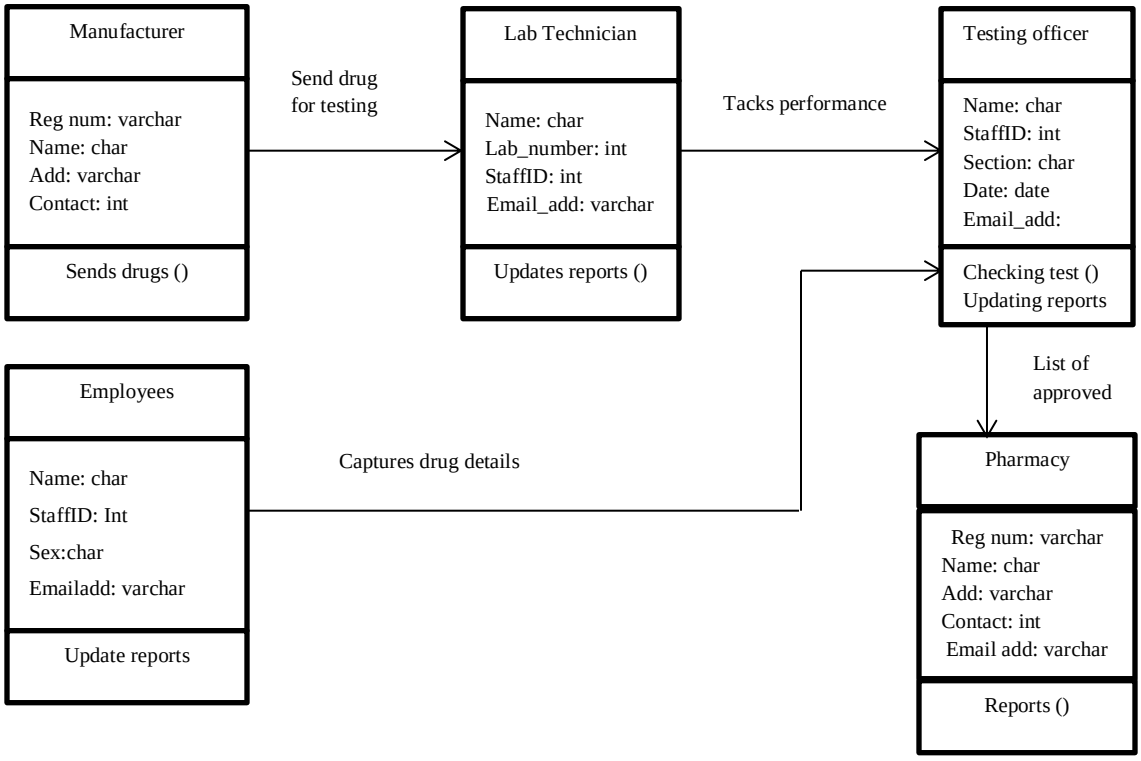


Fig 13 Class Diagram

Package Diagram

(uml-diagrams.org) defines this as UML structure which shows packages and dependencies between the packages.

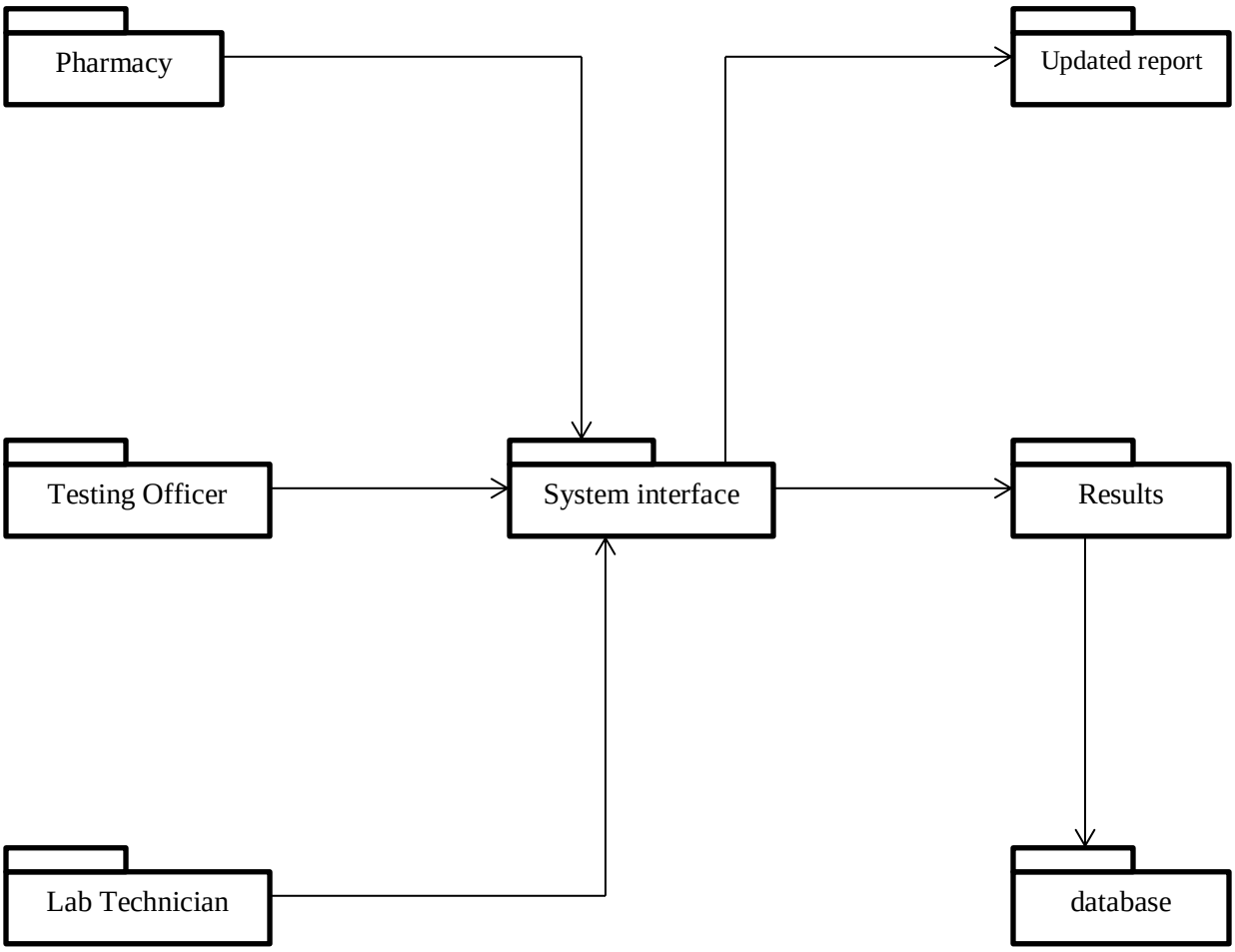


Fig 14 Package diagram

4.6.2 Sequence diagram

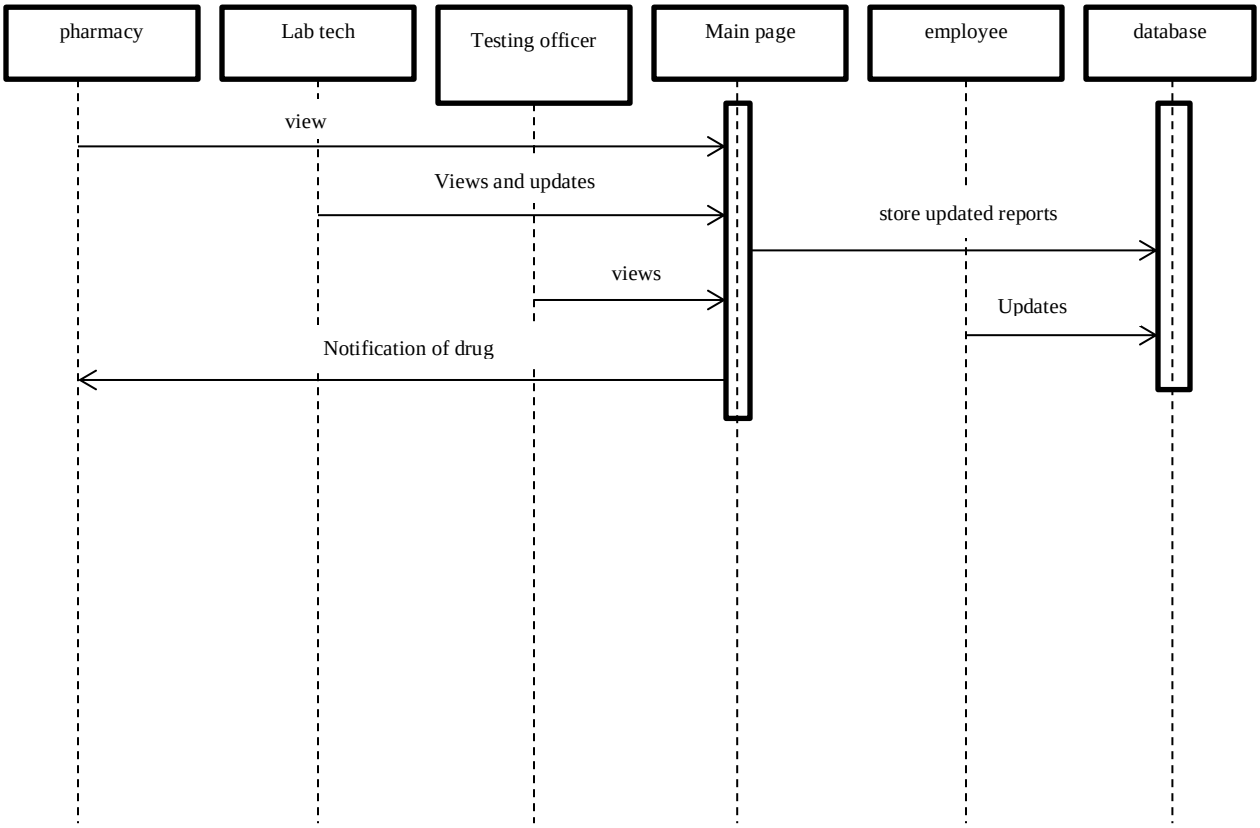


Fig 15 Sequence diagram

4.7 Interface design

It focused on emerging a technique of different components that could be used for development of a project so they well connected and communicated. However, the components related to programs that had to do with the computer such as software, hardware etc. This was the design of a new system to be developed; it illustrated a summary of basic forms in brief that were integrated into the new system.

4.7.1 Functional structure design

As noted by (Tor S B, Britton G A, Chandrashekar M and NG k W, 1998) this is a new perspective towards the research of the upstream design activity and its objective is to provide

computer tools to link design functions with the structural (physical) embodiments used to realize the functions. (Encyclopedia.inc) added that a design method in which the system is seen from the functional viewpoint the design concentrates on isolating high level functions that can then be decomposed into and synthesized from lower level functions. Development proceeds as a series of stepwise refinements of functionality. The GUI technique was chosen as the best method for menu designs reason was to meet objectives of the project system had to be friendly to users. Before any user is authorized permission to the main form the user had to log in first as illustrated below.

Log in form

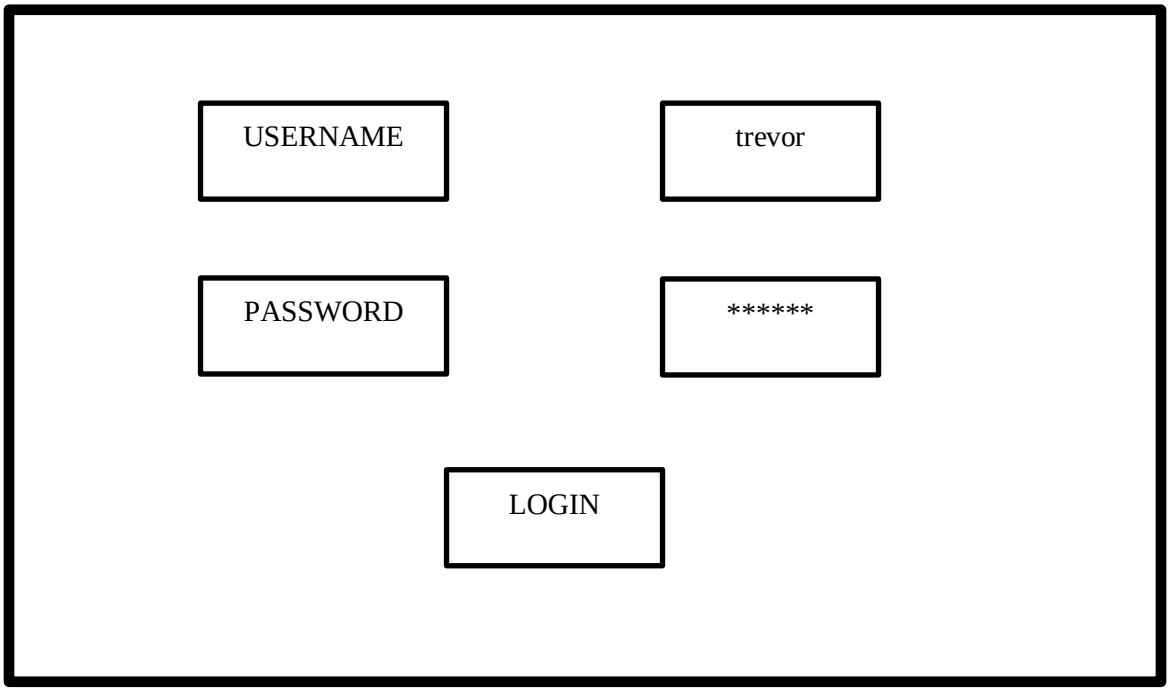


Fig 16 Login form

Input forms are as below

Below was the structure of the main form of the system.

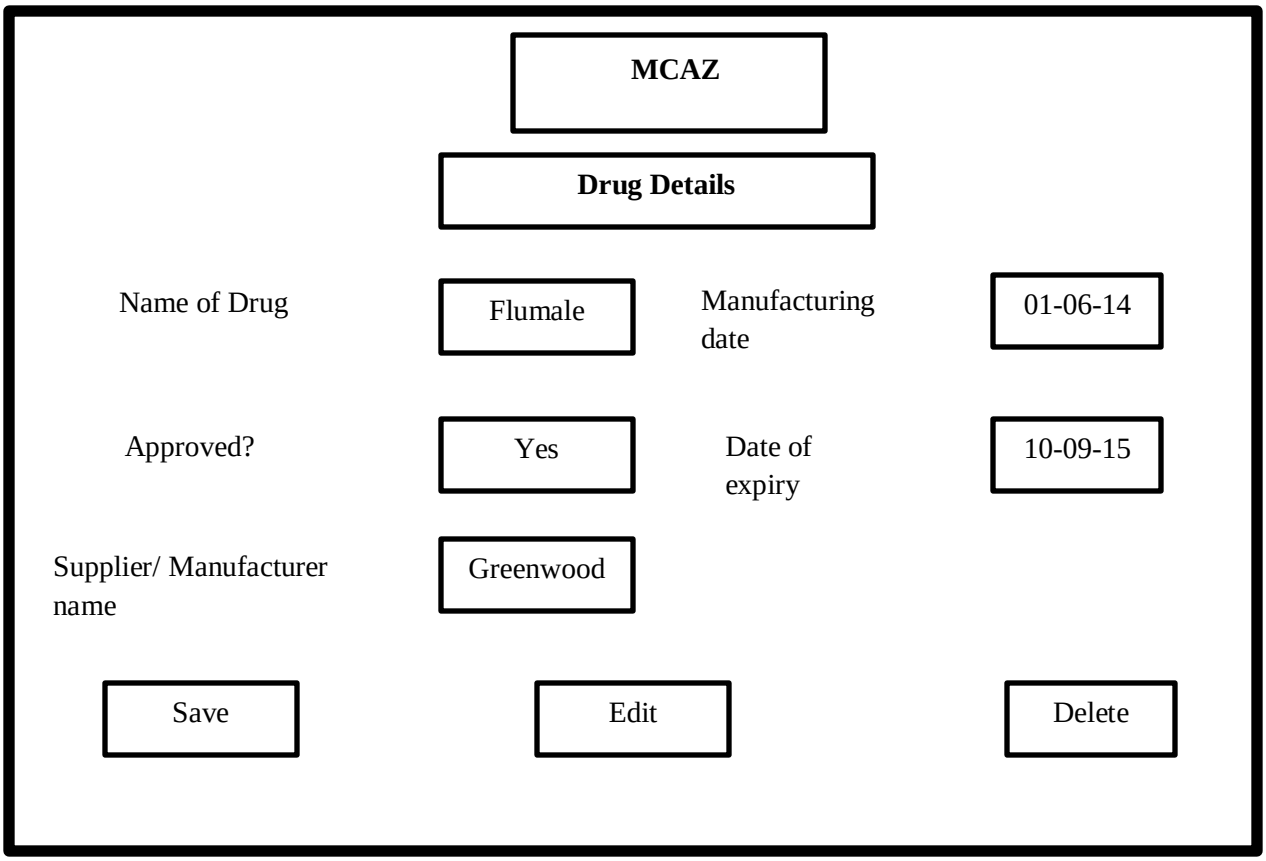


Fig 17 Drug details

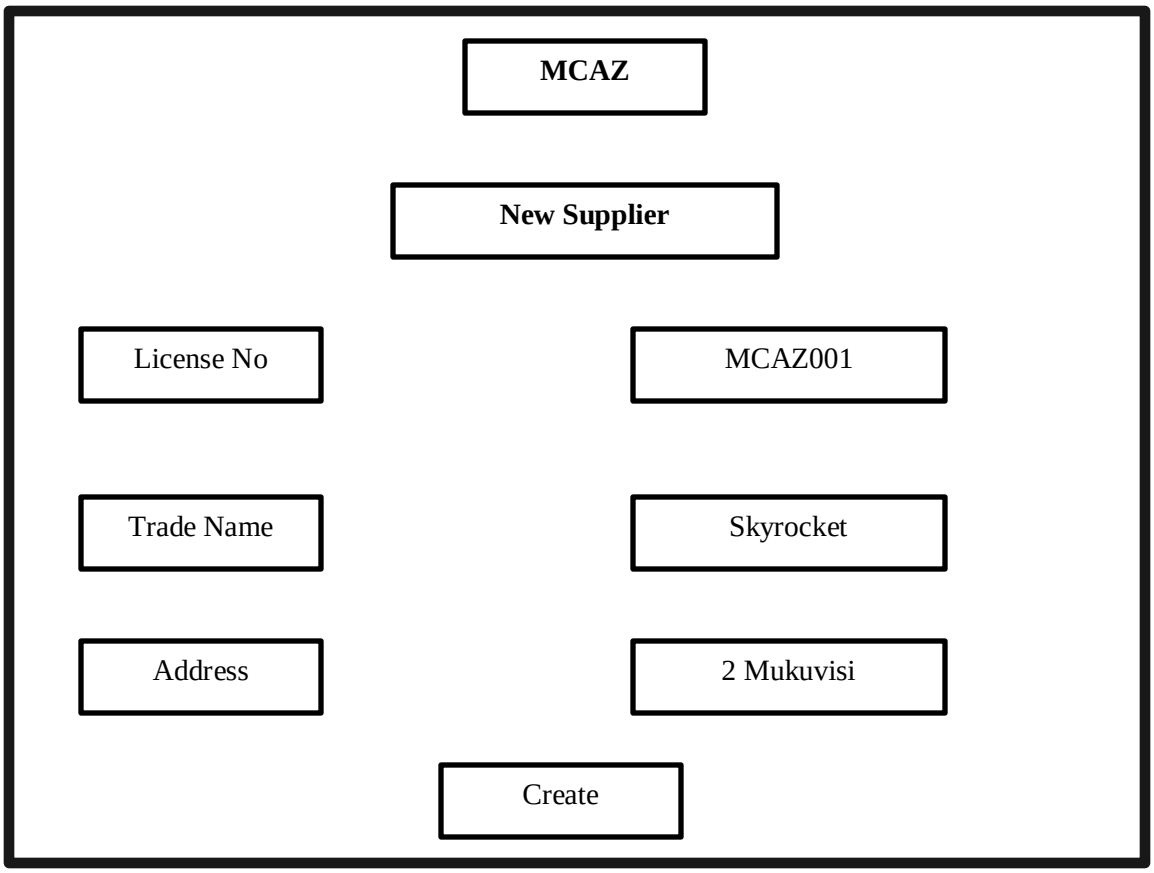


Fig 18 New supplier form

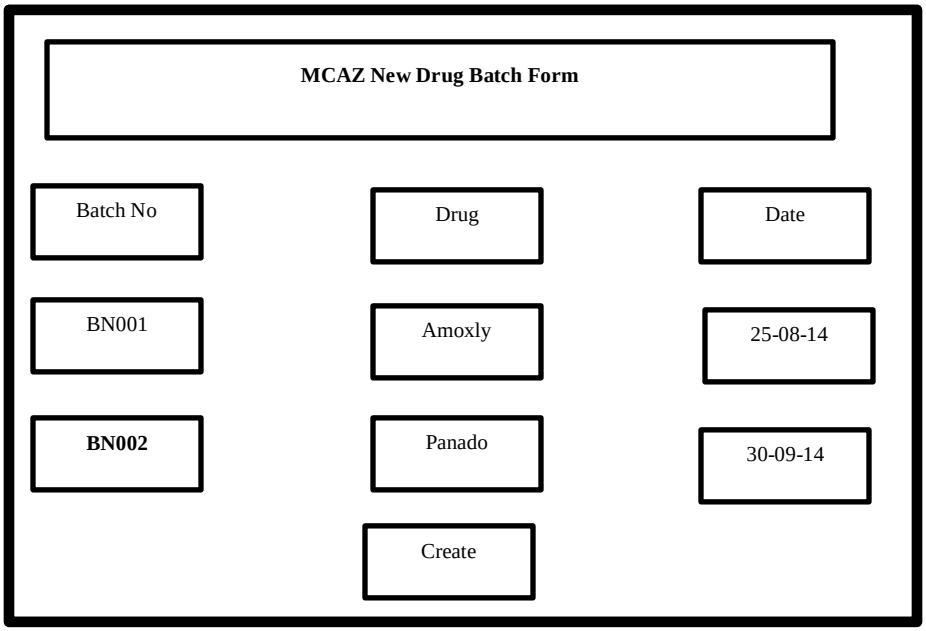


Fig 19 New drug batch form

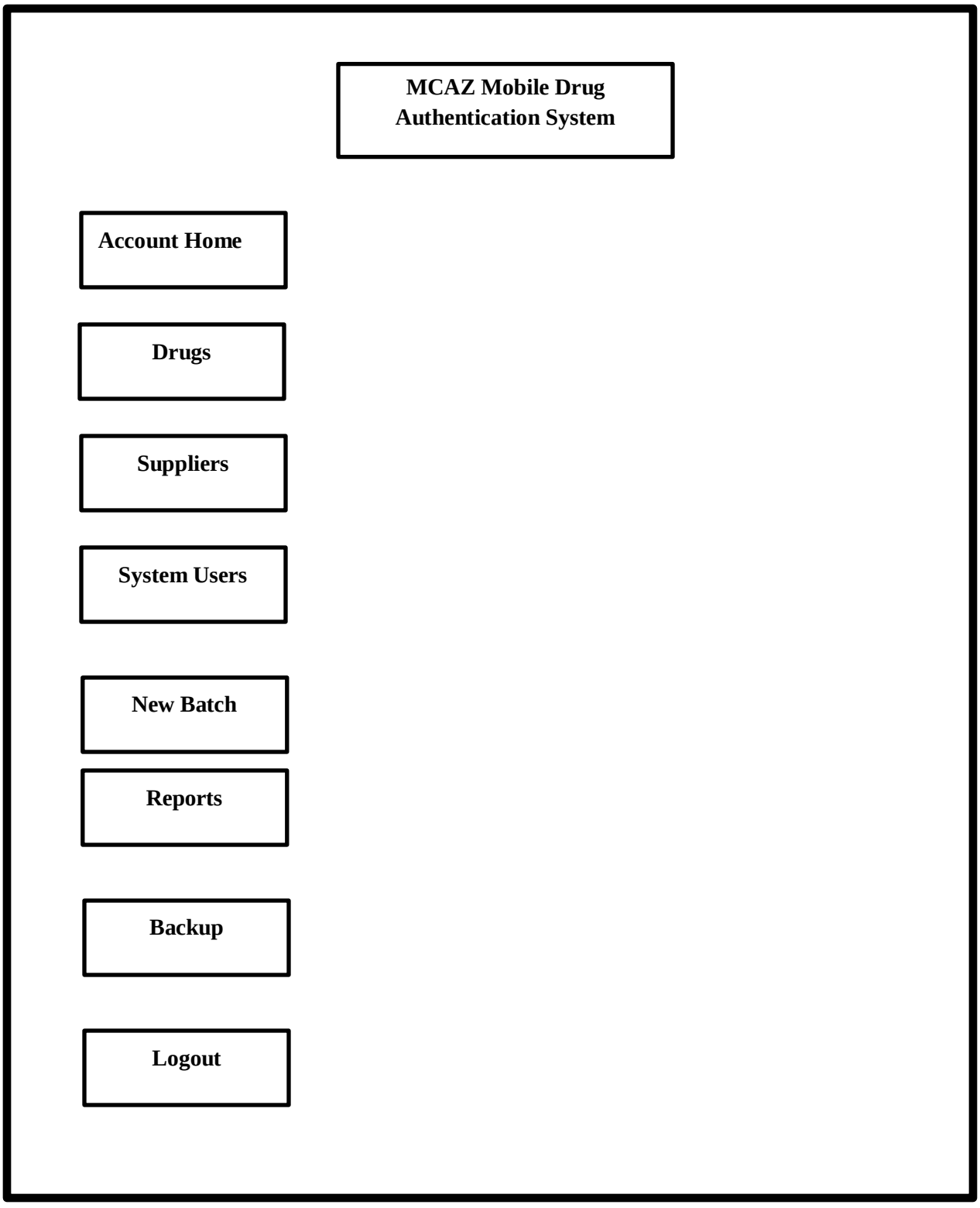


Fig 20Main form

4.7.2 Input design

For users to input data into database they did so through these forms such as below:

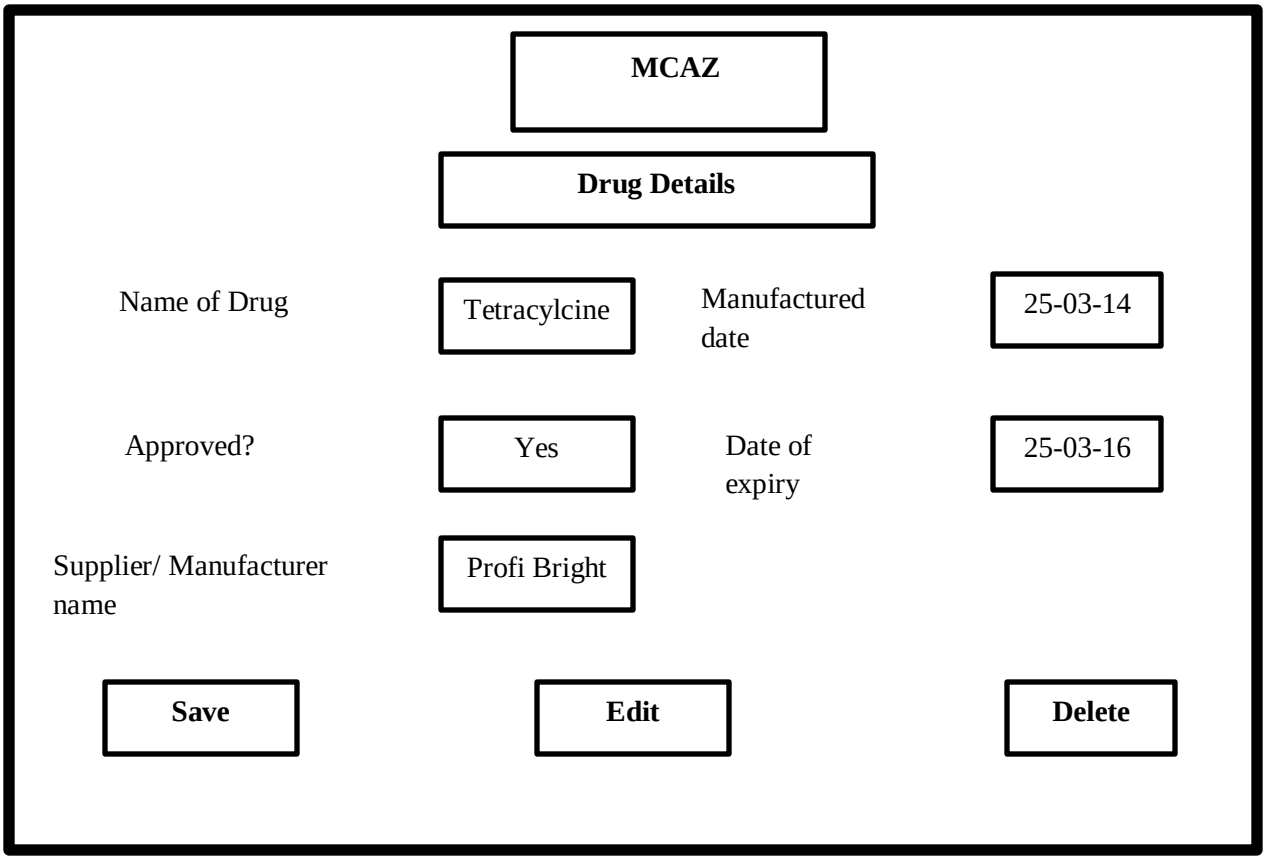


Fig 21 Drug details form

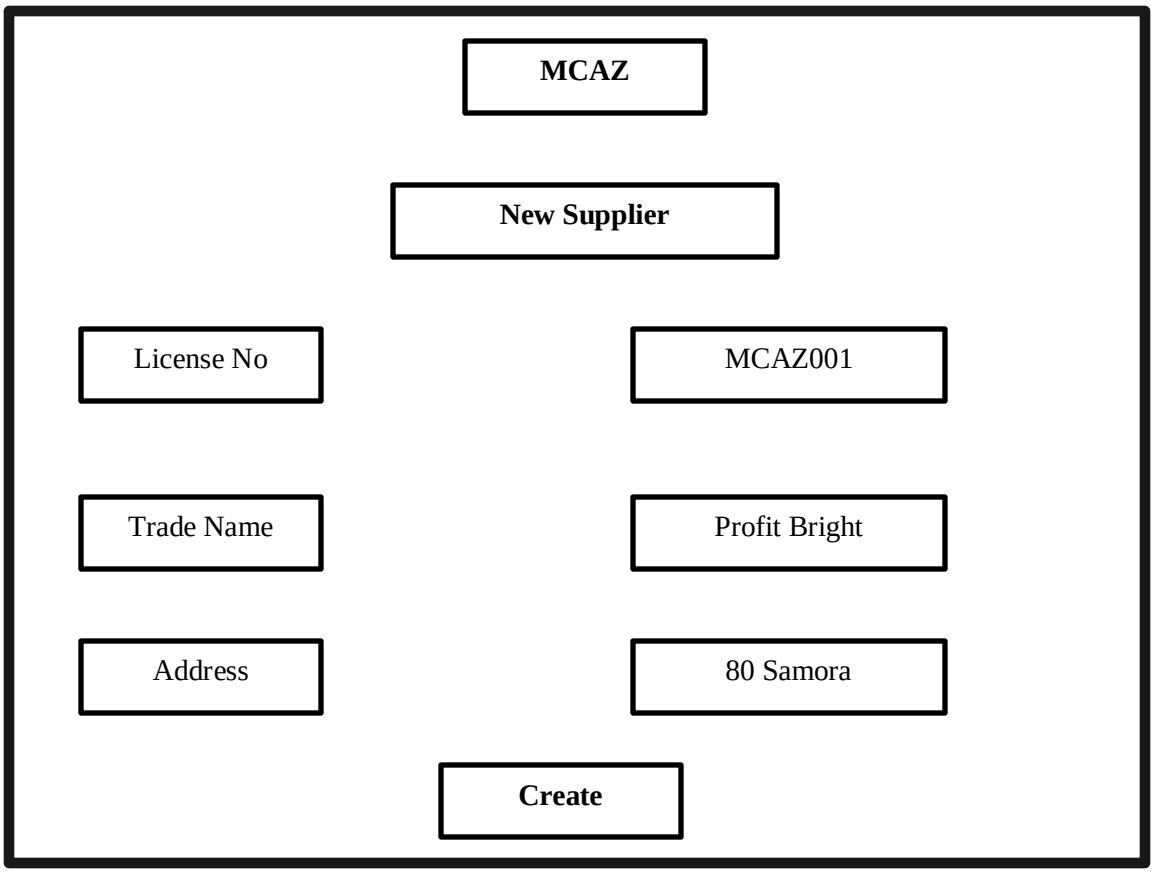


Fig 22 Add new supplier input form

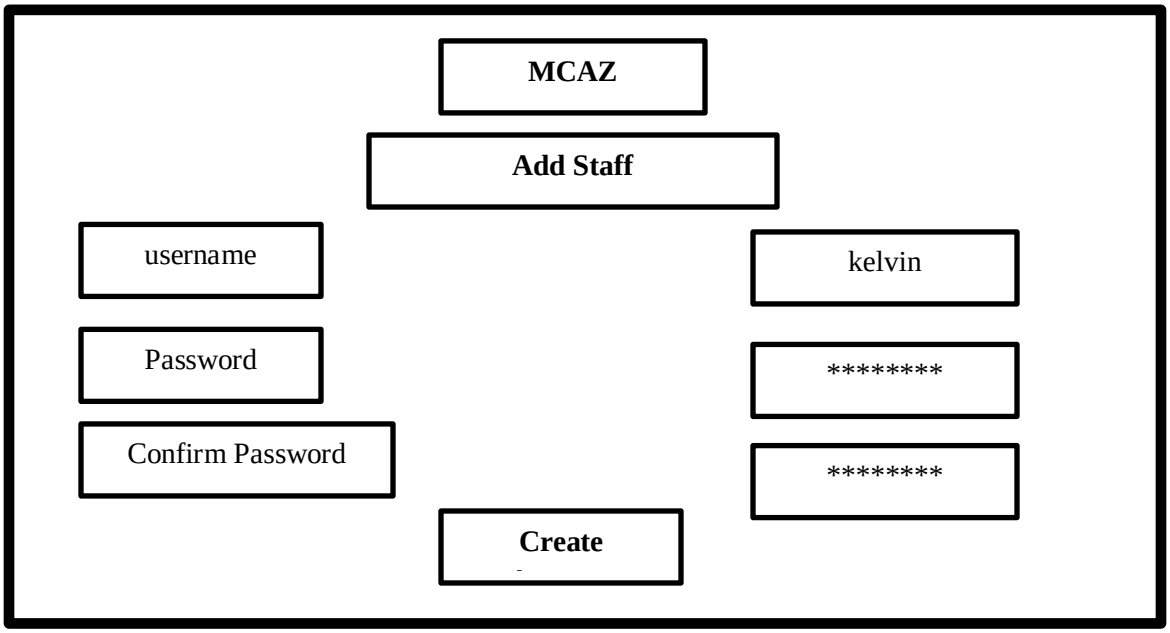


Fig 23 Add staff input form

4.7.3 Output design

The output design showed the sample designs of forms that could be displayed to the screen or printed.

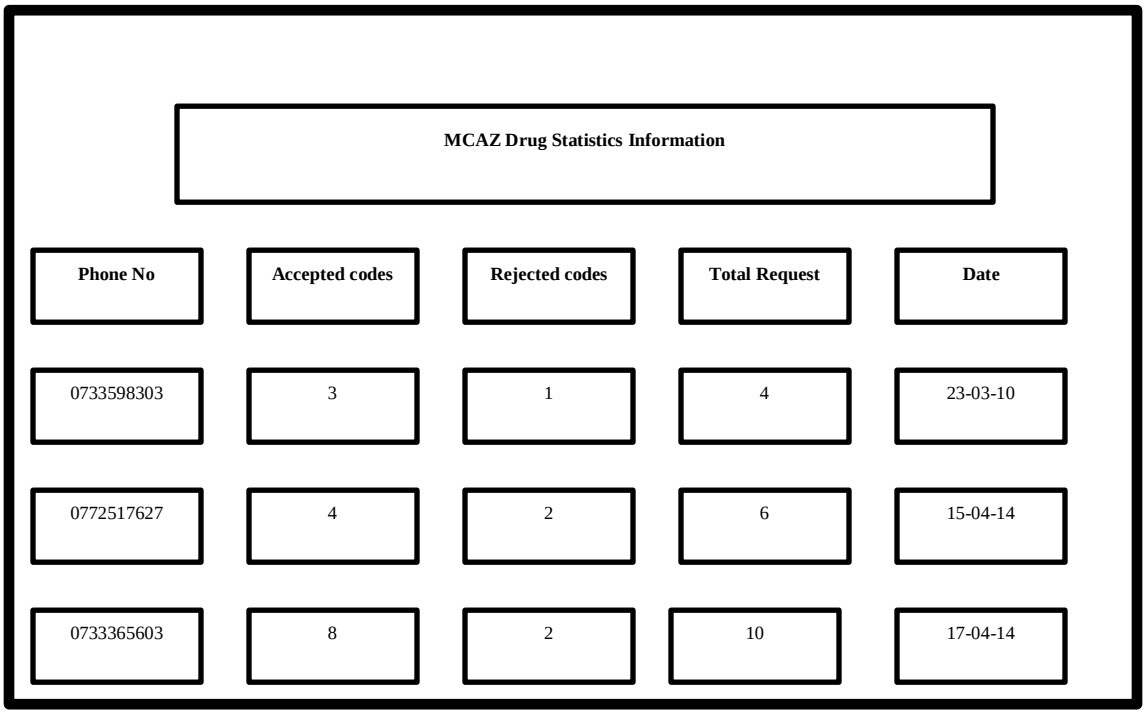


Fig 24 Drug statistics

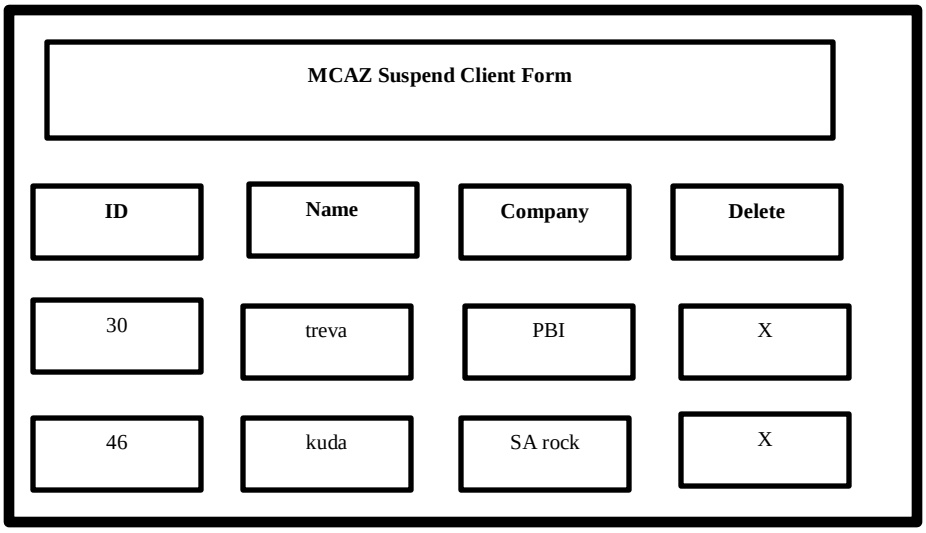


Fig 25 Suspend client form

4.7.4 Security design

The system output was to be developed along the following security concerns.

Mobile Drug Authentication System

Drug Report

Drug	Barcode	Serial No	Date of Manufacture	Expiry Date	Drug type
Panado	798851313	12345	02-02-14	28-02-15	Capsule
amoxly	564135876	24685p	05-05-14	09-09-16	Capsule
Fluemale	020202125	F555x	06-06-13	13-10-15	Fluid
Paracet	753159852	2468	18-10-14	20-12-14	Capsule

Fig 26 Drug report

Mobile Drug Authentication System

Clients Report

ID	Name	Company	Phone #	Status
21	kuda	PBI	0712111546	active
58	trev	Skyrocket	0733191546	active
2	trevor	Greendwod	0772111546	suspended
9	fay	Warrens	0774511154	active

Fig 27 Client Report

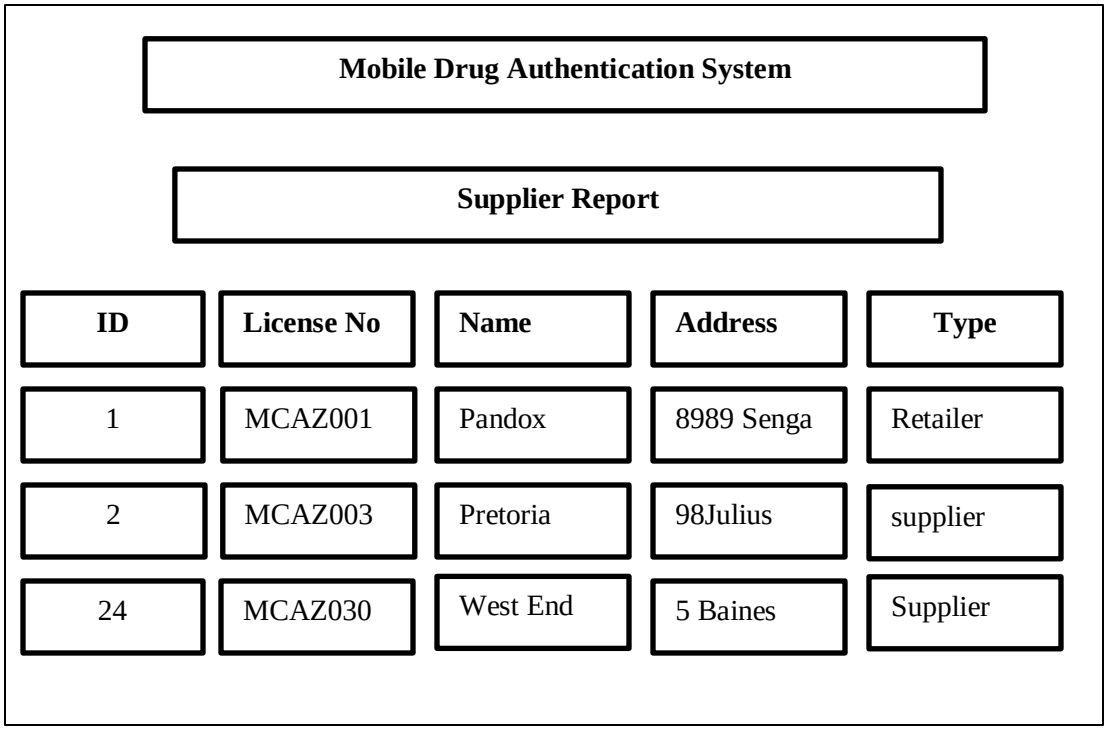


Fig 28 Supplier report

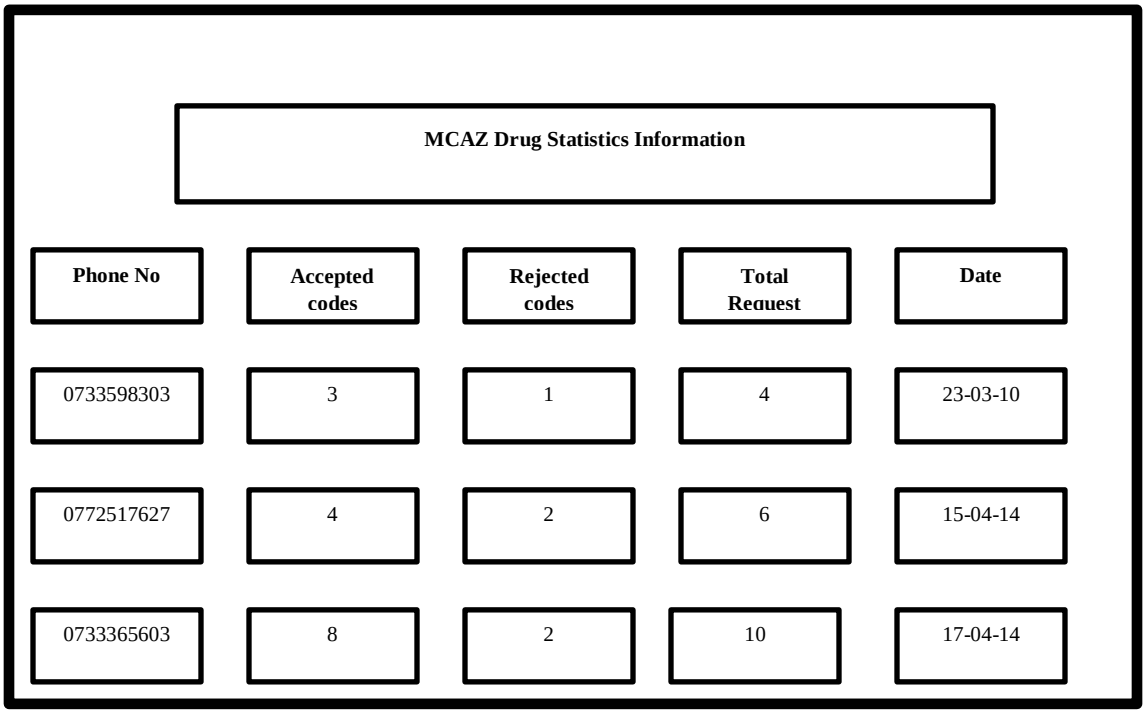


Fig 29 Statistics report

The system was to be developed along the following security concerns.

Security concern

This involved protection of information against accidental loss, destruction or damage by use of login control that had privileges allowing users to access some data thus limiting users to perform duties they were allocated by administrator. Those with those privileges had rights to the system log on.

Access Control

This was a way of controlling data that was accessible by an authorized user's this could be

- System control
- Menu control

Access was audited according to:

- Log on control
- Physical concerns- the system was modelled along by the following levels of physical concerns

Lock and key

Access was restricted to the actual users of the system

Database Security - the database was central hub of all the organization's records

4.8 Conclusion

In conclusion this chapter emphased on designing the system by coming up with how data was going to flow such that the developer could design the whole set up of the new system using that information. System design, architecture design assisted in design the desired program that gave an interface which a user can quickly adapt to and use, above which had agreed upon by everyone including each step to implement he system.

CHAPTER FIVE: IMPLEMENTATION

5.1 Introduction

This involved putting into practice the real system under development through analyzing the performance, safe through security, authentication, training users and putting in place of the system. Utmost highlighted implementing on building the system and discovering of the objectives mentioned proposing the project can be met. This included coding phase in which design of the project that was on paper being transformed into a working model.

5.2 Coding

According to (oxforddictionary.com) it is the process of allocating a code to something for identification. The program used for coding turned to particular instructions that a computer executed. PHP as the programming language was used for coding and construction of the project. Database was created using MySQL Database.

5.2.1 Pseudo code

Logging as Administrator

There should be connection with the database so there was need to check first before proceeding.

Allowed user to enter his or her username followed by password

Allowed to

Go to the Administrator's home page (thus if credentials are correct)

Otherwise if not

Please enter correct credentials!

End if

Creating a new record

User input

Validate all required fields

If input is invalid

Report error

Else

Check database connections

Save details

Close connection

Exit

Updating the database

Get the key fields

Check if records exists

If record does not exists

Report Error

Else

Validate all information

Check database connection

Save the record

Close connections

Exit

Searching a record

Get the record ID

Check the database connection

Establish connection

Retrieve data

If data is not found

Report Error

Else

Display data

5.3 Testing the system

By having the whole project objectives the system was be tested before setting it up, this was for determining if the system could meet initial objectives and checking for errors for example syntax errors. This was done according to the end users expectations and the process of testing was shown as below:

- Unit Testing
- Module Testing
- Subsystem Testing
- System Testing
- Acceptance Testing

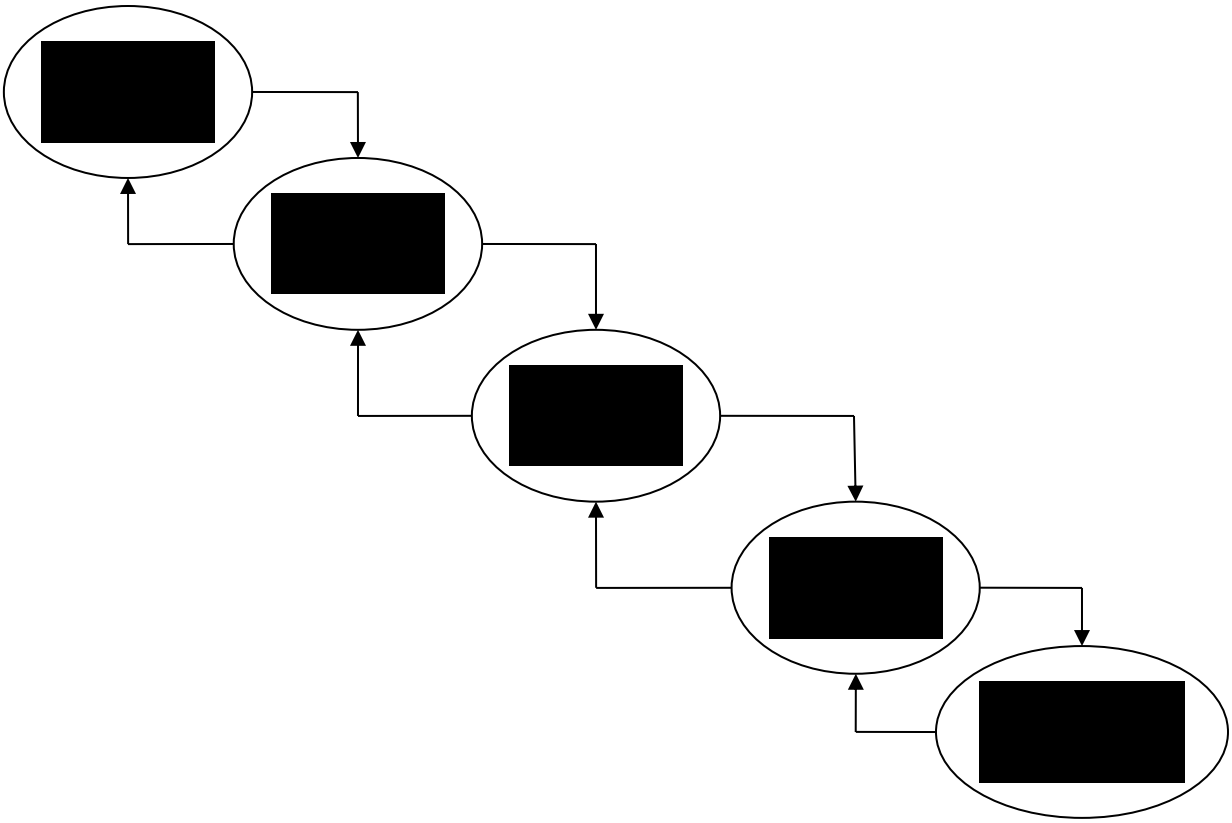


Fig 30 Processes of Testing

System vs Objectives Testing

i. To develop an online system that gives pharmacies or patients an opportunity to verify if the drug they have bought is genuine and registered with Medicines Control Authority of Zimbabwe, this helps to flush out fake drugs that are being sold.

Mobile #	Msg	Date and time received
+263772517627	Hi, Muti Joe ! The barcode 2356149179475 is genuine.	2014-10-03 15:46:02
+263772517627	Hi, Treva ! The barcode 2356149179475 is genuine.	2014-10-03 17:46:59
+263772125972	Sorry, this is not a registered drug	2014-10-04 05:46:14
+263772205234	Sorry, this is not a registered drug	2014-10-04 05:46:40
+263733365603	Hi, Trev ! The barcode Sorry, this is not a registered drug can not be found. For assistance call 04 222254	2014-10-04 05:46:55
+263733365603	Hi, Trev ! The barcode 2356149179475 is genuine.	2014-10-04 05:48:27
+263733598303	Hi, trevs ! The barcode Jam can not be found. For assistance call 04 222254	2014-10-09 07:13:07
+263733598303	Hi, trevs ! The barcode 8872856803063 is genuine.	2014-10-09 07:13:14
+263772517627	Hi, Treva ! The barcode 0000 can not be found. For assistance call 04 222254	2014-10-13 13:54:19
+263772517627	Hi, Treva ! The barcode 2630315334664 is genuine.	2014-10-13 14:00:40
+263772517627	Hi, Treva ! The barcode Jgjt can not be found. For assistance call 04 222254	2014-10-14 07:28:50
+263772517627	Hi, Treva ! The barcode Treva can not be found. For assistance call 04 222254	2014-10-14 08:29:37

Fig 31Barcodes sent reports

ii. To develop an online system that captures information of all drug manufactures or pharmacies in the country.

Fig 32 Suppliers and retailers list

iii. To develop an online system that allows manufacturers or suppliers send their drugs to Medicines Control Authority of Zimbabwe using their batch numbers and the system generates a barcode of those drugs that Medicines Control Authority of Zimbabwe test and approve.

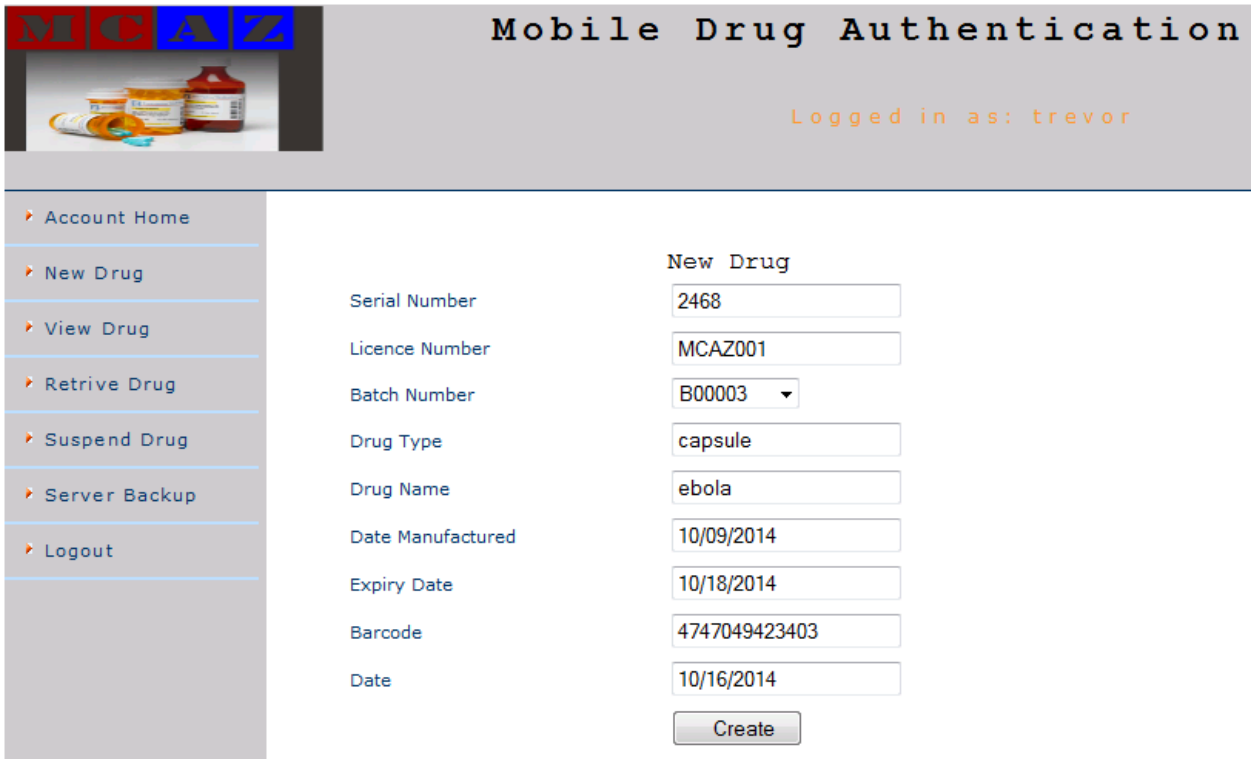


Fig 33 New drug entering form

iv. To develop an online system that gives a platform to top management make decisions or take measures of fake drugs that can be in circulation by the use of statistics reports generated by the system.

Fig 34 Generated reports

v. To develop an online system that allows pharmacies to view all approved manufacturers or suppliers of drugs this helps them to see the manufacturing and expiry dates of drugs

Fig 35 Suppliers list

5.3.1 Unit Testing

(mdsn.microsoft.com) explains this phase as the primary goal of unit testing is to take the smallest piece of testable software in the application, isolate it from the remainder of the code, and determine whether it behaves exactly as you expect. Each unit was tested separately before integrating them into modules to test the interfaces between modules. Unit testing has proven its value in that a large percentage of defects are identified during its use. However this allowed verification of functions and determines that they are working as expected. By entering input we viewed if functions were giving out the proper values and if not the errors were handled in the process of execution.

In this stage we were able to know if the module components and procedures were doing as expected. This was done to forms to test whether they could add, retrieve and edit information in the system. Approaches that were used were as follows:

Black box Testing

By using this approach it allowed testing inputs and outputs that the system could produce but not considering system operations internally. It was carried out independent by the code that was used to program the system. Comprised of viewing specification of the program and also generated test data of input and outputs.

The below diagram showed the testing of system input

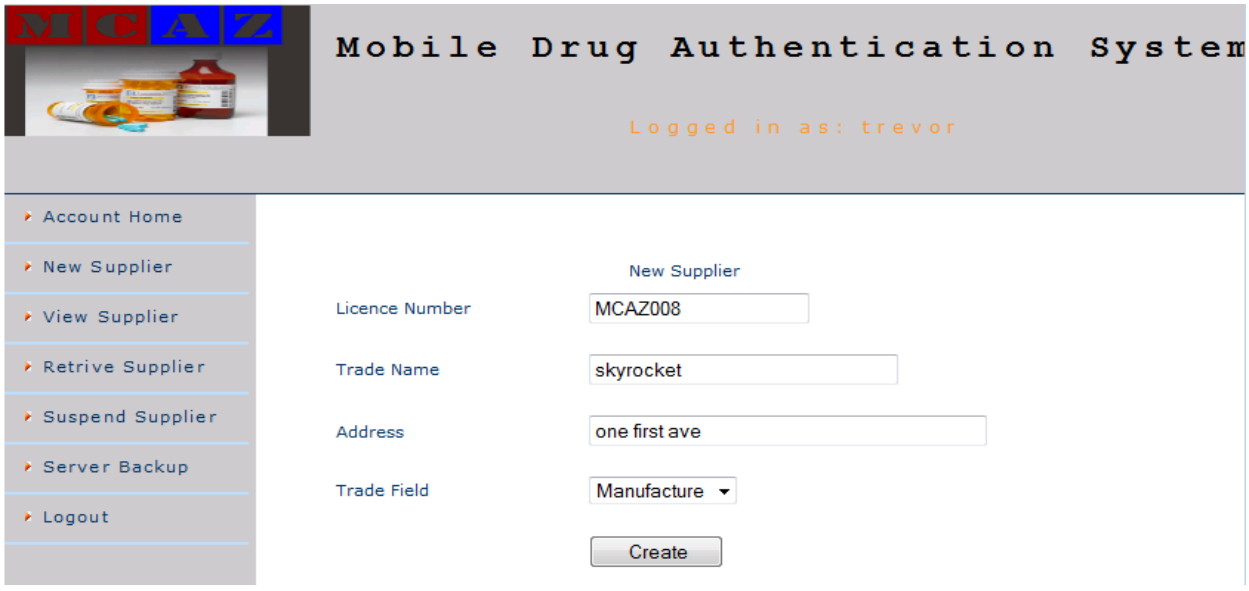


Fig 36 Black box Testing

If correct details were entered it gave the below message

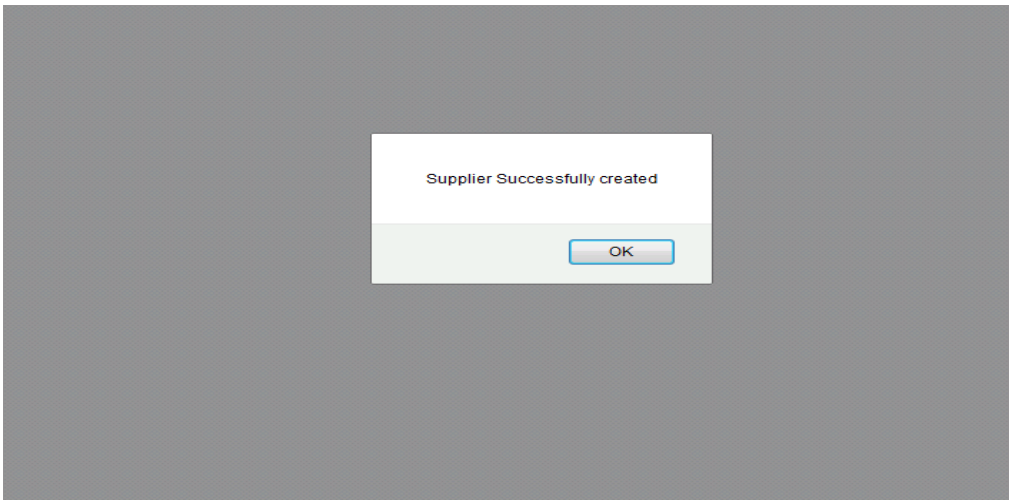


Fig 37 Black box testing of supplier

If all details were not entered an error below was shown

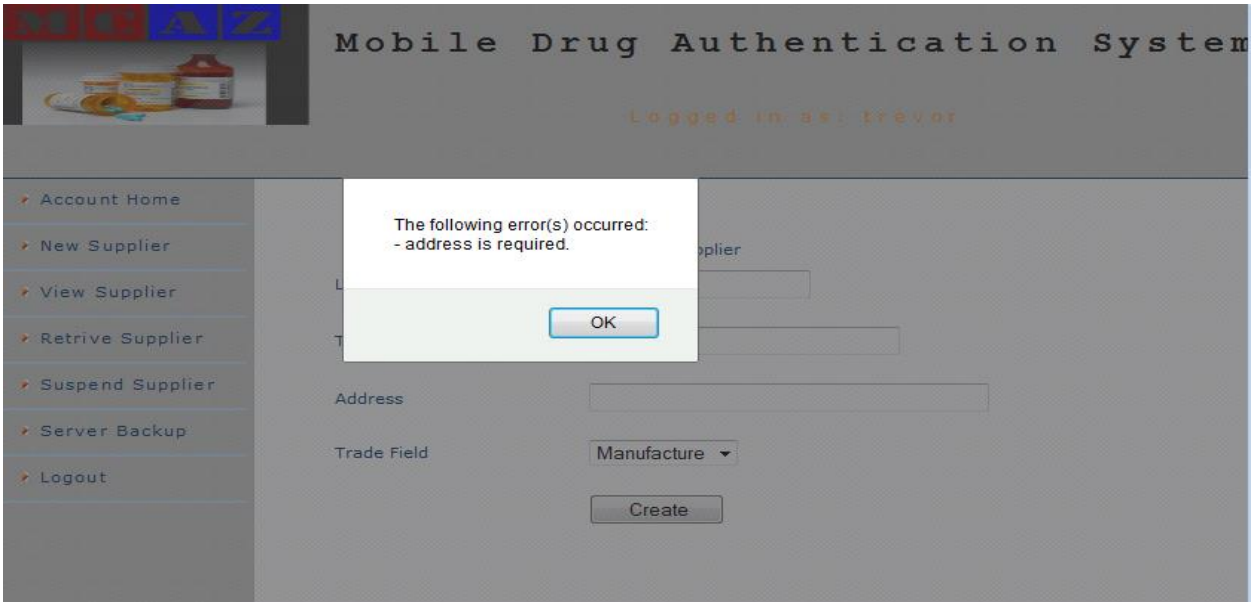
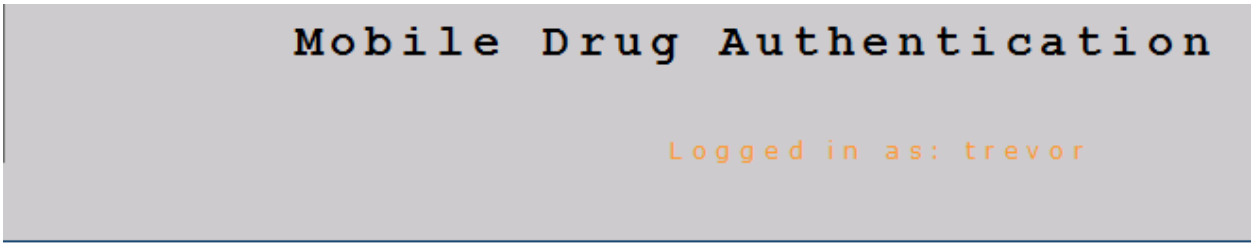


Fig 38 Testing input of supplier

Below was a report that could be printed as output if the system was working



Statistics

Customer ID	Mobile #	Msg	Date and time received
221	+263772517627	Hi, Muti Joe ! The barcode 2356149179475 is genuine.	2014-10-03 15:46:02
223	+263772517627	Hi, Treva ! The barcode 2356149179475 is genuine.	2014-10-03 17:46:59
226	+263772125972	Sorry, this is not a registered drug	2014-10-04 05:46:14
229	+263772205234	Sorry, this is not a registered drug	2014-10-04 05:46:40
231	+263733365603	Hi, Trev ! The barcode Sorry, this is not a registered drug can not be found. For assistance call 04 222254	2014-10-04 05:46:55
233	+263733365603	Hi, Trev ! The barcode 2356149179475 is genuine.	2014-10-04 05:48:27
275	+263733598303	Hi, trevs ! The barcode Jam can not be found. For assistance call 04 222254	2014-10-09 07:13:07
277	+263733598303	Hi, trevs ! The barcode 8872856803063 is genuine.	2014-10-09 07:13:14
279	+263772517627	Hi, Treva ! The barcode 0000 can not be found. For assistance call 04 222254	2014-10-13 13:54:19
281	+263772517627	Hi, Treva ! The barcode 2630315334664 is genuine.	2014-10-13 14:00:40
282	+263772517627	Hi, Treva ! The barcode Jgjt can not be found. For assistance call 04 222254	2014-10-14 07:28:50
286	+263772517627	Hi, Treva ! The barcode Treva can not be found. For assistance call 04 222254	2014-10-14 08:29:37

Fig 39 Statistics Report

White box testing

This stage focused on system internal processes for instance the internal function aspect of a unit this could recognize errors which black box technique did not show. Using white box could make the developer develop test on the below:

- Every path in the module was used more than once internal data structures for validity

5.3.2 Module Testing

This was the testing of the whole module as produced by the compiler when built from source code, this was frequently used when the system environment consisted of dedicate software

testers for example Microsoft product groups. This kind of testing evaluated if the programs that were created if they were functioning together, the reason was to remove errors.

5.3.3 Subsystem Testing

According to (businessdictionary.com) this is a group of interconnected and interactive parts that performs an important job or task as a component of a larger system. This involves incorporation of modules into subsystem and monitors that they work together. By using different module pages the input of one module was checked and tested for consistency. It was done to draw attention on how the system would meet the business specifications and safety of the database.

The below diagram showed the testing of system input by adding drugs to the system hence the system created barcode for that drug as below

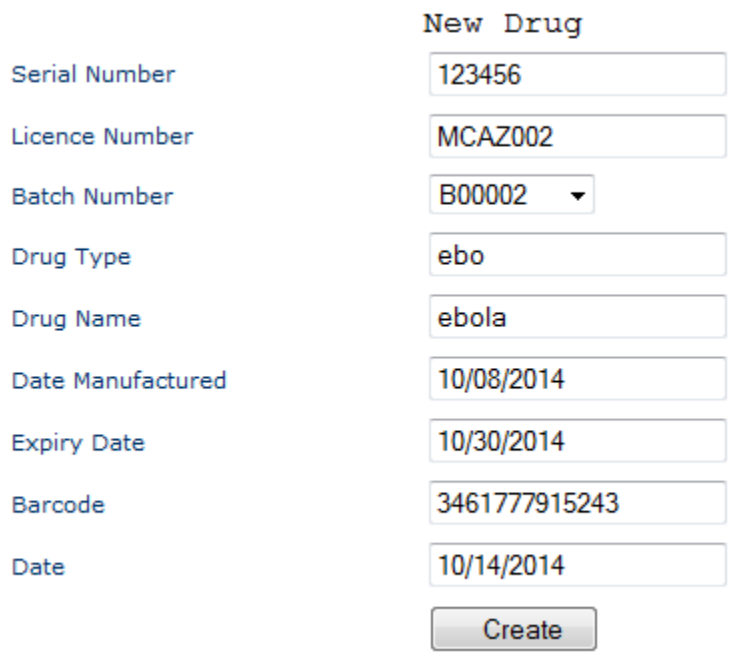


Fig 40 Testing input of new drug

If correct details were entered it gave the below message

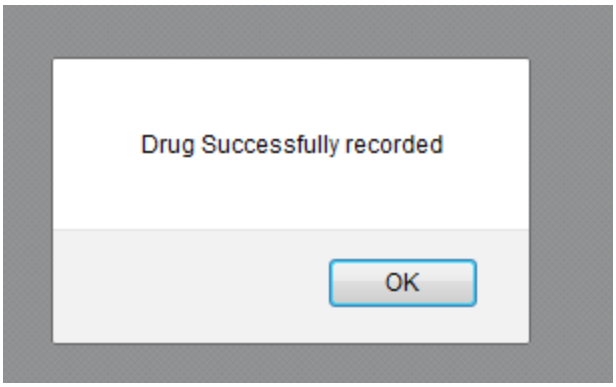


Fig 41 Drug registered message

5.3.4 System Testing

(softwaretestingfundamentals.com) defines this as is a level of the software testing process where a complete, integrated system/software is tested. In order to make a complete system subsystems are joined together. It was a way of tracing errors which may be caused from connections of subsystems and that they function not having errors. As users use the system tasks like security and out generations are measured if they were working perfectly. Using this scenario main emphasis was integration of system and even flow of processes concerning the system and subsystems.

Below was a diagram showing a report of messages that clients sent and this proved that the system was working according to the objective of verifying drugs.

Statistics

Customer ID	Mobile #	Msg	Date and time received
221	+263772517627	Hi, Muti Joe ! The barcode 2356149179475 is genuine.	2014-10-03 15:46:02
223	+263772517627	Hi, Treva ! The barcode 2356149179475 is genuine.	2014-10-03 17:46:59
226	+263772125972	Sorry, this is not a registered drug	2014-10-04 05:46:14
229	+263772205234	Sorry, this is not a registered drug	2014-10-04 05:46:40
231	+263733365603	Hi, Trev ! The barcode Sorry, this is not a registered drug can not be found. For assistance call 04 222254	2014-10-04 05:46:55
233	+263733365603	Hi, Trev ! The barcode 2356149179475 is genuine.	2014-10-04 05:48:27
275	+263733598303	Hi, trevs ! The barcode Jam can not be found. For assistance call 04 222254	2014-10-09 07:13:07
277	+263733598303	Hi, trevs ! The barcode 8872856803063 is genuine.	2014-10-09 07:13:14
279	+263772517627	Hi, Treva ! The barcode 0000 can not be found. For assistance call 04 222254	2014-10-13 13:54:19
281	+263772517627	Hi, Treva ! The barcode 2630315334664 is genuine.	2014-10-13 14:00:40
282	+263772517627	Hi, Treva ! The barcode Jgjt can not be found. For assistance call 04 222254	2014-10-14 07:28:50
286	+263772517627	Hi, Treva ! The barcode Treva can not be found. For assistance call 04 222254	2014-10-14 08:29:37

Fig 42 Report generated by the system

5.3.5 Acceptance Testing

It was the last phase of testing that was completed before the system was used for own use. This constituted of developers and end users of the system to give feedback if the system was complete as per to their needs. This phase of testing was prepared by the management and some other users to verify whether the system was working accordingly. The blunders and faults that designers did not see were discovered in these stages which were addressed by verification and validation.

- **Verification**

Definition from (oxford dictionary) regards this as the process of ensuring that procedures laid down in limitation agreements are followed. Can be known as alpha testing which focused in displaying that the model of the system conforms according to the requirements by using inspections and reviews. This was done to check for omissions and faults concerning end user also the design specification that was stated earlier yet not achieved in the course of construction. This was illustrated by the diagram below that verified if the user was the correct or not.

Fig 43 Verification

- **Validation**

Also known as beta testing which implied that it made sure that the system focused on the needs of the client and this was done through system testing, beta testing and client acceptance testing. If data integrity of data can be kept was achieved means that the data can be accepted and saved into the system. End user tested the system with real data and administrators who were to use the system also inputted their data.

The objective was to test for validation hence below was add staff login into the system if a user only input a few characters as password the system should deny such a password.

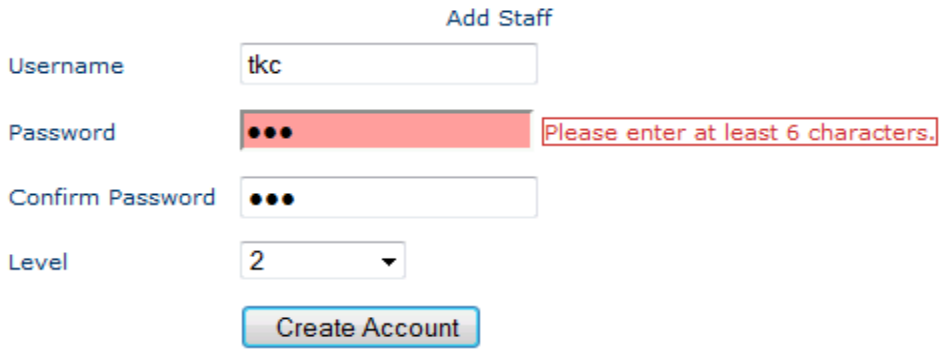


Fig 44 Validation

But if the required length of characters had be entered the system allowed the user to be registered such as given below

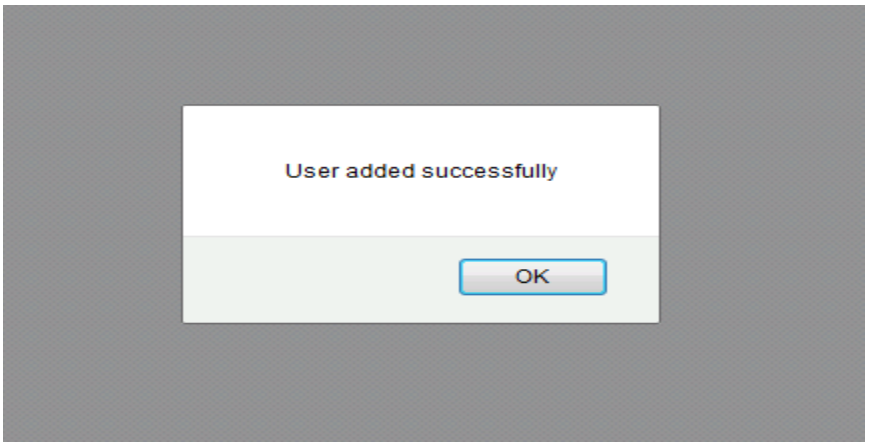


Fig 45 Message for correct validation

If a wrong password had been entered the system gave a user a below error

Fig 46 Error for login

5.3.6 Defect Testing

Data was entered into the system and output was analyzed by inspecting for defects. This was to allow that defects were seen and dealt with before implementing the system. This process could be demonstrated as below:

- Test data –data that was to be used for incorporating reports and queries as expected.
- Test report – this was a report that pointed out incidents done during testing.
- Test cases – this provisioned for testing of input and output
- Test results – these were results known after a test was done

Below was a diagram of the illustration:

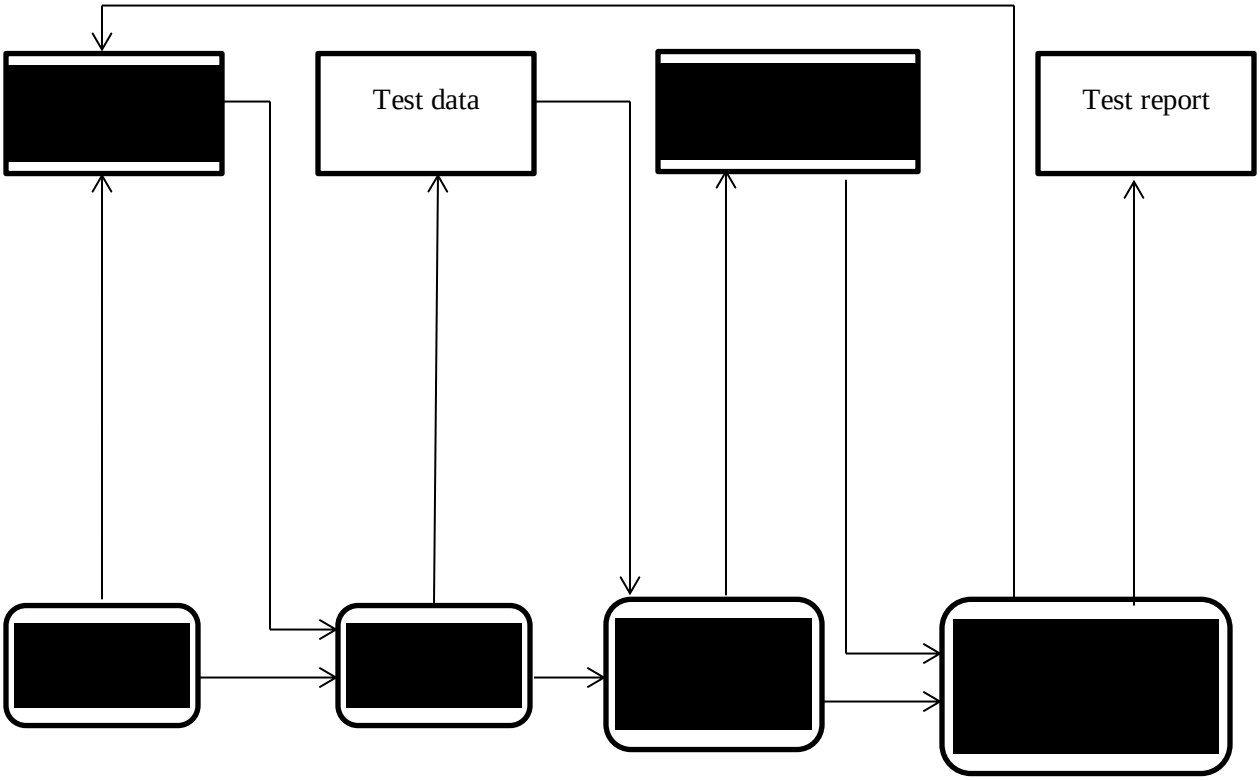


Fig 47 Defect Testing Process

5.3.7 Test Design

Functional Testing (Black Box Testing)

This was carried out in program system independent of code which was used comprised and focused on program requirements and formed set of data test that covered the input, outputs and functions of the program. This was aided by:

- Figuring out of errors
- Illustration functionality of software

Test results

Login Testing

The login testing constituted of trying login where if username and password could allow access to user. Whenever a user attempted to login to the system with incorrect credentials a form appeared showing authentication failure. Below was a diagram of such illustration.

Fig 48 Wrong Login Credentials

Beta Testing Validation

The focus of this testing was to show the invalid data that was entered into the system and how it was validated by the system to inform the user. If data integrity of input could be saved was achieved this meant that the data can be accepted and saved into the system. End user tested the system with real data and administrators to use the system also inputted their data. The diagram that follows showed that no values than that the system expected.

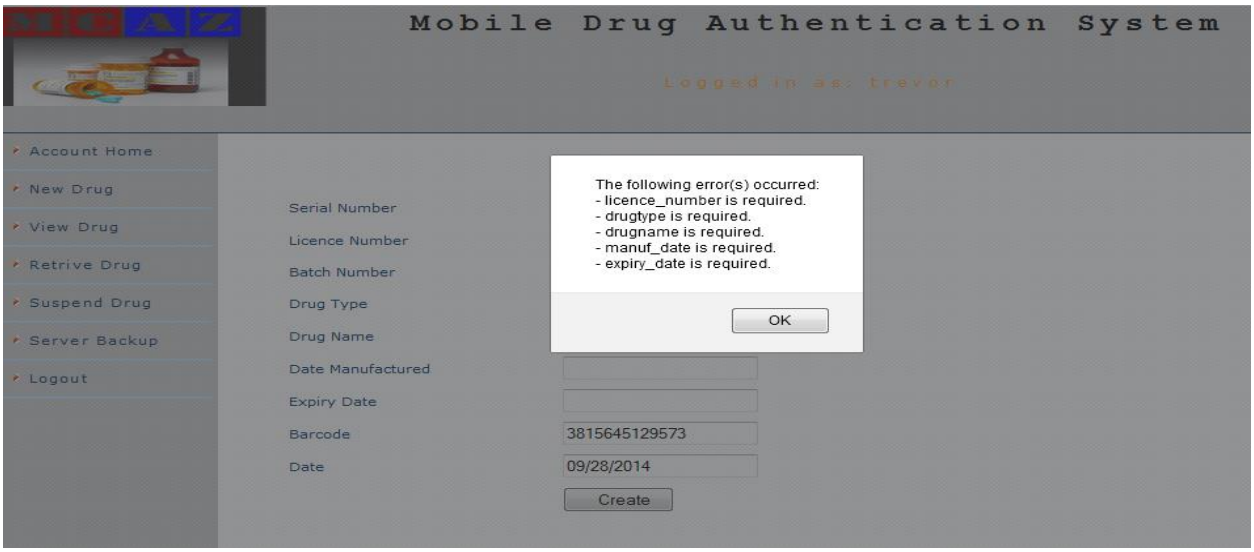


Fig 49 Validation of drug details

Validation of null fields

Whenever a user does not input values in the system the user was notified if information was required or missing. The diagram below showed of such result:

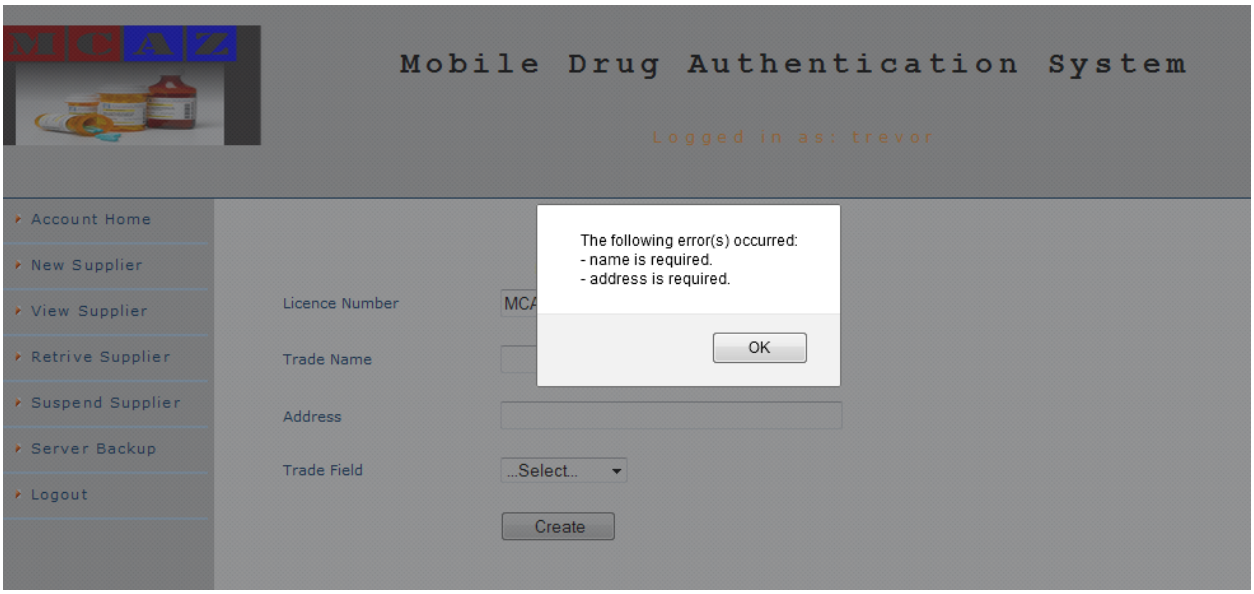


Fig 50 Null Values

By so doing verification and validation was determined by revealing the system had been validated properly as to the objectives.

5.4 Installation

(webopedia.inc) refers to putting software on a computer; install the software, or adding hardware components to your computer installing the hardware. However the system was set up within the project documentation.

- Installed Ozeki NG sms platform on the machine
- Installed Apache Server software on web server
- First time installation setup script and made sure that all details that were appropriately entered in the database and were created automatically. Afterwards would be asked to login.

User Training

This was done on individual level and was expected to be completed in two levels which were module level and system level.

Module level

At this level the aim was mainly on certain modules or components of the system that concerned specific users.

System level

This stage was specially dedicated for management who had to appreciate the development of the system. Also to users that had rights to access all components had to be familiar with the entire system.

Conversion

It was a technique of switching from an old system to a new one in addition this resulted after formation of operational environment and training. The purpose was to achieve acceptance from the end user.

Methods of conversion and system change over

There were a number of different methods that were used to implement a new system these included

- Pilot conversion
- Phased conversion
- Direct conversion
- Parallel conversion

Pilot conversion

If using this kind of conversion it allowed a small section to be installed for aims of testing. This meant the system was to be used with specific users who evaluated the functionality of the system. This technique was reasonable in terms of costs that were to be incurred as one site ran both systems however reducing risks of failure.

Phased Conversion

The reason of this technique was to set up the new system in phases by so doing it allowed users to be aware with the use of the system by removing the old system slowly. This also gave reasonable costs mainly because system was installed in phases and chances of risks were low.

Direct conversion

The purpose of this method was it removed the old system then replaces it with a new one. However the old one becomes out of date meant that departments that were using it had to change over to the new system allowing them to do their day to day responsibilities with the new system. The problem however was this method was associated with high risk of failure because there was no option of back up.

Parallel Conversion (Recommended)

This method has been deemed as the most effective method mainly because it runs two systems at the same time that is the old and new one simultaneously. Hence users got a solid chance to check for any problem that the system may have then tells whether the system was or not functioning as it was supposed to. However because two systems were running at the same time it became costly to operate them both but it had very low chances of failure as there was back up options.

Purpose of using parallel conversion

- It allowed for ample time more to understand the new system
- risk of failure was very minimum
- feedback from users helped to know whether the system function as per to objectives before totally changing to the new system

Stages engaged for parallel conversion

- set up all the workstations to the system
- trained the people to use the system
- Recorded data
- Made sure that activities were working at both systems (that was the old and new)

5.5 Maintenance

This was the work that was carried out to preserve an asset, in order to enable its continued use and function, above a minimum acceptable level of performance, over its design service life, without unforeseen renewal or major repair activities. The main objective of system maintenance was to deal with repairs and precisions of the new system and gave technical support to users facilitating them to obtain importance from the developed system. However this ongoing was ongoing which included updating, upgrading the system. This could be done in three stages as below:

- Systems Maintenance activities
- Interval systems review
- Disaster recovery

Systems maintenance review

At this stage it allowed for alteration of reasonable errors that appeared in the code, adding features and other adjustments proposed by stakeholders.

Interval system review

In the first year of using the system reviews were done after three months and in the second year it was undertaken after six months. The organisation drew up a team from IT and management that looked on the functionality of the system.

Disaster recovery

Back up of documents was done by the administrator on a daily basis so as to protect against uncertainty. This had to be maintained properly and the security system should be complemented with a disaster recovery approach.

Maintenance activities

The most important process that had to be given attention was maintenance. This was important because:

- Alterations that were made came from users
- Any alteration made were developed as the system was used
- Changes of the system was an ongoing process

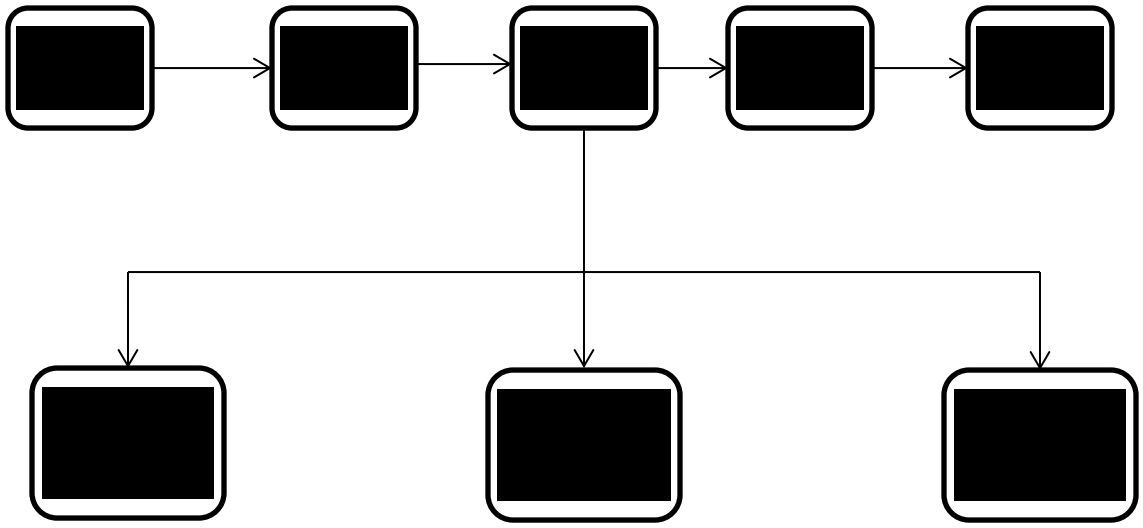


Fig 51 Maintenance activities

Perfect Maintenance

At this phase maintenance was done on system as business description changed by making sure that the system was up to date with user specifications. The maintenance was requested by users and management of the system and any person who required change to the system had to submit a system service request. However in the process developing the system it did not meant that it was best implementation as some as were not designed to the best implementations implemented this was resulted at times by ignorance. Aim for this phase was to implement a better version of the system and adding functions that would be missing by assessing first if it was worth to perfect system. Reviews were done and all steps taken were documented.

Corrective Maintenance

This tried to correct errors that were revealed during maintenance which included wrong implementation to completely not performing. Whenever an error was encountered investigations began to trace the causes of those errors. Once this was done design was drawn to correct the errors. If the errors are corrected reviews are done to ensure everything was working and that there are no new bugs in the course of the fixing. These undertakings were recorded and documented.

Adaptive Maintenance

MCAZ system works in ever-changing surroundings this means it ascertains that the system was developed accordingly. This method demanded for modification then examined an enhanced understanding that indicated to the planning of how to integrate the design into existing system then implement the modification. After this was completed reviews were prepared after every month depending on the size of modification. This addressed that implementation was exact and no bugs developed in the implementation.

Software application backup services

The designer was in charge for the applications back up service for system program related problems; system program fixing and alterations the organisation needed to look for a software developer with knowledge of PHP.

Hardware Backup Services

Computer hardware backup service was essential that was hardware examining, repairs and maintenance.

System Backup

This was the administrator responsibility to backup system files so as to ensure there was no or minimum loss of data and stability in the event there of data damage. Backup copies were to be made and written off on daily basis.

5.6 Conclusion

By taking into consideration the objectives of implementing the system in summary we concluded by saying the project was a success as the objectives were achieved. This was mainly contributed by different stages that were used in testing the system such as validation and the success of installing the system using parallel change over.

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APPENDIX A: USER MANUAL

The system was designed in a way that users for example the staff of MCAZ, pharmacies and clients would not encounter problems in using the system this included capturing details of drugs, suppliers or manufacturers as the forms were categorized relative to what it captures. The command buttons guided users for example to submit data of capturing a drug there had to click a create button to process all the information that was entered for that drug. The system was very interactive as it interacted with user to make sure that they executed any transaction without any complications.

For a user to access the system should enter the correct username and password. Once logged in the user will be directed to account home where he/she will view forms that he/she can choose. The forms include suppliers/manufacturers, drugs, system users, reports form on which the user will choose the form that he/she wants to use. Below are steps the user is to undergo when using the system.

Step 1: Login

Fig 52 Login Form

This form will require inputting username and password so to access the system. Once the user is logged in a screen as below appears with a greeting of that user name in this instance the user is trevor.

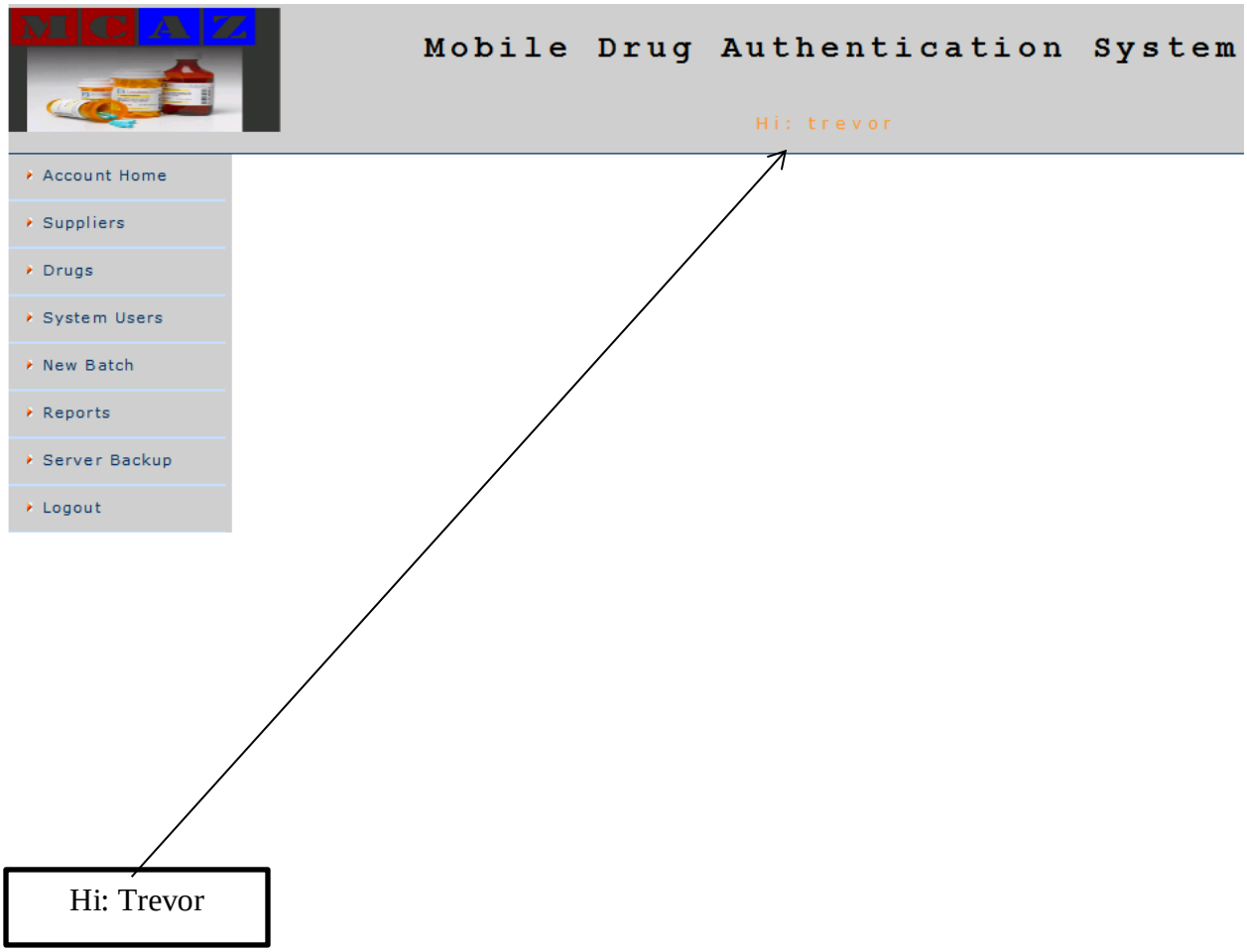

Fig 53 Account home form

Step 2: Register the supplier

Once a user is logged the user has to register the supplier so that the supplier details are stored in MCAZ database and the supplier will obtain registration number from the system which the supplier will use whenever they have a drug to be registered. The user has to click on supplier and as below:

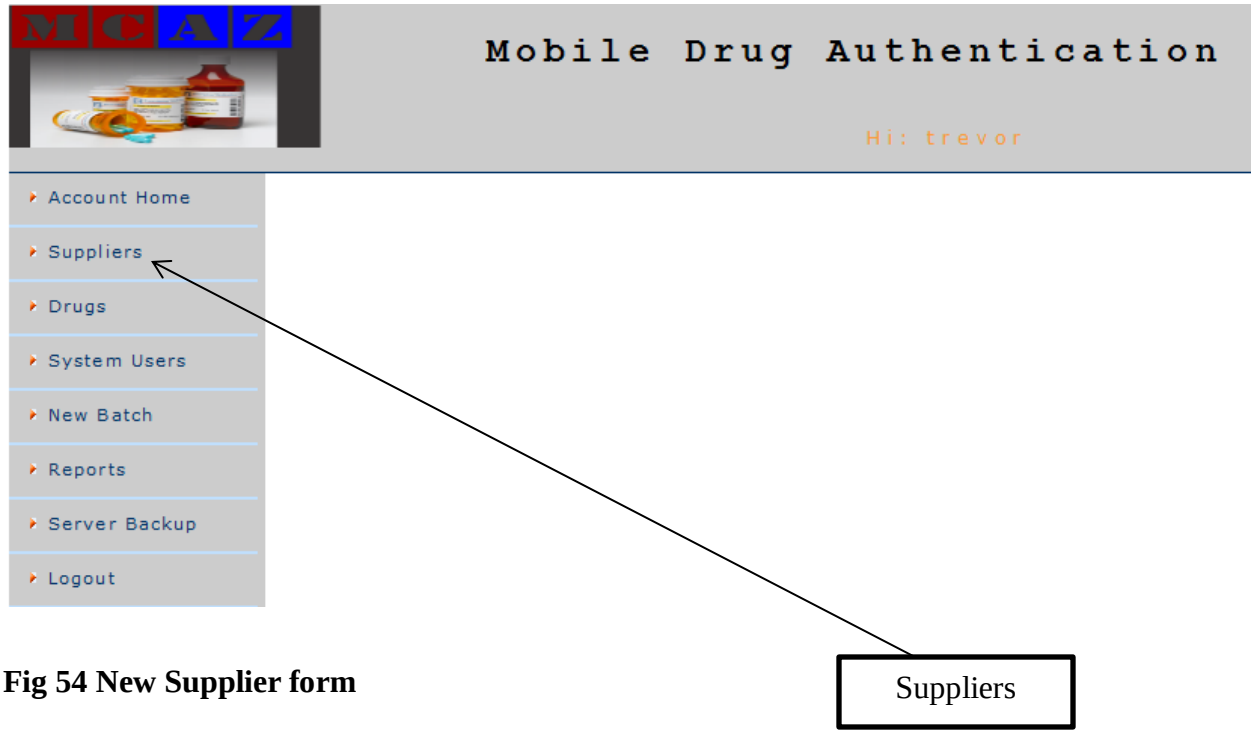

Fig 54 New Supplier form

The form that is below will appear and the supplier details will be entered.

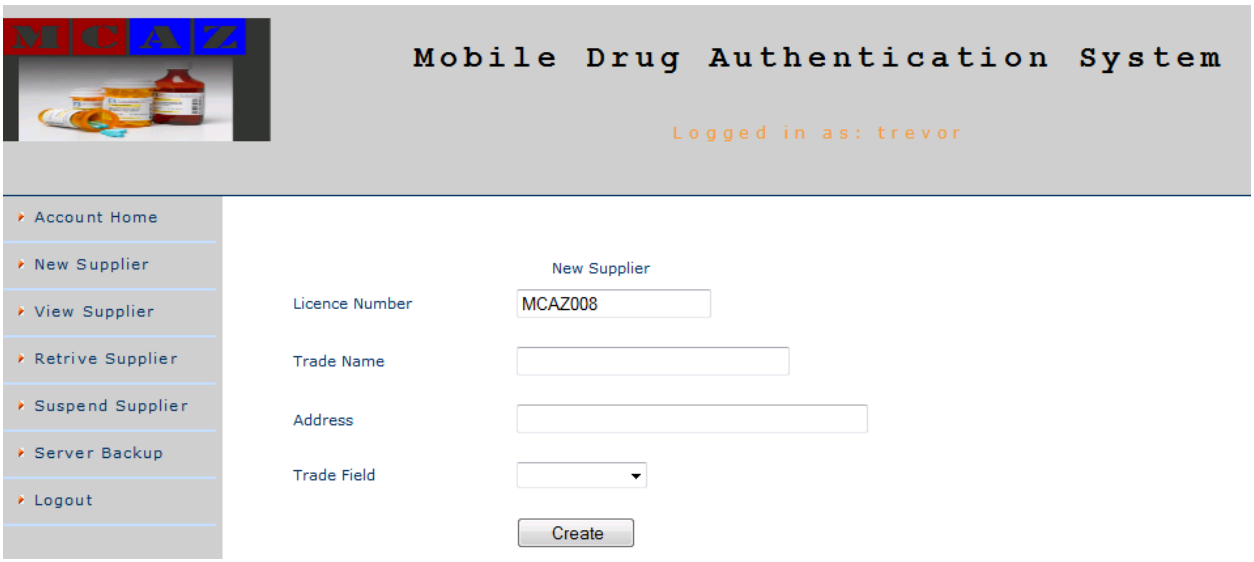

Fig 55 New Supplier details

And upon entering all the required details the user will click create and get a response if details are added successfully as below

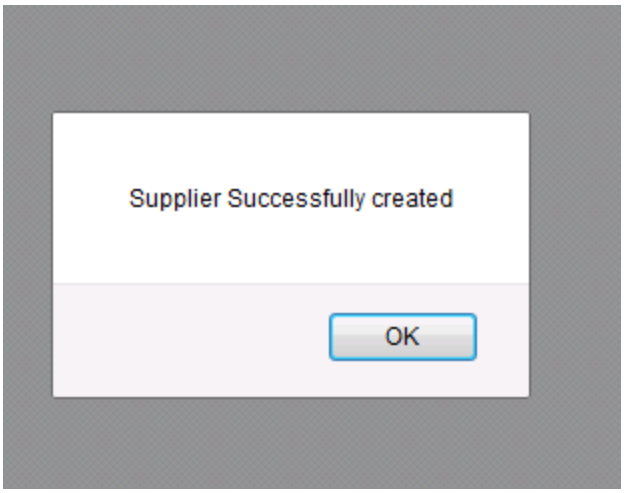

Fig 56 New supplier added Form

The user will have to click OK then is directed back to the supplier page if he she wishes to enter more suppliers details if not can chose to go back to account home.

Step 3: Register the supplier drug(s)

Once the supplier details has been captured in the system then the supplier drug that has been tested and approved can be entered in the system as registration of the drug. The user has to choose the drug option such as below:

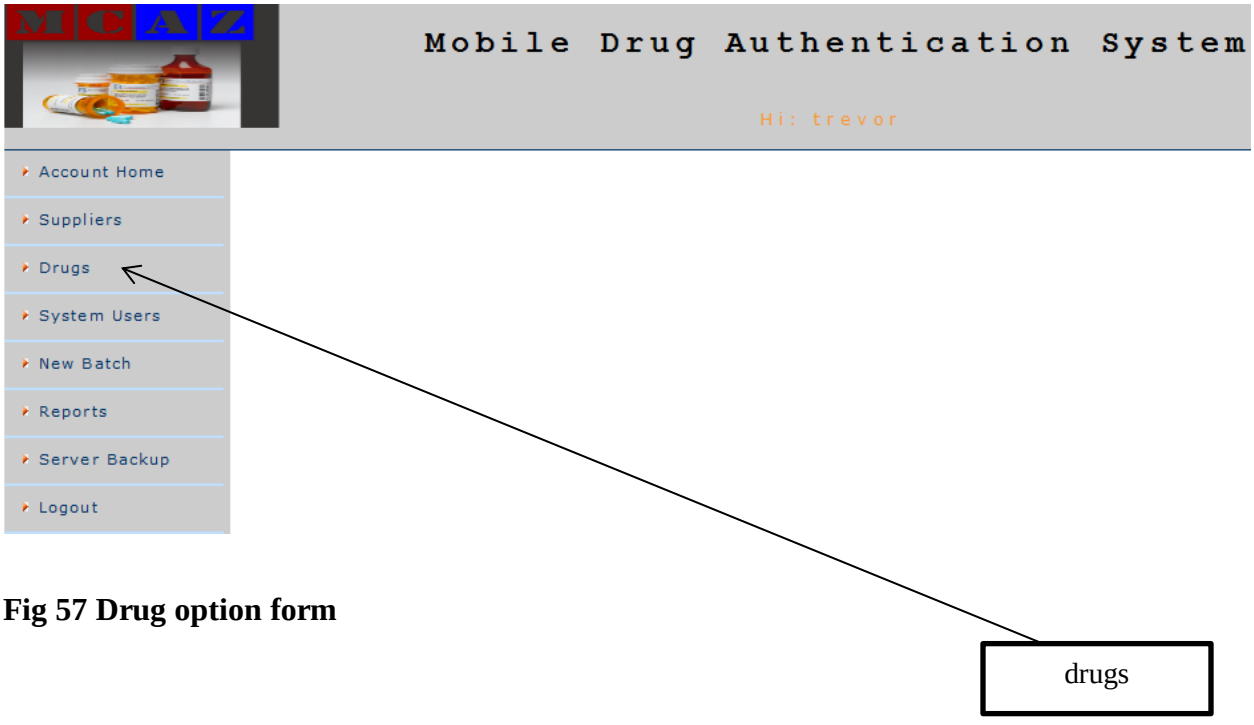

Fig 57 Drug option form

After clicking on drugs the following screen will appear in which the user will add the drug details.

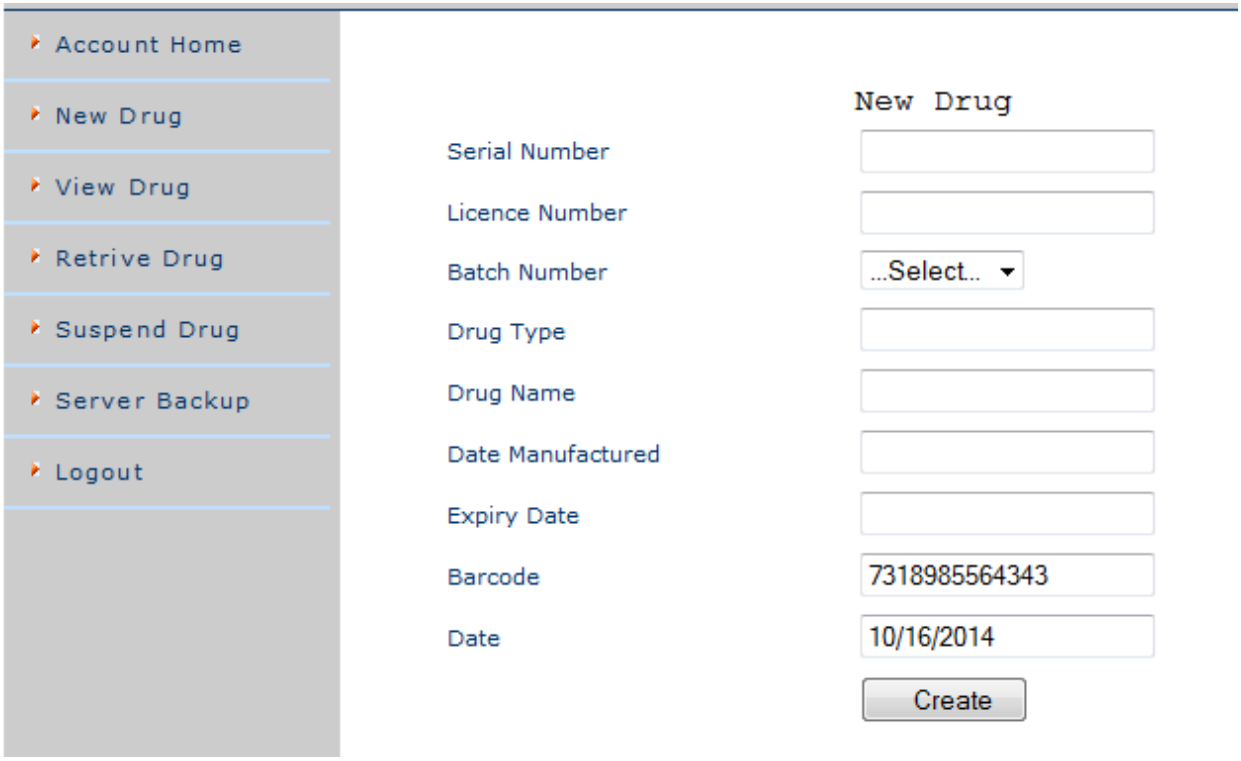

Fig 58 Entering drug details form

After that has been done then the user will click the button create and the drug details will be stored in the system.

Step 4: Entering a new batch of drugs

If a supplier wishes to add a new batch of drugs the supplier maybe manufacturing or supplying the user will have to click on option named new batch as below

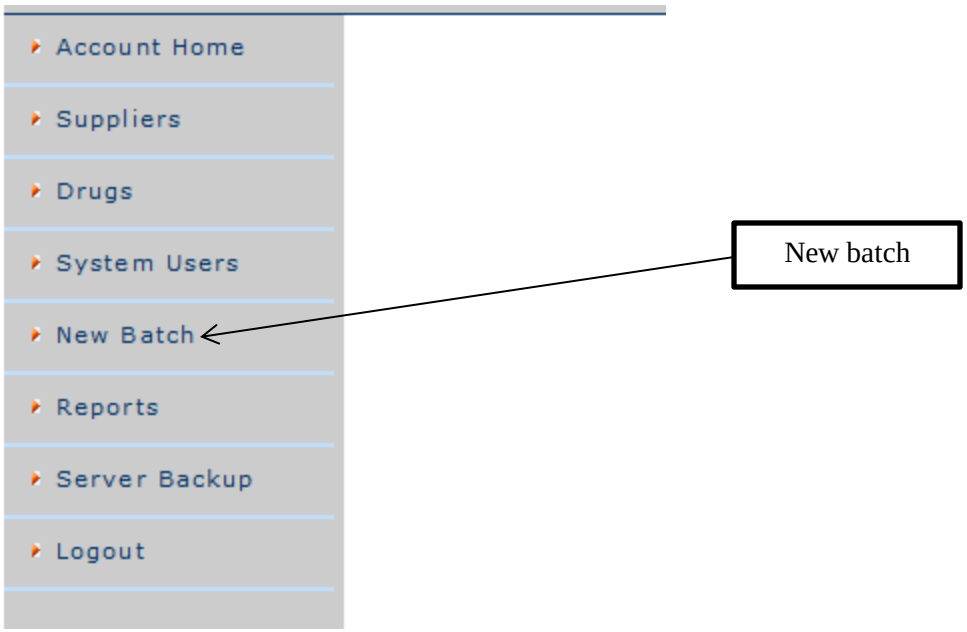

Fig 59 New batch form

Then select batch number and click create as below

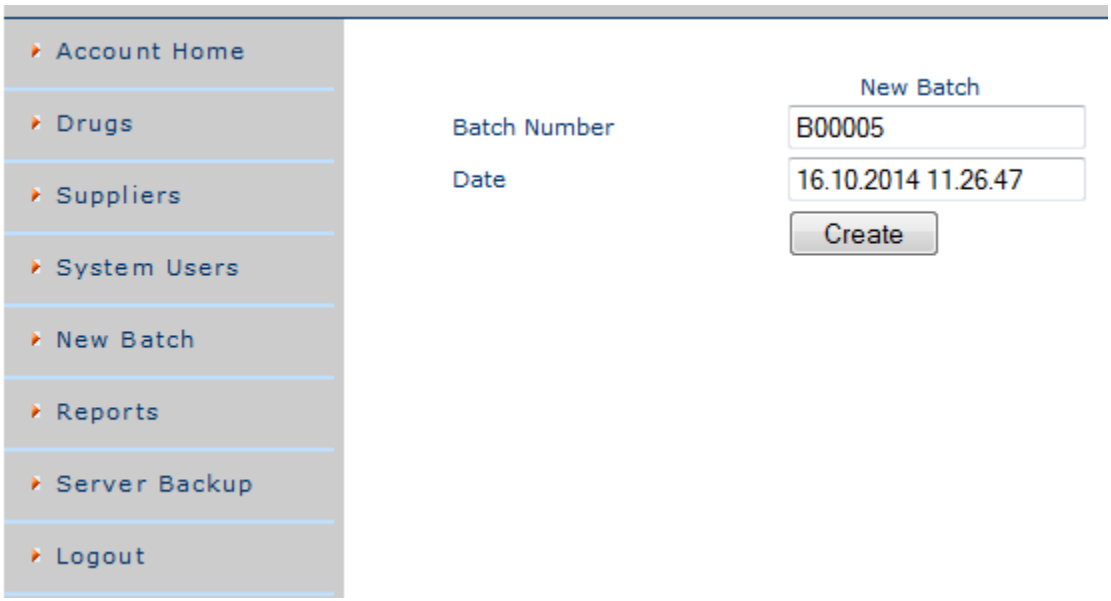

Fig 60 Create new batch number form

Step 5 Checking reports

If user may want to check reports he/she has to click on the option reports as below

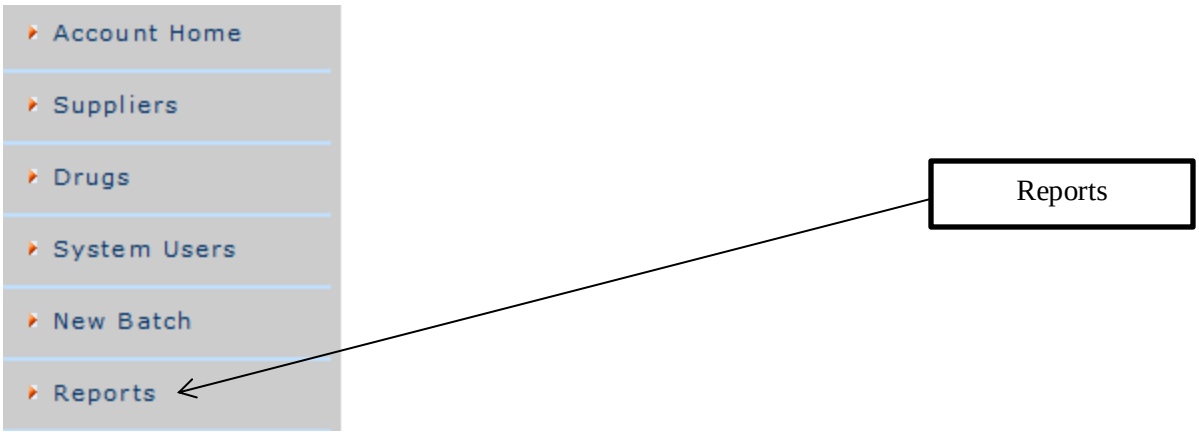

Fig 61 Reports option

The form below will appear

Mobile #	Msg	Date and time received
+263772517627	Hi, Muti Joe ! The barcode 2356149179475 is genuine.	2014-10-03 15:46:02
+263772517627	Hi, Treva ! The barcode 2356149179475 is genuine.	2014-10-03 17:46:59
+263772125972	Sorry, this is not a registered drug	2014-10-04 05:46:14
+263772205234	Sorry, this is not a registered drug	2014-10-04 05:46:40
+263733365603	Hi, Trev ! The barcode Sorry, this is not a registered drug can not be found. For assistance call 04 222254	2014-10-04 05:46:55
+263733365603	Hi, Trev ! The barcode 2356149179475 is genuine.	2014-10-04 05:48:27
+263733598303	Hi, trevs ! The barcode Jam can not be found. For assistance call 04 222254	2014-10-09 07:13:07
+263733598303	Hi, trevs ! The barcode 8872856803063 is genuine.	2014-10-09 07:13:14
+263772517627	Hi, Treva ! The barcode 0000 can not be found. For assistance call 04 222254	2014-10-13 13:54:19
+263772517627	Hi, Treva ! The barcode 2630315334664 is genuine.	2014-10-13 14:00:40
+263772517627	Hi, Treva ! The barcode Jgjt can not be found. For assistance call 04 222254	2014-10-14 07:28:50
+263772517627	Hi, Treva ! The barcode Treva can not be found. For assistance call 04 222254	2014-10-14 08:29:37

Fig 62 Statistics report

Users can also be able to search reports by date or id as below:

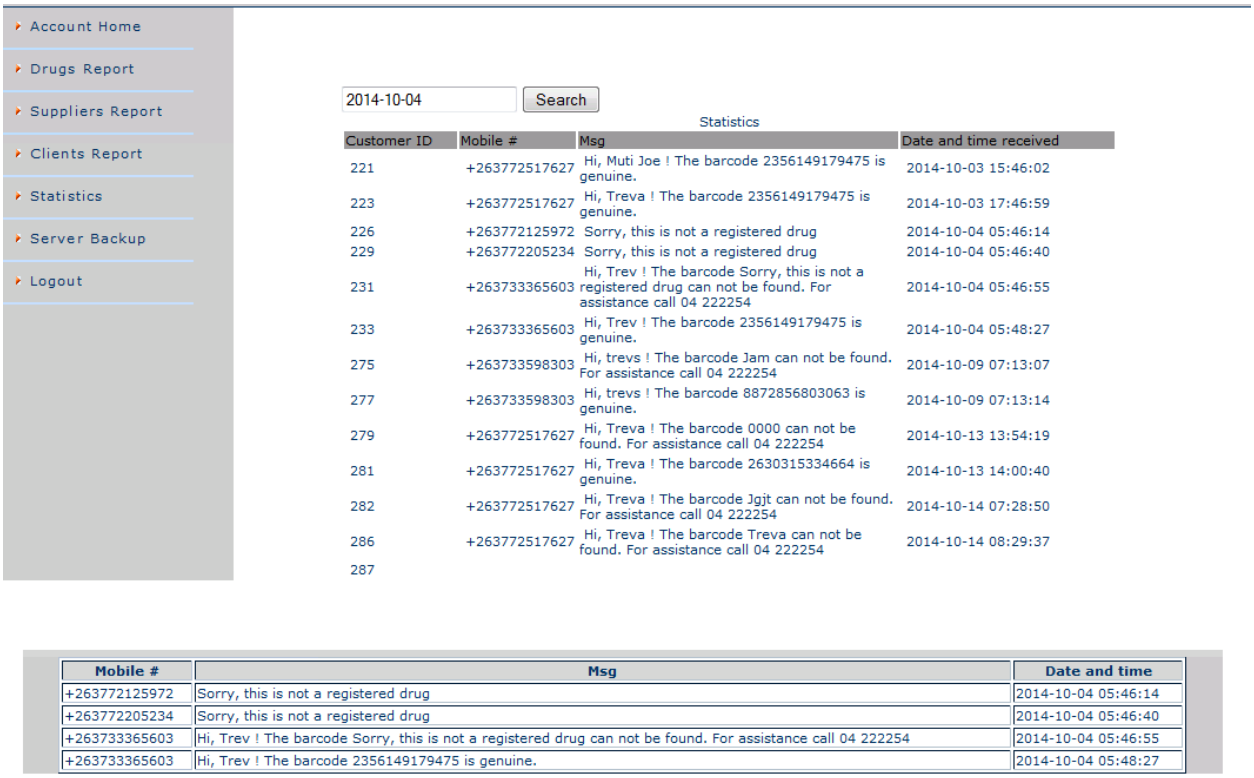

Fig 63 Search by date

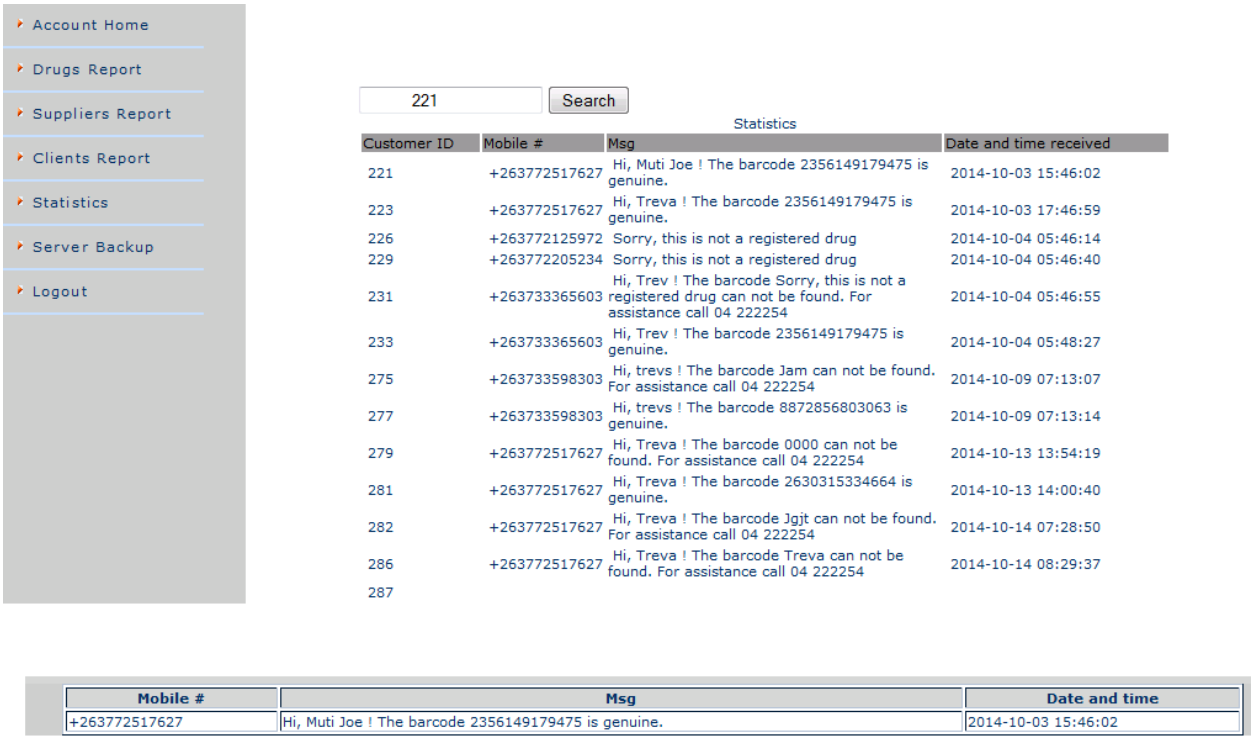

Fig 64 Search by id

Step 6: Backup

In case of emergency or if something is to happen for example if fire breaks out and destroy everything it is better to back up the server in case of such a mishap so a user is advised to do so every time as shown below

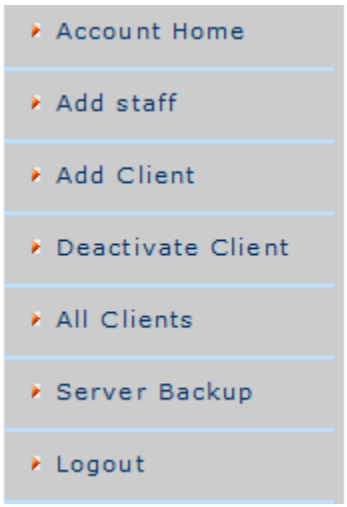

Fig 65 Server backup option

The following screen will appear upon clicking server backup option and click save then OK.

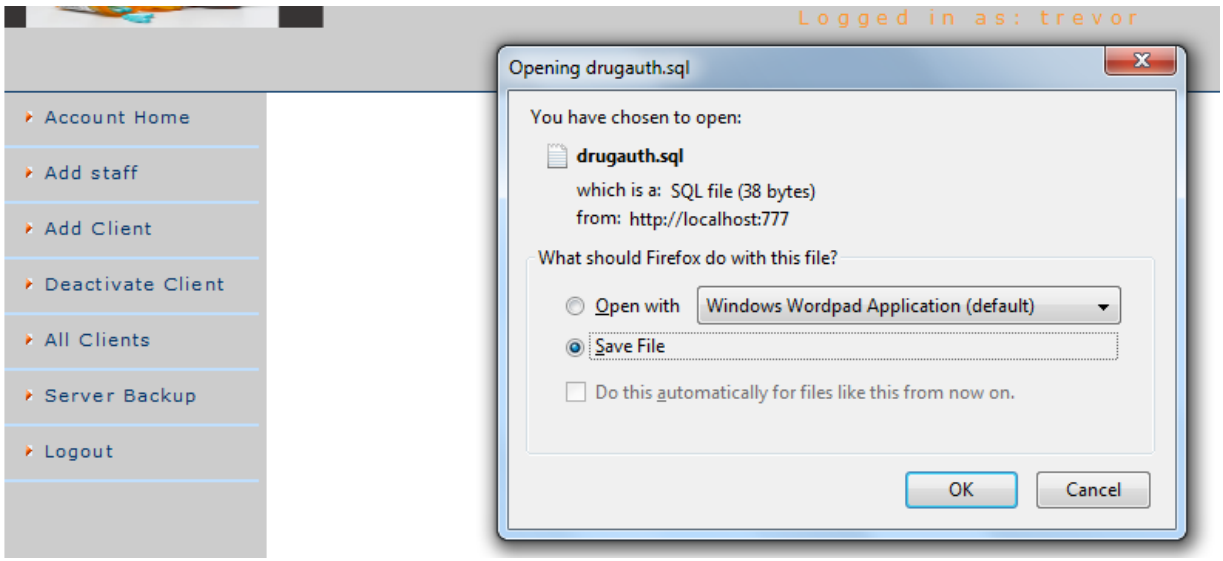

Fig 66 server backup form

Step 7: logging out

If the user is done and may wish to log out the user has to click log out as shown below

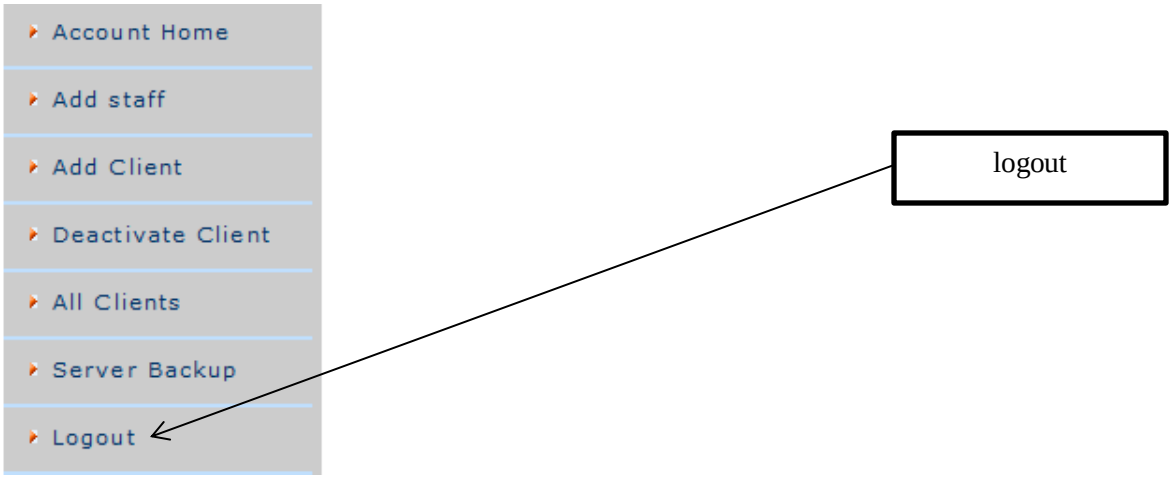

Fig 67 Logout form

APPENDIX B: Interviews checklist

1. How does your current system work with regard to recording or retrieving of data?

   _____

   _____

2. How would you rate the system performance of the current system

   _____

   _____

3. Do you encounter any problems in using the current system

   _____

   _____

4. What roles does the staff member has

   _____

   _____

5. Do you encounter any complaints from clients from the use of the current system in terms making alerts of fake drugs

   _____

   _____

6. Suppose you need to retrieve information about cases of drugs that were reported before what are the procedures to be followed

   _____

   _____

7. What improvement would you consider necessary to your system so that people become more aware of fake drugs

   _____

   _____

8. What are the advantages of using the current system

_____

_____

9. Do you find it necessary to develop a new system

_____

_____

10. How do you store information about drugs or suppliers in your organisation

_____

_____

APPENDIX C: Questionnaire checklist

Current Users of the system

QUESTIONNAIRE

1. How long does it take for you to create a report?

   _____

   _____

   _____

2. Are you happy with the existing system? **Yes.** **No.**
   If **NO** give reasons and recommendations

   _____

   _____

   _____

3. What are your views relatively to the designing of the new system

   _____

   _____

4. Do you think the existing system has adequate security? **Yes.** **No.**

   _____

   _____

5. How often do you encounter cases of fake drugs

   _____

   _____

Clients

QUESTIONNAIRE

1. Do you know about MCAZ and its purpose? **Yes.** **No.**
   If your answer is **YES** how did you get to know it **Through a friend** **Via webiste**

2. Is the service offered by MCAZ satisfying? **Yes.** **No.**
   If your answer is **NO** give reasons and suggestions.

   _____

   _____

3. Do you know that they are fake drugs that can be sold? **Yes.** **No.**
   If **YES** give answer how did you got to know that

   _____

   _____

4. Do your often get access to Internet. **Yes.** **No.**
   If your answer is **YES** how often and If **NO** give reasons why?

   _____

   _____

5. What recommendation would you give MCAZ in raising awareness in reaching a wide range of people about fake drugs?

   _____

   _____

APPENDIX D: OBSERVATION SCORE SHEET

Observation guide schedule

Name of Observer:……Section:……..

Date:……..Time:……..

Observation:……...
……
……
……
……
……
……
……
……
……
……

Conclusion:……
……
……
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……
……