ABSTRACT

This research is aimed at developing a Crop Disease Detection and Control Advisory System which assists the farming community. The idea of developing the system came as a way of mitigating the problems affecting the organization that include poor and slow service delivery in FCC shops when assisting farmers or giving advice to farmers. Farmers from remote areas have to travel long distances to get assistance and be advised on how they can cure certain diseases affecting their plants and knowledge on how they can do their farming activities the best way. In a bid to solve these and some of the problems, the researcher came up with an idea of developing this system that allowed farmers to get knowledge and advice on their farming activities wherever they are and whenever they need it. The system allows a farmer to logon to the web system that will be available online anytime of the day. The proposed system was developed using PHP programming language and MySQL database. Farmers are provided with the best tips about their farming activities and advice on the best pesticides they can use to cure their crop diseases. Information was obtained from observations and questionnaires that enabled the development of the system to be a success. On completion, the system managed to enhance farmers in their farming activities allowing them to increase their production. On the other hand Consultants in the shops are finding work to be easier since they can assist farmers on their desktop machines. A system testing was also carried out to ensure that all user requirements were met.

DECLARATION

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

Signature: ……. Date: ……..

APPROVAL

This dissertation, entitled **"Crop Detection and Control Advisory System"** by **Ruvimbo Revesai** meets the regulations governing the award of the degree of **BSc Honours Information Systems** of the **Midlands State University,** and is approved for its contribution to knowledge and literal presentation.

Supervisor's Signature: …….

Date: ……..

ACKNOWLEDGEMENTS

Firstly I thank the almighty God who was leading me in this journey and for taking me this far. I would like to thank my Supervisor Mrs. T G Zhou for working patiently with me I wouldn't have done this without her help. I want to acknowledge the Department of Computer Science and Information System for allowing me to carry my research, Midlands State University as a whole for enrolling me to study my degree at the Institution. I give thanks to my brother Edson Revesai and my family which was there for me through it all. Not forgetting my friends Vimbainashe Mkwendi, Shalom Mupfiga, Mayshow Mutiza for being there for me during the uptake of this course. My inspiration and mentor Kudakwashe Praise Mutukura for his encouragement and motivation. I cannot forget to mention Mr Kasecha my supervisor at Farm and City Center where I did my Work Related Learning. Special mention goes to the Almighty God again because His love for my life keeps me going.

TO GOD BE THE GLORY!!!

DEDICATION

This project is dedicated to my late parents Mr. and Mrs. Revesai who would have been proud seeing me fulfilling the wish of every parent also to my brother Edson Revesai and my sister Martha Revesai who always encouraged me to be strong through thick and thin. I would like to thank my brother again who have been helping me financially and who was there for me all the time telling me that if you want to be successful in everything that you do begin with the end in mind.

Table of Contents

ABSTRACT i
DECLARATION ii
APPROVAL iii
ACKNOWLEDGEMENTS iv
DEDICATION v
LIST OF ACRONYMS xii
LIST OF TABLES xiii
LIST OF FIGURES xiv
LIST OF APPENDICES xvi
CHAPTER ONE: INTRODUCTION 1
1.1 Introduction 1
1.2 Background of the Study 1
1.2.1 Background of the Organization 1
1.2.2 Organizational structure 3
1.2.3 Vision 4
1.2.4 Mission statement 4
1.3 Problem Definition 4
1.4 Aim 4
1.5 Objectives 4
1.6 Instruments and Methods 5
1.7 Justification and Rationale 6
1.8 Conclusion 6
CHAPTER TWO: PLANNING PHASE 7
2.1 Introduction 7
2.2 Business Value 7
2.2.1 Shareholder value 7
2.2.2 Customer value 8
2.2.3 Employee knowledge 8
2.2.4 Managerial value 8
2.2.5 Supplier value 8

2.3 Feasibility Study 9
2.3.1 Technical feasibility 9
2.3.1.1 Technical Expertise 9
2.3.1.2 Hardware requirements 10
2.3.1.3 Software Requirements 10
2.3.2 Economic Feasibility 11
2.3.2.1 Cost Benefit Analysis 11
2.3.2.2 Development costs 11
2.3.2.3 Operational costs 12
2.3.2.4 Benefits 12
2.3.2.5 Estimated Cost and Benefit Analysis 13
2.3.2.6 Net profit 14
2.3.2.7 Return on Investment (R.O.I) 14
2.3.2.8 Net Present Value (NPV) 14
2.4 Risk Analysis 16
2.4.1 Scope 16
2.4.2 Scheduling Risk 16
2.4.3 Resource Risk 16
2.4.4 Technology Risk 17
2.5 Stakeholder analysis 17
2.5.1 Farmers 17
2.5.2 The Management 18
2.5.3 The consultant 18
2.5.4 Ministry of Agriculture 18
2.5.5 Agriculture Extension officers 18
2.5.6 Agriculture and Rural Development Authority (ARDA) 19
2.6 Work Plan 19
2.6.1 The Gantt chart 20
2.7 Conclusion 20
CHAPTER 3: ANALYSIS PHASE 21
3.1 Introduction 21
3.2 Information Gathering Methodologies 21

3.2.1 Observations 21
3.2.1.1 Advantages of observations 22
3.2.1.2 Disadvantages of observations 22
3.2.1.3 Information obtained from observations 22
3.2.2 Questionnaires 22
3.2.2.1 Open ended questionnaires 23
3.2.2.2 Closed questionnaires 23
3.2.2.3 Advantages of questionnaires 23
3.2.2.4 Disadvantages of questionnaires 23
3.2.2.5 Results from questionnaires 24
3.3 Analysis of existing system 24
3.3.1 Description of the current system 24
3.4 Process Analysis 24
3.4.1 Activity diagram of existing system 24
3.5 Data Analysis 26
3.5.1 Context Diagram 26
3.5.2 Data Flow Diagram (DFD) 27
3.6 Weaknesses of the current system 28
3.7 Evaluate Alternatives 28
3.7.1 Outsource 28
3.7.1.1 Advantages 28
3.7.1.2 Disadvantages 29
3.7.1.3 Reasons for choosing not to outsource 29
3.7.2 Improvement 29
3.7.2.1 Advantages 30
3.7.2.2 Disadvantages 30
3.7.2.3 Reasons for choosing not to Improve 30
3.7.3 Development 30
3.7.3.1 Advantages 31
3.7.3.2 Disadvantages 31
3.7.3.3 Reasons for choosing development as the best alternative 31
3.8 Requirement Analysis 32

3.8.1 Functional requirements 32
3.8.1.1 Use case diagram 32
3.8.2 Non- Functional Requirements 33
3.9 Conclusion 34
CHAPTER 4: DESIGN PHASE 35
4.1 Introduction 35
4.2 System Design 35
4.2.1 User friendly 35
4.2.2 Reliability 35
4.2.3 Maintainability 35
4.2.4 How the proposed system works 36
4.2.4.1 Context Diagram and Data flow diagram 37
4.2.4.2 Data Flow Diagram (DFD) 38
4.3 Architectural Design 39
4.3.1 The components that are required include 39
4.4 Physical Design 39
4.5 Database Design 40
4.5.1 External view 41
4.5.2 Conceptual level 41
4.5.3 Internal view 41
4.5.4 Database tables 41
4.5.5 Enhanced Entity Relationship Diagram EER 45
4.6 Program Design 46
4.6.1 Package Diagram 46
4.6.2 Class Diagram 47
4.6.3 Sequence Diagram 48
4.7 Interface Design 49
4.7.1 Menu design 49
4.7.1.1 Main menu 49
4.7.1.2 Sub Menus 49
4.7.1.3 Input Design 50
4.7.1.4 Log in form for users 50

4.7.1.5 Form for adding users 51
4.7.1.6 Farmer Registration form 52
4.7.1.7 Add plants form 52
4.7.1.8 Add disease form 53
4.7.2 Output Design 53
4.7.2.1 Plant Details 54
4.7.2.2 Symptoms 54
4.8 Pseudo code 56
4.9 Security Design 58
4.9.1 Physical Security 58
4.9.2 Network Security 58
4.9.3 Operational Security 58
4.10 Conclusion 59
CHAPTER 5: IMPLEMENTATION PHASE 60
5.1 Introduction 60
5.2 Coding 60
5.3 Testing 63
5.3.1 Unit Testing 64
5.3.2 Module Testing 66
5.3.3 System Testing 70
5.3.4 Acceptance Testing 74
5.3.4.1 Validation 74
5.3.4.2 Verification 75
5.4 Installation 76
5.4.1 System Changeover 77
5.4.1.1 Direct Changeover 78
5.4.1.2 Parallel Changeover 78
5.4.1.3 Phased Changeover 79
5.4.1.4 Pilot Changeover 79
5.4.1.5 Recommended changeover Strategy 80
5.5 Maintenance 80
5.5.1 Corrective maintenance 81

5.5.2 Adaptive maintenance 81
5.5.3 Perfective maintenance 81
5.5.4 Recommendation for Maintenance 81
5.6 Recommendations for future development 81
5.7 Conclusion 82
REFERENCE 83
Appendix A: User Manual 88
Appendix B: Questionnaire checklist 96
Appendix C: Observation Form 99
Appendix D: Snippet of Code 100

LIST OF ACRONYMS

- DFD Data Flow Diagram
- FCC Farm and City Center
- CFI Consolidated Farming Investment
- EERD Enhanced Entity Relationship Diagram
- GUI Graphic User Interface
- LAN Local Area Network
- WAN Wide Area Network
- PBP Pay Back Period
- SQL Structured Query Language
- ROI Return On Investment
- NPV Net Present Value
- CBA Cost Benefit Analysis
- IT Information Technology
- HTML Hyper Text Markup Language
- PHP Hyper Text Preprocessor

LIST OF TABLES

Table 2.1: Hardware requirements 10
Table 2.2 Software requirements 10
Table 2.3: Development costs 11
Table 2.4: Operational cost 12
Table 2.6 cost benefit analysis 14
Table 2.7 Work plan table 19
Table 4.1 user login 42
Table 4.2 Farmers 42
Table 4.3 Access 43
Table 4.4 Plants 43
Table 4.5 Diseases 43
Table 4.6 pesticides 44
Table 4.7 Pests 44
Table 5.1 test plan 77

LIST OF FIGURES

Fig 1.1 Organogram 3
Fig 2.1 Gantt chart 20
Fig 3.1 Activity diagram 25
Fig 3.2 Context Diagram 26
Fig 3.3 Data Flow Diagram 27
Fig 3.4 use case diagram 33
Fig 4.1 Context Diagram 37
Fig 4.2 Data Flow Diagram 38
Fig 4.3 architectural design 39
Fig 4.4 the proposed system physical design 40
Fig 4.5 EER 45
Fig 4.6 Package Diagram 46
Fig 4.7 Class diagram 47
Fig 4.8 Sequence Diagram 48
Fig 4.9 Menu Design 49
Fig 4.10 Farmer's Main Menu 49
Fig 4.11 Sub Menu 50
Fig 4.12: Users Login 50
Fig 4.13: Add Users 51
Fig 4.14: Farmer Registrations 52
Fig 4.15: Add Plants 52
Fig 4.16 Add Diseases 53
Fig 4.17 Plant Details 54
Fig 4.18 Symptoms 55
Fig 5.1 Testing 63
Fig 5.2 unit testing 64
Fig 5.3 unit testing 65
Fig 5.4 unit testing 66
Fig 5.5 module testing 67
Fig 5.6 module testing 68

Fig 5.7 module testing 69
Fig 5.8 farmer inputting the crop 69
Fig 5.9 module testing 70
Fig 5.10 system testing 71
Fig 5.11 system testing 72
Fig 5.12 system testing 72
Fig 5.13 chat screen 73
Fig 5.14 system testing 73
Fig 5.15 system testing 74
Fig 5.16 validation 75
Fig 5.17 Verification 76
Fig 5.18 direct conversion 78
Fig 5.19 Parallel conversion 78
Fig 5.20 Phased conversion 79
Fig 5.21 Pilot conversion 79
Fig 5.22 Maintenance process 80
Fig A1 farmer home screen 88
Fig A3 farmer login screen 89
Fig A4 farmer welcome screen after log in 90
Fig A5 symptoms screen 90
Fig A6 symptoms and control screen 91
Fig A7 Chat screen 91
Fig A8 enter the crop picture with defect 92
Fig A9 farming tips screen 92
Fig A10 consultant login screen 93
Fig A11 Consultant home screen 93
Fig A12 Farmers in the system 94
Fig A13 Reports screen 94

LIST OF APPENDICES

Appendix A: User Manual 88

Appendix B: Questionnaire checklist 96

Appendix C: Observation Form 99

Appendix D: Snippet of Code 100

CHAPTER ONE: INTRODUCTION

1.1 Introduction

This chapter introduced the topic under study. Its main objective is to review the problem definition of the study, the aim of the study, and the objectives of the proposed system. It also include information about the organization such as its background and its organization structure. The proposed system is going to help farmers to get information about the diseases affecting their plants that is advice on what can be a cure to the effects of poor crop production. Farmers are also going to be advised on what they can grow at certain regions of the country and the likely possible diseases affecting those regions. Advice is also going to be given to farmers on what they can use as drugs to kill certain pests and certain diseases. Farmers are going to be easily given places at which they can get those drugs that is in variety shops of FCC.

1.2 Background of the Study

After discovering that some farmers are failing to be successful in their farming activities due to lack of knowledge and easy access to resources, the researcher came up with the idea of the proposed system. Some farmers are failing to get information of how they can cure certain diseases affecting their plants due them facing difficulties that involves travelling distances to seek for advice to the consultants in shops. The idea of the proposed system came as a way of helping farmers get knowledge of how they can assist themselves in their farming activities by allowing a farmer to get help quickly and easily on the proposed system online application. Also after discovering that FCC can get more loyal customers that is the farmers who may found it necessary to buy their farming products at FCC shops due to the help they will be given by the proposed system.

1.2.1 Background of the Organization

In 1908, the Farmer' Cooperative Society was formed in which Consolidated Farming Investment (CFI) originated. The aim of this society was to produce maize. It emerged as a way of helping farmers who were into maize production. During that time, a largest sailing ship called the MS Kobenvan was there for transporting bags of maize from Beira to London. The society was then renamed to become a limited company in the year 1919.

Traders and cooperatives who were into maize marketing were then stopped form doing their marketing according to the Maize Control Act giving the right to the Maize Control Board. The farmer' cooperative was then forced to stop maize marketing and both global markets and local markets were banned. Business was then proceeded under separate divisions which are groceries and farm produce. A department for helping farmers to acquire fertilizers and other farm input was formed which was called the purchasing department in 1937 and the company and its registration was in 1953.

In 1989 the company was reorganized and started trading as Consolidated Farming Investment and it then purchased the Farmer's Cooperative trading Division with the goal of trading as Farm and city center (FCC). The company was able to open new branches during 1942 and 1947.it opened about 10 branches. In 2010, the goal was achieved and it started trading as farm and city center. New branches were opened in Hauna, Odzi that is Manicaland Province as well as Mutoko in Mashonaland East Province.

Farm and city continued its operations and opened some other new branches in different cities around 2011. These include a branch in Tengwe, Marondera, chitekete and Mt Darwin. All in all farm and city managed to open about 37 branches country wide. The head office of farm and city is located in Harare. Farm and city is trading and its expansion is increasing and it's one of the biggest agricultural shops around the country.

1.2.2 Organizational structure

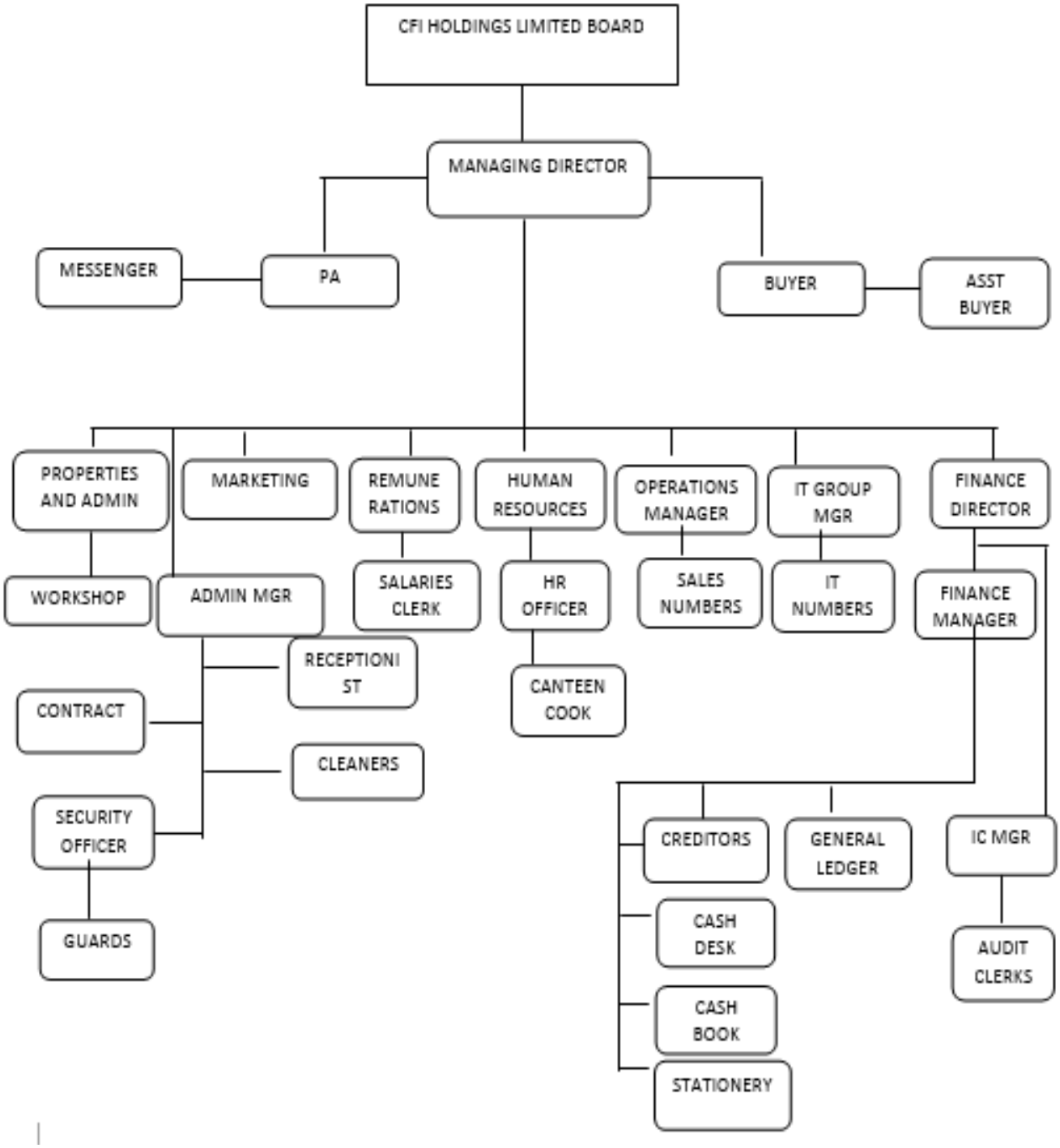

Fig 1.1 Organogram

1.2.3 Vision

To be the most preferred and premier retail outlet in Zimbabwe and all the markets we serve.

1.2.4 Mission statement

To provide all our customers with a comprehensive shopping solution for agricultural inputs, veterinary products, general hardware and groceries.

1.3 Problem Definition

Problems that are caused by the current system include:

Farmers not getting enough advice on information needs about diseases affecting plants and the possible solutions to the diseases. Farmers living in remote areas have to travel long distances to reach the consultants in FCC shops to get advice on their crop production. Sometimes consultants could not manage to have more time with a farmer since some will be waiting for such a service which causes poor and slow service delivery. Farmers growing crops at regions where the crop growth is poor because of lack of knowledge. Farmers facing challenges on how they can get advices about their farming activities due to distance that they have to travel to get access to the consultants in the shops.

1.4 Aim

The aim of the study is to develop a system that help farmers in their farming activities that is by giving them knowledge about farming activities, help them cure certain diseases affecting their crops and advising them on certain tips that they require for better crop production. The study aims at making sure every farmer that needs help and knowledge about farming activities can get it anytime anywhere.

1.5 Objectives

- To prompt the farmer to enter signs of a plant defection and be advised with the type of diseases affecting their plants.
- To provide for the best pesticides to cure certain pests causing diseases on plants based on what information the farmer has provided to it.
- To provide farmers with advise of diseases affecting a certain plants in certain regions of the country.

- To provide a platform of interaction between the farmers and the consultants for easy communication.
- To update farmers on latest information that they may require in their farming activities that is latest equipment, drugs and any other useful information.
- To advice and help farmers solve problems that they maybe encountering during their crop production.
- To provide a chat platform between all the farmers registered in the system

1.6 Instruments and Methods

These are instruments or tools used in the development of the proposed system (Preeti 2013).

The instruments used include

PHP programming language – this is a server side programming language and its full name is Hypertext Pre-processor language. Its use is for developing web-based systems by developers in coming up with best web applications. Php is chosen as the best of programming languages to develop this system because of its ability to come up with the best web applications. This proposed system is a web application designed to be working online.

Adobe Dreamweaver CS6 - this is for use in developing web pages that are more attractive. It can also be defined as a Hypertext Mark-up language that is HTML. It is used for the graphical user interface. This is going to be used to develop the system interface that is it is best when design the picture of what welcomes the users to the system. It is the best when combined with Php programming. A database is also a requirement for storing information and the database that is going to be used is **MySQL** – An open source database management system for secure data storage. It is a repository for information storage and retrieval. It ensures that data is secure and focuses on data consistency. Other instruments include Cascading **Style Sheets** which is a platform to provide styling on web pages and **Apache** which is a server for running web pages locally.

The methods used to collect data include **observations** and **questionnaires**. These are chosen because it is easy to collect data when using observations and questionnaires. It is easy to collect information using observations since there are no disruptions of the ongoing of work. Users can work whilst observations are carried out.

Also questionnaires can be distributed and then collected latter after users have already finished responding to the questions at their free time. Questionnaires also allow users to express themselves and their thoughts to the questions being asked.

1.7 Justification and Rationale

Advising the farmers on what information they need concerning their crop production will create an opportunity for farm and city to target a lot of customers by giving farmers a variety of knowledge on the drugs that can cure their crop diseases. Farmers will then be left with no option than to buy the drugs to where they have been given advice.

The platform also allow farmers to have a direct and quick conversation with the consultants will bring the farmers close to FCC thus creating relationships that will help them to continue advertising their products to the farmers. It is also a benefit for FCC as they can have an opportunity to advertise their products to farmers whom because of the good services on the advisory system will at a greater extent favor FCC compared to other farming shops.

The system also benefits the farmers as it reduces costs of travelling since other farmers will not find it necessary to travel long distances to get assistance at the shops as they can use the platform on the system to ask any question. The system also reduces work overload from the consultants at the shops as most farmers will use the platform on the system to get advice and a few will visit the shops.

1.8 Conclusion

This chapter highlighted what caused the development of the proposed system that is the major reasons for the development brought out by the background of the study. The chapter also clearly showed the objectives of the system that is what the system is going to do. Instruments and methods to be used in developing the proposed system are clearly shown and what the system aims to achieve. A justification that is bringing out the opportunities and benefits that FCC is going to gain through the use of the proposed system are clearly indicated. The next chapter shows the planning phase of the system.

CHAPTER TWO: PLANNING PHASE

2.1 Introduction

The previous chapter had various main points that include the background of the study as well as the main problems that spearhead the development of the proposed system. The last chapter also looked at the objectives of the proposed system that is what the system is going to do and its benefits to the organization. This chapter is the planning phase of the proposed system and it is going to look at the business value of the proposed system. A feasibility study is going to be carried out to show if the proposed system is that beneficial to the organization for it to be proceeded. A cost benefit analysis is drafted to indicate the differences in costs to be incurred in the development process and the benefits that will be brought thereafter. Possible risk factors are going to be outlined and solutions to these indicated. A Gantt chart to show the events of the proposed system is also displayed.

2.2 Business Value

Business value is an informal term that includes all forms of value that determine the health and well-being of the firm in the long run. Business value expands concept of value of the firm beyond economic value to include other forms of value such as employee value, customer value, supplier value, channel partner value, alliance partner value, managerial value, and societal value. (Schwartz 2016) defines business value as the success of an organization as it uses information to obtain its business objectives and goals.

2.2.1 Shareholder value

Shareholders are the owners of the company that is those that are part of the company's vision and goals. Shareholder value according to Fernanda (2012) is actually the expectations that shareholders and investors have with respect to the company's current and future financial performance. Since the proposed system is going to help FCC to gain customer loyalty by keeping customers up to date on the products and information they require, this means that FCC may gain a lot of sales revenue. This may mean that the value enjoyed by the shareholders of FCC increases because of them possessing shares of the company.

2.2.2 Customer value

According to Weinstein (2012), customer value represents the resulting effect of a product or service to the customer's goal and satisfaction. As the targeted customers are the farmers, the system will be of great importance to the farmers and they will benefit through various services offered by the system. Through the use of a messaging platform, a farmer can get advice from anywhere and anytime and also gain knowledge of how they can cure the diseases affecting their farming production.

2.2.3 Employee knowledge

Employees are the most valuable asset companies possess (Namchul 2015). Through the use of the new system, employees are going to gain a lot of knowledge since the system being implemented is something new that has never been implemented before. Employees are going to generate knowledge on how to use a web based system. They are going to learn how to help farmers without the use of face to face conversations. The system administrator is also going to learn and manage the web based advisory system. The IT team is going to gain a lot of knowledge on the use and the maintenance of an expert system.

2.2.4 Managerial value

Managerial values are those preferences from the usage of a resource by the management team over a period of time (Easton 2014). The management team will view the system as of an advantage to them because it will establish a good relationship between the organization and its customers. They would like to create a more attractive business image to farmers through keeping them up to date on most aspects of the business which aims at satisfying customers such being informed on new products.

2.2.5 Supplier value

The system will help suppliers with knowledge on what to produce as per requirement of the customer. Since customers are going to be able to get solutions on how to treat their crops, various drugs or pesticides will be on demand by customers and this will also benefit suppliers since they will produce more of the products demanded by customers.

2.3 Feasibility Study

In order to investigate the worthiness of a project, a feasibility study is carried out that is the study of examining the benefits of carrying out the proposed system in terms of costs and time. All projects are feasible given unlimited resources and infinite time (Kelsey and Gray 2015). But in reality both resources and time are scarce. Project should confirm to time bounce and should be optimal in the consumption of resources. The objective of carrying a feasibility study is to emphasize potential problems of a project and after all the factors are considered, the project should then be carried out. Four different categories are being undertaken to investigate how feasible the project is and these include technical, economic, social and operational feasibility.

2.3.1 Technical feasibility

The success of the proposed system would require adequate resources which include hardware and software. To determine whether the proposed system is technically feasible, one should take into consideration the technical issues involved behind the system (Robert and Philip 2015). FCC crop disease detection and control advisory system uses the web technologies, which is gently employed these days worldwide. The world without the web is incomprehensible today. Technical feasibility brings out the details that include transportation, technology needed that is hardware or software as well as materials needed. In carrying out this technical feasibility, the following situations are taken into consideration.

- The required technology to carry out the project is available or not?
- Whether enough resources are available or not?
- The software and hardware requirements
- The technical expertise that is the technical team.

FCC employees has experience with computers such that training them to use the system will be easier. However, they are other software and hardware required.

2.3.1.1 Technical Expertise

It is established if there are individuals best suited for the development of the system before a project commences. The organization has three options to choose from:

- Consulting other software developing companies

- Training one of its employees
- Employing new IT personnel well versed with system development.

The organization has however competent employees and they will be also responsible for online system maintenance.

2.3.1.2 Hardware requirements

Required items	**Explanation**	**Amount currently available**	**Amount that is required**
Desktop machine	4gig RAM HP ProLiant	1	2
Laptop	8 gig RAM HP	None	1
HP ProLiant server	8 gig RAM	None	1
UPS(uninterrupted power supply)	180Watts	None	1

Table 2.1: Hardware requirements

2.3.1.3 Software Requirements

Item	**Amount currently available**	**Amount that is required**
Database	None	1
Macromedia Dreamweaver	None	1
PHP	None	1

Table 2.2 Software requirements

2.3.2 Economic Feasibility

To see whether the project is economically feasible, expected benefits should be equal or exceed expected costs. A cost benefit analysis is carried out in which expected costs and expected benefits are evaluated if expected benefits outweighs expected costs then we can confidently say the project is economically feasible (Laudon 2016).

2.3.2.1 Cost Benefit Analysis

This is a sub part of economic feasibility in which expected costs and expected benefits are evaluated to check whether the proposed system is worthy proceeding or not. Cost benefit analysis is an approach that is used in estimating strengths as well as weaknesses of various alternatives or activities. It is a process of evaluating costs and benefits of a decision or project (Rosenblatt 2000). If the benefits are exceeding the costs then the development of the proposed system is economically feasible.

2.3.2.2 Development costs

These are costs incurred during the development of the proposed system and they include:

DEVELOPMENT COSTS	**VALUE/ USD**
Development labour	2000
Additional Software	1550
Computer consumables	200
Training	250
Total Cost	**4000**

Table 2.3: Development costs

2.3.2.3 Operational costs

These are costs incurred after the implementation of the system and continue to be incurred as long as the system is in use.

OPERATIONAL COSTS	**VALUE/ USD**
Computer Consumables	200
Software maintenance	300
TOTAL COST	**500**

Table 2.4: Operational cost

2.3.2.4 Benefits

These are obtained by the use of the proposed system and they include

- Reduced labor costs
- Reduced inventory costs
- Improved report quality and correctness for the management and other decision makers
- Improved work performance and efficiency.
- Better delivery of services to users.

These benefits can be converted into monetary value

ITEM	**MONETARY VALUE/ USD**
Reduction in stationary	500
Reduction in maintenance costs	1000
Reduced labor costs	4000
Reduced inventory costs	1500
TOTAL COST	**7000**

Table 2.5 Tangible Benefits

2.3.2.5 Estimated Cost and Benefit Analysis

TYPE OF COST	**ESTIMATED VALUES FOR THREE YEARS**		
	YEAR 1	**YEAR 2**	**YEAR 3**
	USD	**USD**	**USD**
Costs: Hardware			
Desktop machine 2@400	800		
HP laptop 1@450	450		
HP Server 1@1200	1200		
UPS 1@1000	1000		
Software			
Database	1000		
Web servers	0		
Macromedia Dreamweaver	0		
PHP	0		
Development cost			
Development labor	2000	0	0
Additional Software	1550	400	300
Training	250	0	0
Computer consumables	200	0	0
Operational cost			
Other Costs	100	100	100
Computer consumables	200	140	150
Software maintenance	150	100	110
Total cost	**8900**	**740**	**660**
Direct benefits			
Reduction in stationery	500	250	200
Reduction in maintenance costs	1000	200	100
Reduction in manual labor	4000	600	400
Estimated saved expenses(telephone costs)	3000	2000	3000

Reduced inventory costs	1500	900	950
Total Benefit	**10000**	**3950**	**4650**
Excess or (Deficit)	**1100**	**3210**	**3990**

Table 2.6 cost benefit analysis

2.3.2.6 Net profit

It is the difference between the total costs and total income over the life of the project (Albert 2014).

Net Profit=Total Benefits-Total Costs

= (10000+3950+4650)-(8900+740+660)

=8300 profit over the first three years.

2.3.2.7 Return on Investment (R.O.I)

(Albert 2014) says that Return on Investment refers to the profitability of the project expressed in percentage. R.O.I is used to calculate the viability of the project. It is the most widely used cost benefit analysis technique.

Formula

$$R.O.I = \frac{[\text{Total benefits} - \text{Total Costs}]}{\text{Total costs}} * 100$$

$$= \frac{18600 - 10300}{10300} * 100$$

$$= 80.58\%$$

Ratio of income generated to investment is sufficient and favorable.

2.3.2.8 Net Present Value (NPV)

This refers to a today's value of a project's future cash flows (Marc 2016). NPV can calculate the risks involved with the development of the project.

NPV can be calculated as follows:

$$\frac{\text{Value in year t}}{(1+r)_t}$$

Where t is the year and r is the rate

Assuming a rate of 0.1 and an initial investment of **$7000**, the NPV can be calculated as follows:

Year 1= $\frac{1100}{(1.1)^1}$

= $**1000**

Year 2= $\frac{3210}{(1.1)^2}$

= $**2652.89**

Year 3= $\frac{3990}{(1.1)^3}$

= $**2997.75**

NPV = ($7000-(1000 + 2652.89 + 2997.75))

= **$349.36**

To conclude, basing on the techniques above, the proposed system is economically feasible because benefits outweigh costs.

2.4 Risk Analysis

Risk analysis include the investigation of negative or unwanted impacts during the progress of a project (Charles 2015). Every project may encounter these problems and for a project to be a success, there should be measures taken to minimize these potential risks for the success of the project. The main aim of risk analysis is to identify these risks and find ways to reduce their effect on the project. There are four types of risks and these include scope, scheduling, resource and technology.

2.4.1 Scope

This is a risk caused by changes in scope that is changes in the possibility time required to deal with the project (David 2015). In terms of scope, the proposed system may grow in complexity as users might need to add more requirements during the development of the system and this lead to complexity. A change of how the system is going to look like maybe affected especially when new requirements appear after the development of the project has already started.

FCC can address this type of risk by not leaving out every requirement or needy to the system no matter how small it is.

2.4.2 Scheduling Risk

This type of risk is whereby a project cannot be proceeded in the way or time it was scheduled. Scheduling risk involve things like natural factors or errors in estimation or delays in acquisition of parts (Terje 2014). A project can have a number of reasons as to why the project has to fail to meet the scheduled time.

The project team has developed a Gantt chart so as to address this type of risk. A Gantt chart shows the scheduled time for every process in the development of the project. The team can also use a work breakdown structure for better and easy scheduling.

2.4.3 Resource Risk

Gregory and Rachel (2015) states that this type of risk involves the shortage of required resources during the development of the project. This could be a shortage of funds to finance the needs of the project. Resource risk can also include things like shortage of a skill required to finish the project very well.

The project team has developed a cost benefit analysis that is a budget that include all the costs involved in developing the system such that funds are available from the start. All the resources required in the development of the project are written down and every skills available.

2.4.4 Technology Risk

This type of risk involves a failure in a service or platform or a delay that arouse because of defects in hardware or software (David 2015). This type of risk also involves using a software that is known to be complex or a new software during the development of the project. This risk may affect areas such as a wrong user interface developed which may require a redesign and implementation.

The team has to consider the hardware or software failures that can arouse and how to mitigate these vulnerabilities. The stability of the hardware that is being used in the development of the project. Analyze any potential risks and how they can come up with solutions to these technology risks. This type risk can also be addressed by ranking up the potential risks and then specify the desired outcome. Also coming up with the probability of occurrence of every risk that can be encountered.

2.5 Stakeholder analysis

The objective of stakeholder analysis is to identify all the stakeholders involved in the development of the proposed system their requirements and expectations to the proposed system (Benjamin 2014). Stakeholders refers to entities who are involved or who have interests in the development of the project and these may propose their requirements and expectations to developers of the system. Since various stakeholders may have various requirements, these are all required to see if they can be merged together in the functionality of the new system.

2.5.1 Farmers

These are the main stakeholders who have the main interests in the development of this system as they are the targeted group of people by the company. These farmers expect to get quick communication or quick response to their questions. They also expect to get solutions to any problem that they may upload so that they can quickly cure the diseases that maybe affecting their plants.

Farmers are also expecting to get information on any new things that maybe of requirement to the planting of certain crops in certain seasons. Farmers are also looking forward to have messaging platform in which they can communicate with the consultants for various needs.

2.5.2 The Management

The management as the group that monitors the operations of the business expect to see their customers satisfied and appreciating the system. They expect their business operations to increase as well as their sales. They expect to see their company on top of its competitors that is gaining a competitive advantage over their competitors. The system should provide them with information that they can use for decision making purposes and future purposes.

Report generation is also a requirement by the management as it allow them to make any decisions for the proposed system.

2.5.3 The consultant

These are the employees that works in FCC shops assisting farmers who have questions on various problems affecting the growth of their plants. These expect to work well on an easy platform when advising farmers, they also expect the system to better than the manual they were using. They also expect reduction in work load in shops during business operations.

2.5.4 Ministry of Agriculture

This is the ministry that is concerned with agriculture development and its impact to various farmers around the country. The ministry of agriculture would expect the system to help in the development of agriculture processes such that farming activities can be easier. It can also expect the system to be used at many farming organizations for the development and success of farming activities in the country.

2.5.5 Agriculture Extension officers

These act as intermediaries between research and farmers. Their job is to facilitate farming activities by helping farmers in decision making and they ensure that proper knowledge is obtained for the best results. These would expect the system to work on their behalf by giving advice to farmers. They also would expect the system to include a lot of knowledge that can be used by farmers in their farming activities.

2.5.6 Agriculture and Rural Development Authority (ARDA)

This is a development that is under the ministry of education that ensures the development of agriculture in areas that lack resources and in developing the rural areas of the country. ARDA assists in farming production in the rural sector. This would expect the system to be used also by farmers that are in the outskirt areas such that they get used to technology and easy crop production.

2.6 Work Plan

This plan shows the activities in the development of the project from the start to the end of the development (Roger et al 2013). Its objective is to highlight the start of a project activity and its end as well as when the other one starts.

The following table shows the work plan that is going to be adopted in the development of the proposed system

PHASE	STARTING DATE	COMPLETION	TIME FRAME
Project Proposal	03/09/2018	07/09/2018	1 week
Introduction	10/09/2018	14/09/2018	1 week
Project Planning	24/09/2018	05/10/2018	1 week
System Analysis	08/10/2018	19/10/2018	2 weeks
System Design	22/10/2018	09/11/2018	3 weeks
Implementation	12/11/2018	24/11/2018	2 weeks
Maintenance	20/11/2018	Ongoing	Ongoing

Table 2.7 Work plan table

2.6.1 The Gantt chart

This shows the time scheduled for each activity in the development process (Roger et al 2013). It is a graphical representation of that scheduled time.

Time in Weeks

Activity/Period	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***
Proposal										
Planning Phase										
Analysis Phase										
Design phase										
Implementation										
Operation and Maintenance Ongoing										

Fig 2.1 Gantt chart

2.7 Conclusion

This chapter highlighted a lot of activities involved in the development of the proposed system and these include the business value of the system that is its value to the shareholders of the organization and the users. It also covered the feasibility of the proposed system that is the technical feasibility issues, the economic, the operation as well as the social feasibility. Various risks that maybe involved in the system's development were also outlined. Stockholder analysis and the work plan of the proposed system was highlighted. A Gantt chart showing the development stages and their scheduled time was also highlighted.

CHAPTER 3: ANALYSIS PHASE

3.1 Introduction

The last chapter which is the planning phase highlighted the business value of the proposed system, the feasibility study as well as risks involved in coming up with the proposed system. The primary focus of this chapter is to analyses the current system coming up with a clear understanding of what was affecting FCC. To come up with information concerning the current system, various information gathering techniques were used. A clear understanding of the problems affecting FCC employees as well as customers is known through these techniques. A better solution can be displayed that can surely solve the situation that is at hand. Activities involved in the current system are also displayed in a diagrammatic way for a better understanding. A requirement analysis is shown of the proposed system that addresses the problems and weaknesses of the current system. The chapter will also include the functional requirements of the proposed system.

3.2 Information Gathering Methodologies

These are devices or methods used to gather data that is regarding how the current system works in relation to its clients (James, 2015). They aid in helping examiners of the proposed system to come up with some information they can use to enhance the development of the proposed system. This is where all the required data concerning the current system is collected. Two methodologies used are observations and questionnaires.

3.2.1 Observations

Observations can be defined as a tool that is normally used socially to gather information of what is happening currently (Elvis, 2014). Observations were carried out at FCC shops where the analyst was observing what and how services were offered to farmers by the consultant. This was done during working hours that is from 8am up to 5pm on the 10th of October 2018. The analyst visited a variety of FCC shops in a bid to obtain correct information especially on the reactions of both the farmer and the consultant. From the observation, the analyst discovered that farmers had to wait for long to be serviced by the consultant who would take time to finish assisting another farmer. Farmers had to sometimes come with a plant leaf to show the consultant the problem that is affecting their plants for easy explanation. Sometimes other farmers were coming from very far places such that no matter what, a farmer had to sacrifice to wait for assistance.

3.2.1.1 Advantages of observations

- First-hand information was obtained from farmers and consultants by the use of observations. Also observations avoids the issue of getting biased information.
- Information was obtained in the course of operation that is farmers were observed as well as the consultants without disturbance of each one's activity.
- The customer and the consultant's actions gave the observers the data they needed without the need to ask questions.

3.2.1.2 Disadvantages of observations

- It wasn't clear and even not understandable to come up with a conclusion to why the customers that is the farmers behaved that way.
- Observing the way the customers reacts in the shops to come up with tangible information takes a lot of time so observations are time consuming.
- No immediate feedback was obtained from farmers by using observations.

3.2.1.3 Information obtained from observations

It was discovered that farmers visits the shops to buy their necessities as well as asking questions concerning certain issues on their farming production. As most of the customers who visits the shops are farmers, most of the questions asked are in relation to crop production and diseases affecting the crops. Farmers would ask questions such as when their plants changes color or when they are dry yet they are getting enough of the water or manure. Farmers would ask if they are any drugs that can be used to cure these signs or the kind of diseases that would be affecting their plants. This could take time since a farmer would need to understand well what the consultant would be advising yet others will be waiting for the same consultant.

3.2.2 Questionnaires

Questionnaires are a good method of data gathering as they can allow users to clearly express themselves by writing information concerning the questions they have been asked in relation to the current situation (Powell and Steele 2016). Attitudes can be inspected, behaviors and thoughts can be reviewed of the users through expressions in writing. One hundred questionnaires were distributed on the 25th of September 2018 to various FCC shops and these were given to the farmers that were found in the shops as well as the consultants. Areas that were mostly covered with these questionnaires are the areas that needed more attention that is where a consultants had to record

what they have been asked by farmers in files and also where a farmer had to wait to get assisted. Using questionnaires helps cover a wider sample of what is required in developing the proposed system. Important views are brought out with reasonable views. Two types of questionnaires were used which are open ended and closed questionnaires.

3.2.2.1 Open ended questionnaires

These are the type of questionnaires which allow the respondents to express themselves by replying freely what they want and expressing their reactions to the system. The analyst used these type of questionnaires so as to have different opinions from the respondents on what they think about the current system and the introduction of new developments into the system. Open ended questionnaires included questions such as what do the respondent think about the current system etc.

3.2.2.2 Closed questionnaires

These are questionnaires in which the respondent is to choose between the given answers that is the respondent have limited number of responses. For this approach to be practicable, the investigator will lists all the potential answers that are possible for the question and the respondent will have to choose.

3.2.2.3 Advantages of questionnaires

- Questionnaires are favored mostly since subjects could attend them in their free time without hurry.
- Information acquired from questionnaires is usually accurate since respondents can reply in privacy as to how they think about the current system.
- Variety of information was obtained in a short space of time
- Less time was consumed by using questionnaires.
- Closed questionnaires enabled easy translation and analysis of data.

3.2.2.4 Disadvantages of questionnaires

- Respondents interpreted questions differently which resulted to collection of biased information.
- The system examiners could not get clear reasons as to why respondents have to reply that way.
- Coming up with the possible questions took a lot of time.

3.2.2.5 Results from questionnaires

Questionnaires are the ones that brought much of the information required for the analysis of the current system. Users were able to express themselves concerning their views to the development of the proposed system.

3.3 Analysis of existing system

The current system is a manual system that is all the reports, records and enquiries are done manually all records are kept on hard copies.

3.3.1 Description of the current system

A farmer has to visit any FCC shop in order to meet up with the consultants in shops to ask for the diseases that are affecting their crop production. On visiting the shop, a farmer awaits for the consultant to be free if he or she finds him occupied. The consultant has to record the various questions that farmers have asked during the day by typing them on a machine but usually the consultant writes them on paper and type them at the end of the day because he or she will be occupied during the day. Farmers may ask for the solution to the diseases affecting their plants and if there's any of the drugs in the shops, the farmer can buy or a quotation be generated for them. Any advice, a farmer has to visit the consultant to the nearest FCC shop.

3.4 Process Analysis

This is the breaking down of the system into its comprehensible parts as well as generating the required model of the processes involved in the system (Russ and Kim 2015). What processes are involved in the system and how they get linked with each other? An activity diagram can be used to illustrate how the current system works and the following is an activity diagram for FCC current system

3.4.1 Activity diagram of existing system

Russ and Kim (2015) says that an activity diagram represents the work flows of stepwise activities and actions**.** Below is the activity diagram of the proposed system.

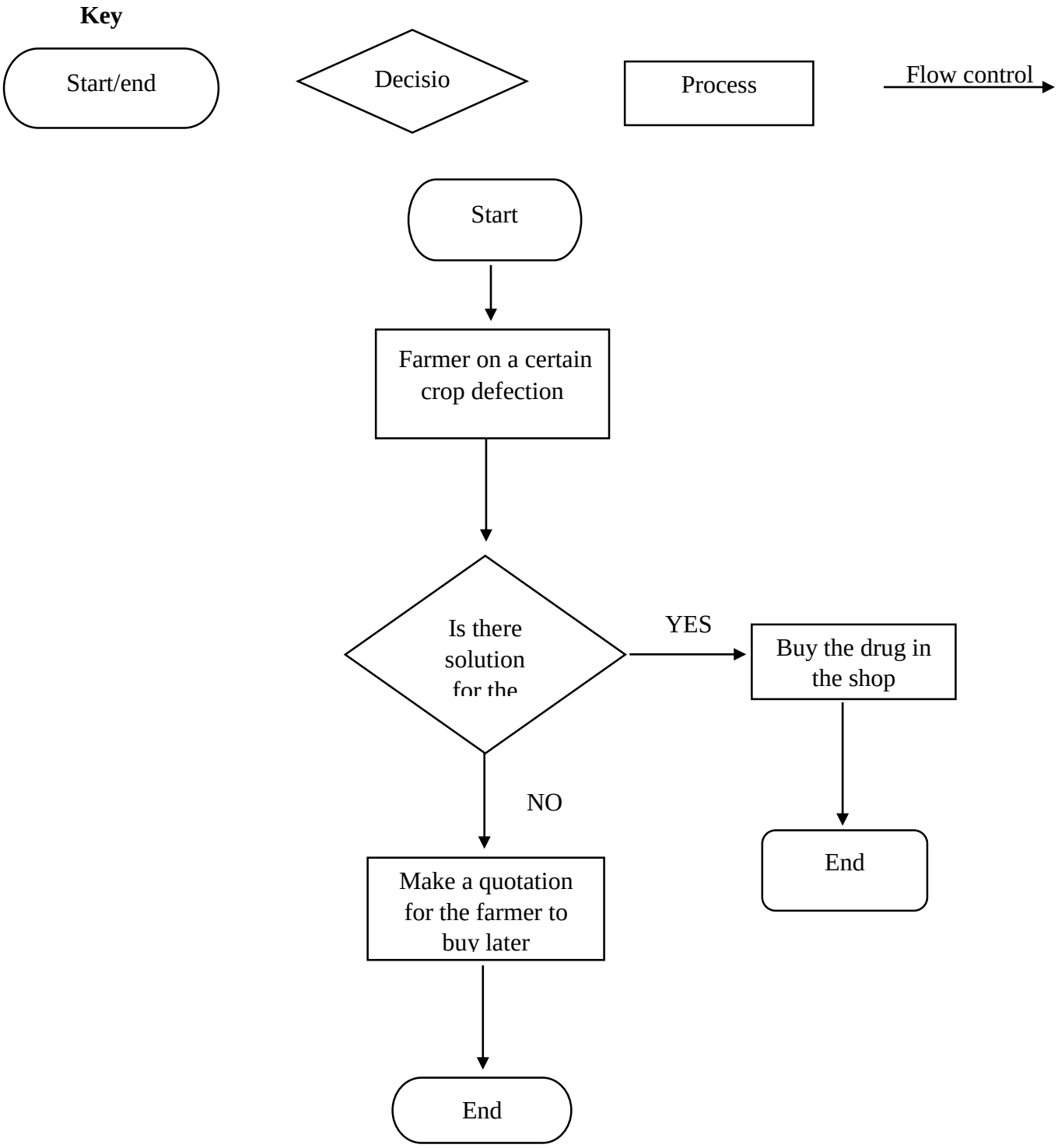

Fig 3.1 Activity diagram

3.5 Data Analysis

This is when the functionality of the current system regarding its components and what data is transferred between each of the components is observed (Singh 2016). The main objective of this is to see how data is handled between the system components and the yield produced. Data is modelled, inspected, transformed in such a manner so as to discover vital information. The current system's data is interpreted to get its meaning and then organized and then displayed in tabular form or any other representation. A context diagram and a Data Flow Diagram (DFD) are used as a way of representing the analyzed data.

3.5.1 Context Diagram

This is a diagram that explains the margin between the system or part of the system and its components (Leszek 2016). It shows the entities that communicate with it. A context diagram is a high level view of the current system or it can be termed a block diagram.

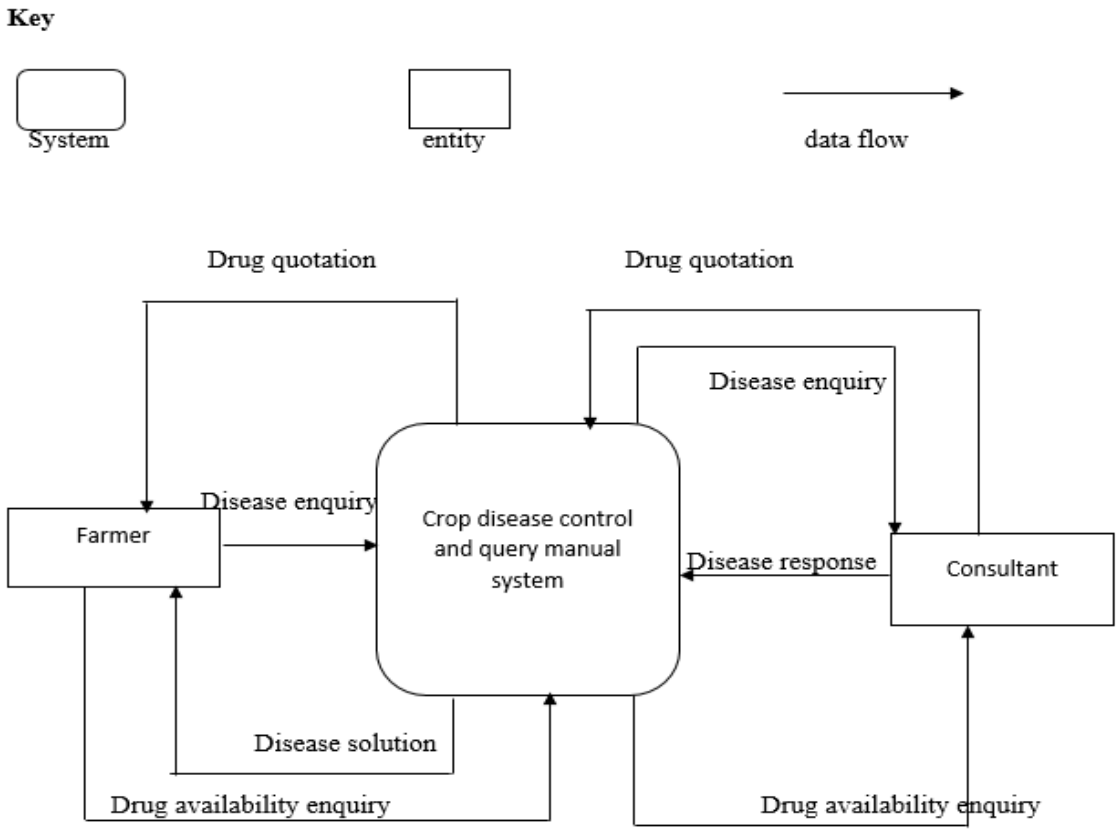

Fig 3.2 Context Diagram

3.5.2 Data Flow Diagram (DFD)

Leszek (2016) describe a data flow diagram as a graphical representation to indicate the flow of data within a system.

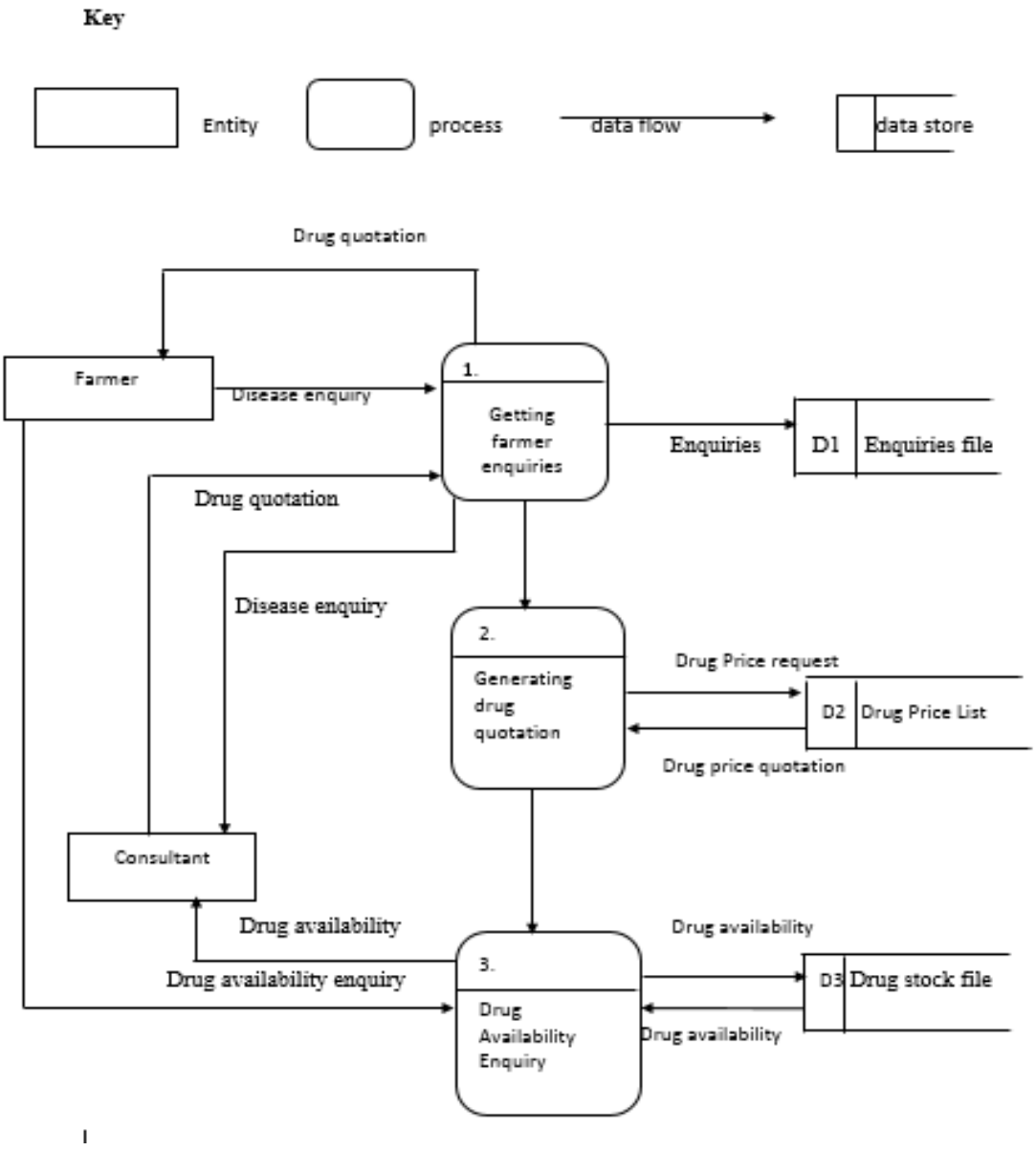

Fig 3.3 Data Flow Diagram

3.6 Weaknesses of the current system

During the process of collecting data and analyzing the existing system, the following limitations or weaknesses of the current system were discovered:

- Lack of proper information that can assist farmers in their crop production.
- Poor services in the shops sometimes a farmer may suffer boredom and decides to leave without being assisted.
- Some consultants may not be polite and friendly to farmers.
- Farmers are not given current information quickly that is they are not kept up to date on certain conditions or diseases that may affect their plants.
- The current system requires every shop to have more consultants which is costly.
- Too much work overload to consultants in the shops.

3.7 Evaluate Alternatives

After discovering how the current system works, it is possible now to come up with a computerized system for FCC since it has been discovered that the current system is less beneficial and have a lot of weaknesses. Evaluating alternatives is when the best option is chosen out of the selected to develop the new system. The selected options are:

1. Outsourcing
2. Improvement
3. In-house Development

3.7.1 Outsource

Outsourcing is a method whereby the software development and designing are carried out by an external party that may not be part of the organization but does the business process as requested by the Organization. Hamido and Mohamed (2014) says that companies today can outsource a number of tasks or services. They often outsource information technology services, including programming and application development as well as technical support.

3.7.1.1 Advantages

- Developing system using an external party will not only benefit the company but will reduce costs of buying infrastructure as the outsourced company will bring its own equipment to develop the system.

- Usually outsourcing speed up the introduction of a new technology that is its utilization will be quick.
- Chances that the software will be of greater quality are high especially when the outsourced company is one of the best that has a remarkable status.

3.7.1.2 Disadvantages

- Outsourcing the system can be expensive especially when the outsourced company is one of the best or one with a remarkable status.
- The outsourced company may overestimate its ability to develop the system and this may result to a poor system being developed.
- Outsourcing may cause conflict due to different views in what the outsourced company possess as beliefs and those of FCC. Things like culture and priorities may differ and this may be difficult to link the two companies for better communication during the system development. This affects the project successfulness.
- Security issues may arouse since during development a lot of confidential information may be revealed and this will require tight security otherwise FCC may face a problem especially if the contractor works for its competitor also.

3.7.1.3 Reasons for choosing not to outsource

After analyzing this alternative, it is viewed that it is not suitable for the development of the advisory system, the reason being its weaknesses. It is costly to develop the system using this alternative especially when outsourcing to the best contractor and the other reason being the issue of confidential information may be revealed which may result to data insecurity. Above all the cost of developing and maintaining is above the budget as planned.

3.7.2 Improvement

This alternative requires that the current system be improved be improved to incorporate other things such as new ideas and new technology (Ebert 2011). The current system needs to be improved as it is prone to errors and it is very slow. Areas that need improvement include that time when services are being provided to farmers by the consultants in the shops. Services are poor and farmers need not to wait for long to be assisted. Farmers had to get assistance and advice whenever they need it. Also farmers do not need to travel long to get assisted rather they can get what they need wherever they are.

3.7.2.1 Advantages

- Improving the current system may increase efficiency and productivity to business operations.
- Less training will be required for the users since only a few things will be incorporated in the current system.
- Users will continue with their operations as new things are being incorporated into the system and this does not require a lot of time nor does it require users to leave their jobs while in the process of introducing new things.
- Costs may be minimized that is costs of developing a new system.

3.7.2.2 Disadvantages

- Some users may not be quick to adapt to changes that may be taking place
- Improving the current system may become a challenge since some parts of the current system may be changed and some may not which result to a complex system.
- The incorporation of new changes in the system may not work with the current system activities which may result to a biased system.
- Activities may not be easily linked due to differences between the introduced things and that of the current system.

3.7.2.3 Reasons for choosing not to Improve

This alternative cannot be adapted due to its complexity that is the introduction of new things in the current system might cause conflict between activities and it may be difficult for users to adapt to certain changes in the system. Improving the current system cannot solve all the problems currently faced by FCC such that its benefit to the organization cannot be seen.

3.7.3 Development

This alternative requires the internal system designers of the organization built the new system required to solve the problems faced by the organization (Duncan 2015). No outsourcing is required thus the system designers develop the system without help from the contractors. Using this approach requires user to be involved making it easier to develop the system.

3.7.3.1 Advantages

- Involving users in the development process will enable the designers to come up with a successful project since requirements won't be biased.
- Maintenance and training will be easy since users will be informed of every detail of the system development.
- A quality software is produced since all control procedures will be done by the internal project management team that knows the requirements and values of the organization.
- Less costs are incurred when doing an in-house development since there will be no any external provider hired for developing the system.
- Unlike outsourcing, development is a secure alternative that is information is being taken care of by the organization team.
- Users may be given time to communicate with the system that is the copy of the system or prototypes prior to the final installation.

3.7.3.2 Disadvantages

- Resistance to change by some users may cause poor progress to the success of the project.
- The project may take a lot of time since there will be involvement of users who may come with new ideas during the process development.

3.7.3.3 Reasons for choosing development as the best alternative

This alternative has proved that it is the best since it involves users during its development process and this enables users to bring all their requirements prior to the development process. A software of quality can be produced since requirements will not be biased. Documentation and maintenance will be easy since the project management will be taking full responsibility of every process involved. In terms of costs comparing with other outsourcing, this approach is much cheaper since there will be no costs of hiring an expertise and or costs of employing new individuals. There will be no need to buy a lot of new equipment since some of the current system machines can be used.

This approach is adopted since farmers can also put their requests and they can be incorporated into the system development. This even enables FCC to gain a competitive advantage over its competitors since by so doing it would increase its customer satisfaction.

Though this approach can be costly when compared to improving the current system its impact and benefits outweighed those of improving the current system and have proved that it can solve all of the problems that are currently faced by FCC.

3.8 Requirement Analysis

Requirement analysis looks at the picture of the proposed system as a way of assuring that it meets the requirements of the users and that it is solving all the problems that users are facing with the currently used system (David 2013). This analysis will ensure that all that is supposed to be done by the system is included in its development and that it satisfy user needs and the organization requirements. Two requirements are analyzed which are functional and non-functional

3.8.1 Functional requirements

After thorough analysis was taken, a list of the necessities required to come up with a functional system are discovered. The aim of coming up with this list is to identify those activities that are going to be performed by the new system (Grady 2016). These include:

- Login and registration of farmers- farmers should be registered prior to using the system.
- Taking customer requests- the system should be able to take customer requests.
- Informing farmers on any new diseases to certain plants in each season
- Assist a variety and large number of farmers- the system should cover a wide range of farmers.
- Always allow messaging for advice - the system should allow farmers to chat with the consultants for any queries or advice that may not be presented by the system.
- Feedback and complaints- the system should give feedback as well as accepting complaints from farmers.

To illustrate clearly the functional requirements, a use case diagram is designed for better understanding

3.8.1.1 Use case diagram

Kurt and Ian (2014) describe a use case diagram as a simple representation of how the user interacts with the system.

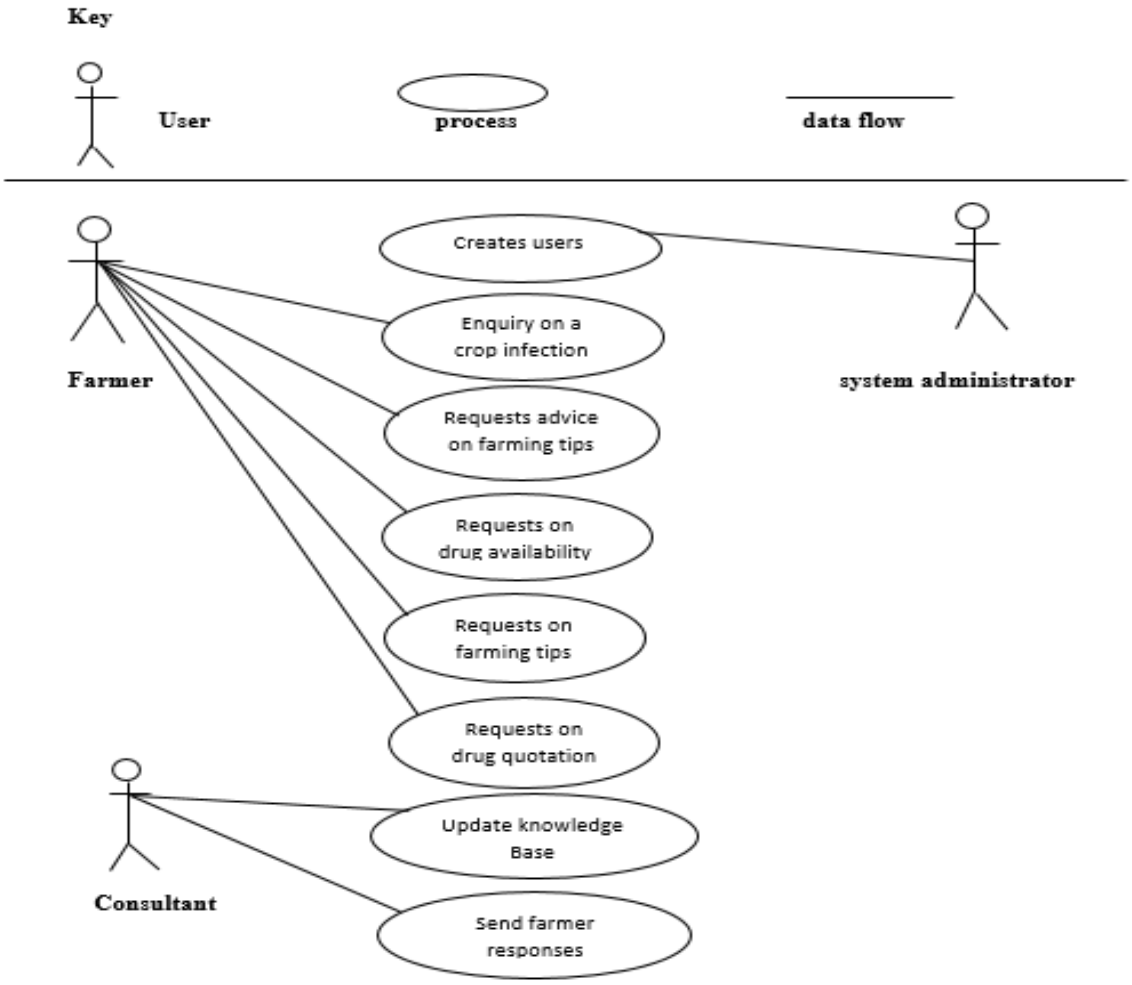

Fig 3.4 use case diagram

3.8.2 Non- Functional Requirements

Robertson and Robertson (2015) describes nonfunctional requirements as those additional properties that should be found on the system functionality. Below are the non-functional requirements that the proposed system should have:

- The system should ensure data integrity that is data should be always kept secure.
- There will be high security as each user will have a separate username and password which they use to access their accounts
- The system should have a user friendly interface and should not be complex to use especially by persons of elementary computer literacy

- Easier access, faster response and execution speed
- Maintainability that is the system should be maintainable and the system administrator should make sure the system is well maintained for future use.

3.9 Conclusion

The chapter highlighted the information gathering techniques that were used in the collection of data. A description of what the current system does was shown through the analysis of the existing system and its weaknesses clearly outlined. Various alternatives that can be used to develop the proposed system were clearly explained and the best approach selected. Also the functional requirements of the proposed system were shown. In a nutshell, the chapter provides a great detail of what the current system is all about. The next chapter is going to bring about the design of the proposed system.

CHAPTER 4: DESIGN PHASE

4.1 Introduction

After clearly analyzing the system in the previous chapter, the system need to be designed. According to Brian (2013), the design phase employs several techniques and methodologies to sufficiently represent the proposed system so as to support its implementation. This chapter include the architectural and physical design of the proposed system, the database design and program design as well as the interface design. The database design showing how data is going to be grouped in the database. The interface design showing how the system is going to interact with the user. Relationship between entities of the system is shown through the Enhanced entity relationship diagram and what processes are involved in the system are shown through the use of a data flow diagram which also indicate the flow of data within the system.

4.2 System Design

System design can be viewed as the analysis of components, modules and the interfaces of the proposed system and coming up with a better view of understanding how the proposed system works (Michael, 2015). These components will produce a system that will have the best functionality. The system will work by allowing farmers to create their accounts which are secure, allowing good communication thus being user friendly.

4.2.1 User friendly

How well the system is appreciated depends on how easy is it to use. Users prefer systems that are easy to use and navigate. The proposed system is user friendly and gives users an interface that is so easy to understand.

4.2.2 Reliability

The system can be termed as reliable if it gives what is required that is meeting the user requirements at any given time. The proposed system is reliable to the users as they can access it anytime whenever they are in need of information.

4.2.3 Maintainability

Maintainability is a process whereby the system is being used by the users whilst its effects are noticed and taken into account that is if the new system is easy to maintain or not concerning the

addition of new features as well as removing old features. With the help of a user manual, the expert system is easy to maintain since users will have access to the proper procedures of how to use the system and can refer back to the manual each time they face difficulties.

4.2.4 How the proposed system works

Farmers create their accounts on the advisory system interface where the platform for registration is provided. After registering, a farmer has to log in with the credentials he has provided. On logging in a farmer is welcomed by the system and some farming tips are provided for them before they even ask anything. Information about the type of crops they can grow at certain regions of the country. There is a platform where a farmer can type the symptoms of diseases affecting his or her crops and a farmer can even post a picture and the system is able to give him what may be the cause of the disease and the prevention methods for that.

For any other queries, a farmer can type the query by sending a message to the consultant by clicking a message tab that is provided. A farmer can explain well the problems using that message platform where advice can be given to them by the consultants at the shops. If there's need for any drug to be purchased, a farmer is given a quotation of the drugs to be purchased and given the directions of the nearest FCC shop where they can purchase the drugs.

System inputs, processes and outputs can define well how the proposed system works and these are well indicated in the context and data flow diagram below.

4.2.4.1 Context Diagram and Data flow diagram

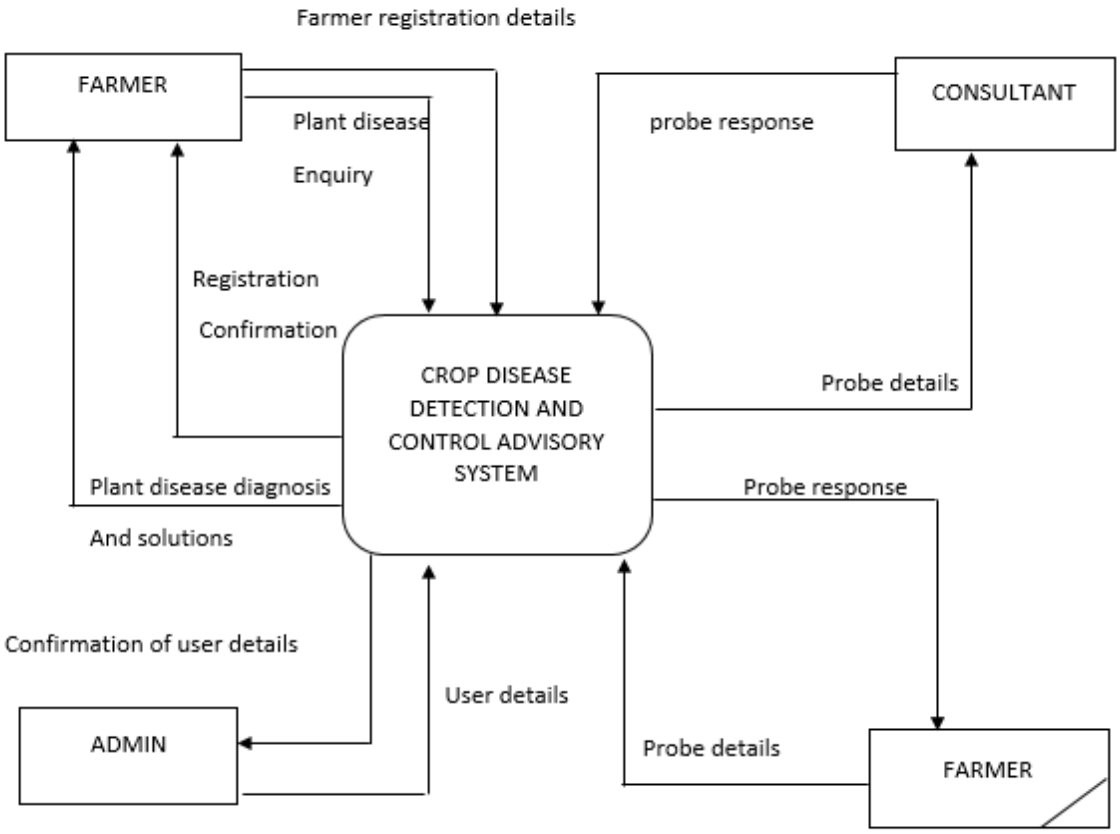

Fig 4.1 Context Diagram

4.2.4.2 Data Flow Diagram (DFD)

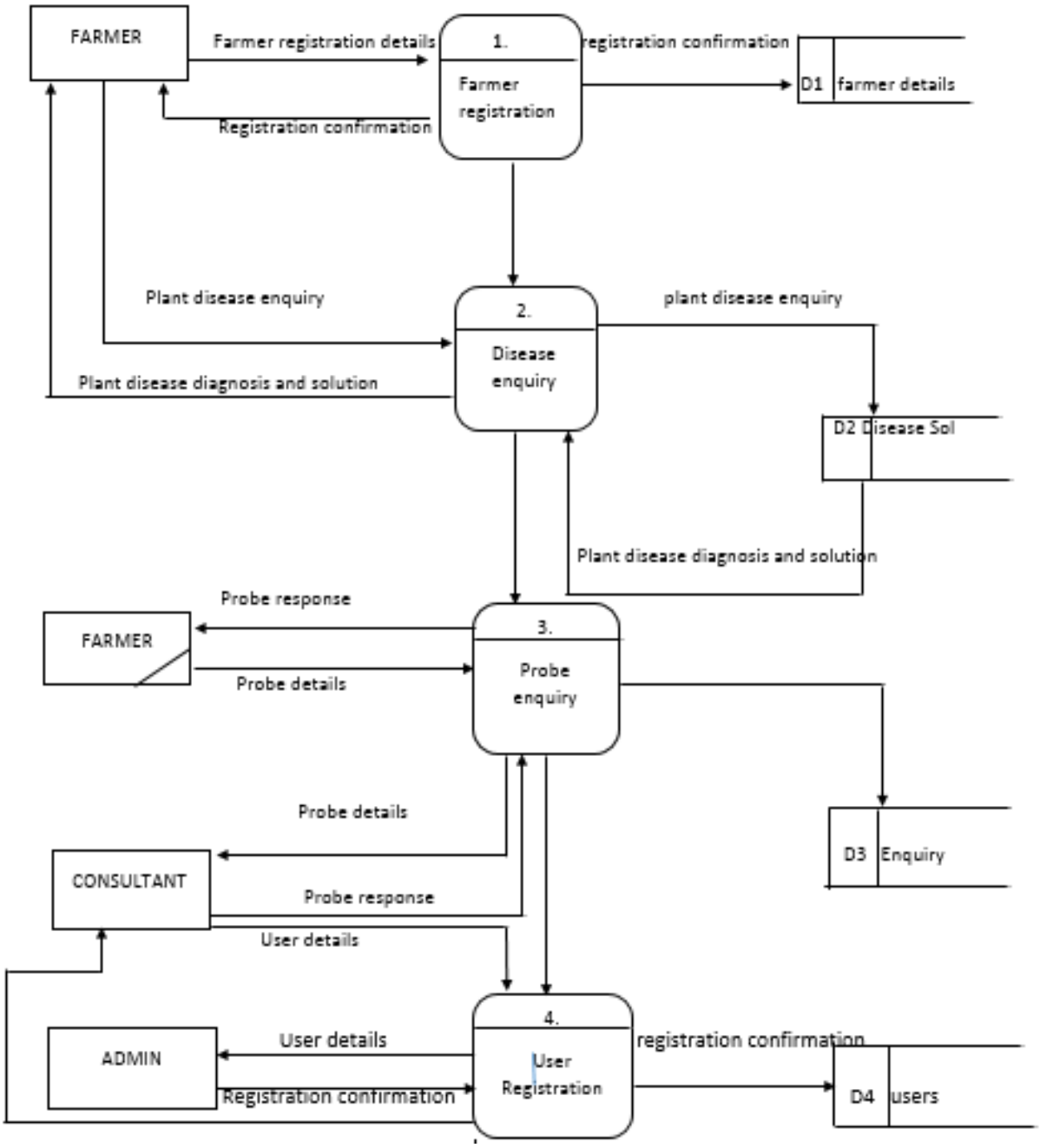

Fig 4.2 Data Flow Diagram

4.3 Architectural Design

The proposed system architectural design clearly illustrates the structure of the system as far as hardware components are concerned. Architectural design represents the connection between the system design and what is required of the system (Jerome and Frans 2014). The way the system works is affected by the architectural system and how the system is maintained. The system will use a client server architecture whereby user computers will have access to the server machine.

4.3.1 The components that are required include

Server – this will be used as a means of storage that is used for storing data that will be readily available for use by clients or users.

User computers- these will be used to feed information into the server as well as used by clients to access data from the server.

Printer- this is used for printing reports and other print outs required for use by the users.

The client server architecture looks like below

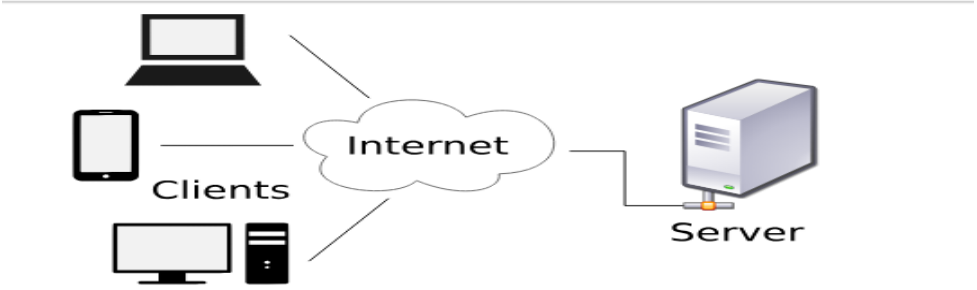

Fig 4.3 architectural design

4.4 Physical Design

The communication between hardware and software to suit the user requirements is the physical designing (Andreas et al 2015). The requirements of the users are now transformed into operation. The physical design also shows how software and hardware are setup for easier access by the users to the main server containing the data stored for use. The physical design include issues such as how data is entered and retrieved from the system, the way it is stored and how it flows throughout

the system. The proposed system contains components such as routers and firewalls which communicate with each other via a network.

All the data is stored in the server and users access it via the network and as for the farmers as the customers will access the system online using a computer, a laptop or a smart phone. Below is how the physical design of the proposed system looks like

Fig 4.4 the proposed system physical design

4.5 Database Design

A repository well organized for storing data for an organization as per its requirements is what is called a database as explained by (Toby et al 2011). Database design involves designing, development as well as maintenance of the organization's data. Data is grouped into tables that is easy for retrieval. Database design ensures that there is data integrity and security is guaranteed. The database will be installed on the server where it will be accessible by different users. The database that is going to be used for the proposed system is MySQL.

The database architectural design include the 3 levels from the ANSI SPARC model that clearly illustrates how a database is viewed. This model consists of views that are the external view of the database, the conceptual view and the internal view. The proposed system database will have these views so as to enable different users to have different rights and access as to how to use the system.

4.5.1 External view

David (2013) says that the external view of the database is the level that shows the view that every individual has in the database. This is typically the controlled view of the database where users or a class of users can view the database differently. The proposed system will have different users of the proposed system view the database in different views. In this scenario, the consultant will only view information concerning the needs of the farmer. The System admin will have all the views of the databases because he knows all the access levels and has control over the database.

4.5.2 Conceptual level

This view is a representation of the entire information that is stored in the database (Jan 2016). This view indicate how information is characterized in the database and the association between data. It defines the data type of the information, the entities in the database as well as user operations and constraints. In this case, the proposed system data will be represented in the form of tables and these tables include the pests table, the drug table the user table.

4.5.3 Internal view

The internal view of the database describes the access paths when accessing the database and how the information is stored in the database (Sam et al 2014). This level also determines the data types of the data stored that is characters or Boolean etc.

4.5.4 Database tables

These present information in an organized way. Michael (2014) says that tables helps in eliminating data redundancy and facilitates data integrity. Tables are the main part of the data structures. They contain rows and columns for presenting information.

Table 4.1 users Login Table

FIELDS NAME	DATA TYPE	DESCRIPTION
Id	Int	Primary Key, Auto Increment
Name	Varchar(150)	Name of the user
Surname	Varchar(100)	Surname of the user
Username	Varchar(40)	Login username
Password	Varchar(20)	Not less than 8 characters
Accessid	Int	Determine privileges, Foreign key

Table 4.1 user login

Table 4.2 Farmers Table

FIELDS NAME	DATA TYPE	DESCRIPTION
Farmer id	Int(20)	Primary Key, Auto Increment
Name	Varchar(100)	Name of the farmer
Surname	Varchar(100)	Surname of the farmer
Contact	Int	Farmer's cell number
Address	Varchar(50)	Farmer's residential address
Username	Varchar(30)	Farmer's login username
Password	Varchar(15)	Farmer's login password
Disease_id	1nt(35)	**Foreign key**

Table 4.2 Farmers

Table 4.3 Access Table

NAME OF FIELD	TYPE OF DATA	EXPLANATION
Accessid	Int(15)	PK
Accessname	Varchar(25)	Access description, for example admin

Table 4.3 Access

Table 4.4 Plants Table

NAME OF FIELD	DATA TYPE	EXPLANATION
Plant_id	Int(20)	Primary Key
Plant_name	Varchar(20)	Name of the plant
Description	Varchar(100)	A brief description of the plant
Farmer_id	Int(30)	**Foreign key**

Table 4.4 Plants

Table 4.5 Diseases Table

FIELD TITLE	DATA TYPE	EXPLANATION
Disease_id	Int(30)	Primary key
Disease_name	Varchar(20)	Name of the disease
Symptom1	Varchar(50)	Main Symptom
Symptom2	Varchar(50)	Second Symptom
Symptom3	Varchar(50)	Third Symptom

Table 4.5 Diseases

Table 4.6 Pesticides Table

FIELD TITLE	DATA TYPE	EXPLANATION
Pesticide_id	Int(20)	Primary key
Pesticide_name	Varchar(20)	Name of the pesticide (Foreign key)
Usage	Varchar(500)	Information on how to apply the pesticides
Pest id	Int(35)	**Foreign key**

Table 4.6 pesticides

Table 4.7 Pests Table

FIELD NAME	DATA TYPE	EXPLANATION
Pestid	Int(35)	Primary key
Pesticide_id	Int(20)	**Foreign key**
Pest_name	Varchar(20)	Name of the pest
Associated_disease1	Int	Contains the disease_id
Associated_disease2	Int	Contains the disease_id
Associated_disease3	Int	Contains the disease_id
Pesticide1	Int	Contains pesticide_id
Pesticide2	Int	Contains pesticide_id

Table 4.7 Pests

4.5.5 Enhanced Entity Relationship Diagram EER

This is a database design that reflects data properties and constraints more precisely. (ShioKumar 2013).

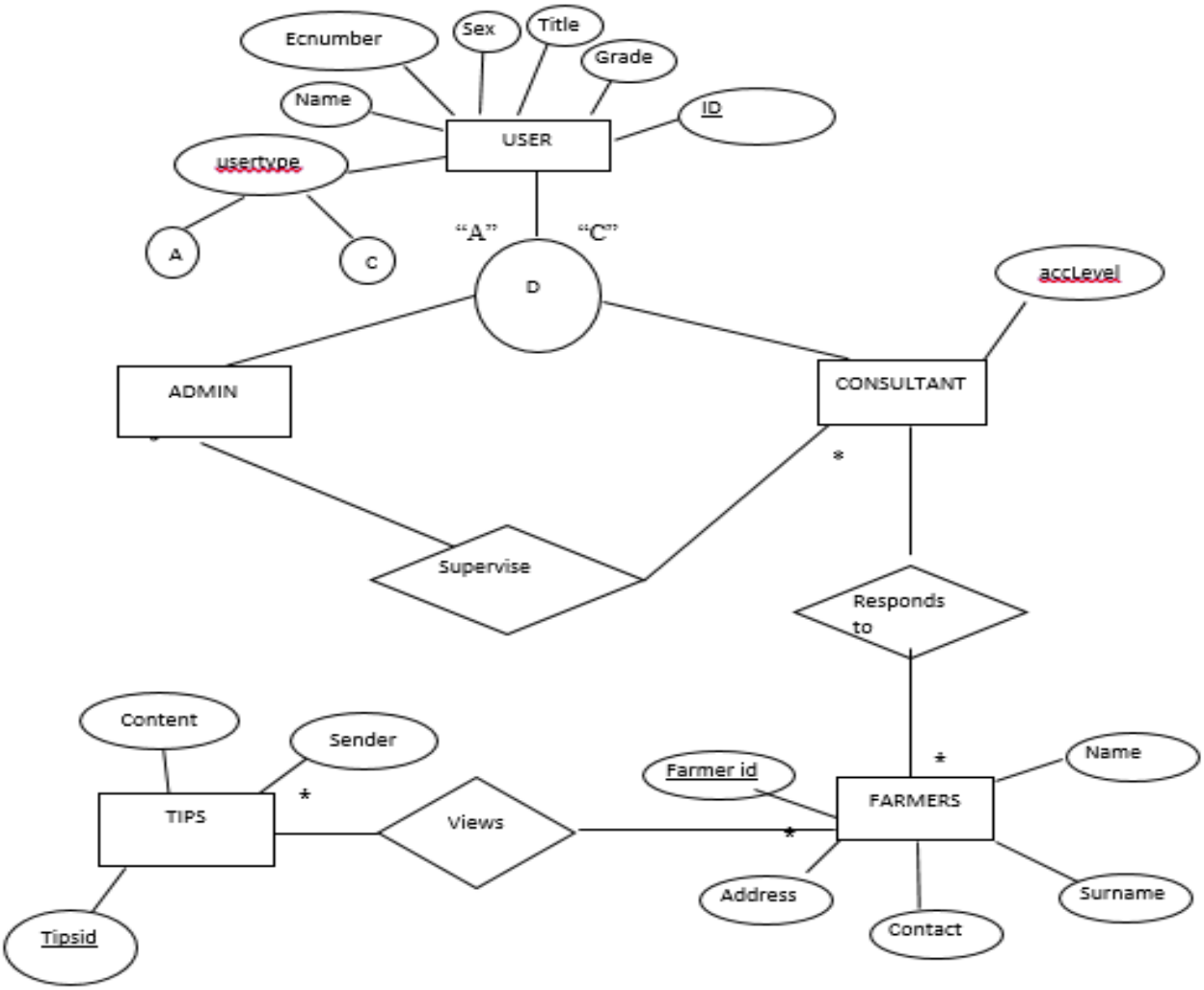

Fig 4.5 EER

4.6 Program Design

This design clarifies what is to be developed and how to develop it. It provides specifications on how the system is to be developed. (Rosenblatt et al 2011) states that program design is vital in designing system flows. A package and a class diagram have been selected illustrate the program design of the proposed system

4.6.1 Package Diagram

This is a diagram that shows the components of the system inherited from a class diagram (Rosenblatt et al 2011). System elements are also shown.

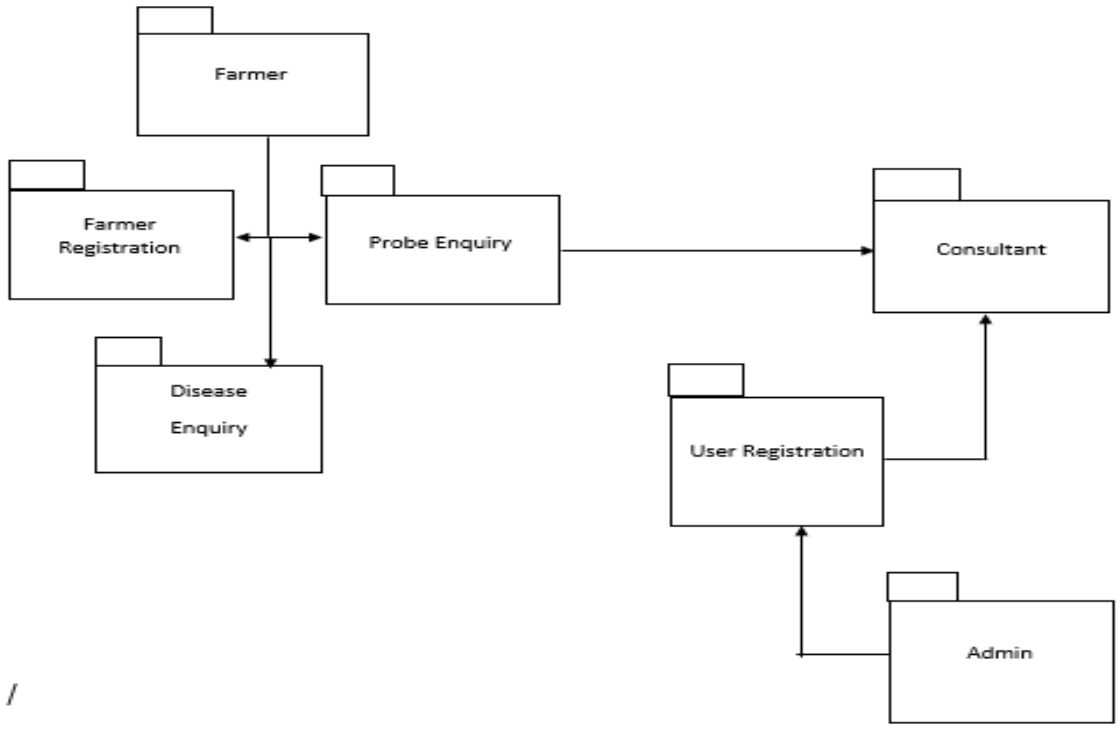

Fig 4.6 Package Diagram

4.6.2 Class Diagram

A class diagram explains all the features of the proposed system and it does not define the processes the system as defined by Toby (2011). It shows the association between the entities and the class.

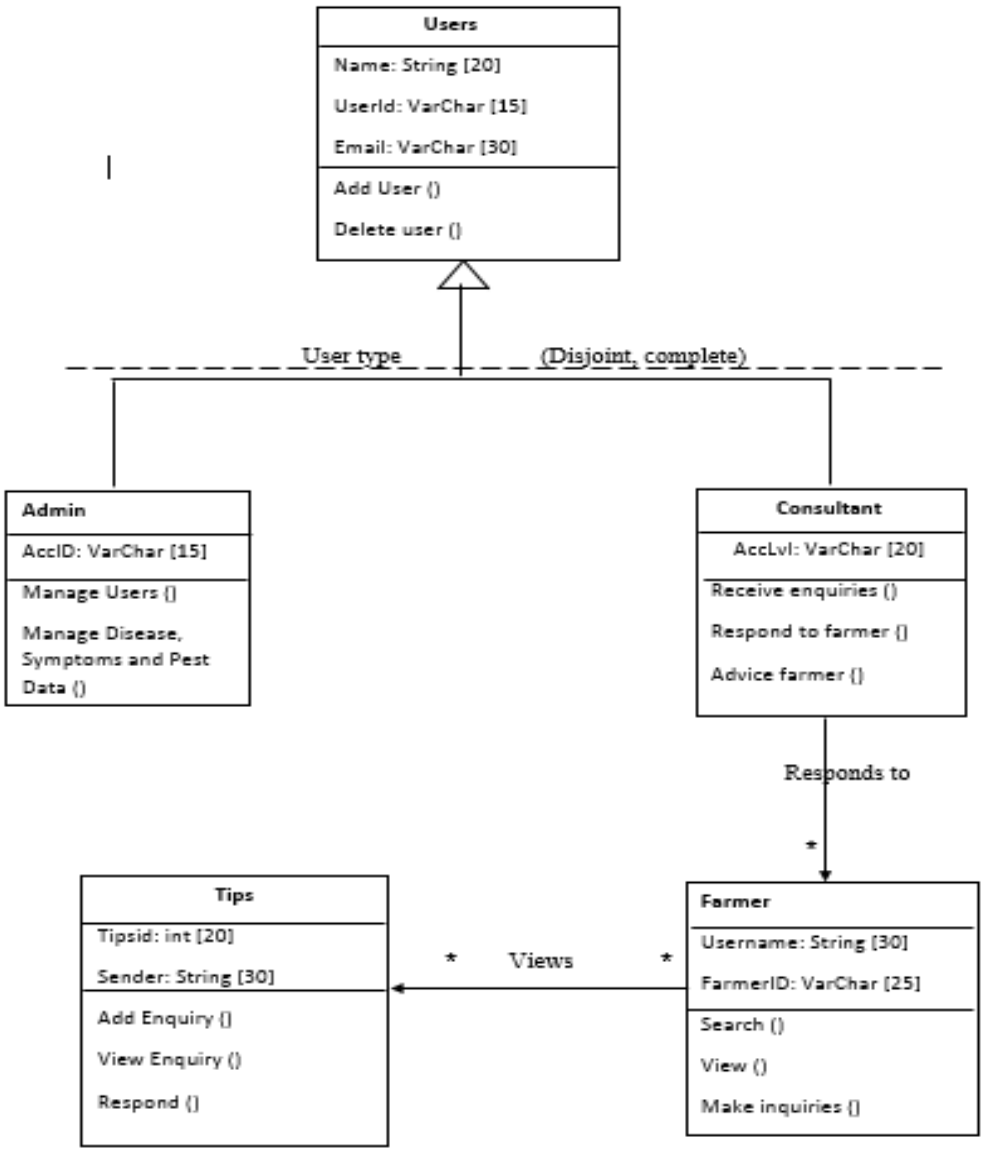

Fig 4.7 Class diagram

4.6.3 Sequence Diagram

Usually called an event diagram, a sequence diagram shows how a group of objects relate to each other and in what order (Daniel and Rene 2013).

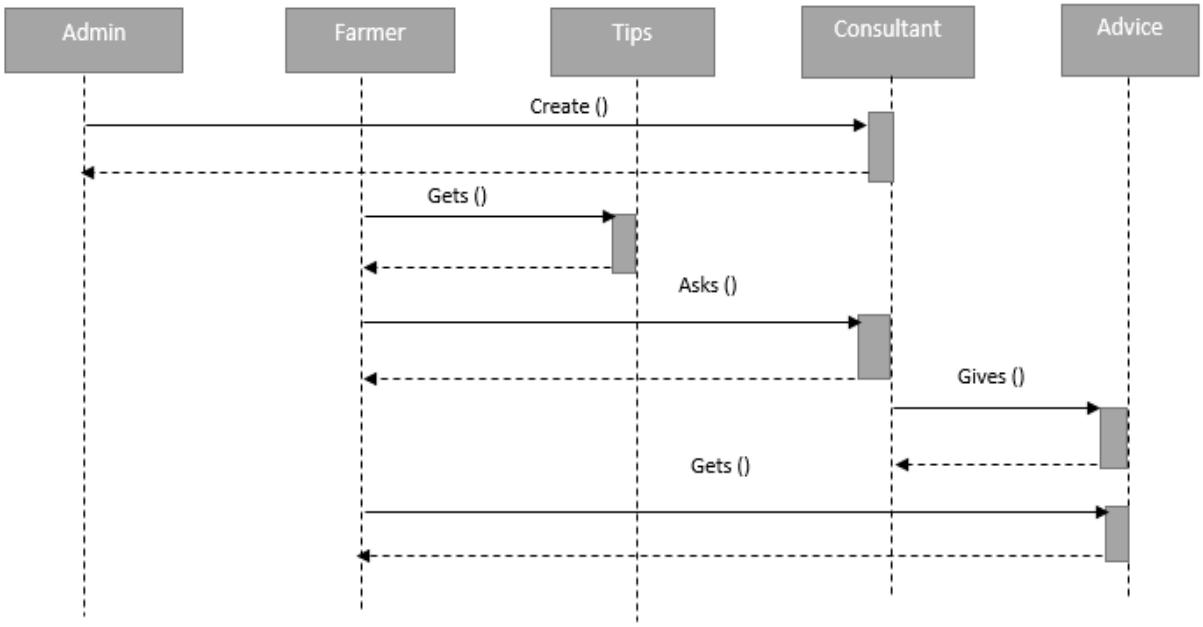

Fig 4.8 Sequence Diagram

4.7 Interface Design

Designing an interface for the proposed system that is user friendly and that is not difficult to understand can make users get used to the system quickly (Jenifer 2013).

4.7.1 Menu design

Menu design shows how data is captured by the new system (Piet et al 2012). A graphical user interface is used for easier understanding and use.

Below is how the proposed system homepage will look like

HOME	LOGIN	ABOUT US	CONTACT US

Fig 4.9 Menu Design

4.7.1.1 Main menu

After logging into the system, the user is welcomed by the homepage. The farmer's menu consist options for entering symptoms, changing password and logging out of the system.

ACCOUNT HOME	SYMPTOMS	CHANGE PASSWORD	LOGOUT

Fig 4.10 Farmer's Main Menu

4.7.1.2 Sub Menus

After selecting any option from the main menu, the admin is provided with many options from the submenus. Actions of updating or inserting are usually found on submenus.

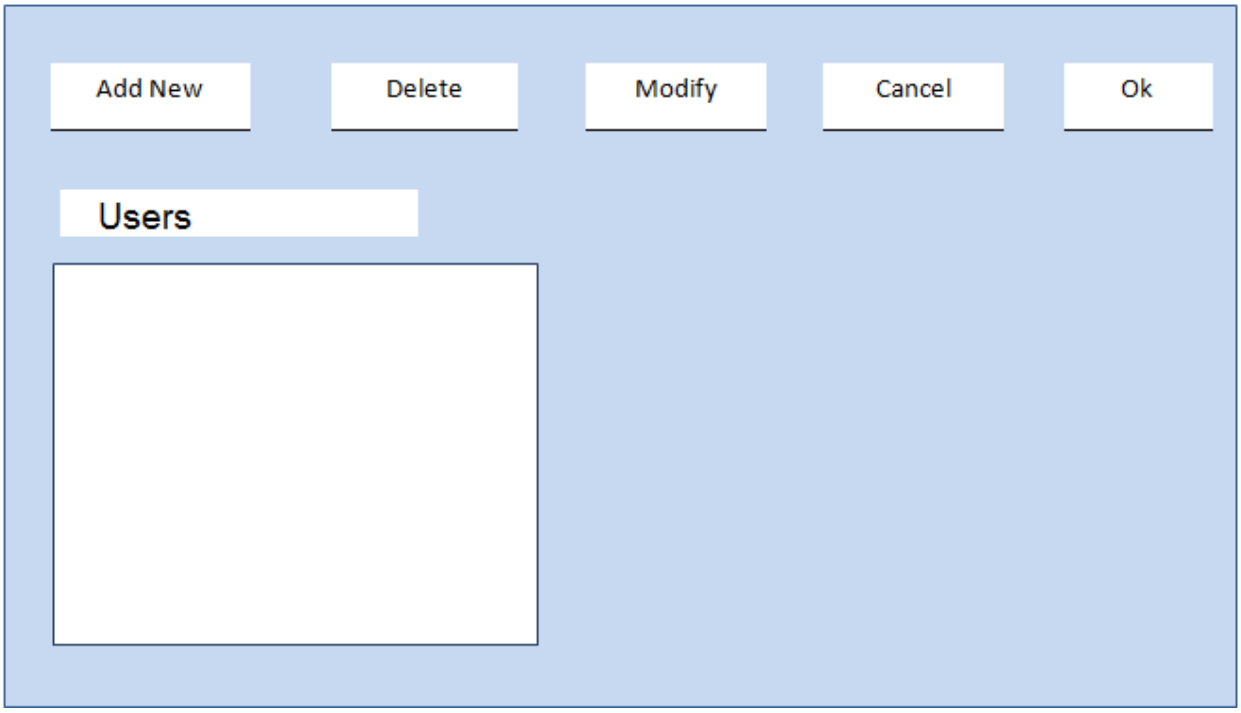

Fig 4.11 Sub Menu

4.7.1.3 Input Design

The representation of the system is designed into what the programmer intend to do as said by Somerville (2011). Input design consists of defining the data format, length or filed length.

4.7.1.4 Log in form for users

Correct login details need to be provided to access the system. Failure to do so will result to an error.

`

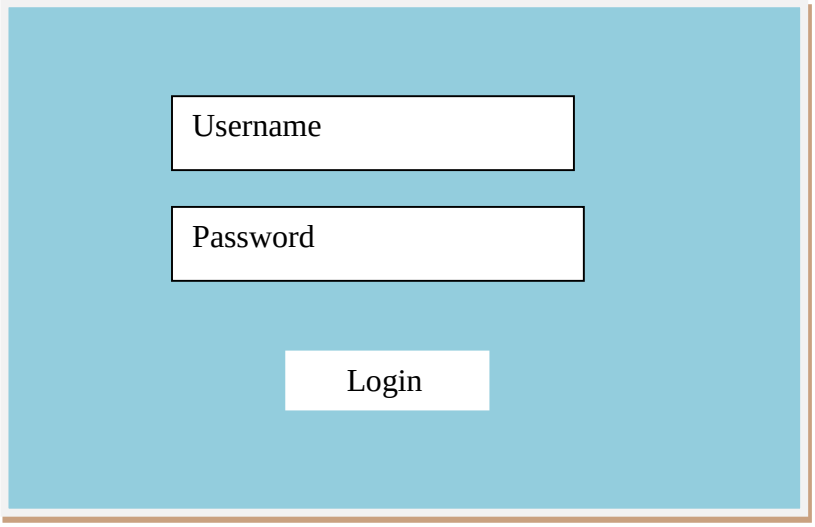

Fig 4.12: Users Login

4.7.1.5 Form for adding users

User details that are correct are added by the admin in the database and saved. The user will then be able to login using the given ecnumber and password.

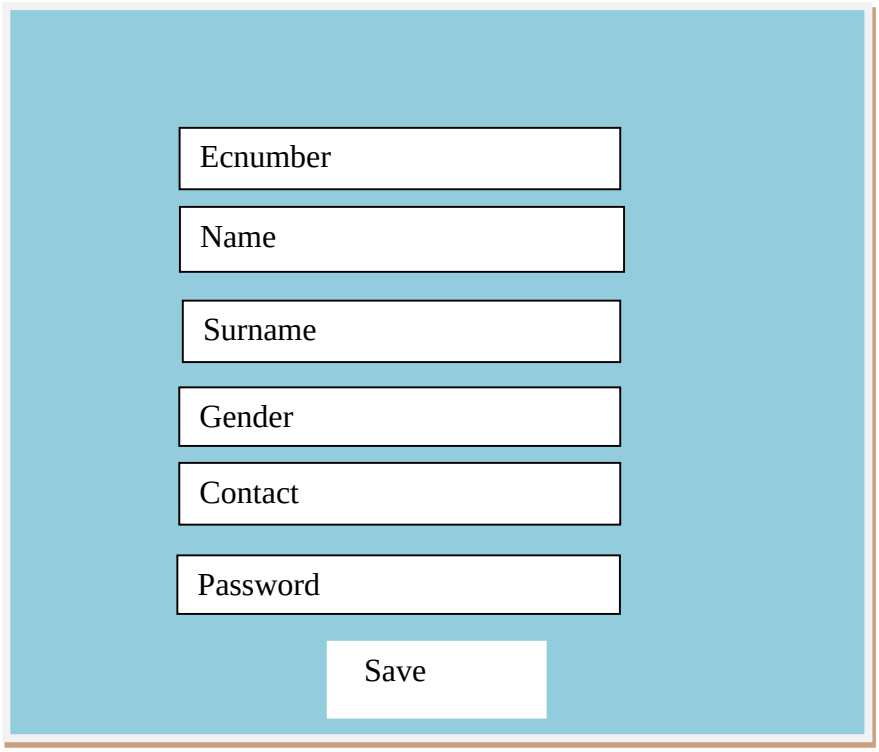

Fig 4.13: Add Users

4.7.1.6 Farmer Registration form

The farmer needs to provide correct user details and save them into the database. The farmer will then be able to login using the username and password.

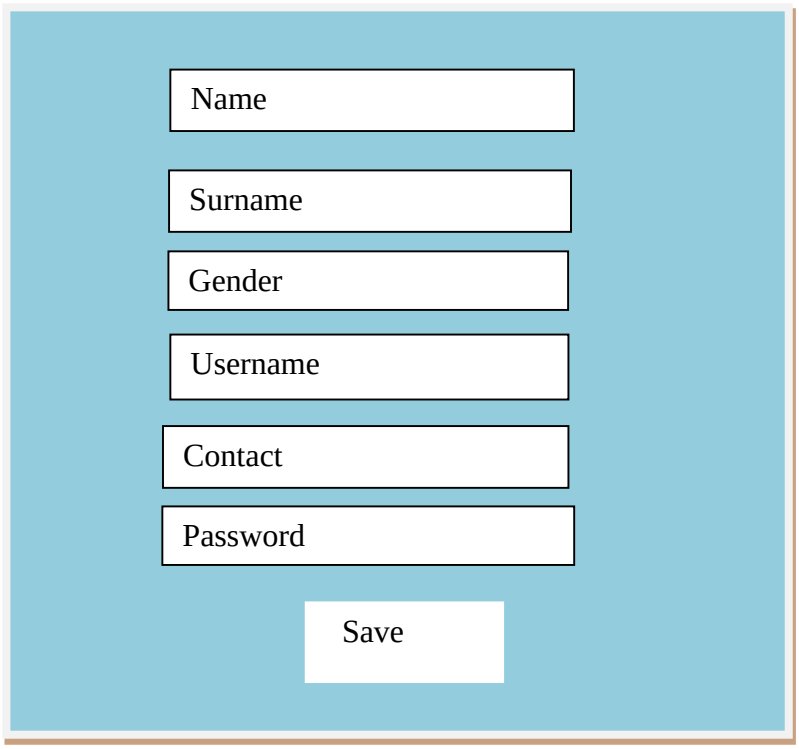

Fig 4.14: Farmer Registration

4.7.1.7 Add plants form

The admin is the one who is authorised to manage plants within the system. The admin captures information which include plant name and a brief description of the plant.

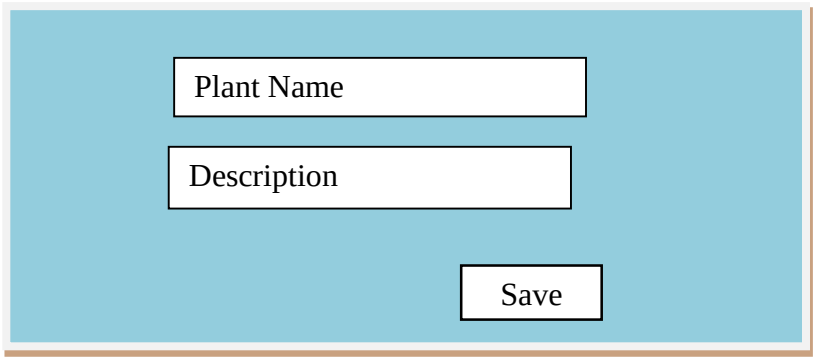

Fig 4.15: Add Plants

4.7.1.8 Add disease form

The admin is the one who is authorised to manage disease details within the system. The admin captures information which include disease name and disease symptoms.

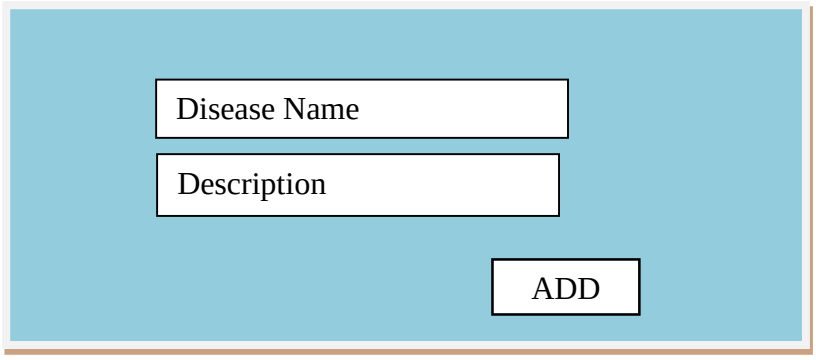

Fig 4.16 Add Disease

4.7.2 Output Design

Every system has to produce an output that is accurate. The output design indicates the system's outcome.

4.7.2.1 Plant Details

When user wants to search for a certain plant, the plant details design form will be seen below

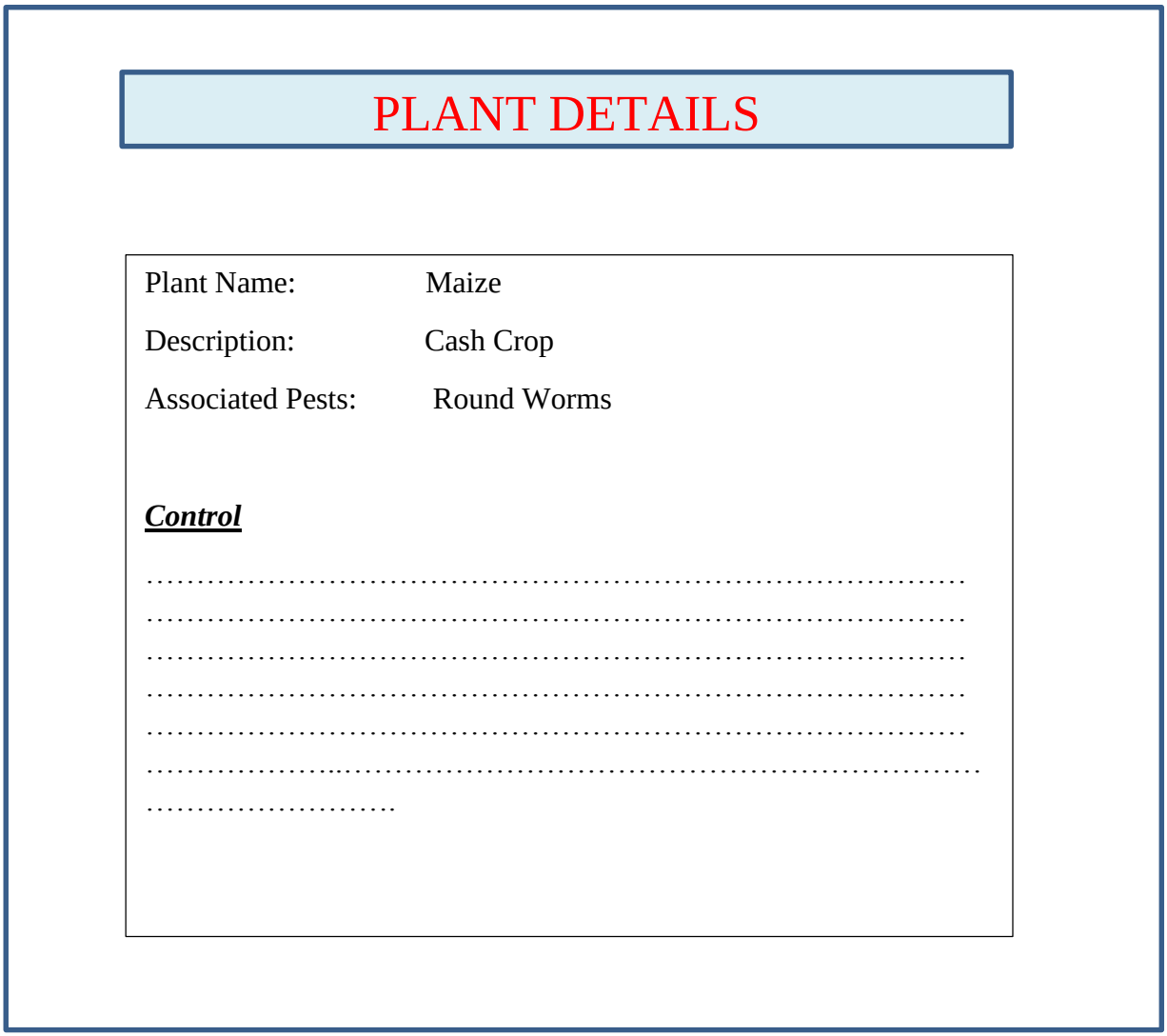

Fig 4.17 Plant Details

4.7.2.2 Symptoms

If the user enters symptoms, the diseases associated with those symptoms pop up as well as their control measures.

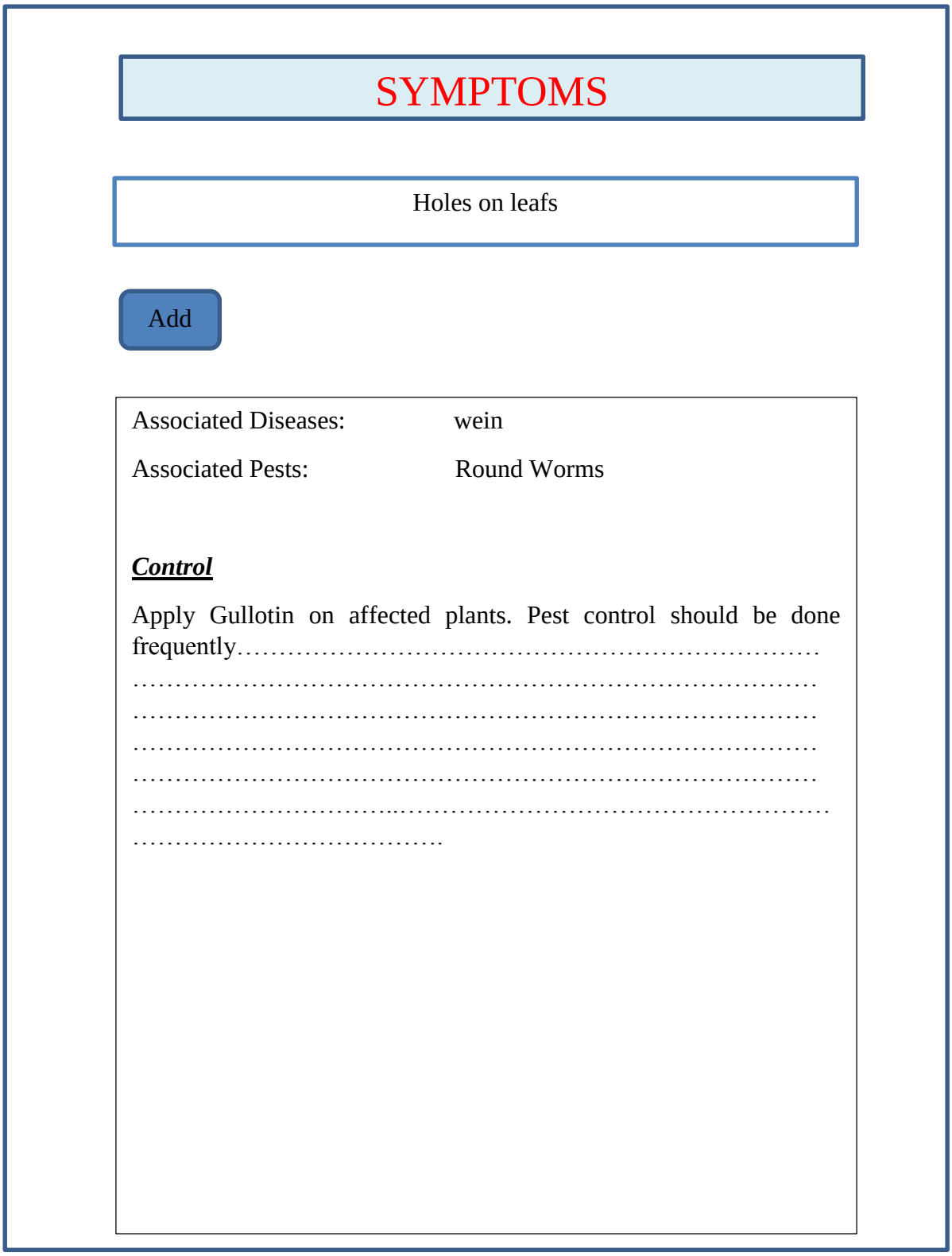

Fig 4.18 Symptoms

4.8 Pseudo code

According to Bailey and Kris (2013) a pseudo code is a language that is understood by a computer that illustrates what a computer algorithm is supposed to do.it is in some cases used as an informative step when developing a program. The following is what the proposed system pseudo code looks like

Login

Enter Username and password
If match is found
Go to your account
Else
Pop a login error message

Adding a new user

Fill in user details
If ecnumber exists
Error(User exists)
Elseif username exists
Select another username
Else
User successfully added

Add Disease

Log in to the system as admin
Provide disease details
If disease name already exist
Error(disease already exist)
Else
Save the details

Add Pest

Log in to the system as admin

Provide pest details

If pest name already exist

Error(pest already exist)

Else

Save the details

Add Pesticide

Log in to the system as admin

Provide pesticide details

If pesticide name already exist

Error(pesticide already exist)

Else

Save the details

Diagnosis

Log in to the system as farmer

Provide symptom details

If symptoms exists

Display (Associated Diseases, associated pest and control measures)

Else

Send message to the consultant

Getting Diseases Associated with a certain plant

Enter plant details

If found

Display associated pests and diseases and control measures

Else

Error (plant not found)

Getting out of the system

Click the Logout link

4.9 Security Design

Security design ensures that systems are not vulnerable to any attack that is by making sure data is secure throughout the system.

4.9.1 Physical Security

Physical Security is the protection of the organization's hardware, software and networks as well as data from physical activities and any situations that may result to serious loss of data or damage to the property (Michael 2016). The proposed system's IT resources are going to be kept secure from physical attacks that may include fire, flood, burglary and theft or vandalism. All the computers that are going to be of help when developing the system will be located in the same location that will be locked whenever there are no operations being done.

The server is going to be put in a room that has low temperature that is for preventing overheating. A fan that is going to help in producing low temperature is installed in the room. Security measures such the use of cameras for protecting the location with the machines are installed.

4.9.2 Network Security

Network security is the key technology for the organization since communication between staff is via the network. When data is being transmitted it should not be vulnerable to attacks during transmission (Thomas 2014). Network security prevents hackers from aiming themselves at the channel of communication as their aim is to decrypt data such that they can pass on a false message.

For the proposed system network security, sanctioned users are given the platform to communicate through a specific network. Information available in the network will always remain private. Encryption measures are ensured to enable data to be secure through the network. A firewall is going to be installed that prevent unauthorized access to the new system and that will scan every packet of data. Through the use of passwords and monitoring user access, network security is going to be ensured.

4.9.3 Operational Security

Monitoring behaviors on how users interact with the IT resources and the information in the system with the aim of avoiding risks is what is termed operational security (Thomas 2014). This is preventing information from falling into the wrong hands. The organization is going to make sure that the proposed system is operationally secure by allowing certain users to have certain

information to view in the database and to monitor control of different users who have access to the system.

Different rights are going to be given to certain data in the database for privacy sake. The administrator is going to be responsible for deleting or editing information in the database. The admin is also the one responsible for giving access rights to different users in the database. Operations of how users are doing their work are going to be monitored to prevent issues of information destruction and misuse.

4.10 Conclusion

In a nutshell, this chapter clearly showed the steps involved in developing the proposed system. This whole chapter described how the proposed system is going to function in satisfying and meeting the user requirements. How information flows around the system was clearly outlined by the use of dataflow diagram to indicate the entities involved and processes that are involved in developing the proposed system. How the database is designed was also shown by use of tables for easy access and to increase the integrity of data. No one needs a system that is not welcoming and the proposed system shows that it is user friendly even by the menu design and the interface design to clearly capture the interests of the users. This chapter also explained the security designs to indicate how the proposed system is going to be well protected and prevented from unauthorized access and hackers. The next chapter is going to be looking at the implementation stage as to how this system is going to be functional.

CHAPTER 5: IMPLEMENTATION PHASE

5.1 Introduction

The previous chapter looked at the design phase of the proposed system that is how the system is going to work. It also covered the database design of the proposed system as well as the interface design. Various security designs were outlined that is the physical security, network security and the operational security. This chapter is the implementation phase of the proposed system, the stage where the system is going to be employed. This phase consists of various testing procedures that are going to be done in implementing the system. Installation techniques and how to maintain the system is also covered in this phase.

5.2 Coding

Coding refers to procedures or guidelines well documented to clearly illustrate programs in the analysis, design and implementation of these programs (Howarth 2013). Dreamweaver was used to construct the graphical user interface of the system. All the functionalities are grouped in modules and all the coding is done using PHP programming language. To clearly show the input, processes and output design of the proposed system, quality coding is done and all the input from major contributors to the system. Below is an example of a code snippet

Farmer registration code

```
<?php
   include_once ('functions.php');
   session_start();
   $login_error='';
   require('mydb.php');
   $name = clean($_POST["names"]);
   $surname = clean($_POST["surname"]);
   $email=clean($_POST['email']);
        $phone=clean($_POST['phone']);
        $gender=clean($_POST['gender']);
```

```
        $province=clean($_POST['province']);
        $password=clean($_POST['password']);
        $cpass=clean($_POST['cpass']);
        if(strlen($name)==0 || strlen($surname)==0 || strlen($email)==0 || strlen($phone)==0 || strlen($gender)==0 || strlen($province)==0 ||
        strlen($password)==0 || strlen($cpass)==0)
        {
    ?>
    <script language="javascript">
    alert("Please Fill All the fields");
    </script>
    <?php
```

Login code

```
    <?php
    error_reporting(0);
        ?>
    <!DOCTYPE html>
    <html dir="ltr" lang="en-US">
    <head>
    <meta charset="utf-8">
   <title>Sign in | PIGS</title>
     <meta name="viewport" content="initial-scale = 1.0, maximum-scale = 1.0, user-scalable = no, width = device-width">
<?php include_once('head_infor.php'); ?>
   <style type="text/css">
        .art-sheet
        {
```

```
vertical-align:central; margin-top:150px; width:700px; background-image:url(images/white.JPG);

        }

        </style>

      </head>

   <body onload="JavaScript:AutoRedirect(5000);">

  <div id="art-main">

   <div class="art-sheet clearfix">

    <center>

<h2 class="art-postheader" style="margin-left:0; border-radius:15px">Sign in to your account</h2>

 <div style="margin:50px; width:600px;">

   <form class="form-horizontal" id="myForm"  method="POST" action="process_login.php">

  <div class="control-group">

   <input type="text" name="ecnumber" id="ecnumber" placeholder="Username" autocomplete="off" autofocus required>

   </div>

   <div class="control-group">

   <input type="password" name="password" id="password" placeholder="Password" required>

   </div>

  <div id="ack"></div>

   <div class="control-group">

   <button id="submit" name="login" class="btn btn-success"><i class="icon-signin icon-large"></i> Sign in</button>

   </div>

   <br><br>

   </form>

  <script type="text/javascript" src="scripts/jquery-1.11.2.min.js"></script>

   <script type="text/javascript" src="scripts/my_script.js"></script>
```

```
    </div>
  </center>
 </div>
  </div>
</body>
  </html>
```

5.3 Testing

Every software needs to be tested to ensure that it meets the system specifications and requirements. To indicate the nature and frequency of testing to be carried out, test plans are usually drawn up (Howard 2016). The testing procedures that are going to be done include unit testing, integration testing, system testing and user acceptance testing. The main reasons for system testing is to check the validity and verification of the proposed system functionality.

The following diagram indicate various testing procedures

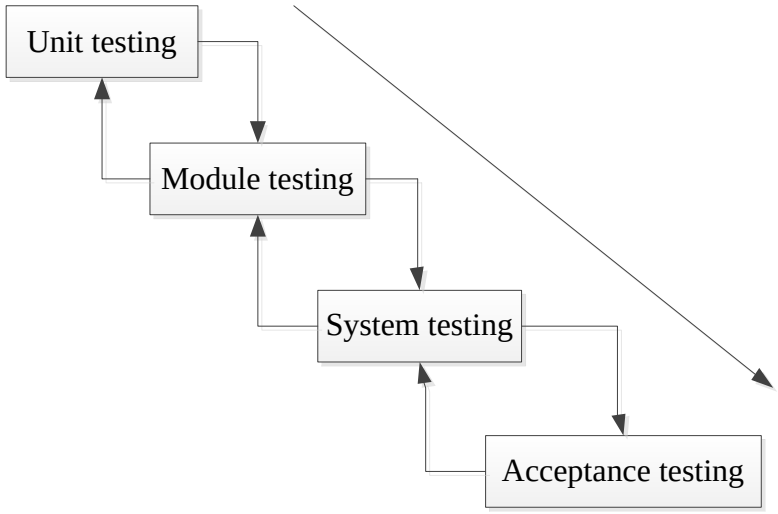

Fig 5.1 Testing

5.3.1 Unit Testing

This is when individual modules of the system are tested. The reason for unit testing is to remove syntax errors or logic errors (Edwards 2007). Each module of the system was tested separately. The system was broken down into several testable units and these were thoroughly tested as separate entities. An example of unit testing that was tested was that of a user trying to login and user can only be allowed access as long as the correct credentials are provided. Below is an example of the unit testing done on registration and logging in of a farmer.

A farmer has to fill in the desired fields required for them to become fully registered to the system. The figure below shows a user trying to register and typed wrong email address, the system will deny the user to register.

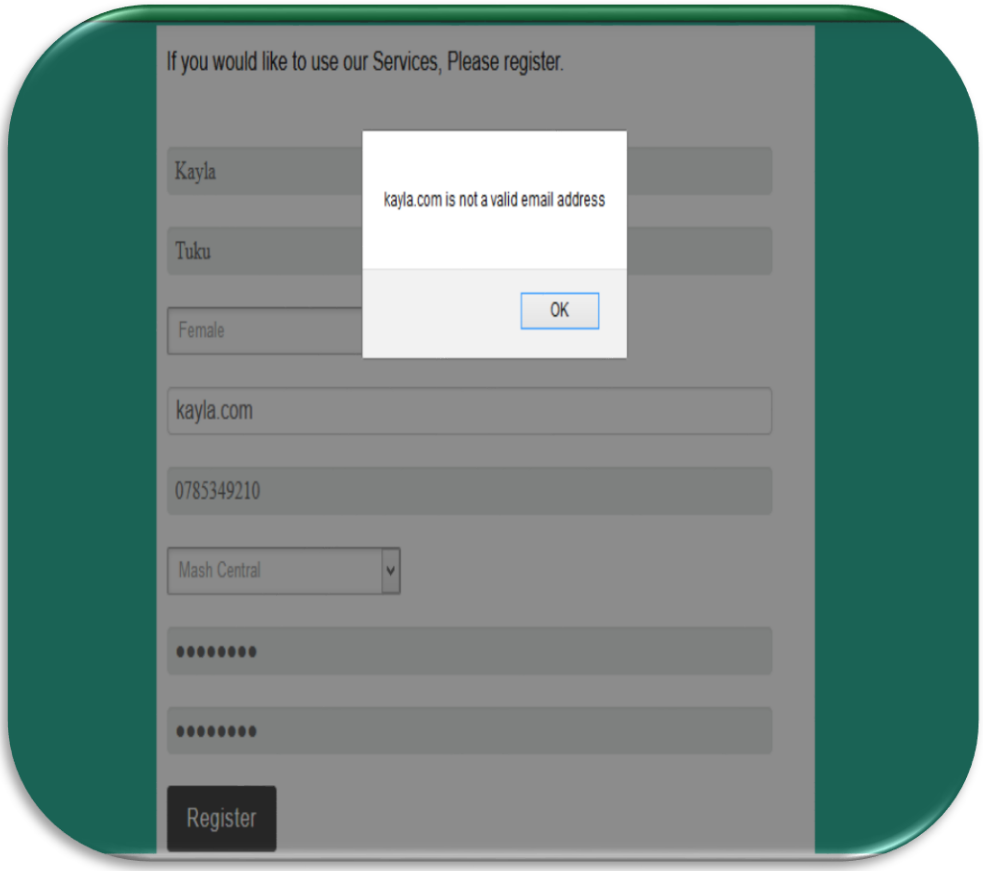

Fig 5.2 unit testing

Another unit testing done was that a farmer has to get registered after filling all the required fields. A farmer cannot get registered if any of the fields are empty as shown below

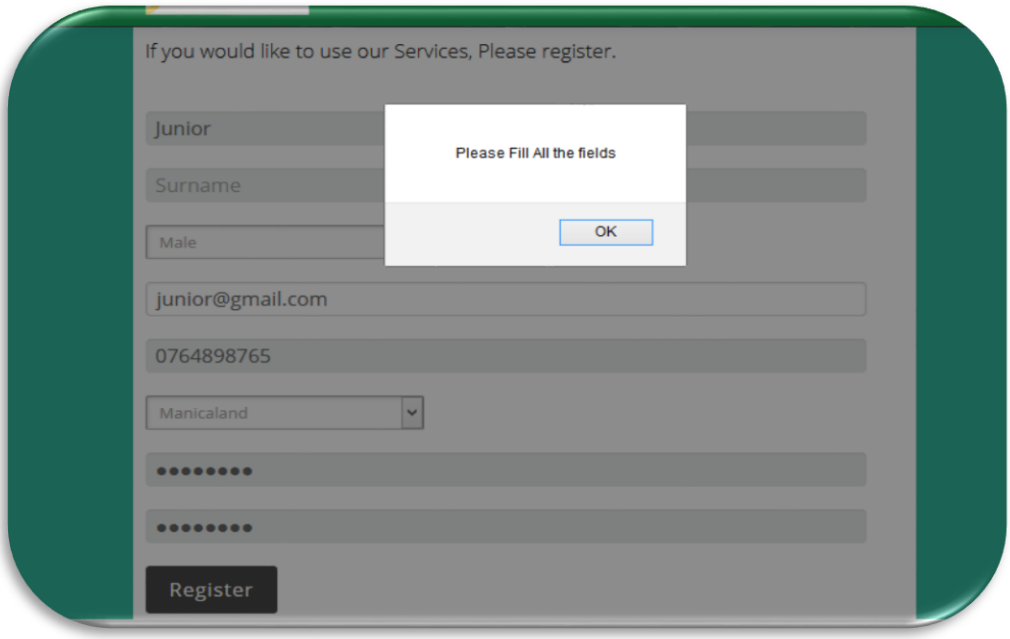

Fig 5.3 unit testing

Another unit testing carried was that of passwords, a mismatch in passwords cannot allow a user to proceed with registration as shown below

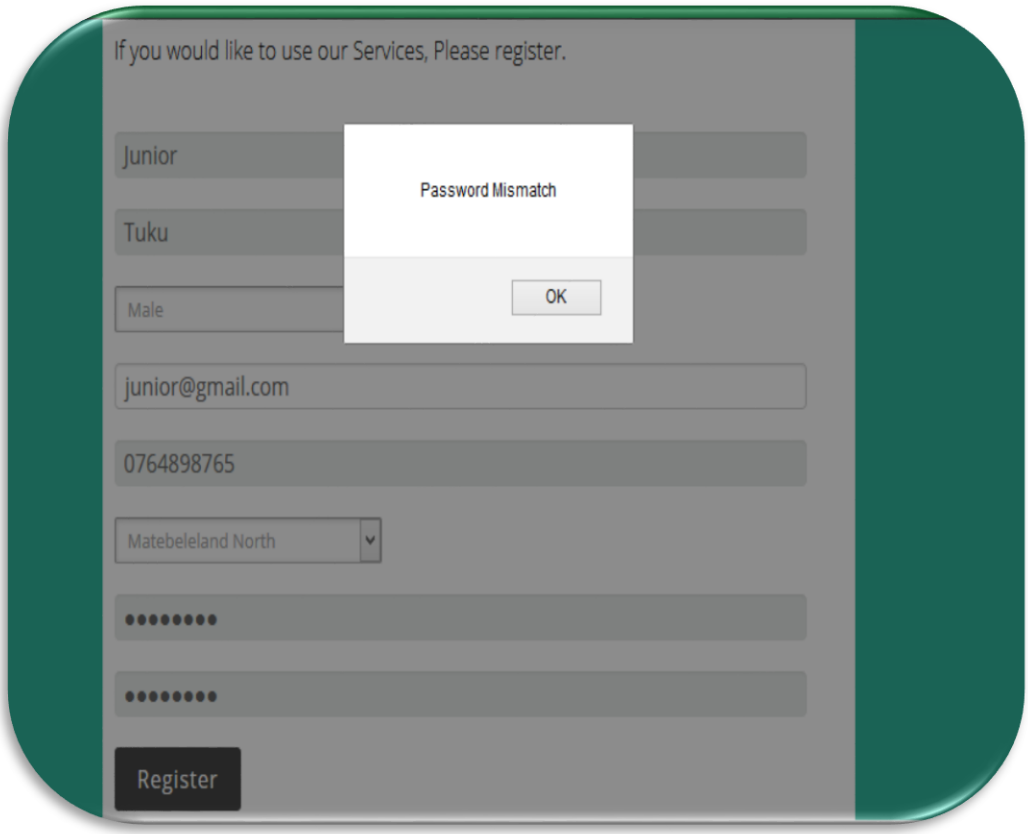

Fig 5.4 unit testing

5.3.2 Module Testing

This is when two or more modules that are related to each other are tested together so that their interaction to each other can be termed correct or incorrect (Schwalbe 2010). For every module of the system, all the forms were tested for functionality that is to see if they were executing as desired. Things like extreme data, error handing and execution path were all checked. Every module receives an input does some processing and expected output generated. If not, then the modules may have contain some bugs or errors that needs to be corrected. A farmer is expected to register given that all the details are provided are correct. Below is a figure that is showing a farmer trying to register and accidentally, the farmer puts a phone number already in the system. All the required units that were tested are included in this but unfortunately the farmer puts a wrong phone number and failed to be registered. The system will tell the farmer that phone number already exists in the system as shown below

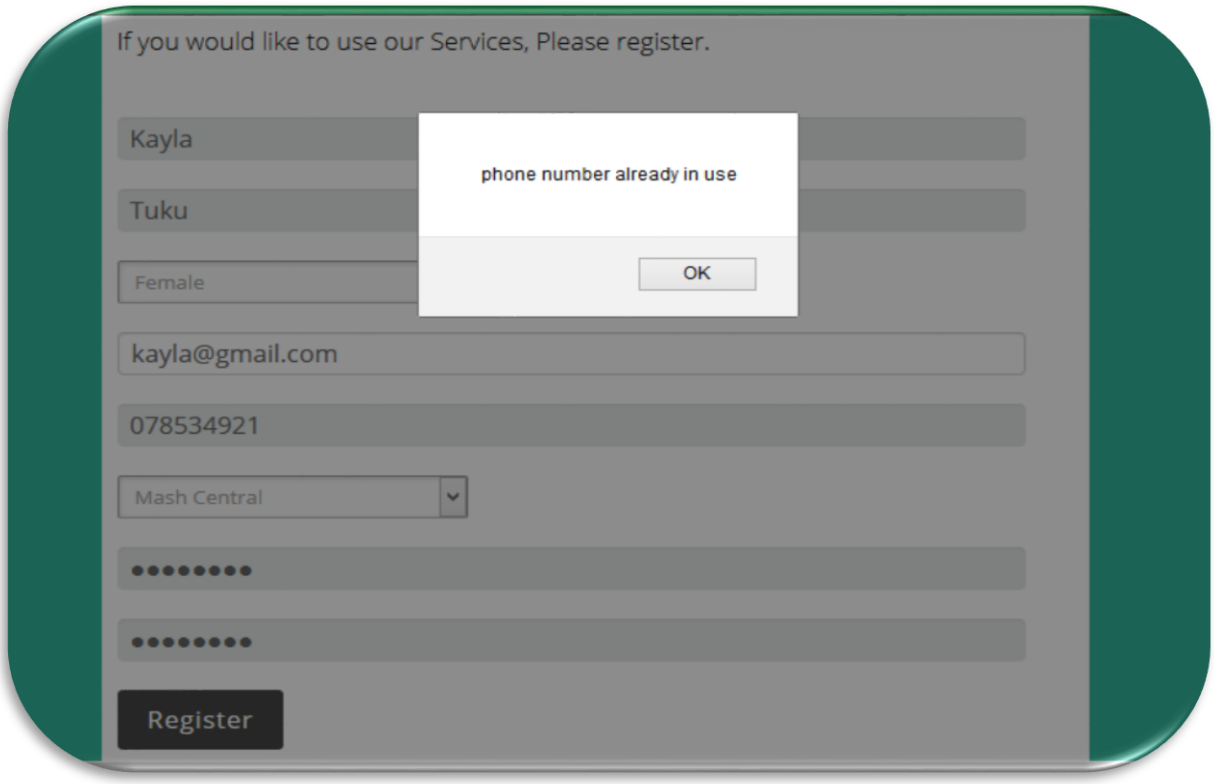

Fig 5.5 module testing

Another module tested was that after the farmer has entered all the requirements on registration, a message that the registration is successful has to pop up

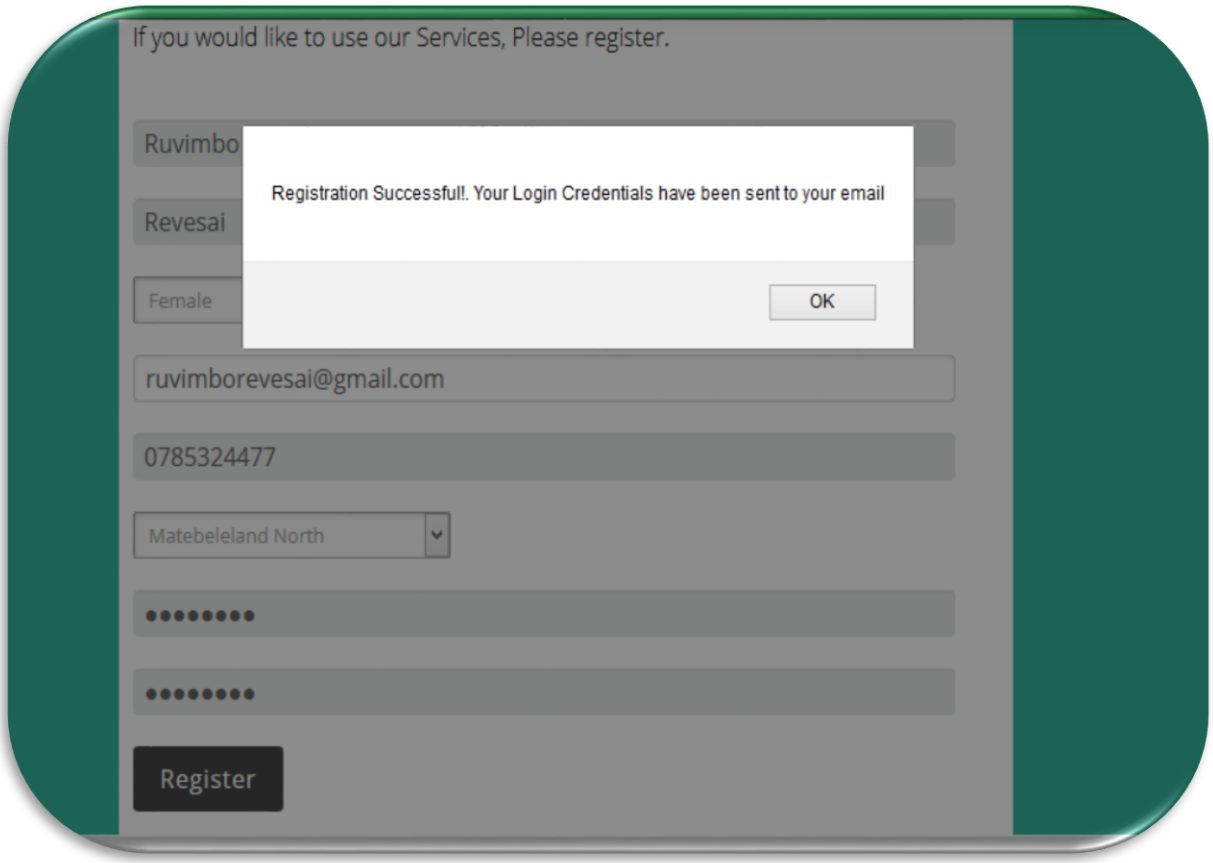

Fig 5.6 module testing

Another module tested was on symptoms, after a farmer has typed the type of maize he or she is interested in, variety of symptoms should be seen where the farmer will select and the the type of disease or pests appear as shown below

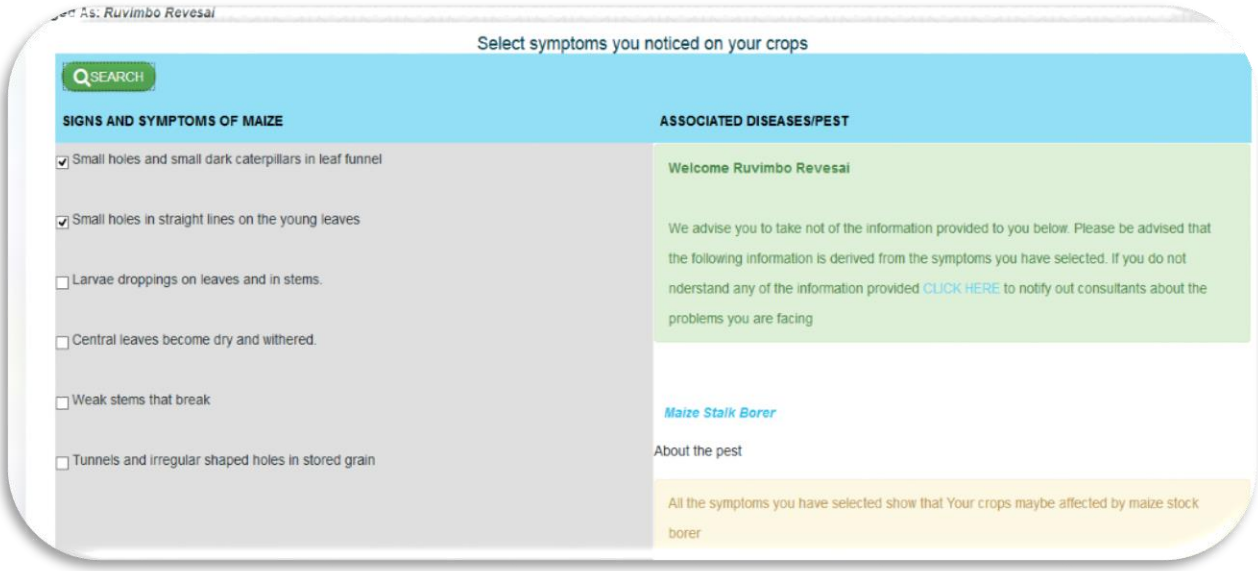

Fig 5.7 module testing

Another module testing carried out, a farmer has to input the type of crop he or she is interested in and the field size he is possessing and advice on the water required and type of seeds required as well as the expected yield should be shown as indicated below

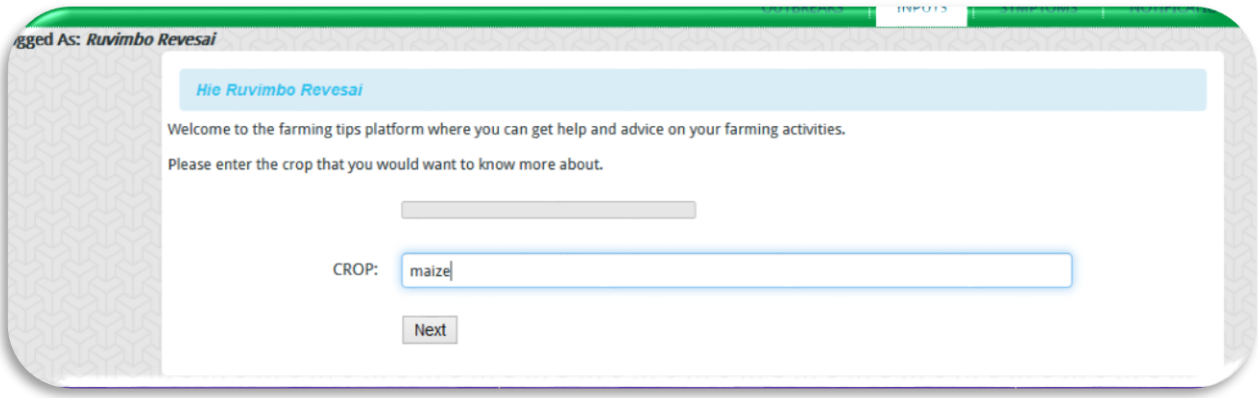

Fig 5.8 farmer inputting the crop

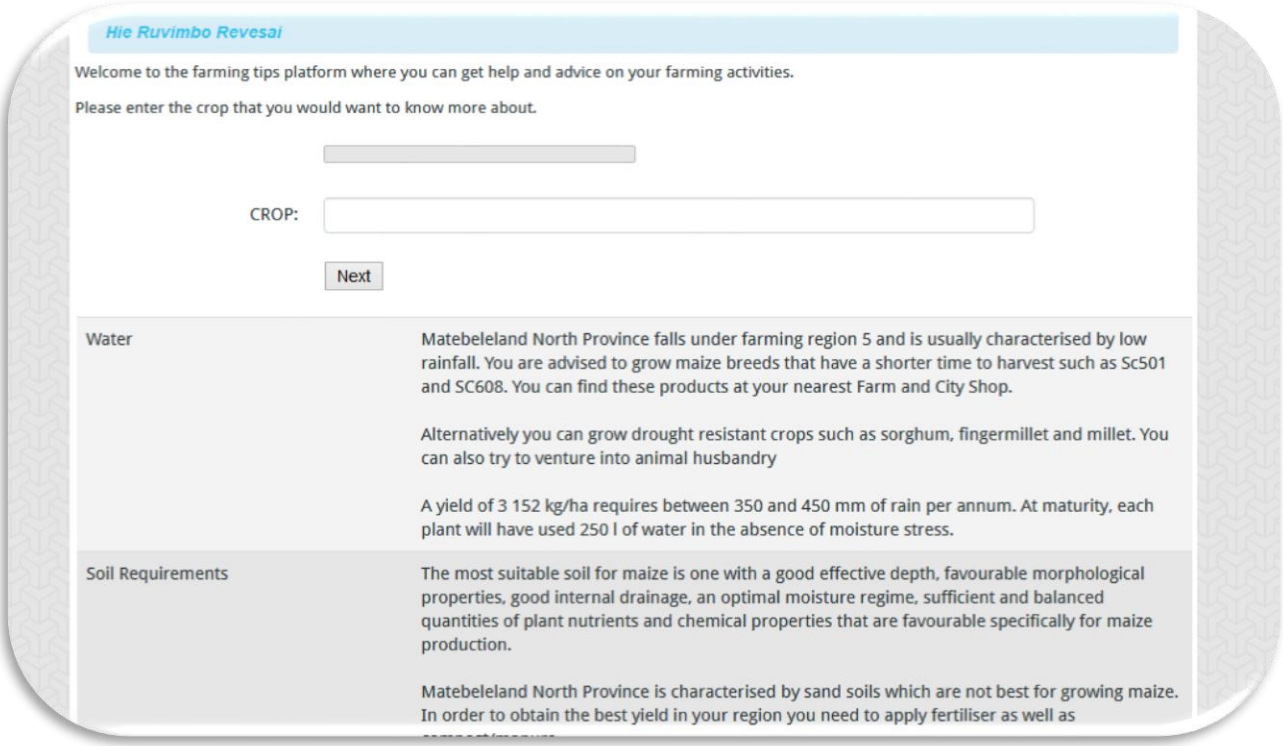

Fig 5.9 module testing

5.3.3 System Testing

System testing comprises of the whole system that is all the modules or programs are being tested. Its purpose is to ensure that the specifications as per user expectations are met (Horwarth 2013). System testing ensures that quality is designed and built-in. changes made during module testing should not produce new errors if so, they are discovered in system testing. System testing ensures that objectives are met. The figures below shows how the system was tested to meet the objectives and requirements of the users.

To prompt the farmer to enter signs of a plant defection and be advised with the type of diseases affecting their plants. This is shown below

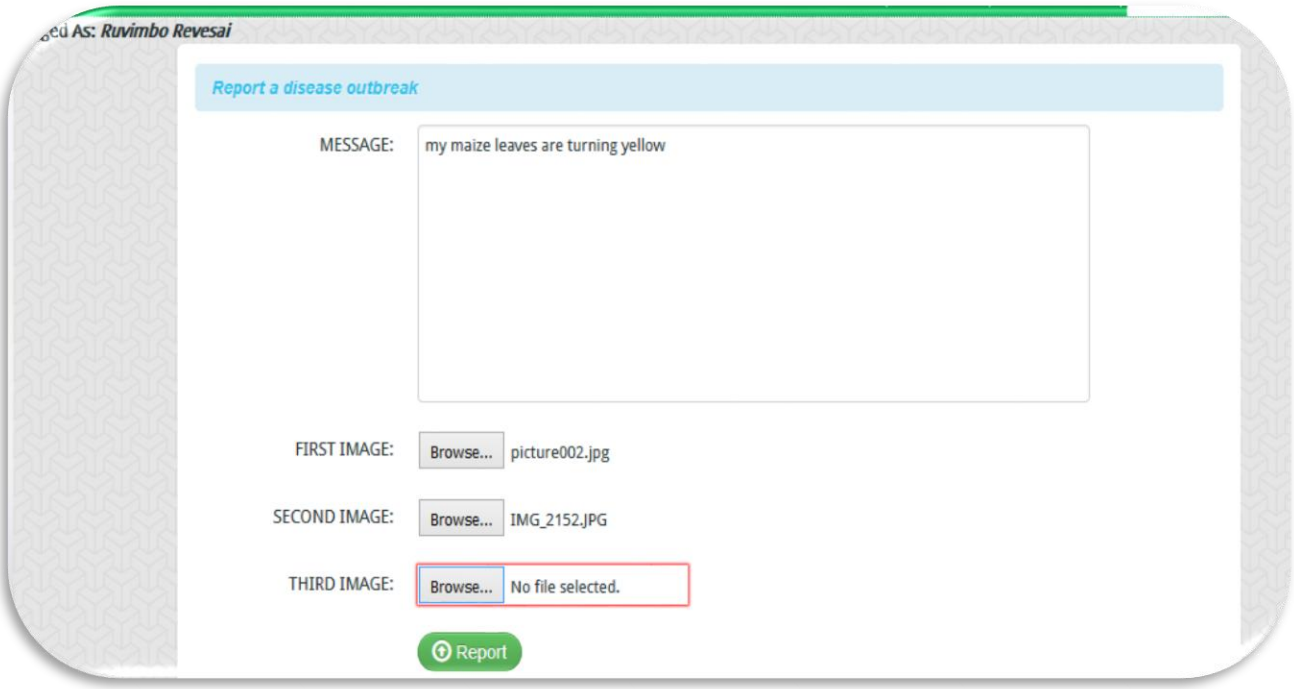

Fig 5.10 system testing

To provide for the best pesticides to cure certain pests causing diseases on plants based on what information the farmer has provided to it.

A farmer is given a variety of control measures and the farmer is directed to the platform where he or she can see the prices of the drugs in the shops and other farming products.

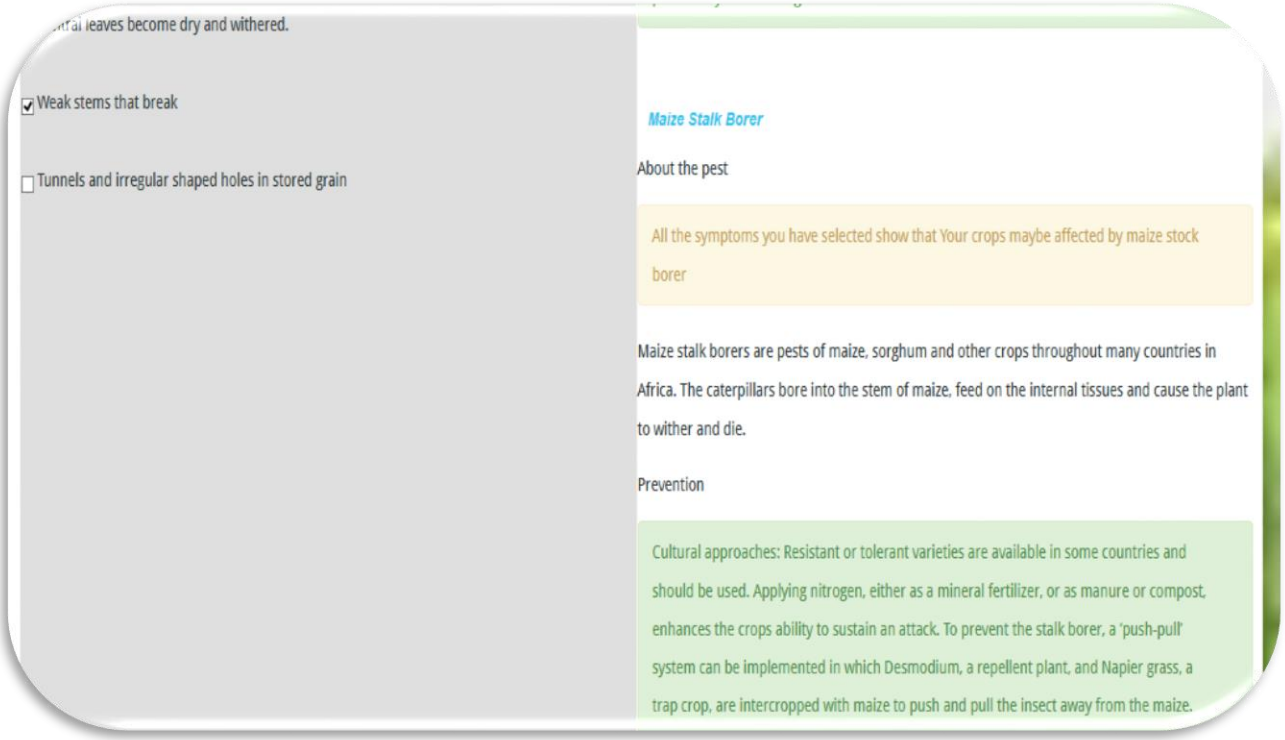

Fig 5.11 system testing

Prevention and control is given to farmer and then a farmer can click where it is written FCC Shop to access the products available in the shops

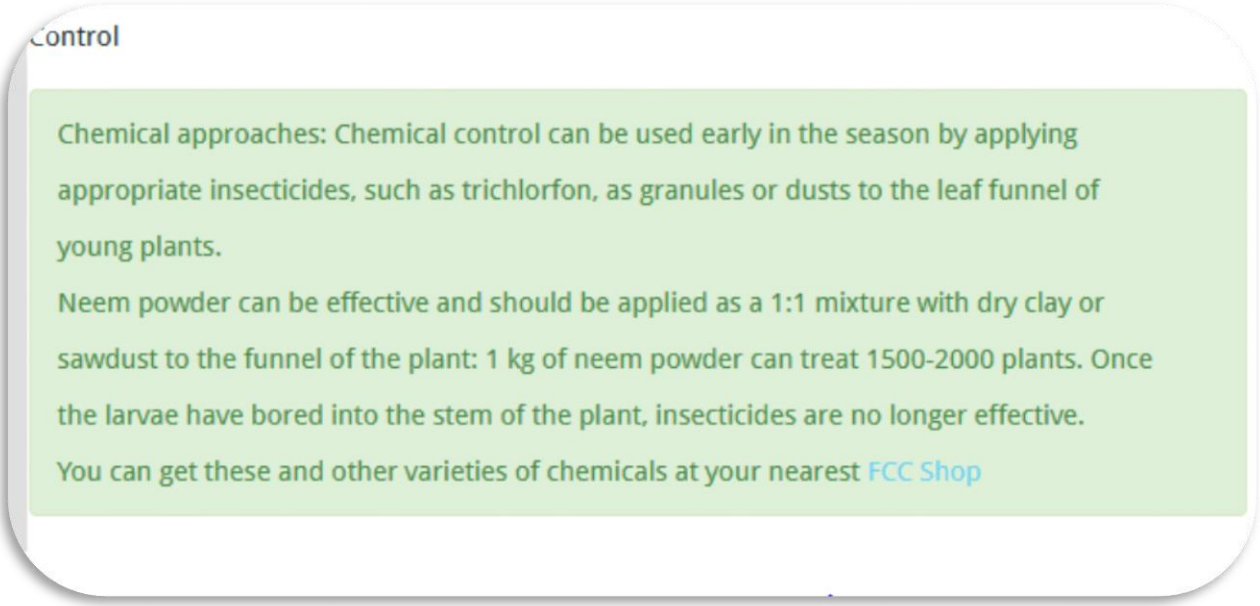

Fig 5.12 system testing

To provide a platform of interaction between the farmers and the consultants for easy communication.

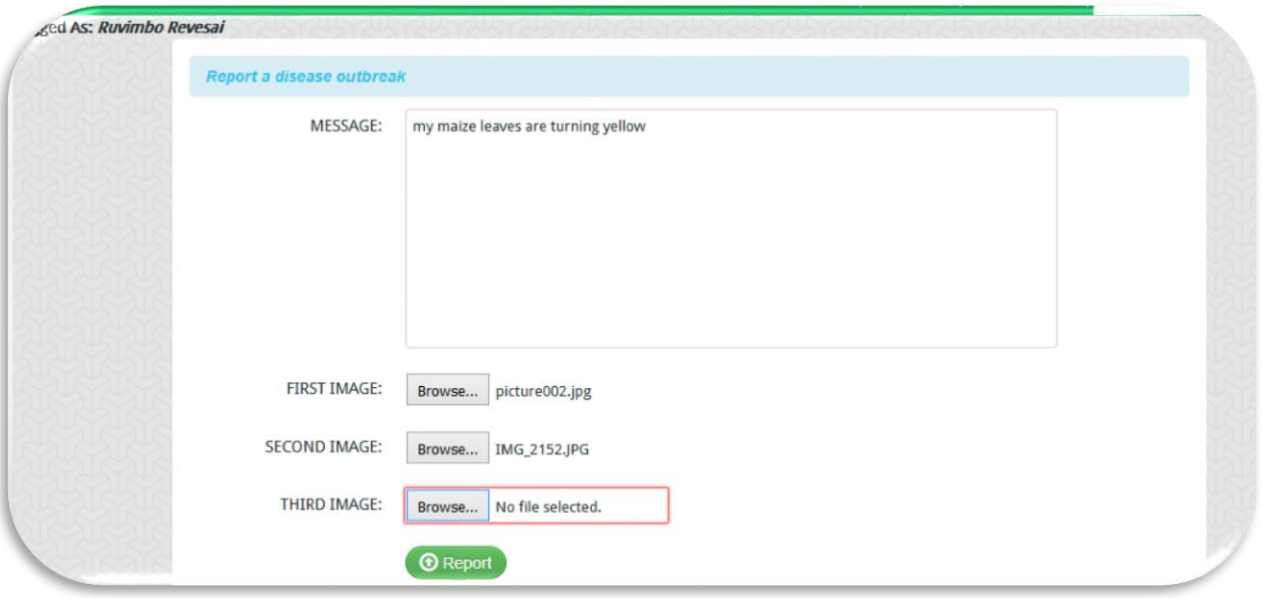

Fig 5.13 chat screen

To advice and help farmers solve problems that they maybe encountering during their crop production.

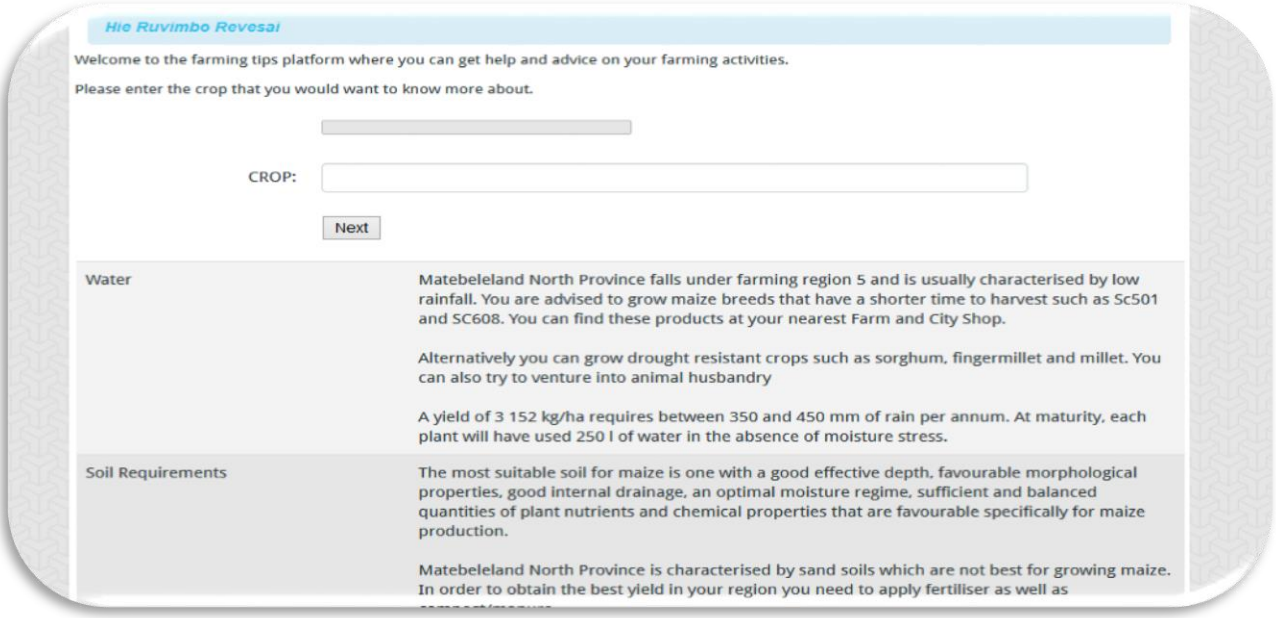

Fig 5.14 system testing

To provide a chat platform between all the farmers registered in the system

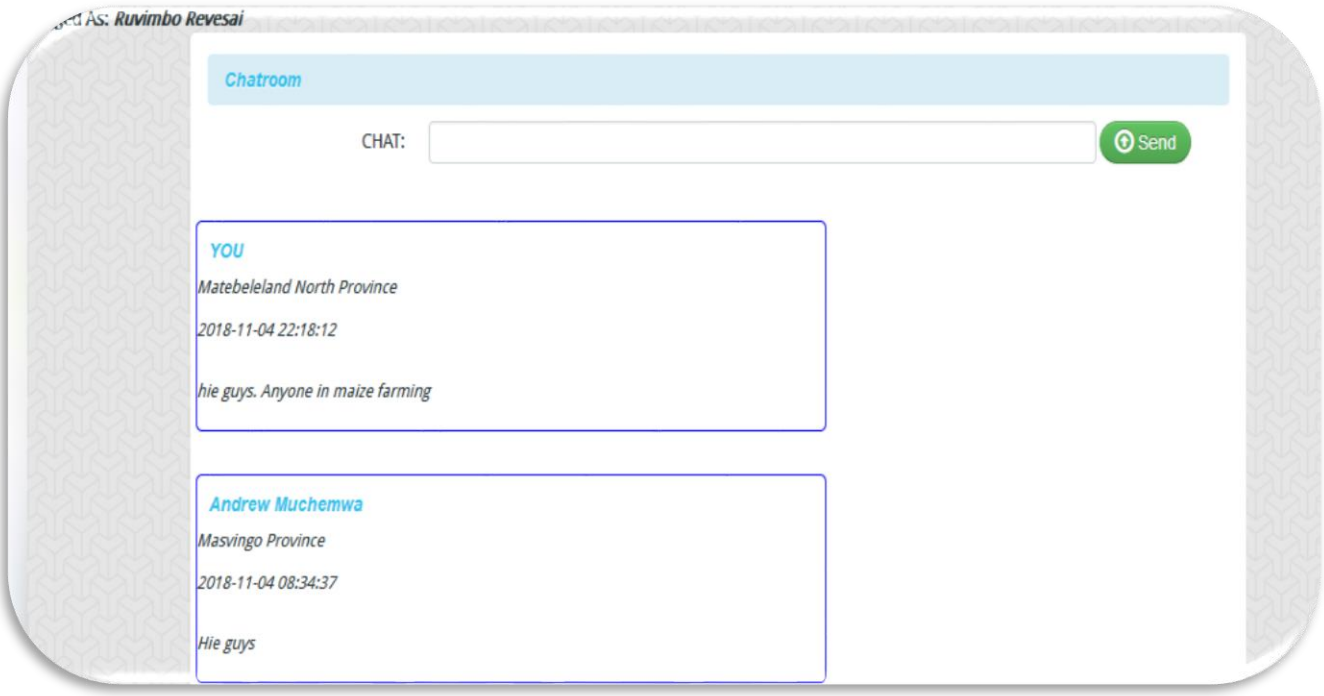

Fig 5.15 system testing

5.3.4 Acceptance Testing

After system testing, users can be invited to check if the system is performing as per their requirements and expectations thus acceptance testing (Srinivasan 2014). User trainings may be required first for acceptance testing. Acceptance testing is the last phase carried out when testing the system. Acceptance testing is going to be done by the end users of the system and this is carried out to verify and validate all the user requirements. Validation and verification procedures are performed here. It is only after the system has passed acceptance testing for it to be in proper and continuous use. Acceptance testing is tested on the validation and verification of the system.

5.3.4.1 Validation

This is the process of checking whether the system is satisfying the user requirements and specifications (Lawson et al 2014). It is usually done at the end of the development process. The system was tested for validation and user requirements are met as per the user specification. The

diagrams below shows how the system is going to ensure validation. Marcus (2015) defines validation as a process that comes after the system is completed to validate the user requirements.

The figure below shows a validation check made on farmer registration process. A farmer had to fill all the fields to be registered.

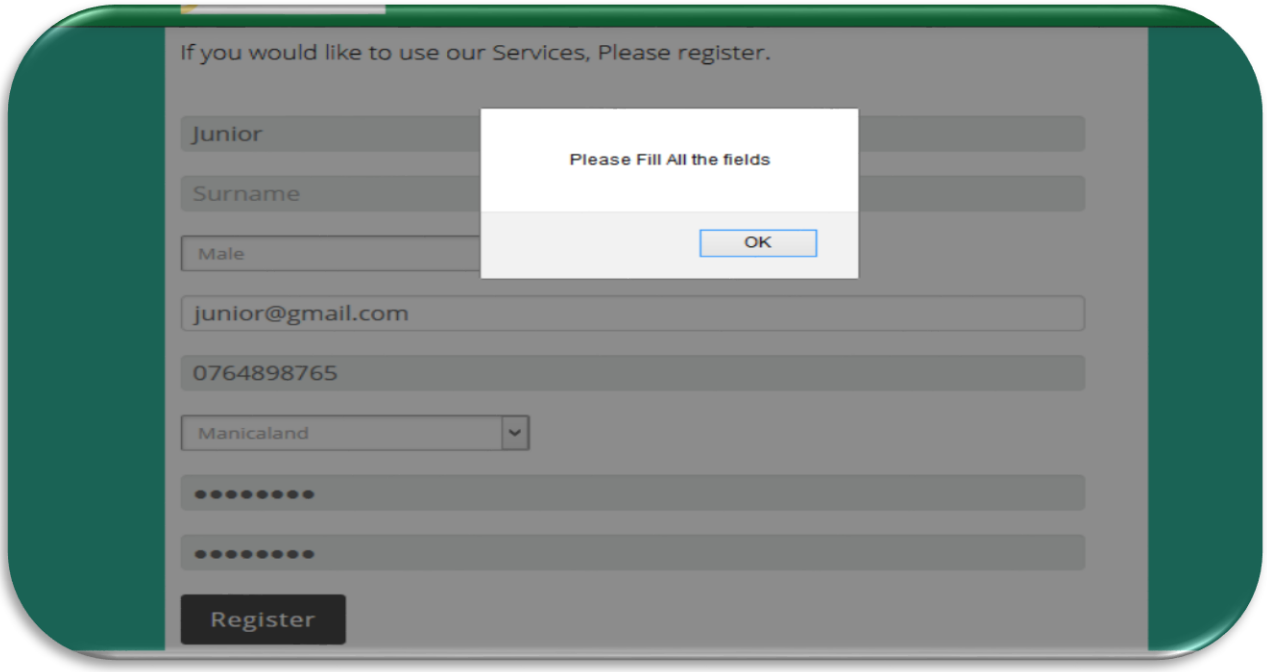

Fig 5.16 validation

5.3.4.2 Verification

Verification checks the correctness of certain areas of the system that is the system fitness for use (Lawson et al 2014). Certain areas needs to be verified to check if user requirements are being met. Various verification testing procedures are going to be displayed indicating the correctness of the proposed system as per user requirement. Deutsch (2013) further goes on to say verification looks at how correct the system is in fulfilling the demands of the user. Verification example below shows how a user is denied access after entering wrong credentials.

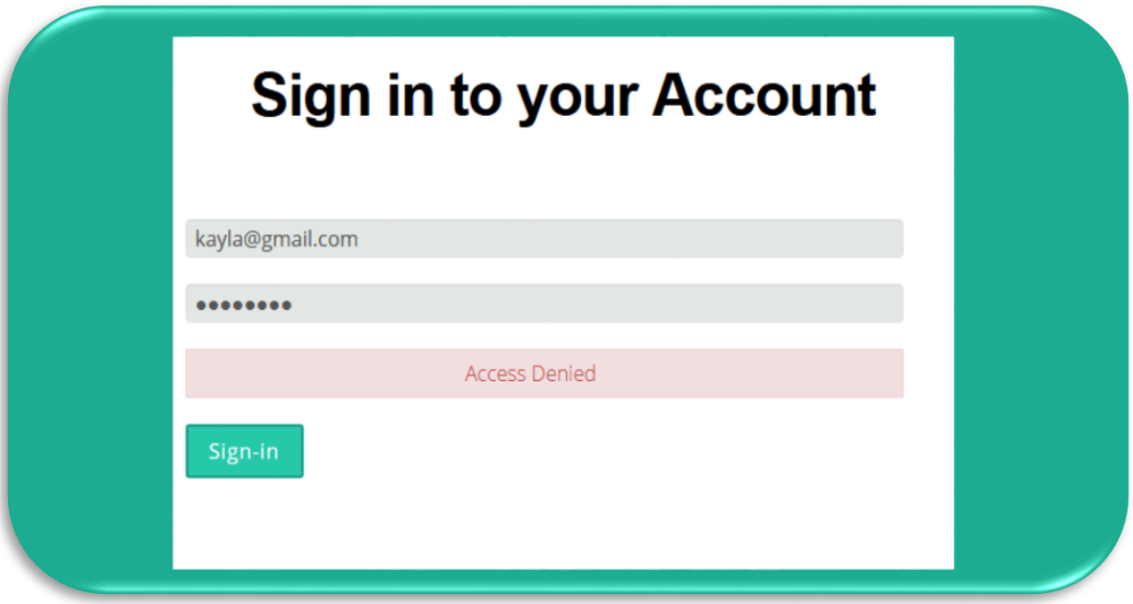

Fig 5.17 Verification

5.4 Installation

This is when the application developed is positioned for use in various devices where it will be operated (Kenneth 2013). The proposed system is going to be deployed in desktop machines. What the users are going to be performing was specified and hardware configured as well as software. Data was converted from the current system to the proposed system. Major processes include:

i) Software and hardware installation
ii) User training
iii) File Conversion

i) Software and Hardware Installation

This involves necessary hardware and software for the proposed system being installed (Richard 2013). This included user computers, all the network installations and then installing the system afterwards. Software include installing the PHP programming language, installing the database and other necessary soft wares.

ii) User Training

Before the system is released, user training should be conducted. The amount of training required will depend on the level of the use of the system to be undertaken (Gerald and Raymond 2014). The training of the proposed system was done to the consultants. The system administrator who is responsible for managing projects and users is also responsible for backup and troubleshooting together with the other IT team guys had to train the users on how to use the system. A test plan was produced on how the training was going to be carried out led by the system admin.

Training venue	FCC Boardroom
Date	17/11/2018
Attendees	IT team, coordinators, Admin, Consultants
Requirements	Laptops and projector
Facilitator	Systems Administrator

Table 5.1 test plan

iii) File Conversion

This had to be done in order to convert the old data into digital which was going to be used. Rather than using test data, this conversion was important so that the system could be tried in real time and in the real operational environment.

5.4.1 System Changeover

Keisuke and Kenichi (2012) defines system changeover is the process of shifting from one way of doing things to another, it normally involves putting new information and retiring from the old one. A strategy of how changeover can take place has to be made whenever a new system is replacing an existing system. For the new system to start working properly, data from the existing system is required (Tahir 2014). After user training and system testing, the changeover strategy has to be noted amongst the various strategies. Changeover can be either direct, parallel changeover, pilot or phased.

5.4.1.1 Direct Changeover

This is when the old system ceases to operate as soon as the new system is implemented (Whitten 2015). Direct changeover is mostly the least in terms of cost but it is risky since it is difficult to revert back to the old system if the new system encounters serious problems. High data loss is experienced with this changeover method since users will start using the new system and the old system is immediately cancelled and it's no longer in use.

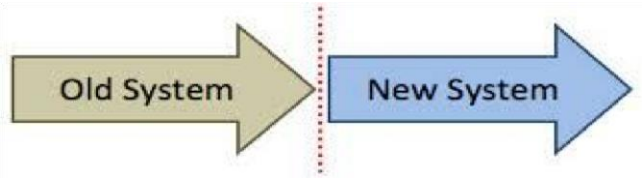

Fig 5.18 direct conversion

5.4.1.2 Parallel Changeover

This changeover strategy keeps the old system in use alongside the new system. This is an ideal method especially if the new system encounters serious problems. It is somewhat costly since there will be two systems in use. This approach allows to check the outputs for both systems to see which one is performing very well. Risks are reduced when using this method since only one department can be affected if anything goes wrong with the new system use. Backup is always there also if there in event of failure.

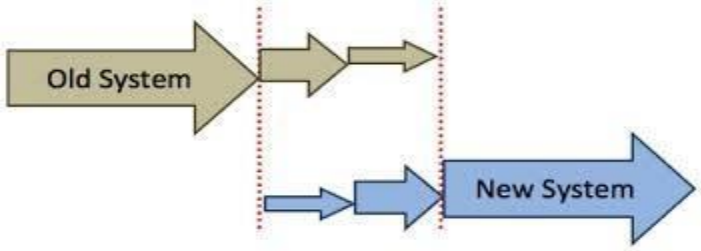

Fig 5.19 Parallel conversion

5.4.1.3 Phased Changeover

This approach allows the system to be implemented in phases or stages. Risk is also reduced since one part of the system is affected when there are serious problems. This approach is also less costly compared to parallel operation provided the new system can be modularized that is if it can work together with the existing system. In some cases, phased conversion can be costly that is if the system consists of a number of separate phases. Because of these phases, it can be difficult to apply phased operation approach.

Fig 5.20 Phased conversion

5.4.1.4 Pilot Changeover

The changeover technique involves implementing the complete new system at a certain selected location of the company that is it can be a branch of a company. The existing system will still be in use by the organization such that when problems occur, only a few users can be affected. A full back up is also possible in events of new system failure. Pilot operation can be a combination of parallel operation and direct method.

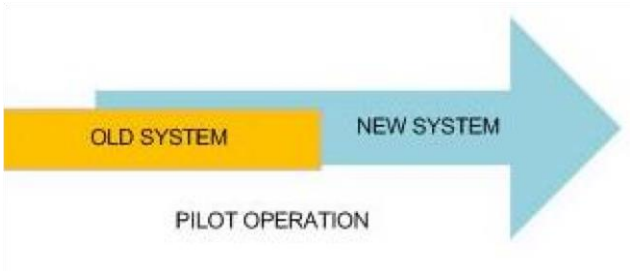

Fig 5.21 Pilot conversion

5.4.1.5 Recommended changeover Strategy

After all the changeover strategies have been outlined, the parallel changeover strategy was chosen and the reason being that

i) It minimizes the loss of data during implementation.

ii) A clear picture of how the new system is compatible is checked. Since it will be working side by side with the old system.

iii) Users can get used to the new system while they are learning the old one bit by bit.

5.5 Maintenance

System maintenance ensures that the system operates reliably in a secure environment. Supported by the IT team, the system is maintained as soon as it is released. System maintenance means that the system is working properly and in situations where a failure occurs, the system is corrected quickly and work should continue as usual (Anthony, 2016). Maintenance is an important process to the system since changes will be arising, identification of bugs as well as the operating environment may change and for that reason the need for maintenance for a successful long run of the system. Generally maintenance involves improving, modifying or upgrading the system to make it better as new requirements emerge with time. Below is the maintenance process and various maintenance strategies involved

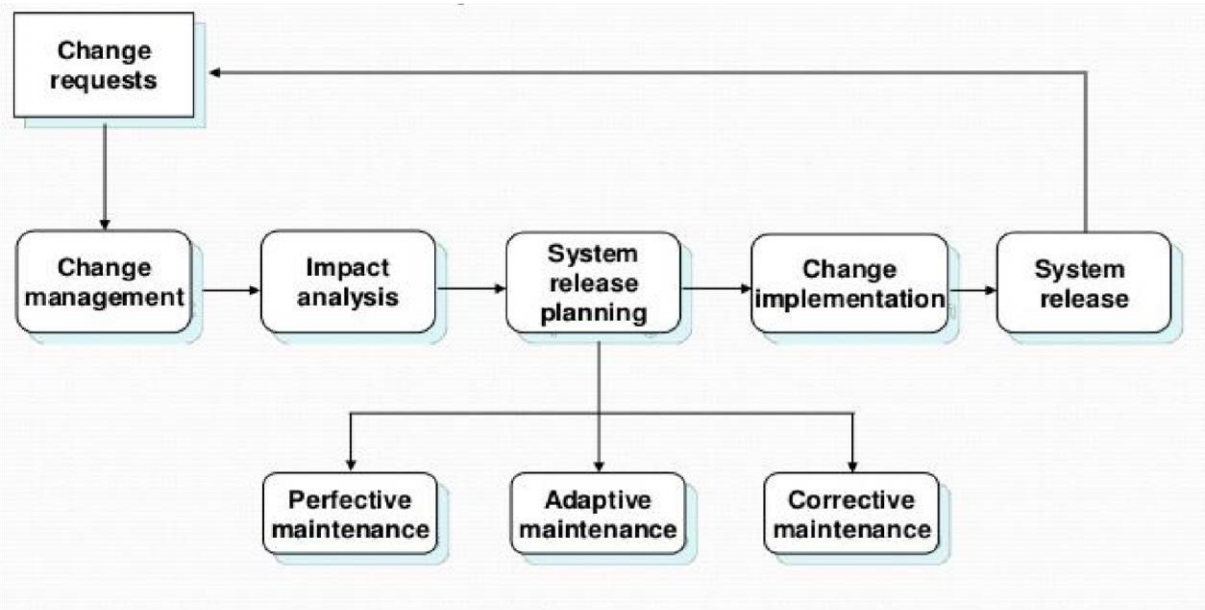

Fig 5.22 Maintenance process

5.5.1 Corrective maintenance

Corrective maintenance involves dealing with faults that are mainly hardware and software. Faults that may cause the system to malfunction properly which are called bugs may also produce incorrect results unexpectedly (Khaled and Yan, 2014). Debugging is a method that can be used to remove these bugs and usually other software programs are used. Hardware problems that maybe encountered include PC failure or network failure that will need to be addressed. The IT team has to assess how serious the faults are so as to know the right action to take to address the fault.

5.5.2 Adaptive maintenance

Addresses changes to the new system that is those that may require to deal with new demands (Hambling, 2007). Usually adaptive maintenance is as a result of an outside agency that have impact on how the system works and its requirements may cause the system to have alterations. Environmental changes also might be a push factor that is the introduction of new technology may require the system to be upgraded to suit the changes.

5.5.3 Perfective maintenance

There may be a need to improve the systems performance and functionality. This maybe by adding a new report or upgrading the system's hardware to increase the response time of services.

5.5.4 Recommendation for Maintenance

Maintaining a system needs to be carefully considered. The managers recommended that maintenance is necessary especially if the system is to live longer. Bugs may occur, environment may change as well as third partys may be involved and this means that necessary measures be taken to carter for all that thus the need for maintenance.

5.6 Recommendations for future development

The researcher worked very closely with the organization and discovered that there are some areas that needed reviewing. Recommendations included that

1) The maintenance and back-up plan should be seriously taken into action as these play a major role in case of hardware or software failure thus followed as per the designed plan.
2) System modules are recommended that would track all the inputs usage and the farming activities.

3) The system include suppliers in the future that can help farmers advertise their products and sell them.

5.7 Conclusion

The crop disease detection and control advisory system is a computerized system for Farm and City that helped in controlling the manual system that was being used. This chapter highlighted various main points concerning the development of the system and these include the testing of the new system if it was performing as requested by users. Also various installation changeover methods that included how the system was going to be implemented. The maintenance section also showed that as the system is going to be continuously used, there is need for maintenance since various activities can affect the system such that changes may be required.

REFERENCE

Albert Lester (2014), *Project Management, Planning and Control*, Elsevier: USA

Andreas, Rainer, Junyu and Daniel (2015), *System Design*, Kluwer Academic Publishers: USA

Anthony Kelly (2016) *Maintenance Systems and Documentation*, Elsevier Limited: USA

Baumeister H and Weber B, 2013, *Agile Processes in Software Engineering and Extreme Programming*, Springer: 2013.

Benjamin Crosby (2014), *Stakeholder Analysis*, USAID: USA

Charles Yoe (2015), *Principles of Risk Analysis*, CRC Press: USA

Daniel R. Windle and L. Rene Abreo (2013), *Software Requirements Using the Unified Process*, Prentice Hall: New Jersey

David C. hay (2013) *Requirements Analysis*, Pearson Education: New Jersey

David Howe (2013), *Data analysis for Database Design*, Butterworth-Heinemann: Britain

David Yose (2015), *Risk analysis*, John Wiley and sons: UK

Duncan .W.R., (2015), *A Guide to the Project Management Body of Knowledge*, Project Management Institute, United States.

Easton S. (2014), *Supplier relationship management*, Apress: New York City.

Ebert .C, (2011), *a guide to distributed development, projects and outsourcing*, Wiley, USA.

Edward, P, (2007), *Software Analysis& Design*, McGraw Hill, New York.

Elvis C. Foster (2014) *Software Engineering*, Apress: USA

Fernanda C et al (2012) Managing Knowledge Assets and Business Value Creation in Organizations, Academic Publishing International Ltd, UK.)

Grady,O (2016) *System Requirements Analysis*,Elsevier inc .USA

Gerald D and Raymond M (2014) Software *Testing, Testing Across The Entire Software Development Life Cycle*, John Wiley and sons Pub: New Jersey

Gregory Allen and Rachel Derr (2015), *Threat Assessment and Risk Analysis*, Elservier: UK

Hamido F and Mohamed M (2014), *New Trends in Software Methodologies, Tools and Techniques*, IOS Press: Netherlands

Horwarth N (2013), *information systems, Select Knowledge*, Hertfordshire: UK

Howard G. (2016) *System analysis and Design*, Addison-Wesley Publ. Co: UK

James, K, L (2009) *Software Engineering*, Phi ltd: New Delhi.

Jan L (2016), *Relational Database Design and Implementation*, Morgan Kaufmann: USA

Jenifer Tidwel (2013), *Designing Interfaces*, O'REILLY: Canada

Jerome H and M.Frans (2014), *Principles of Computer System Design*, Morgan Kaufmann: USA

Joanne, K. (2006), *Database Systems: Concepts, Design and Applications*, Pearson Education, New Dehli, India.

Khaled M and Yan (2014) *Managing Corporate Information Systems Evolution and Maintenance*, Idea Group Pub: USA

Keisuke Arai and Kenichi Sekine (2012) *Kaizen for quick changeover*, CRC Press: New York

Kelsey and Gray (2015), *The feasibility study process*, American Alliance for health, physical education, Recreation and Dance: USA

Kenneth Kendall (2013) *System Analysis and Design*, Pearson Education Limited, 7th Edition: UK

Kim H.Pries and John M. Quigley (2016) *testing complex and embedded systems*, CRC Press: USA

Kurt Bittner and Ian Spence (2014), *Use Case Modelling, Addison Wesley*: Canada

Laudon K. C. and Laudon J. P. (2016), *Essentials of management information systems,* prentice hall: New Jersey.

Lawson .J. (2004), *BTEC for IT practitioners, Software Development*, Heinemann

Educational sPublishers, UK

Leszek M (2016) *Requirements analysis and System Design*, Addison Wesley: Canada

Marc Resch (2016), *Strategic Project Management Transformation*, J. Ross: USA

Marcus S. Fisher (2015) *Software Verification and Validation*, Springer USA

Mathers, M. (2000) *Software Engineering*, Harvest Printers, Mexico

MG Limaye(2009) *Software Testing*, Tata Mc Graw Hill Education Private Limited: New Delhi

Michael Deutsch (2013) *Software Verification and Validation*, Prentice Hall: New Jesrsey

Michael Erbschloe (2016), *Physical Security for IT*, Elsevier: UK

Michael J. Hernandez (2014), *Database Design*, Addison- Wesley: USA

Michael J. (2015), *Computer System Design*, John Wiley and sons: Singapore

Namchul Shin (2015), *Creating Business Value with Information Technology,* IRM Press: USA

Nathan P (2005) *System Testing with an Attitude*, Dorset House Pub: New York

Piet Westerndorp, Carel Jansen and Rob Punselie (2012), *Interface Design and Document Design,* Rodopi: Netherlands

Preetie Gupat (2013), *Structured System Analysis and Design*, Firewall Media: New Delhi

Richard Murch (2013), *The software Development Life Cycle*, Richard Murch: USA

Robert E. Stevens and Philip K Sherwood (2015), *How to Prepare a Feasibility Study*, Prentice Hall: USA

Roger H.L Chiang, Keng Siau and Bill C Hardgrave (2013), *System Analysis and Design*, M.E. Sharpe: USA

Rosenblatt, G. B. (2011) *Systems Analysis and Design (9th Ed.),* Boston: Course Technology

Russ M and Kim H (2015) *A Pragmatic Introduction to UML*, O'REILLY: USA

Sam Lightstone, Toby Teorey and Tom Madeau (2014), *Physical Database Design*, Morgan Kaufmann: USA

Savenkov R (2014) *How to become a software tester*, Roam Savenkov Consulting: USA

Schwalbe, K (2010) *Managing Information Technology projects* 6th Edition, Cengage Learning.

Schwartz M. (2016), *the art of business value,* IT Revolution: Portland.

Shio Kumar Sigh (2013), *Database Systems*, Pearson Education: India

Singh (2016) *Information Systems Management*, APH Publishing: New Delhi

Software Engineering institute. (n.d). Process and Performance Improvement: https://resources.sei.cmu.edu

Srinivasan D (2014) *Software Testing*, Dorling Kindersley: India

Tahir A (2014) *Developing information Systems*, BCS Learning and Development Limited: Finland

T.E Bailey and Kris (2013), *Program Design with Pseudocode*, Brooks Publishing: UK

Terje Aven (2014), *Foundations of Risk Analysis*, John Wiley and Sons: UK

Thomas Norman (2014), *Integrated Security Systems Design*, Elsevier: UK

Toby. J. T, (2011), *Database Modelling and Design: Logical Design*, Elsevier, USA

Weinstein A. (2012), *Superior customer value: Strategies for winning and retaining customers, 3rd edition,* CRC Press: Florida.

Whitten (2003), *System Analysis,* Prentice Hall, USA

Appendix A: User Manual

INTRODUCTION

The Crop Disease Detection and Advisory system backed enables farmers to receive advice on crop diseases from Farm and City Centre (FCC). The system enables farmers to receive information on farming tips and disease detection and control. It also allows farmers to chat and get updates about farming information.

Technology

The system is built on the following technology:

Adobe Dreamweaver CS6

MySQL

XAMPP

The following are a random sample of the some of the module screens.

Front -end

Main home screen

Fig A1 farmer home screen

User Registration

A farmer has to register before login in to the system for the first time. Enter information required to register

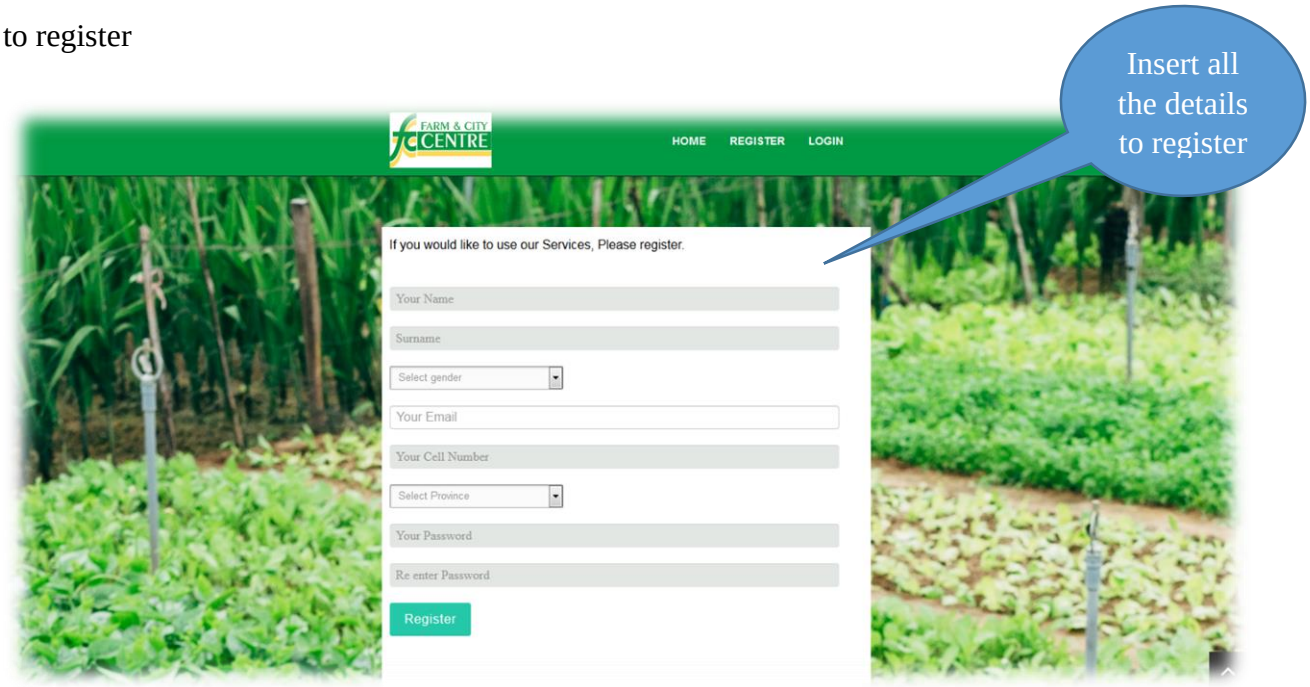

Fig A2 register screen

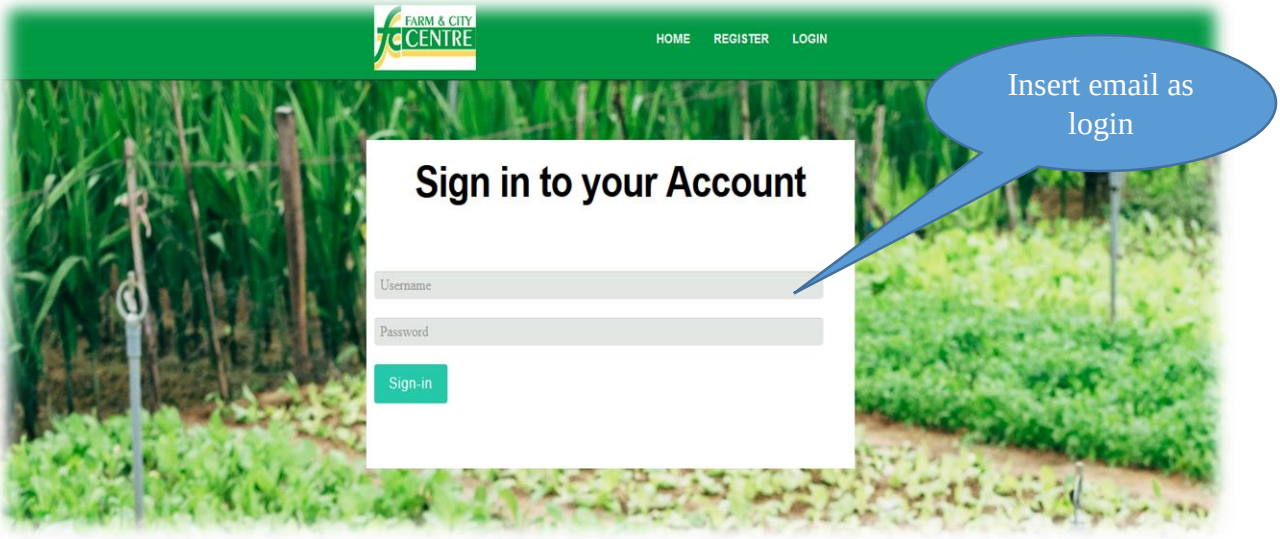

Fig A3 farmer login screen

After logging into the system, this is the screen where farmer can select any option

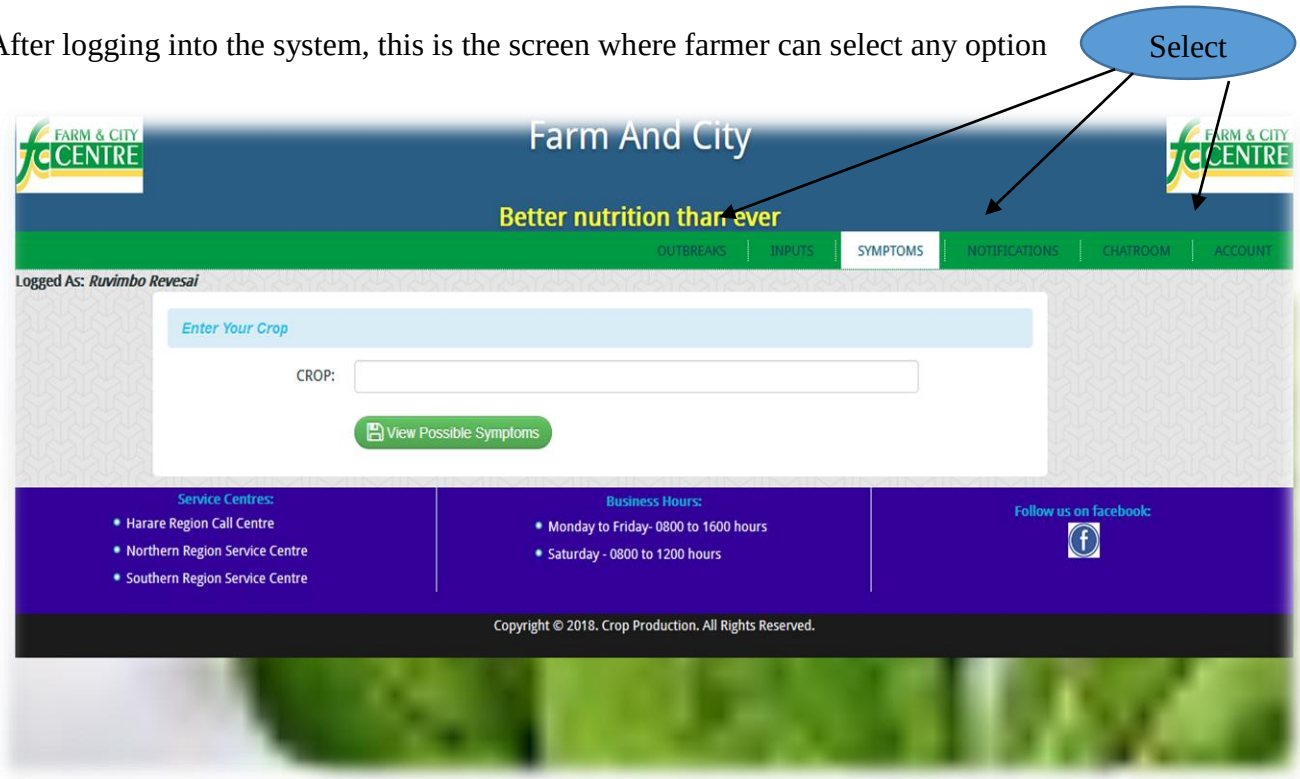

Fig A4 farmer welcome screen after log in

Symptoms screen

Fig A5 symptoms screen

And the symptoms are detected

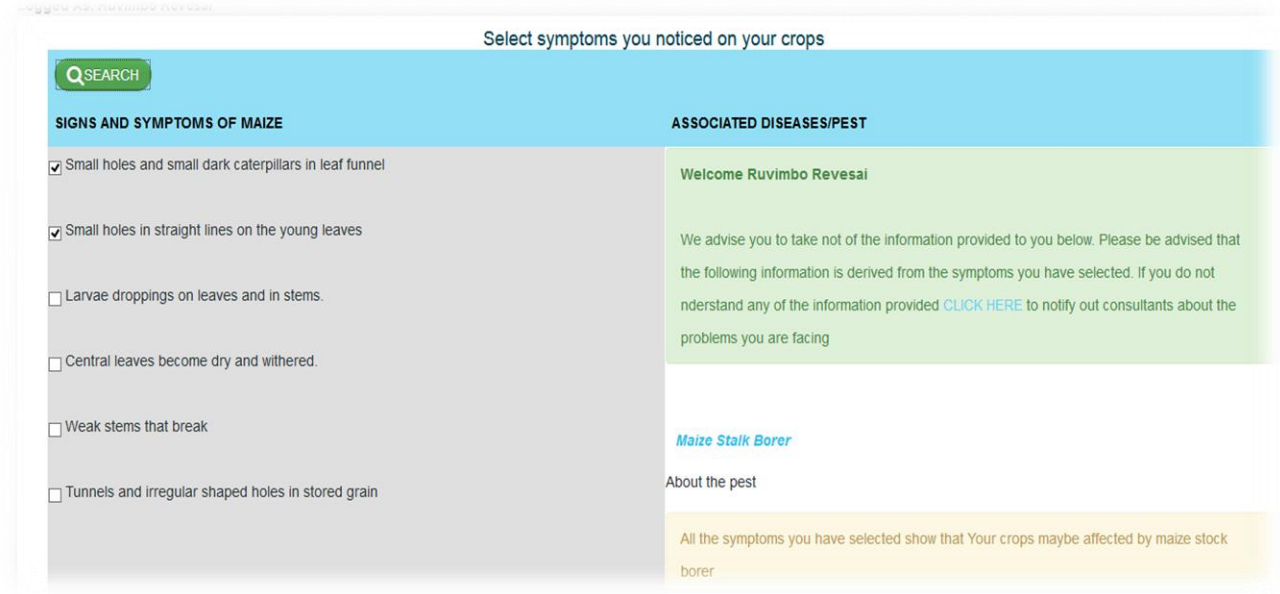

Fig A6 symptoms and control screen

Chat with other farmers Screen

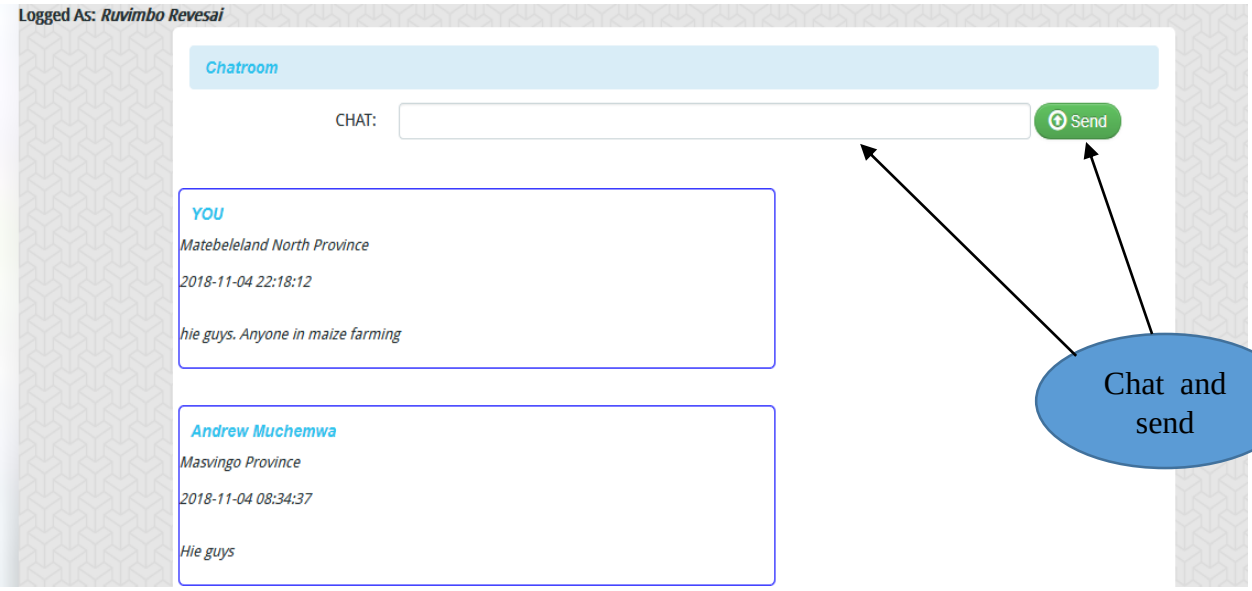

Fig A7 Chat screen

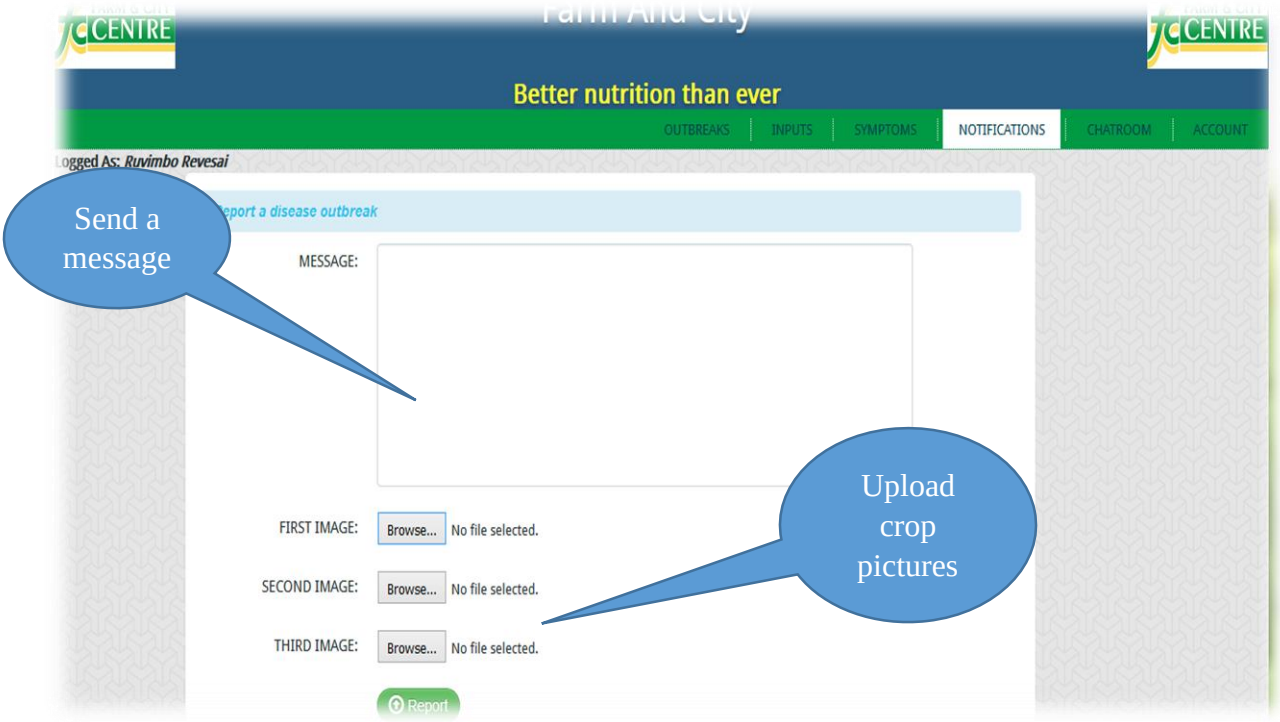

Fig A8 enter the crop picture with defect

Farming tips screen

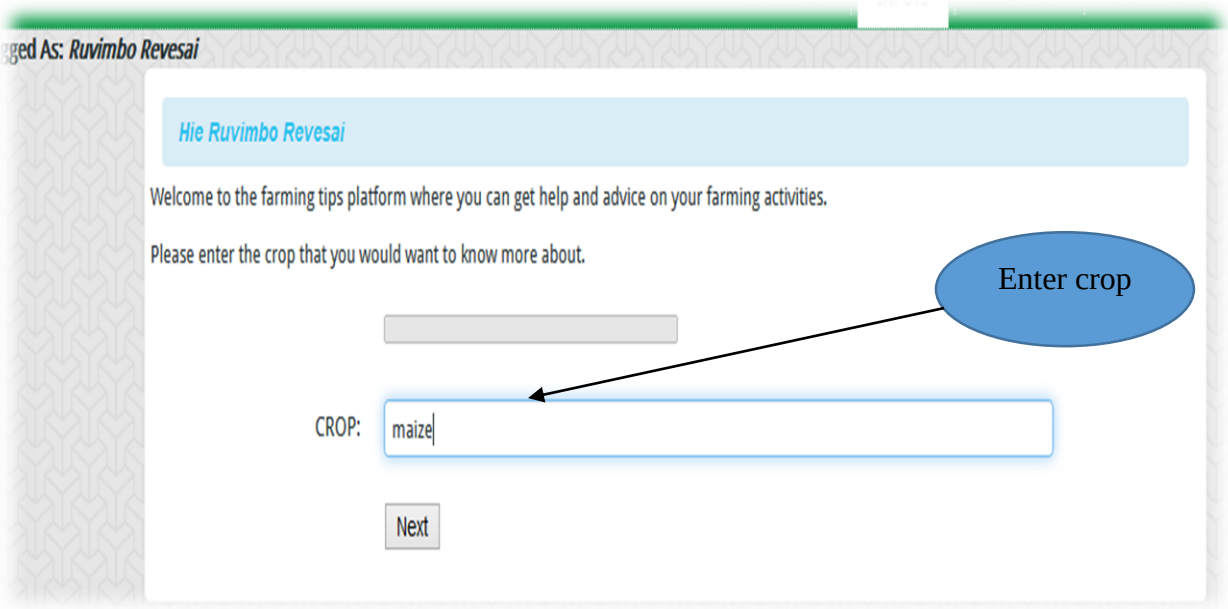

Fig A9 farming tips screen

Logout of the system by clicking account then logout

Backend

Consultant login screen

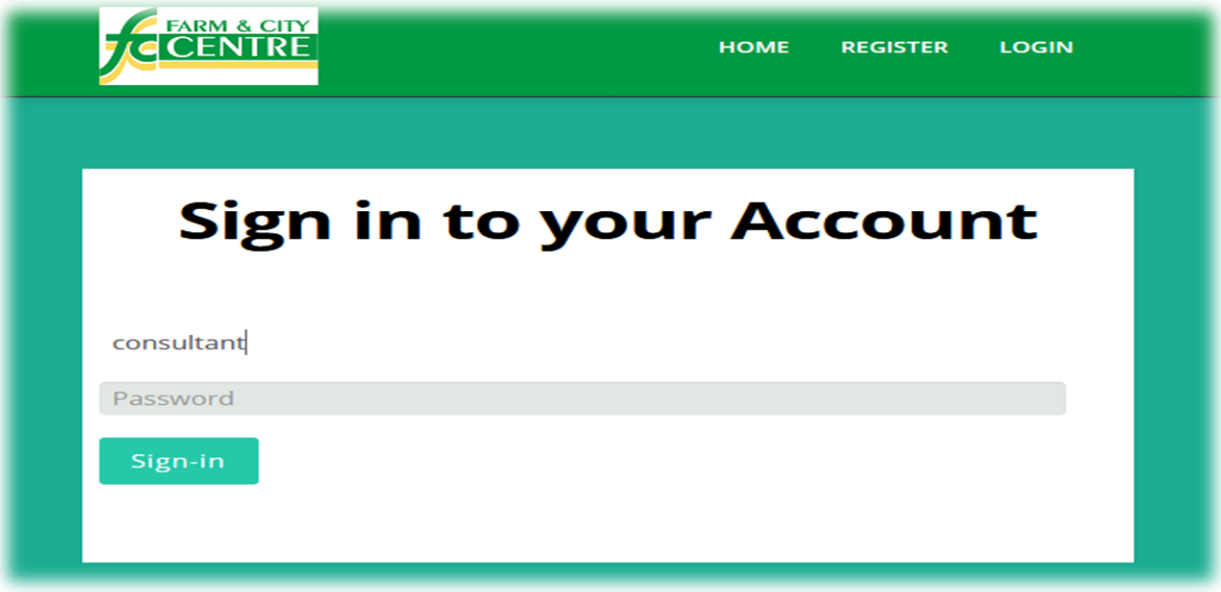

Fig A10 consultant login screen

Consultant home screen

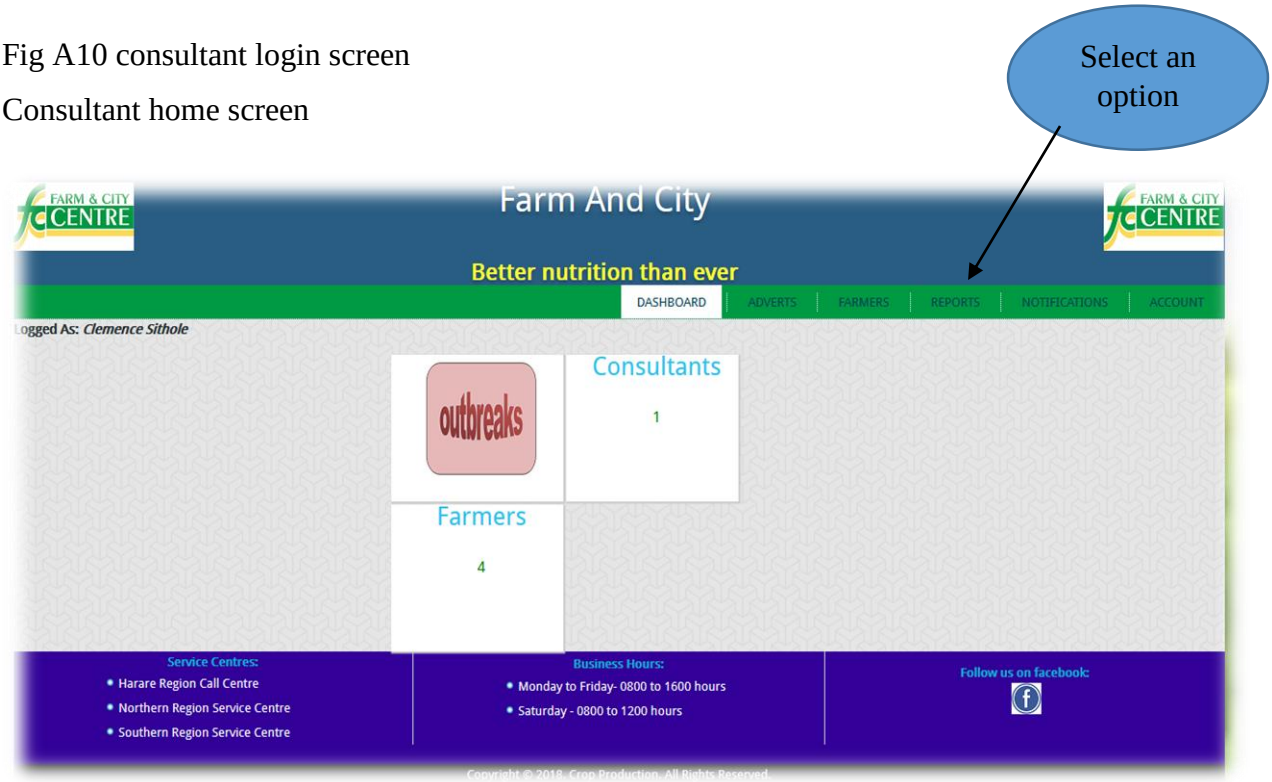

Fig A11 Consultant home screen

Farmers registered in the system

Fig A12 Farmers in the system

Reports screen with menu

Fig A13 Reports screen

See messages uploaded by farmer

Fig A14 notifications screen

Logout of the system by clicking account then logout.

Appendix B: Questionnaire checklist
(TICK WHERE RELEVANT)

What can you say about the current system's performance?

Excellent ☐ **Good** ☐ **Fair** ☐ **Poor** ☐

Are you satisfied with the current system? **Yes** ☐ **No** ☐

Are you satisfied with the service offered? **Yes** ☐ **No** ☐

If No may you please state problems that you are facing with the current system?

……

……

……

How do you rate the current system?

Poor ☐ **Good** ☐ **Average** ☐

What are the processes involved in the current system for offering services to farmers?

……

……

……

……

……

……

……

……

How many farmers on a daily average visits the shops for advice and specify what they usually ask for (specifically on the crop infection).

Average number …….

……

……

……

……

……

Do you favor the idea of the new system compared to the old system?

Yes ☐ **No** ☐

If **Yes** state the reason why you in favor

……

……

……

……

……

If **No** state the reason why not

……

……

……

……

……....

What do you think should be included in the new system to improve its services?

……

……

……

……

……

……

Any other contribution or recommendation to the new system please write down below

……

……

……

……

……

……

……

YOUR COOPERATION IS GREATLY APPRECIATED

Appendix C: Observation Form

Date……..

Time……

Department: ……..

OBSERVATION	**NOTES**	**RECOMMENTATIONS**

Appendix D: Snippet of Code

Farmer registration code

```
<?php
    include_once ('functions.php');
    session_start();
    $login_error='';
    require('mydb.php');
    $name = clean($_POST["names"]);
    $surname = clean($_POST["surname"]);
    $email=clean($_POST['email']);
        $phone=clean($_POST['phone']);
        $gender=clean($_POST['gender']);
        $province=clean($_POST['province']);
        $password=clean($_POST['password']);
        $cpass=clean($_POST['cpass']);
        if(strlen($name)==0 || strlen($surname)==0 || strlen($email)==0 || strlen($phone)==0 || strlen($gender)==0 || strlen($province)==0 ||
        strlen($password)==0 || strlen($cpass)==0)
        {
    ?>
    <script language="javascript">
    alert("Please Fill All the fields");
    </script>
    <?php
```

Login code

```
    <?php
```

```
    error_reporting(0);
        ?>
    <!DOCTYPE html>
    <html dir="ltr" lang="en-US">
    <head>
    <meta charset="utf-8">
   <title>Sign in | PIGS</title>
      <meta name="viewport" content="initial-scale = 1.0, maximum-scale = 1.0, user-scalable = no, width = device-width">
<?php include_once('head_infor.php'); ?>
   <style type="text/css">
        .art-sheet
        {
            vertical-align:central; margin-top:150px; width:700px; background-image:url(images/white.JPG);
        }
        </style>
       </head>
    <body onload="JavaScript:AutoRedirect(5000);">
   <div id="art-main">
    <div class="art-sheet clearfix">
     <center>
<h2 class="art-postheader" style="margin-left:0; border-radius:15px">Sign in to your account</h2>
  <div style="margin:50px; width:600px;">
    <form class="form-horizontal" id="myForm"  method="POST" action="process_login.php">
   <div class="control-group">
   <input type="text" name="ecnumber" id="ecnumber" placeholder="Username" autocomplete="off" autofocus required>
```

```
    </div>
    <div class="control-group">
    <input type="password" name="password" id="password" placeholder="Password" required>
    </div>
   <div id="ack"></div>
    <div class="control-group">
    <button id="submit" name="login" class="btn btn-success"><i class="icon-signin icon-large"></i> Sign in</button>
    </div>
    <br><br>
    </form>
   <script type="text/javascript" src="scripts/jquery-1.11.2.min.js"></script>
    <script type="text/javascript" src="scripts/my_script.js"></script>
      </div>
    </center>
  </div>
    </div>
 </body>
    </html>
```

Add user code

```
        <?php
        include_once('header.php');
        include_once('../functions.php');
        ?>
      <?php
    if(isset($_POST['Submit']))
        {
    $ecnumber = $_POST['ecnumber'];
```

```
    $name = $_POST['name'];
        $surname = $_POST['surname'];
    $phone = $_POST['phone'];
    $email = $_POST['email'];
    $gender = ucfirst($_POST['gender']);
    $password = $_POST['password'];
    }
        ?>
<script type="text/javascript">
    $(document).ready(function() {
        $("#ecnumber").keyup(function (e) {
    //removes spaces from username
    $(this).val($(this).val().replace(/\s/g, ''));
    var ecnumber = $(this).val();
    if(ecnumber.length < 1){$("#user-result").html('');return;}
    if(ecnumber.length >= 1){
    $("#user-result").html('<img src="icons/loader.gif" />');
    $.post('check-ecnumber.php', {'ecnumber':ecnumber}, function(data) {
                            $("#user-result").html(data);
                        });
                    }
            });
    });
    </script>     <script type="text/javascript">
    $(document).ready(function() {
        $("#password").keyup(function (e) {
        //removes spaces from password
```

```
    $(this).val($(this).val().replace(/\s/g, ''));
var password = $(this).val();
    if(password.length < 1){$("#pass-result").html('');return;}
    if(password.length >= 1){
    $.post('check-password.php', {'password':password}, function(data) {
                                $("#pass-result").html(data);
                               });
                        }
                });
    });
    </script>
 <script type="text/javascript">
    $(document).ready(function() {
          $("#password").blur(function (e) {
    //removes spaces from password
    $(this).val($(this).val().replace(/\s/g, ''));
    var password = $(this).val();
    if(password.length < 1){$("#pass-result").html('');return;}
    if(password.length >= 1){
    $("#pass-result").html('<img src="icons/loader.gif" />');
    $.post('check-pass.php', {'password':password}, function(data) {
                                $("#pass-result").html(data);
                               });
                        }
                });
    });
    </script>
```

```
    <script language="javascript">
function lettersOnly(evt) {
evt = (evt) ? evt : event;
var charCode = (evt.charCode) ? evt.charCode : ((evt.keyCode) ? evt.keyCode :
((evt.which) ? evt.which : 0));
if ( (charCode < 65 || charCode > 90 ) &&
(charCode < 97 || charCode > 122) && (charCode != 39)) {
if(charCode != 8){
return false;
}
}
return true;
}
        </script>
 <SCRIPT language=Javascript>
                                <!--
                                function isNumberKey(evt)
                                {
                                        var charCode = (evt.which) ? evt.which : event.keyCode
                                        if (charCode > 31 && (charCode < 48 || charCode > 57))
                                                return false;
                                   return true;
                                }
                                //-->
                        </SCRIPT>
```

```
    <div class="art-layout-wrapper">
    <div class="art-content-layout">
    <div class="art-content-layout-row">
    <div class="art-layout-cell art-content">
    <article class="art-post art-article">
<h5>Logged As: <em><?php echo $_SESSION['name']; ?></em></h5>
     <div class="art-postcontent art-postcontent-0 clearfix">
    <div class="art-content-layout">
    <div class="art-content-layout-row">
    <div class="art-layout-cell layout-item-0" style="width: 100%" >
     <div class="addrequest" style="border-radius:5px; padding:5px">
    <h2 class="details">Add User</h2>
    <center><h4 style='color:#F00' id="ack"></h4></center>
    <form class="form-horizontal" action="<?php $_PHP_SELF ?>" method="POST" enctype="multipart/form-data" style=" padding-right:10px">
  <div class="control-group">
                        <label class="control-label" for="inputEmail">EC Number:</label>
                        <div class="controls">
                        <input style="max-width:80%" name="ecnumber" type="text" autocomplete="off" id="ecnumber" value="<?php echo $ecnumber; ?>" required/>
          <div id="user-result"></div>
                        </div>
                </div>
       <div class="control-group">
                        <label class="control-label" for="inputEmail">Access Level:</label>
                        <div class="controls">
           <select name="access" required>
            <option value="">..Select Access..</option>
```

```
<option value="1">Admin</option>

<option value="2">Accountant</option>

<option value="3">Farmers</option>

</select>

</div>

</div>

<div class="control-group">

<label class="control-label" for="inputEmail">Password:</label>

<div class="controls">

<input style="max-width:80%"  name="password" pattern="(?=.*\d)(?=.*[A-Za-z]).{8-12}" type="text" id="password" value="<?php echo $password; ?>"

placeholder="Should be 8-12 alphanumeric characters" maxlength="12"  required/>

 <span id="pass-result"></span>

</div>

</div>

<div class="control-group">

<div class="controls">

<button name="Submit" id="submit" type="submit" class="btn btn-success"><i class="icon-save icon-large"></i> Save</button>

</div>

</div

</form>

</div>

</div>

</div>

</div>

</div>

</article>
```

```
</div>
</div>
</div>
</div>
<?php include_once('../footer.php'); ?>
 <?php
      if(isset($_POST['Submit']))
       {
require("../mydb.php");
       $ecnumber =  clean($_POST['ecnumber']);
$access =  clean($_POST['access']);
$password =  clean($_POST['password']);
        $query = "select * from employees where ecnumber = '$ecnumber'";
$result = mysqli_query($dbcon, $query);
                $count = mysqli_num_rows($result);
if($count<1){
?>
<script language="javascript">
alert("EC number not found");
</script>
<?php
       exit();
}
       // password should be 8 or more alphanumeric characters
       if(@!preg_match("/(?=.*\d)(?=.*[A-Za-z]).{8,}$/", $password))
       {
?>
```

```
    <script language="javascript">
    alert("<?php echo strlen($password) ?>");
    </script>
    <?php
        exit();
    }
$password = SHA1($password);
        $query2 = "Insert into users (ecnumber, password, access)
                values ('$ecnumber', '$password', '$access')";
    $result2 = @mysqli_query($dbcon, $query2);
        if($result2){
    ?>
    <script language="javascript">
    alert("User successfully created");
    parent.location = 'users.php'
    </script>
    <?php
        exit();
    }
        //free the memory used for result, $result1 and $result2 sets
        mysqli_free_result($result);
        mysqli_free_result($result2);
    mysqli_close($dbcon);

    }
    ?>
```