



UNIVERSITY OF NAIROBI
SCHOOL OF COMPUTING AND INFORMATICS
PROJECT PROPOSAL
ONLINE DAIRY FARMING RECORD MANAGEMENT SYSTEM

MUIRURI DENNIS BANGA

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Project Supervisor

PROF. ELIJAH OMWENGA

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LIST OF ABBREVIATION

SMS	-	Short Message Service
MOLD	-	Ministry Of Livestock Development
USAID	-	United States Agency for International Development
RAM	-	Random Access Memory
LAMP	-	Linux Apache MySQL PHP
GSM	-	Global Systems for Mobile
PCDART-		Personal Computer Direct Access to Records by Telephony.

DFD- Data Flow Diagram.

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1.0 INTRODUCTION

1.1 BACKGROUND

Kenya is an agricultural based economy with most of the citizens relying on small holder agriculture production. Dairy farming been part of the agricultural sector contributes greatly to the economy. It involves rearing of dairy cattle whose main purpose is to produce milk, reproduce to provide replacement cows for the future and most of all provide a means of living for the farmers in the dairy business. It is dominated by small scale farmers. For farmers to effectively and efficiently manage the dairy cattle they need to keep records. These records contain identification, breeding, feeding, production, vaccination, health and financial records. Keeping of records helps the farmer to think of their dairy farm as a business. To see good care and good management also influences the production and profitability of their dairy farm.

According to Brannstorm (2008), dairy farming is a complex business that demands accurate records and careful financial management. Farmers normally see dairy record keeping as a mundane task. Muhammad et al (2004) proved that farm record keeping is a key practice to successful farmers and vice versa. A farm record provides timely and consistent information to assist in the management process, keeping track of how many cows he/she has, what their health is and what he/she is feeding them. In addition, obtaining grants and loans from financial institutions for small scale dairy farmers require that you have financial records to show what you have earned and what your expenses are, financial statement to prove that the farm is financial viable.

Most of the small scale dairy farmers don't keep comprehensive records for their cattle and usually use paper records. Paper records have shortcoming as there may be duplication of data thus making it difficult to keep track. In addition, the paper records may be lost meaning the data is lost completely. Analysing handwritten records is tedious, cumbersome and time consuming. Also these records are not always accessible as they are localized. In addition, many farmers don't know details for good dairy records thus predefined forms will assist farmers and at the same time get to know the details. Arise in the record keeping problems using the manual records seeks an alternative way for storage of dairy cattle information and data.

Online platform providing management for the dairy cattle records can assist these farmers in efficient record storage and thus this records can help the farmer in decision making, keep memory, assess profitability/ losses and helps the farmer in improving the efficiency of the operations. SMS based

Platform to update the records online using a GSM mobile can be easier for the farmers who cannot access the online platform.

1.2 PROBLEM DEFINITION

Currently, dairy farmers using the paper records to keep information about their dairy business is ineffective since manual records are prone to errors; inconsistency in recording leading to duplication, analysing is time consuming, losing the records means information and data is lost too, have a short lifetime and they are localized. Also most of the farmers being small scale farmers have no information about what good dairy records entails, thus their records may not capture essential details. In addition, it is difficult for dairy farmers to know the financial status of their business whether they are making loss or profits depending on their cost and income.

Therefore, there is need of an online platform for keeping records and analysing the financial records of the dairy farmers to enable them to effectively manage their dairy cattle business and easily access the information of their cattle.

This project will provide an online platform that supports SMS system and that will enable recording, analysis and access to records in a manner that is easy and accessible from anywhere. Also the records details will be predefined thus capturing essential information.

1.3 GOAL

To come up with an online platform that will provide recording of dairy cattle data, storage, analysis of financial data and updates through SMS, and access of the information stored in a formatted way.

1.4 OBJECTIVES

In order to achieve the above goal, the objectives to be met include:

- 1) To provide an online platform that allows dairy farmers to store their dairy records online.
- 2) To provide an SMS based platform that will allow users to update financial records using SMS.
- 3) To provide dairy farmers with reports from their online records.
- 4) To analyse financial records of the dairy cattle business.
- 5) To provide SMS reminders to the dairy farmers on dairy farming activities.

1.5 PROJECT JUSTIFICATION

To have an online platform that stores dairy cattle information will be beneficial to the farmers, as chances of online records being lost is minimal. In addition, analysing of the financial records of the dairy farming business will be easier on the online records and the farmers will not have to waste time analysing manual records. In online records, duplication is unlikely to arise. It will capture the essential

details of good farm records and thus farmers will have good kept records. Having a SMS platform in the system for updating and querying from the records will make it easy for the farmers to access the service from their mobile phones. Using the SMS service will be scalable and effective as most farmers own a mobile phone.

Generating reports on their income and expenses, hence these reports can be used by financial institutions while appraising the farmers for loans.

Currently in Kenya there is no system that is providing online storage and analysis of financial records of dairy farmers. Therefore, this will be the first system of its kind.

1.6 ASSUMPTION

Small scale farmers can be able to access and use Internet services as well as the SMS services.

EXPECTED OUTCOME

After successful completion of this project, an online web application will be developed that will enable dairy farmers to sign up, register individual cow details in the system, add records of the cows in the system, provide reports from the records and also update their records. The farmers will also be able to set reminders for their dairy farming activities.

The system will also have a SMS platform that will enable farmers to update their income and expenses records by use of SMS and also be able to query information of their records.

1.7 PROJECT SCOPE

The scope of this project is restricted to:

1. Develop an Online platform linked to an SMS gateway.
2. Records kept will be for dairy cattle farming only.
3. SMS platform will be used for updating and querying financial record.

2.0 LITREATURE REVIEW

2.1 DAIRY FARMING IN KENYA

Dairy farming is type of livestock rearing where cattle are kept for milk production with sole purpose of selling milk to the consumer.

In Kenya dairy industry is dominated by small-scale farmers. It is well-developed in the livestock subsector contributing about 6% GDP, and it is practiced in the medium and high rainfall areas mainly in the central highlands, Rift valley, Eastern and coast lowlands (MOLD, 2006). Majority of the small scale farmers are concentrated in the Central highlands and they own 1-5 cows (USAID, 2008). Also this farmers market their milk either through the formal or the informal market. In the informal market it comprises of direct deliveries to consumer, or through intermediaries such as traders. This channel accounts 85% of the marketed milk and only 15% of the marketed milk flows through the formal market via cooperatives and processors (Thorpe, 2000; USAID, 2008).

The growth of the dairy sub sector has been highly contributed by the high domestic demand for milk and dairy products due to growing population.

2.2 RECORDS AND IMPORTANCE OF DAIRY RECORDS

Record keeping is an essential tool to any business and it plays a major role regardless of the size, nature or type of the business, thus a good entrepreneur must be a good record keeper. In the present day, farming operations are becoming more and more business oriented. To remain in business, is not only to become a good producer but also a good financial manager.

To keep track of what is happening on a dairy farm requires some records. Good farm management requires having a good useful set of farm records. Good records do not ensure the farm will be successful; however, success is unlikely without them. To keep records is simply to collect relevant information that can help you as a farmer to take good decisions, keep track of activities, production and important events on a farm.

Farm records are like report cards students receive at school. With a farm report card, farmers can tell how they are managing their operation compared to other producers and they can see their strengths and weakness in their operation. Farm records provide the farmer with data, information and knowledge. Keeping of records should be systematic and simple.

The use of the farm records include:

1. Be used in determining profitability of techniques used in the farm.
2. Used to keep memory on what the farmer did or what happened.
3. Used in decision making to make proper management decisions.
4. Helps the farmer to improve the efficiency of the farm's operations.

Importance of record keeping in dairy farming:

1. To keep track of the dairy cattle.
2. Evaluation of livestock for selection
3. Aid in selecting animals with the right characteristics for breeding.
4. Helps in feeding and management.
5. Helps in disease management by keeping track of treatment.
6. To assess profitability or losses.
7. Credit and loan access having financial records.

The types of records kept in a dairy farm include:

1. *Identification records* -These are records that identify individual animals e.g. by giving the animals an ear tag, names, tattooing or paints and dyes.
2. *Breeding records*- To provide information about cows such as age at the first service, age at first calving, date of calving, number of services per conception, date/time of insemination of the cows.
3. *Production records*- These are records that indicate the production of the cows, their milk yield.
4. *Feeding records* -To indicate the amount of feed given to the cattle as well as the type of feed.
5. *Health records* – To provide information about health status of the individual cows such as vaccination, dipping/spraying, deworming and treatment.
6. *Financial records*- Provide farmer with information about profitability of his/her farm. Includes expenditure and expenses records.
- 7.

Online storage of records is whereby the records' data and information are stored in a database and can be accessed on a web platform for updating or viewing.

2.3 EXISTING RELATED PROJECTS

2.3.1 Ag Squared

It is a web-interface program designed to serve the record keeping needs of small farms that is primarily for crop farmers to track field management, labour and equipment use, planting and harvesting schedules, and crop yields. It does not provide recording of dairy farming information. Thus cannot support dairy farmers' needs by storing their dairy records electronically.

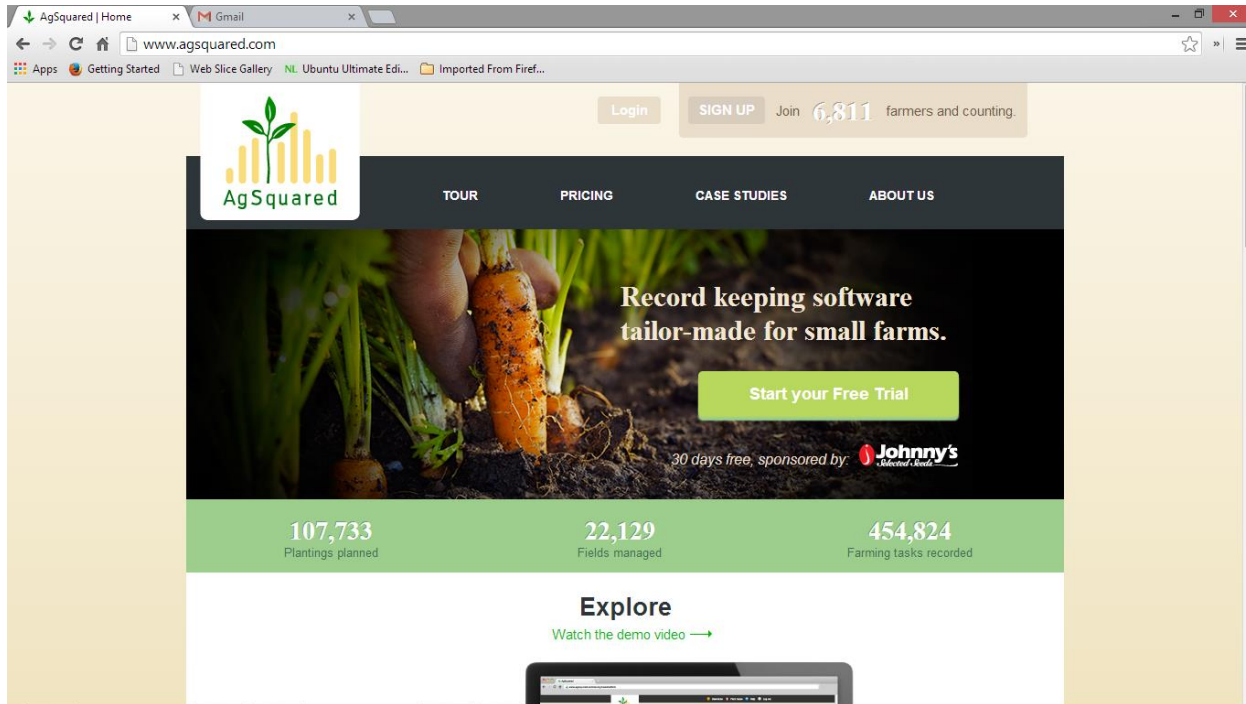


Figure 1- Agsquared site

2.3.2 Pocket Dairy App

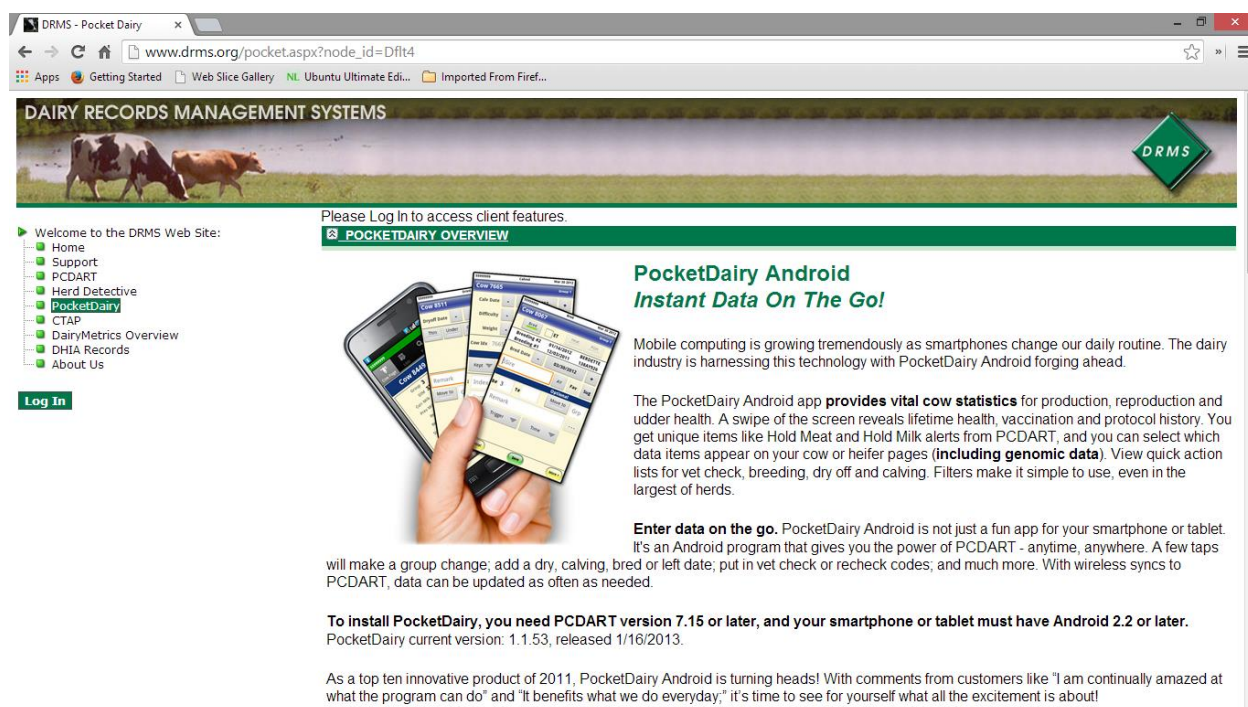


Figure 2- Pocket Dairy App site

It is an android application that provides vital cow statistics for production, reproduction and udder health. It runs in android version 2.2 and above, and has a monthly charge of \$10 plus 3cents per cow and \$50 start-up fee.

Used for large herds of dairy cows and does not provide financial analysis. Most small scale farmers don't own smartphones as it operates in android platform. In addition, it is expensive to farmers and it will not be viable for Kenyan farmers as most of them are small holder farmers.

Pocket dairy App also uses Radio Frequency Identification (RFID) and the PCDART which is desktop software for management of herds. The PCDART which is PC software and provides management of large herd of cattle as it can be integrate with most on-farm automated milk recording, robotic and heat monitoring systems. This system is not suitable for small scale farmers as the cost of operation is expensive, also due the few number of cows; the system utilization will not be to the fullest.

2.3.3 Pioneer Online Record Keeping System

It is an online program that provides recording to field operations regarding crop management.

It does not provide storage of dairy farming records but only deals with records pertaining field crop operations such as planting. It provides storage of field operations only to pioneer farmers. This system will not be usable to dairy farmers to store their records.



Figure 3- Pioneer Online record Keeping System site

2.3.4 eCow

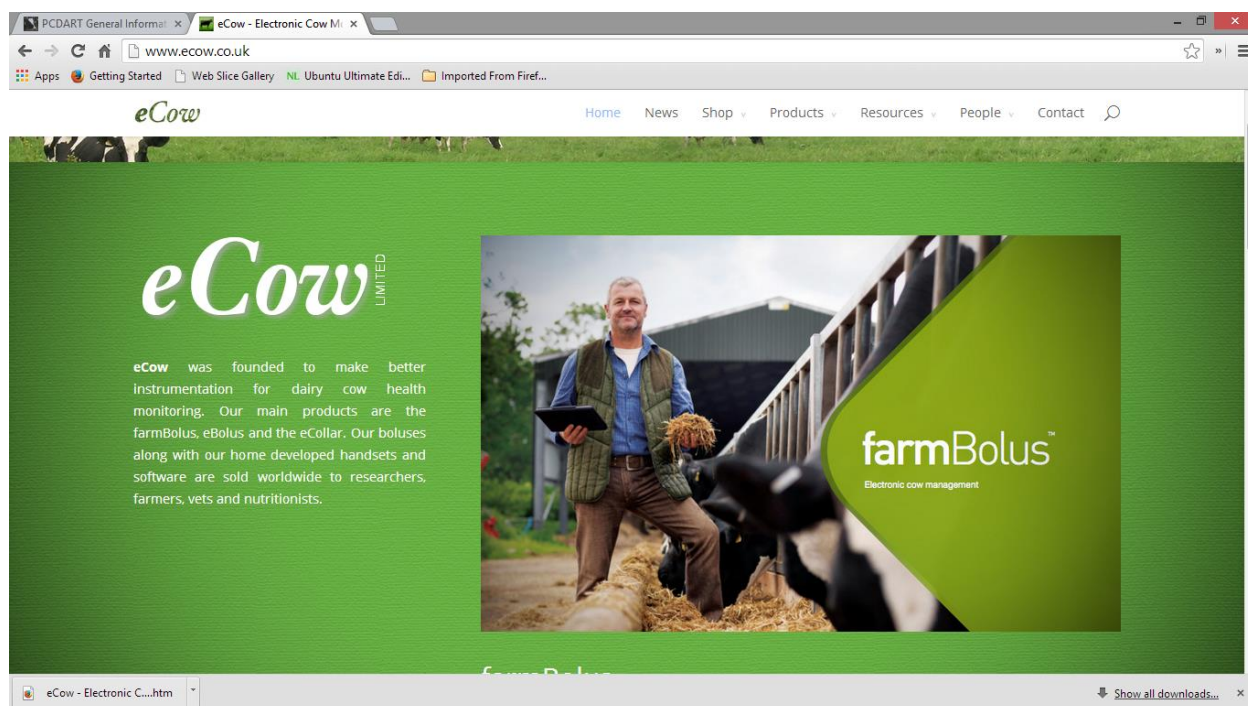


Figure 4- eCow site

ECow provides the instrumentation for dairy cow health monitoring. It has the farmBolus system,

which is rumen monitoring system for commercial dairy herds that records acidity levels and temperatures within a Cow. Data gathered by eCow farmBolus allows farmers, vets and nutritionist to achieve optimal ruminal conditions which lead to healthier cows.

This system does not provide the storage of various records for dairy farming but only addresses monitoring of the cow health by storing acidity levels and temperatures. It is also mostly used for commercial dairy herds and thus expensive for the small scale farmers.

Online dairy farming record management system will provides the recording of cattle data for various records kept in dairy farming and also analysis of financial records. This system will be viable for small scale dairy farmers as it will meet their record storage needs.

3.0 METHODOLOGY

This proposed system will be best implemented using Modified Waterfall Methodology. This methodology allows adjustments to a set of requirements unlike the pure waterfall methodology. The phase of development are permitted to overlap hence a number of tasks can function concurrently and allows back tracking to incorporate changes in the requirements based on what is learned during development. There is also some flexibility to correct mistakes and make small change realised during the development. This ensures that the system is developed in a systematic and sequential manner.

3.1 APPROACH

3.1.2 REQUIREMENTS SPECIFICATION AND ANALYSIS

This is a stage of the System development lifecycle which involves collection of information that is relevant for the development of the system and then analysis of the data and information to build a logical model of the system that will be used in the design phase. It will involve carrying out a feasibility study to determine the operational, economic, schedule and time feasibility of development of the project. The acquisition of data and information of the system requirements will involve interviewing farmers, observation and document review. The fact-finding result will be used to develop the system logical model that explains the system functionality. Data Flow Diagrams and Entity Relational Diagrams will be used to represent the logical model.

3.1.2 DESIGN

This stage involves the creation of a physical model that will satisfy the entire documented requirement for the system. At this stage, the user interface will be designed and the identification necessary

outputs, inputs, and processes. In addition, it will involve determining the application architecture to transform the logical design into program modules and code.

3.1.2 IMPLEMENTATION AND CODING

This stage involves the translation of the developed designs into an actual system using suitable programming language. This being a web application, it will be developed through use of programming languages: MySQL, PHP, HTML and CSS to achieve both the defined functionalities and user interface requirements.

3.1.2 TESTING and EVALUATION

At every stage of development there will be validation and verification of the requirements. After completion of development of the system it will be tested to verify it is working in a credible manner. In addition, evaluation of the system will be carried out to ensure all functionalities of the system works as desired and produces expected outputs for specified inputs.

4.0 SYSTEM ANALYSIS

It involves investigating a system, identifying the problems and using the information recommended to system. Also the understanding of how things are done and checking if the proposed system would be viable. System analysis involves:

- 1) Data Collection
- 2) Feasibility Analysis
- 3) Requirements Analysis
- 4) System Modelling

4.1 Data Collection

Data collection was conducted in few homesteads in Murang'a County which practised dairy farming. It was carried out to collect information from the dairy farmers about the proposed system. The following methods were used for data collection:

- i. Informal interview
- ii. Observation
- iii. Written Documents and Online Documents.

4.1.1 Informal Interview.

Dairy farmers were interviewed to obtain information and their view about the development of the system. In addition, what records they kept for their cattle, access to internet services and if they were able to assess the profitability of their farming.

Findings from the interview:

Most of the farmers kept records on the milk they sold. They wrote it down on an exercise book and cancelled off when they got paid. All the farmers interviewed had mobile phones and could use the sms service. Records on insemination and treatment, they just kept the receipt given by veterinary doctor. They had a challenge when they lost/misplaced the exercise book recorded amount of milk sold. Some had mobile phones which could access Internet services. Some of the farmers had challenges in knowing what profit they got from the farming. They responded positive on having a way they can store their records online.

4.1.2 Observation

From observation most of the farmers had average of 2 cows. Their milk production record was shallow, as it just included the amount of milk they had sold. From the receipts given by the veterinary doctors, got information on what the insemination record should contain.

4.1.3 Written Documents and Online Documents

Online and written documents were reviewed to get information on what records the dairy farmers should keep and the details of the records.

4.2 FEASIBILITY ANALYSIS

Feasibility analysis is the process by which project feasibility is measured. A feasibility study was done to find out whether the proposed system was viable in terms of economic, schedule, technical and operation feasibility.

This is the test of the proposed system in terms of its workability meeting users' requirements, effective use of resources and cost effectiveness.

4.2.1 Economic feasibility

It involves checking whether the system would be affordable to build and maintain. In terms of the resources required; most of the tools are freely available and accessible. Once the system is deployed it has potential of generate income.

4.2.2 Technological feasibility

A technological feasibility study revealed that the technology required to develop the system is available and with the increase use of the internet and mobile phones, the system would be able to target a large number of farmers.

4.2.3 Schedule feasibility

According to the work schedule of completing this project, approximately 1.5 months has been allocated for the development of the system which is enough time to design, test and evaluate the system successfully.

4.2.4 Technical feasibility

This study involves checking the availability of hardware, software and personnel for building and running of the system. The proposed system was found to be technically feasible since it would not require staff to operate it and the required hardware and software to design and maintain the system is available.

4.2.5 Operational Feasibility

It was necessary to change the current method of storing records by farmers from manual to electronic. The target audience being farmers, having tips and help tools could assist them to easily use the system.

4.3.1 Functional Requirements

Farmer

- i. Unregistered farmers can register.
- ii. Registered users' can login in the system.
- iii. Registered farmers' to add new cows' details in the system.
- iv. Farmer can delete a record or update a record.
- v. The farmer can set activities reminders and then get reminders via sms.
- vi. A farmer can generate reports from the record stored
- vii. A farmer can view records of his/her cows.
- viii. The farmer can update income, expense, and milk production records using the SMS service.

System

- i. The system should interact with the SMS gateway to enable receiving and sending of messages to the users.
- ii. The system should send login password to the user via SMS.
- iii. The system should analyse the income and expenses of the farmer and send results via SMS.

4.3.2 Non-functional requirements.

- i. The system should be secure, only authorized users are allowed to log in and use the system.
- ii. Efficiency response time performance and page generation speed.
- iii. The system should be usable, has tips displayed on each page and provide a concise interface for users.
- iv. The system should be reliable in user input validation.
- v. The system should be stable, be available to multiple users who have logged in at the same time and using the system simultaneously.

4.4 System Analysis Models

4.4.1 Use Case Diagrams

These are diagrams that were used during the analysis phase to identify and split functionality of the system. They are made up of actors and use cases. Actors represent the various external people or entities that interact with the system.

The use case of the system consists of one actor (farmer):

The activities carried by the farmer include:

- 1. Registering/ Login
- 2. Viewing records
- 3. Adding new cows details.
- 4. Updating records.
- 5. Deleting records.
- 6. Setting reminders.
- 7. Generating and viewing reports.

USER CASE DIAGRAM



Fig 5. Use case diagram.

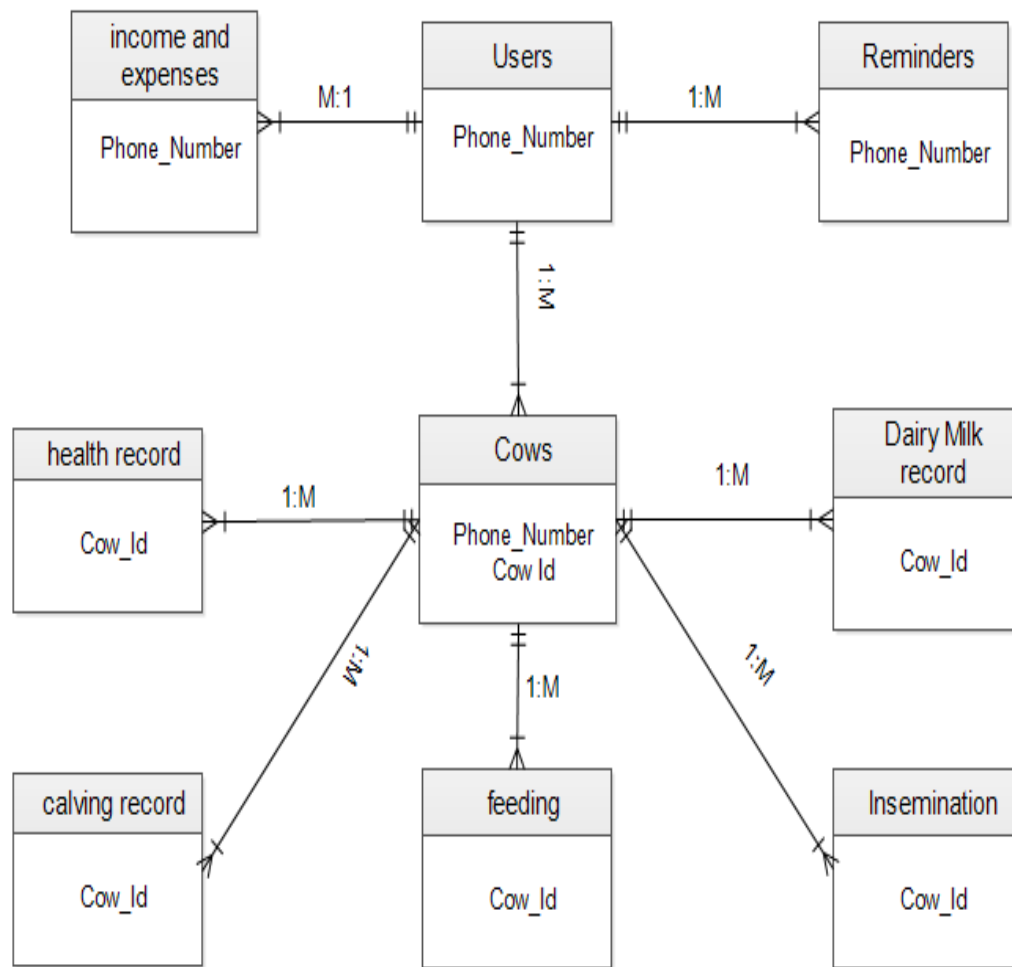


Fig 6. Entity Relationship Diagram

5.0 SYSTEM DESIGN

5.1 Architectural Design

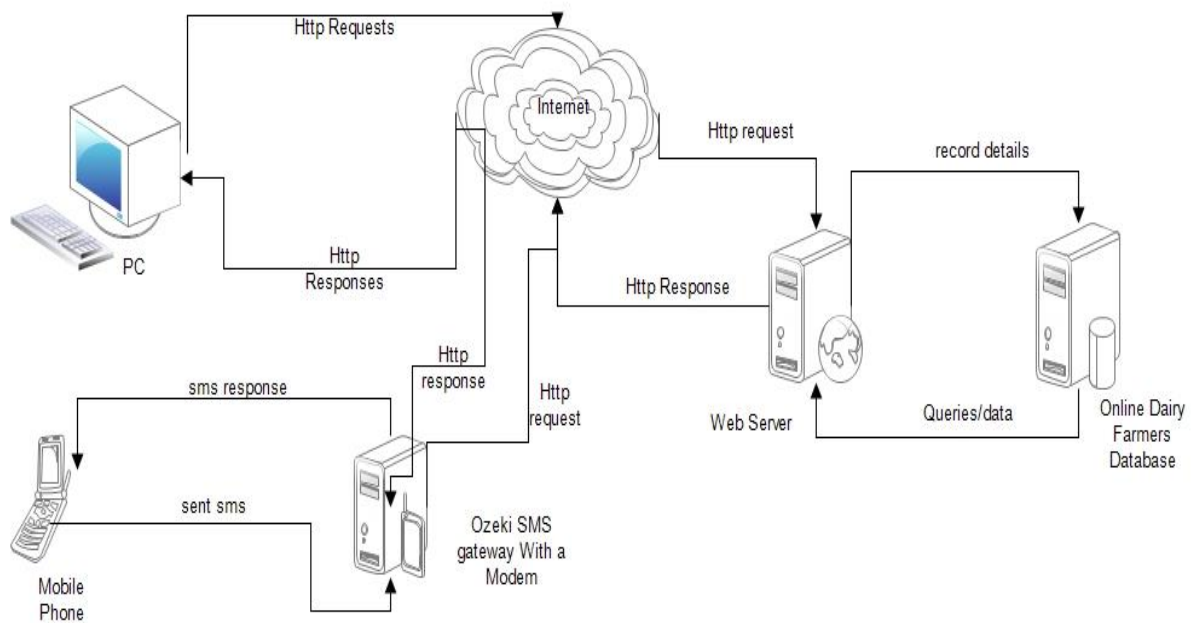


Fig 7. Architectural Design diagram

Context Diagram

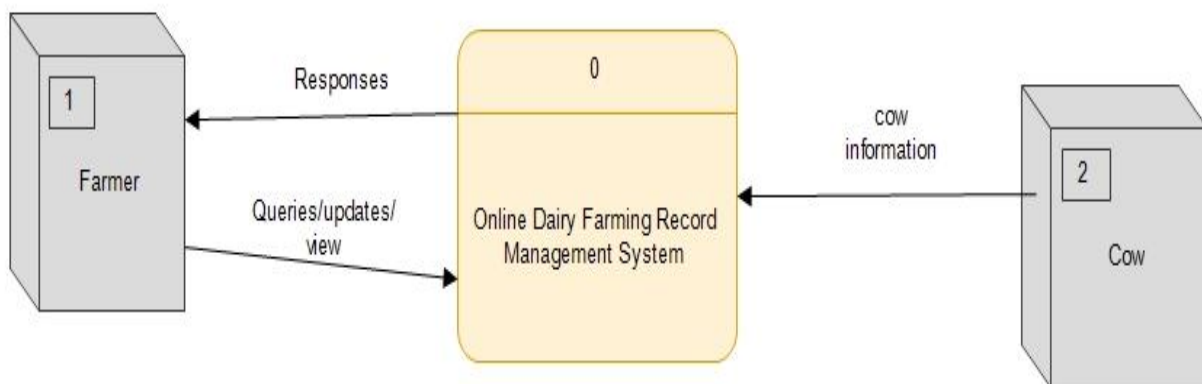


Fig 8. Context diagram.

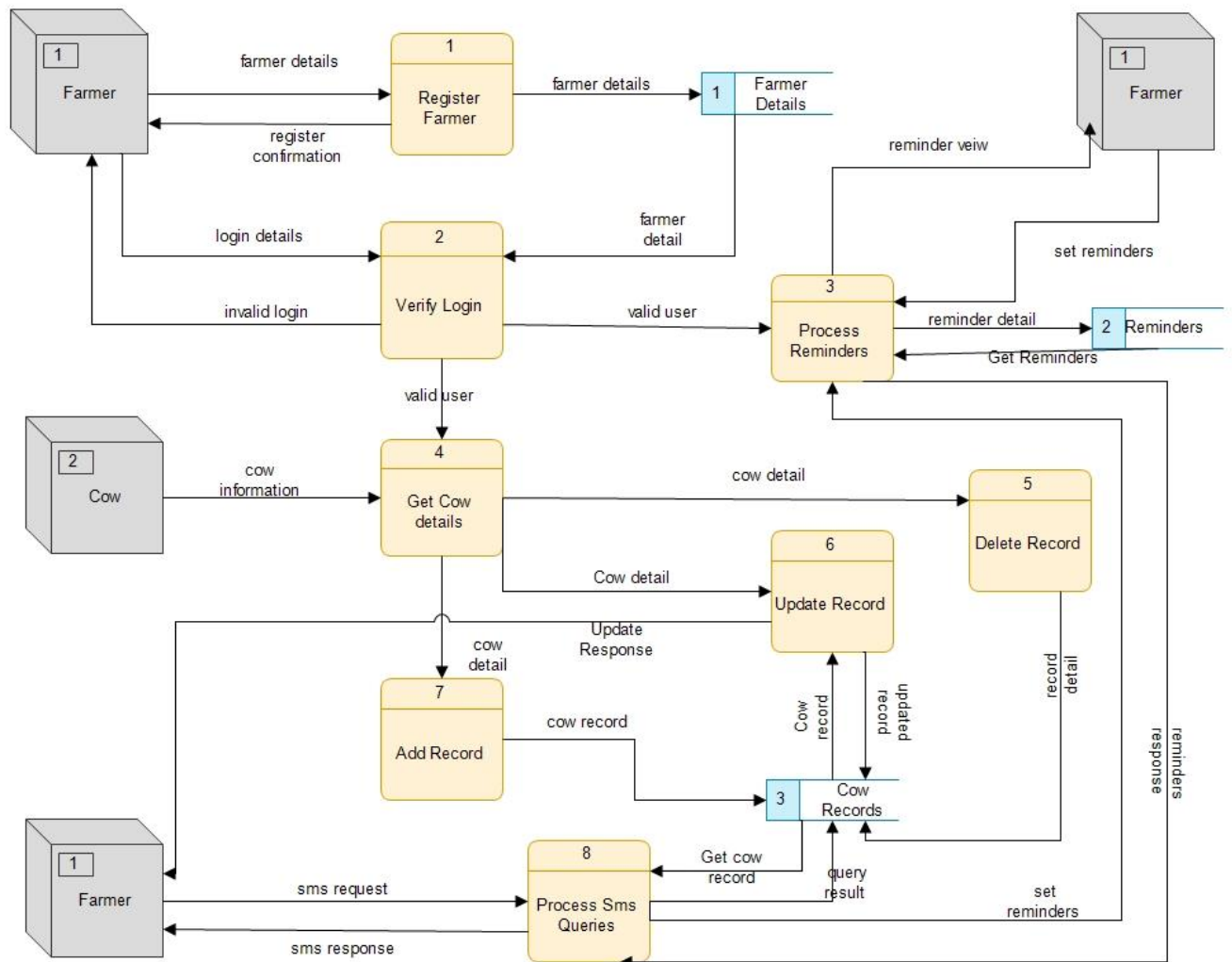


Fig 9 .Level 1 dataflow

5.2 DATABASE DESIGN

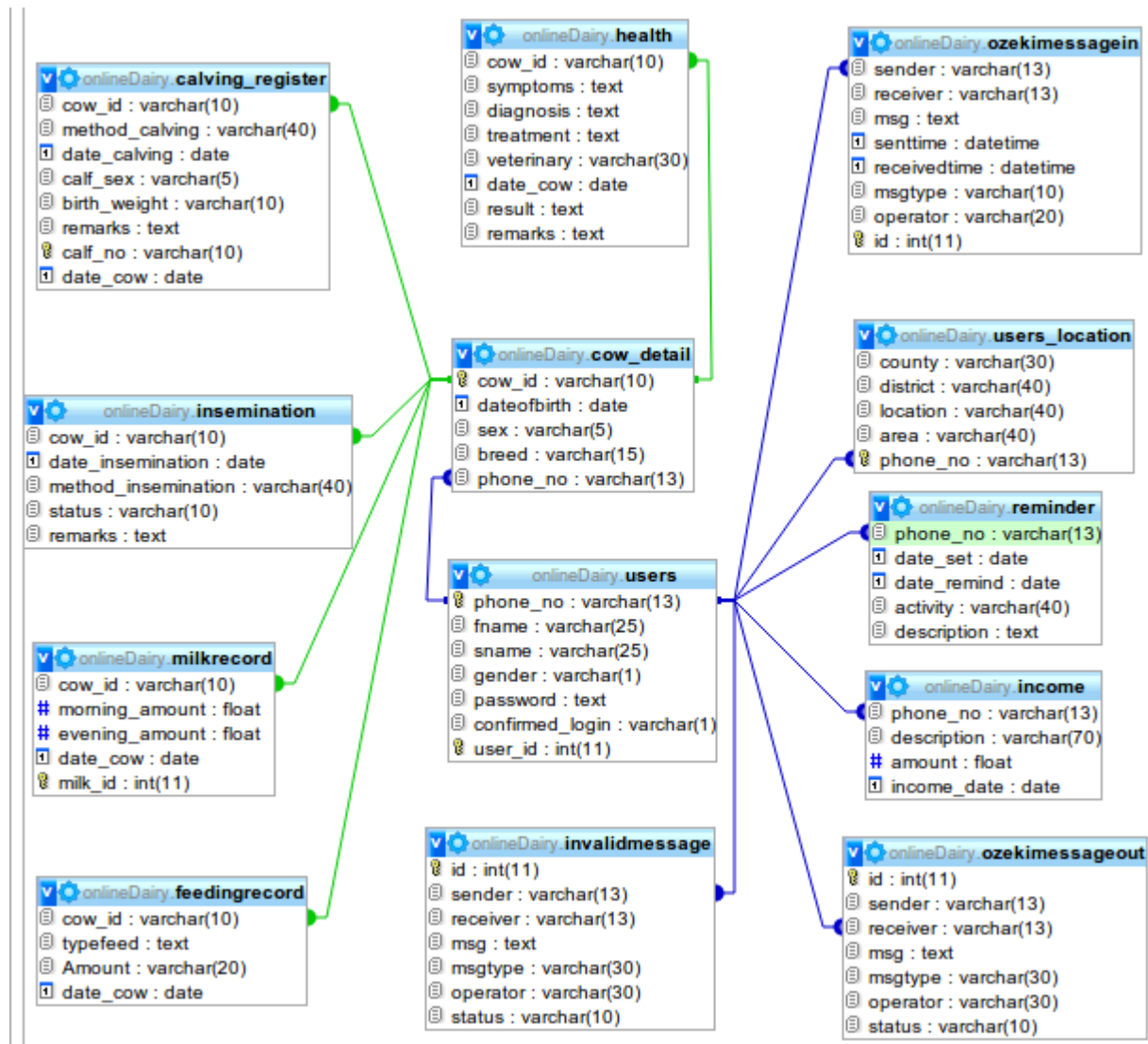
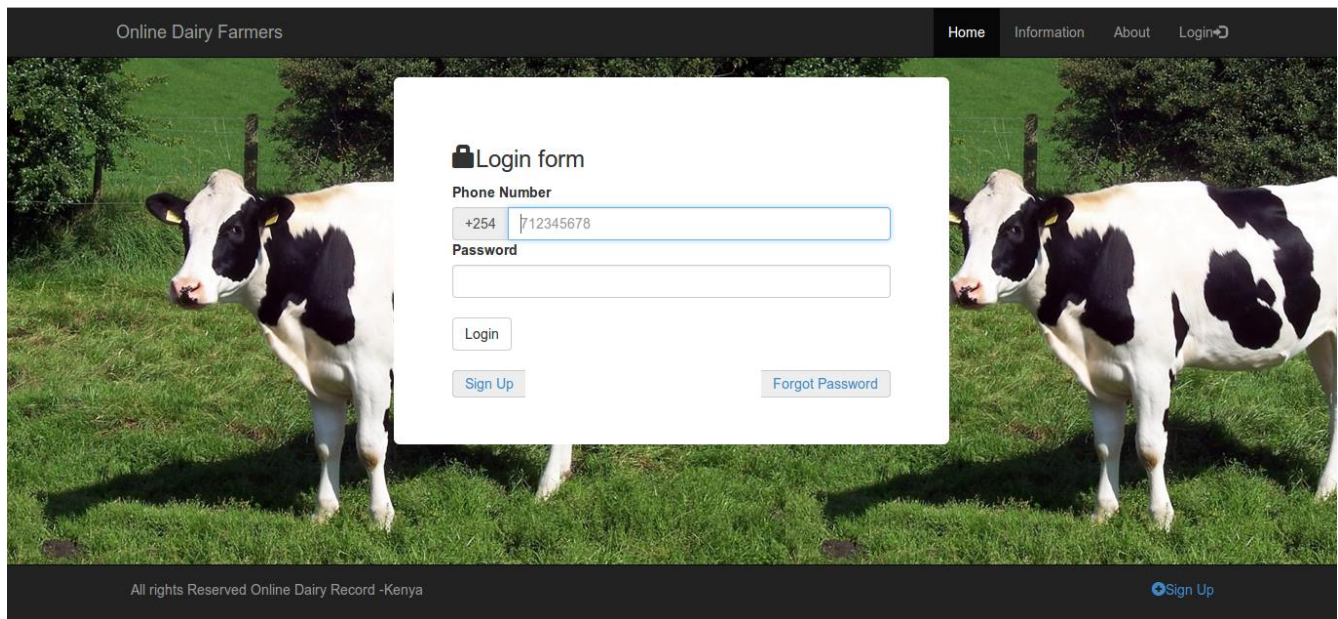


Fig 10. Database diagram

5.3 USER INTERFACE DESIGN



The screenshot shows the login page of the 'Online Dairy Farmers' application. The background is a photograph of two black and white cows in a green field. A white login form is centered on the page. The form has a title 'Login form' with a lock icon. It contains a 'Phone Number' field with a dropdown for the country code '+254' and a text input containing '712345678'. Below this is a 'Password' field. At the bottom of the form are three buttons: 'Login', 'Sign Up', and 'Forgot Password'. The top navigation bar includes 'Home', 'Information', 'About', and 'Login' with a user icon. The footer contains the text 'All rights Reserved Online Dairy Record -Kenya' and a 'Sign Up' button.

Online Dairy Farmers

Home Information About Login

Login form

Phone Number

+254 712345678

Password

Login

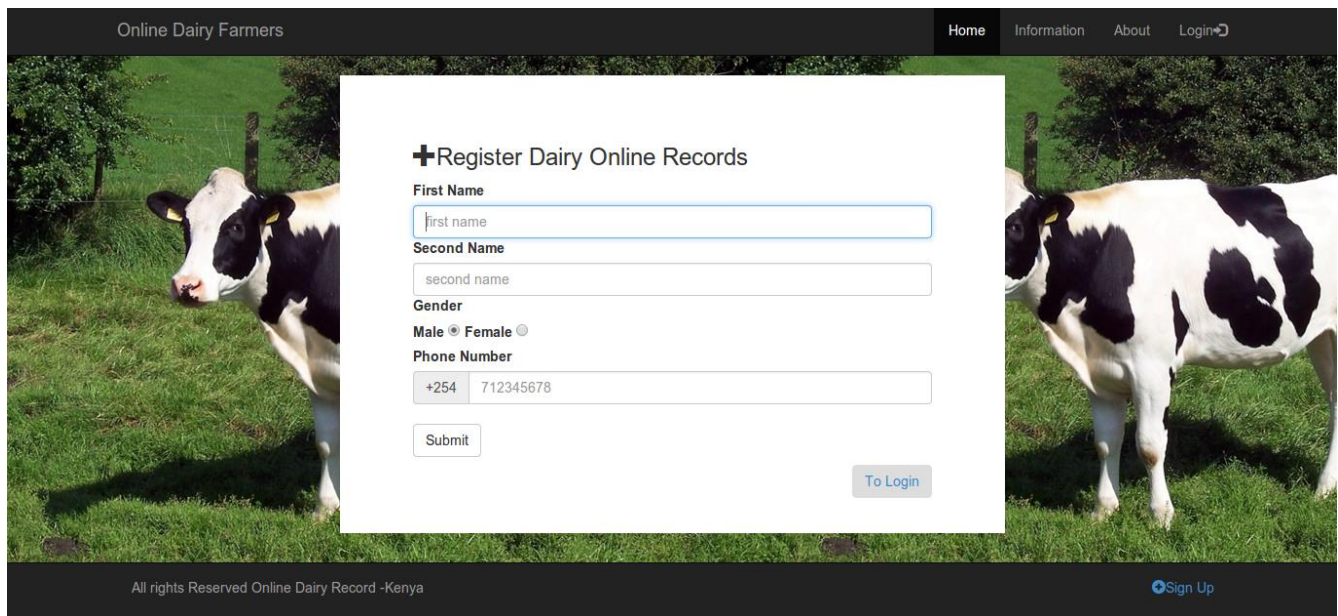
Sign Up

Forgot Password

All rights Reserved Online Dairy Record -Kenya

Sign Up

Fig 11. Login page



The screenshot shows the registration page of the 'Online Dairy Farmers' application. The background is the same photograph of two black and white cows in a green field. A white registration form is centered on the page. The form has a title '+Register Dairy Online Records'. It contains fields for 'First Name' (with placeholder 'first name'), 'Second Name' (with placeholder 'second name'), 'Gender' (with radio buttons for 'Male' and 'Female', where 'Female' is selected), and 'Phone Number' (with a dropdown for the country code '+254' and a text input containing '712345678'). At the bottom of the form are two buttons: 'Submit' and 'To Login'. The top navigation bar includes 'Home', 'Information', 'About', and 'Login' with a user icon. The footer contains the text 'All rights Reserved Online Dairy Record -Kenya' and a 'Sign Up' button.

Online Dairy Farmers

Home Information About Login

+Register Dairy Online Records

First Name

first name

Second Name

second name

Gender

Male Female

Phone Number

+254 712345678

Submit


To Login

All rights Reserved Online Dairy Record -Kenya

Sign Up

Fig 12. Registration page

Online Dairy Farmers
Home
Information
About
Login



Reset Password

First Name


Second Name

Phone Number

+254 Phone No

Reset Password

[To Login](#)



All rights Reserved Online Dairy Record -Kenya
[Sign Up](#)

Fig 13. Reset password page

Online Dairy Farming Record
Home
Register_Cow
Health
Milk
Feeding
Income_Expense
Reminders
Logout

Add Record
Update Record
Delete Record

Cow Details Recording

Cow Identification Number

Date of Birth

Sex

Breed

Add

Fig 14. Add cow record page

Online Dairy Farming Record
Home
Register_Cow
Health
Milk
Feeding
Income_Expense
Reminders
Logout

Add Record
Update
Analysis
Graph Representation

Select Cow Id to Update Record Cow Identification Number

Time Period of Milking

Morning Amount
Milk Amount Litres

Evening Amount
Milk Amount Litres

Date
dd/mm/yyyy

Add

Fig 15 .Add Milk record page.

6.0 RESOURCES

The development and deployment of this web application will require hardware and software Resources as listed below.

6.1 HARDWARE

- 1) Personal Computer 64 bit
- 2) Hard Disk 320GB
- 3) RAM 4GB
- 4) GSM modem (Airtel).

6.2 SOFTWARE

- 1) Ozeki SMS Gateway server.
- 2) Operating System (Linux Ubuntu 12.04)
- 3) LAMP Server.
- 4) CodeIgniter, PHP framework.
- 5) Gantt Project Management software.
- 6) Sublime Text Editor
- 7) E-Draw

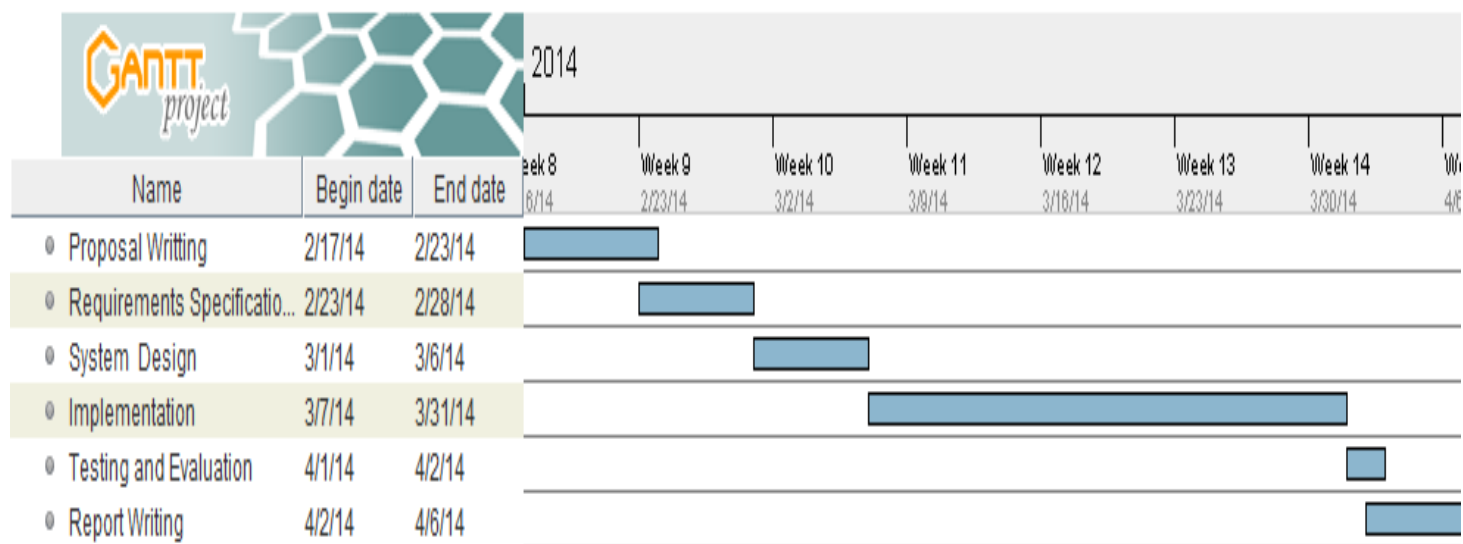
7.0 PROJECT WORK PLAN

7.1 Project timeline

To implement the research project proposed, the following project timeline will be observed.

	Task	Scheduled Begin Date	Scheduled End date	Duration
1	Proposal writing	17/2/2014	23/2/2014	4 days
2	Requirements elicitation and Data Analysis	24/2/2014	28/2/2014	5 days
5	System Design	1/3/2014	6/3/2014	5 days
6	Implementation	7/3/2014	31/3/2014	24 days
7	Testing	1/4/2014	2/4/2014	1 days
8	Documentation	2/4/2014	6/4/2014	5 days

7.2 GANTT CHART



8.0 REFERENCES AND BIBLIOGRAPHY

1. Ministry of livestock development. (2006). Annual Report.
2. Ministry of livestock development. (2006). Small holder Farmers Guide to Dairy Farming as a Business.
3. USAID. (2008). Kenya Dairy Sector competitiveness program: Milk shed Assessment and small business organization needs analysis. Land O Lakes/ Fibec limited Report
4. Thorpe W., Muriuki, H. G., Omoro, A., Owango, M.O. and Staal, S. (2000). “Dairy Development in Kenya: The past, the present and the future”. Paper presented at the Annual Symposium of the Animal Production Society of Kenya, Nairobi.
5. Moran J.(2009), Business Management For Tropical Farmers. Land Links Press, Colloywood, Australia.
6. Muriuki, H, G. (2003). Milk and Dairy Products, Post-harvest Losses and Food Safety in Sub-Saharan Africa and the Near East, a Review of the Small Scale Dairy Sector – Kenya. Rome, Italy: Food and Agricultural Organization.
7. Brannstorm A.J., (2006). Using Farm Records Effectively For Business & Financial Management. Faculty , UW Centre for Dairy profitability.
8. Muhammad, S., Tegegne, F., Ekanem, E. (2004). Factors Contributing to Success of Small Farm Operations in Tennessee, Institute of Agricultural and Environmental Research Tennessee State University Nashville, Tennessee, Journal of Extension.
9. Tranel, L, F. (2002). Managing Dairy Farm Finances. IOWA State University Cooperative Extension
10. Pakistan’s 1st Online Dairy Farming Guide. [www] <http://www.pakdairyinfo.com/record.htm>. (Accessed on February 02, 2014).
11. AgSquared. [www] <http://www.agsquared.com/> (Accessed on February 14, 2014).
12. Pioneer Online Record Keeping System. [www] <https://www.pioneer.com/home/site/ca/programs-services/online-record-keeping/>. (Accessed on February 14, 2012).
13. Pocket Dairy Android Application. [www] <http://www.drms.org/pocket.aspx> (Accessed on February 14, 2014).
14. eCow. [www]. <http://www.ecow.co.uk/>. (Accessed on 28/2/2014)

