VETERINARY ALLOCATION INFORMATION SYSTEM (VAIS)

GROUP 23

DEPARTMENT OF INFORMATION SYSTEMS

SCHOOL OF COMPUTING AND INFORMATICS TECHNOLOGY

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A report submitted to the School of Computing and Informatics Technology
For the Study Leading to a Project in Partial Fulfillment of the
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Information Systems and Technology of Makerere University

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DECLARATION

As Group 23, we declare to the best of our knowledge that this final year Project report has not been submitted by anybody or presented in any university for any academic award and therefore confirm its authenticity and originality as our own and that due acknowledgment where used was done in form of references to their ideas or work as related to the project.

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APPROVAL

This is to approve that this project report for "Veterinary Allocation Information System (VAIS)" has been produced under the supervision of;

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Name: **Dr. GRACE KOBUSINGE** Date

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DEDICATION

This final-year project is dedicated to the members of Group 23 because of the dedication and hard work we put into finishing it. It is also dedicated to our parents because without their support and encouragement, we would not have been able to successfully complete this beauty of a job. May the All-Powerful God favour and reward us richly.

ACKNOWLEDGEMENT

We would want to thank the Almighty God first and foremost for enabling us to conduct our research effectively. He granted us the gift of life, which boosted our will to complete this endeavour.

We then express our gratitude to our loving parents and guardians, who worked hard to make sure they could support us financially and give us everything we needed for our project. They also helped us develop our minds and inspired us spiritually, which contributed to our success.

We also recognize the arduous efforts of the whole faculty and staff at Makerere University's College of Computing and Information Sciences, who prepared us for the social, mental, and moral empowerment granted to us during our degree program. They gave us a lot of support and encouragement, which helped us finish the degree course and final year project.

Not to mention Dr. Kobusinge Grace, our cherished supervisor, for all of her direction and corrections that helped us complete the project successfully. She patiently and painstakingly helped us with the project by reading every section of the report attentively, offering helpful recommendations, and recommending that it be submitted. We want to express our gratitude for her contribution at this moment.

Last but not least, we owe a debt of gratitude to our Information Systems and Technology classmates for their contributions, advice, and ongoing support throughout the entire semester and this project. We pray for God to bless you and look forward to doing more business with you in the future.

ACRONYMS

API- Application Programming Interface

DBMS- Database Management System

DFD- Data Flow Diagrams

ERD- Entity Relationship Diagrams

HTTPS- Hyper Text Transfer Protocol Secure

MQL- MongoDB Query Language

UML- Unified Modelling Language

VAIS- Veterinary Services Allocation Information System.

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ABSTRACT

Small-scale farmers have limited access to veterinary services, with the main providers often being paraprofessionals. Inaccessibility of veterinary services results into high rates of animal loss. Veterinary services play a key role in the government's efforts to reduce poverty through agricultural commercialization and animal husbandry.

The study adopted a mixed-methods approach that involved applying both qualitative and quantitative methods while collecting information. For quantitative, questionnaires and surveys were employed and for our qualitative, interviews and documentation review were used. We discussed the tools as well as the techniques that we employed as we collected this information.

The IVET information system that has been developed allocates farmers to veterinary doctors within their nearest location.

This is done by presenting vet doctors offering a specific service (that which is required by the farmer), starting with the one in the nearest approximation.

The system has a chat platform, where farmers are able to seek for appointments with the Vet doctors nearest to them.

All three users of the system (Farmer, Vet and Administrator) are required to create accounts for them to benefit from the services that the system offers.

The Administration dashboard enables the administrator to check that the system is functioning as it was purposed to, that is appointments are being scheduled, completed, or cancelled, the registered Vets are verifiable and farmers are able to report any dissatisfaction with the registered Vet doctors.

CHAPTER ONE

1.0 Introduction

Expectations of the public regarding the role of veterinary services is on the increase and will possibly remain so. This leaves us with a challenge of finding new and efficient ways to deliver quality and affordable veterinary services.

Information seeking is searching and locating the information by using sources of information whether printed or online. Information seeking can be done for different purposes; in the educational setting information seeking is done by students for school/university projects (IGI Global, n.d.) Information seeking is done to achieve a form of utility, which both veterinarians and animal owners strive to do. The Uganda government is trying to see a shift from subsistence farming to commercial farming as a key strategy to reduce poverty in the country (Anna, 2022). A shift to commercial farming will see an increase in the number of animals and thus a need for accessibility of timely and efficient veterinary service.

Hence, the veterinary allocation Information System has enabled the scheduling of appointments with doctors, allocation of veterinary doctors in the nearest approximation and charting between the veterinary Doctors and animal owners.

1.1 Background

Animal husbandry can be a little bit tricky if there is no proper way for you to access quality and professional services in time and the service being affordable as well. Animal diseases leave many animal owners in despair even after they call on their local service providers who may turn out to be paraprofessionals or straight-out quacks. Animal diseases pose a risk to public health and cause damage to businesses and the economy at large.

However, their potential as a route out of poverty is limited by, among other things, disease and health problems (5–8). Smallholders have limited access to veterinary services, with the main providers often being paraprofessionals (Anna, 2022) .

The quantity and quality of paraprofessional training varies, with the result that they can offer important advice and support to animal owners as well as cause severe animal suffering due to inappropriate treatment. Consequently, even seemingly minor and non-fatal problems, such as worms and diarrhea, significantly constrain production and lead to livestock loss (Arvidsson, 2022). In light of this, veterinary services play a key role in the government's efforts to reduce poverty through agricultural commercialization in general and animal husbandry in particular. The economic and institutional framework of the livestock industry is quite different in several respects in developing and developed countries (FAO, 2006).

The aim of this study was to contribute to an understanding of the structure of veterinary support in order to determine how to dispense appropriate volumes of support to the animal owners who seem to be in more need of the services. Every veterinary hospital staff consists of a team of caring individuals, each contributing his or her unique abilities to ensure high quality veterinary care for animals and compassionate interactions with animal owners. Dedication to service remains a top priority (AVMA, n.d.). Paying particular attention to paraprofessionals because of their availability

compared to professionals, we determine their abilities and deploy them to work on issues they are more knowledgeable about.

In this paper, we examined the possibility of animal owners having access to quality veterinary services in different results that the service providers can offer as efficiently and cost effectively as possible.

Above all, the inaccessibility of veterinary services results into high rates of animal loss.

1.2 Problem Statement

Limited access to qualified veterinary personals and quality services. The main service providers being paraprofessionals are not qualified to carry out these services and only have basic knowledge of animal medicine hence leading to poor quality of services provided by these paraprofessionals (Uganda Vet Association, 2020).

The quantity and quality of paraprofessional training varies, with the result that they can offer important advice and support to animal owners as well as cause severe animal suffering due to inappropriate treatment. Consequently, even seemingly minor and non-fatal problems, such as worms and diarrhea, significantly constrain production and lead to livestock loss (Arvidsson, 2022). In light of this, veterinary services play a key role in the government's efforts to reduce poverty through agricultural commercialization in general and animal husbandry in particular. The economic and institutional framework of the livestock industry is quite different in several respects in developing and developed countries (FAO, 2006).

1.3 Objectives

1.3.1 Main Objective

To develop a veterinary Allocation Information System to ease accessibility to veterinary services between service providers and those in need of the service.

1.3.2 Specific Objectives

- To identify the requirements for the veterinary Allocation Information System.
- To design the model for theVeterinary Allocation Information system.
- To implement the Veterinary Allocation Information system.
- To test and validate Veterinary Allocation Information system.

1.4 Scope

Here the limits of this project were highlighted. The purpose of this project was to create a system that would help to dispense approved and accredited information between animal owner and service providers of animal health services.

1.4.1 Geographical Scope

The study was carried out within the geographical bounds of the veterinary school at Makerere University mainly. This included the veterinary students in the field as our service providers and the individuals they work with in the field as paraprofessionals and the animal owners of the locations they carry out these field attachments from. However, veterinary centers involved in the due course of carrying out this study informed of concretive and appropriate research were included.

1.4.2 Theoretical Scope

The theoretical scope helped limit the scope of the relevant data and information by focusing on specific variables and defining a specific framework that the researchers took in analyzing and interpreting the data to be gathered.

This study explored how actors in the Ugandan veterinary sector frame accessibility as a factor hindering animal owners' animal husbandry and what solution was developed to address these specific problems.

1.5 Research Outcomes/Significance

This research was carried out in order to find out if the lack of a communication platform directly impacts the quality of services that are provided within the veterinary sector.

The main purpose of this study was to produce a proposal for a system that would solve the issue of communication and quality of veterinary services. The beneficiaries of this study are listed below;

1.5.1 System Developers

The system developers, which is us developed hands on skills and experience and also enjoy the financial prowess which will come from the system being successful and being rolled out nationwide.

1.5.2 Animal owners

The animal owners are going to be the greatest beneficiaries from this project because not only will it improve the quality of the services that they are getting, it will also make sure they have access to the most affordable services there are.

1.5.3 Veterinary Centers

The system will act as an advertising platform for these locations, which in turn increases sales and profit. It also will help them to know how the current competition is prevailing in the veterinary industry.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter, light was shed on previously published literature on projects similar to our Information system. Scholarly articles, books, journals, and other sources that are pertinent to our research were used. The purpose of literature review was to establish the academic and research areas that other scholars have talked about which were relevant to the subject under investigation. All the information presented was reviewed from the magazines, books, journal articles, newspapers and web pages that document related information to the topic.

2.2 Synopsis of Veterinary

Veterinary medicine, also called veterinary science, medical specialty concerned with the prevention, control, diagnosis, and treatment of diseases affecting the health of domestic and wild animals and with the prevention of transmission of animal diseases to people (Bowen, 2022). Veterinarians address the health needs of domestic animals, including cats, dogs, chickens, horses, cows, sheep, pigs, and goats; wildlife; zoo animals; pet birds; and ornamental fish.

In Uganda, the Uganda Veterinary Board is the profession regulatory body established by an Act of Parliament. The board is appointed by the minister of Agriculture, Animal Industry and fisheries with approval from the cabinet. The major mandate of the board is to ensure that qualified, registered and licensed veterinary professionals under their regulatory supervision offer animal health services. To do this, the Board runs several activities including, but not limited to, registration of professionals and their premises of practice; establishment of standards for training, practice and professional conduct of veterinary professionals; provision of guidance and support for continuing professional development programmes and community education (Uganda Veterinary Board, 2013).

2.3 Existing Allocation Systems

2.3.1 Feed Allocation System

Feed Allocation System (FAS) is a precision software platform that tracks and executes your nutrition and health (medication use) programs. Developed to manage livestock production with real-time information, our technology automates management of multiple animal groups across any number of barns (Prairie Systems, 2018).

FAS helps to avoid out-of-feed moments that affect growth performance of animals. It verifies that the right feed is being delivered to the right feed bin at the right time. It monitors animal inventory and groups to simplify and clarify the feed ordering process thus creating a traceable feeding process so as to reduce the feed budget.

2.3.2 Veterinary Information management system

Veterinary informational management system (VIMS) capable for the capture, storage, analysis and retrieval of data and providing the opportunity for the cumulative gathering of the knowledge and capability for its competent interpretation (Plavšić, 2009).

The system enables collection of appropriate data including quality management, and inspection controls from all agricultural establishments and commodities in a structured predefined format to facilitate analyses of such data as well as improve existing programmes

The role of information system in animal disease diagnosis, surveillance and notification, control of national and international trade of commodities, food safety management, and investigation of diseases, predictive microbiology and quantitative risk assessment is of great importance for the quality of veterinary service (Plavšić, 2009).

2.3.3 Resource Allocation Planning System

Resource Allocation Planning System (RAPS) is a generic human-computer software user interface designed to support a person making resource allocation decisions. The system is designed to make these allocations with minimal human judgement with an inclusion of a decision support system than organisational charts. Organisational charts become increasingly difficult to use as the size of the resource allocation problem increases (O'Hargan, 2006).

2.3.4 Summary

Highlighted in the figure below are the features of VAIS and whether existing systems have the same features.

Name of System	User profiling	Scheduling	File sharing ability	Admin Dashboard	Review
Feed Allocation System	Yes	Yes	No	Yes	No
Veterinary Information System	Yes	Yes	No	Yes	Yes
Resource Allocation Planning System	Yes	Yes	No	Yes	No
VAIS (proposed system)	Yes	Yes	Yes	Yes	Yes

1 Features

2.4 Quality of Veterinary services in Uganda

A study conducted by Ilukor and Birner shows that the dominance of veterinary paraprofessionals in the animal health markets has been linked to the decline in quality of veterinary services. They go ahead to say that their study uses a role play experiment to analyse how the interaction of farmers and service providers influences the quality and the demand for clinical services for cattle. The quality of clinical services was measured by scoring the accuracy of the service provider prescribing the appropriate drug for selected cattle diseases (Ilukor, 2014).

The study goes ahead to show that the accuracy of paraprofessionals is not that different from that of veterinarians in prescribing drugs. However, the ability of untrained service providers to perform these tasks is significantly lower than that of paraprofessionals. Paraprofessionals interacting with veterinarians gradually improved their ability to perform these tasks compared to paraprofessionals with no formal training or education.

2.5 Role of Veterinary Services in Uganda

The Veterinary Services contribute to the achievement of these objectives through the direct performance of some veterinary tasks and through the auditing of animal and public health activities conducted by other government agencies, private sector veterinarians and other stakeholders.

The Veterinary Authority retains the final responsibility for satisfactory performance of delegated activities.

At the farm level, through their presence on farms and appropriate collaboration with farmers, the Veterinary Services play a key role in ensuring that animals are kept under hygienic conditions and in the early detection, surveillance and treatment of animal diseases, including conditions of public health significance.

The Veterinary Services may also provide livestock producers with information, advice and training on how to avoid, eliminate or control food safety hazards (e.g. drug and pesticide residues, mycotoxins and environmental contaminants) in primary production, including through animal feed.

Producers' organisations, particularly those with veterinary advisors, are in a good position to provide awareness and training as they are regularly in contact with farmers and are well placed to understand their priorities.

The Veterinary Services play a central role in ensuring the responsible and prudent use of biological products and veterinary drugs, including antimicrobials, in animal husbandry. This helps to minimise the risk of developing antimicrobial resistance and unsafe levels of veterinary drug residues in foods of animal origin. Section 3.9. of the OIE Terrestrial Code contains guidelines on the use of antimicrobials.

Meat inspection Slaughterhouse inspection of live animals (ante-mortem) and the carcase (post-mortem) plays a key role in both the surveillance network for animal diseases and zoonoses and ensuring the safety and suitability of meat and by-products for their intended uses. Control and/or reduction of biological hazards of animal and public health importance by ante- and post-mortem meat inspection is a core responsibility of the Veterinary Services and they should have primary responsibility for the development of relevant inspection programmes.

2.6 Integrating Information and Communications Technology in determining the Quality of Veterinary Services

Ilukor (2014) Shows that the quality of the services provided by veterinarians is related to the training level of the person providing these services and how much they interact with professional and well qualified veterinarians. The training level of these service providers is important as well as the means to reach out to these individuals. A way for animal owners and their veterinarians to communicate and seek out each other. ICTs could help to improve veterinary practice, timeliness and accuracy of data collection and reporting for disease surveillance and animal health monitoring (Idrissi, 2021).

The ICTs can be used to map and monitor different Veterinarians, paraprofessionals and untrained service providers. This can be in form of quality measures, location, speciality and pricing. This was the focus our study for this proposal.

2.7 Conclusion

The goal of this literature research is to look at the previously published literature on projects similar to our Information system and assess case studies in order to identify the most significant and necessary characteristics and features that was incorporated in our proposed system to efficiently meet the needs of our end users.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

This section gives a description of the methods, techniques, tools that were used to achieve the specific objectives of the research study. These methodologies include; research approach, requirement gathering, analysis, design, implementation, testing and validation of the system. For quantitative, questionnaires and surveys were employed and for our qualitative, interviews and documentation review were used.

3.2 Research Approach

The study adopted a mixed-methods approach that involved applying both qualitative and quantitative methods while collecting information. The quantitative methods are used to determine the relationship between the vets and their respective animal owners within the scope of the study (Brians, 2011). The qualitative methods are used to better understand participants' perceptions, motivations, and emotions (Cleland, 2017).

3.3 Requirements Gathering

In this part of our study, we gathered and collected the requirements that were used to identify the requirements of our system as well as our system requirements. We discussed the tools as well as the techniques that we employed as we collected this information.

At this stage we gathered information that is relevant to the VAIS in order to determine system requirements. Data collection is a methodical process of amassing and analysing specific statistics to proffer solutions to applicable questions and examine the results (Formplus, 2019). Our research was carried out in the following ways;

3.3.1 Questionnaires and Surveys

This refers to a technique for gathering statistical information about the attitudes or actions of the student vets and animal owners by a structured set of questions (Berdie, 1974). The benefits of this technique include a short response from the target group, smooth evaluation of effects, and visualization and practicability.

3.3.2 Interviews

Interviewing involves asking questions and getting responses from participants (Gorden, 1975). Phone interviews are more preferred for this study. This is because, they are cheaper and faster than face-to-face interviews to conduct and use fewer resources than face-to-face interviews.

3.3.3 Documentation review

Also known as archival research, we used documents from literature that has already been published about topics related or exactly like our system (Prairie Systems, 2018).

Various documents were reviewed and these included, to mention but a few, books, journals, blogs, written reviews, existing VAIS like systems so as to get in-depth knowledge about how they function, their processes and limitations so as to find points of weakness to improve on.

3.4 Data Analysis

Analysis of the collected data was carried out in this phase in order to gather all specific details for the requirements of VAIS. The data analysis carried out through graphical representations of the collected data inform of graphs, charts and tables. This helped us interpret the data we had collected.

3.5 Design

In this design, we prepared a blueprint of what our proposed system would have looked like. The design of the system was given in approaches highlighted below;

3.6 Process modelling

Data Flow Diagrams were used to show logical flow of data. These are context diagrams that are used to describe the interactions outside the system and how and what information is being transacted.

3.7 Data Modelling

This was used to analyse the data objects and their relationships to the other objects**.** Entity Relationship Diagrams were employed as well. These were used during data modelling to analyse relationships between different attributes and how they were to interact with the system.

3.8 System Architecture

The system architecture highlighted a framework of how the system worked.

3.9 Implementation

Here, all the iterations were brought together and integrated to make one working system. The system was implemented using programming languages like MQL for databases, PHP for creating codes that linked the forms in the database, HTML and CSS for designing and styling the interfaces.

3.10 Testing

Testing is carried out to ensure that the developed system is aligned with the functional and non-functional requirements that it is going to be designed for. A test plan was drafted to achieve effective and efficient unit and integration testing.

Unit testing was used to test different units of the system independently. This is done to ensure accuracy and correctness of the different units in our proposed system.

Integration testing was employed as well to test the interfaces between modules and ensure that modules are integrated and working properly.

System testing was also done to evaluate how the complete system compiled against the specified system requirements. This entailed testing all components of the system to ensure that they are fully functional.

CHAPTER FOUR
SYSTEM ANALYSIS AND DESIGN

4.1 Introduction

We were able to make decisions by using data analysis to logically and statistically explain the range of the facts and graphically display them. According to section 4.2, questionnaires and interviews were used to gather the facts.

4.2 Methods employed in analysis

For analysis, interviews and questionnaires were used to collect the data used in this phase. These are explicitly expounded in the next sub section.

A composition of the respondents from the questionnaires is given below taking into consideration that all of the Veterinarians have been farmers at one point

User	**Number of respondents in category**
Farmers	25
Veterinarians	5
Total	**25**

1 Questionnaire Respondents

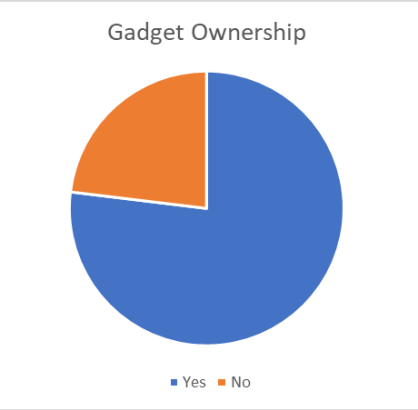
4.2.1 For interviews

In the interviews, an interview guide was carefully selected to investigate if the respondents had a proper and deep understanding of what exactly the project was about. The interviewee's ability to react extensively to the questions was important since it allowed to determine whether they understood the notion of Vet Systems and whether the system would be recommended.

The sample size was chosen to be 8 people because it felt they could provide sufficient information while being a reasonable number to work with. These individuals were chosen with belief that they had more information on what activities and are actively involved in animal husbandry. They were chosen because they had insight more than the average citizen concerning animal husbandry.

Computing device ownership

When asked whether the veterinarians that farmers interact with own smartphones or computing devices majority of the respondents agreed.



2 Gadget Ownership

Other Stakeholders

When asked which other stakeholders should be included, they responded like this

Responses
Agricultural Officers
Groomers
Animal Breeders
Animal Feed sellers
Trainers

3 Stakeholders to add

Features to add

When asked about what features they would be willing to see in the system, they responded this way. Many of them said know citing they were comfortable with the system as it was.

Responses
Artificial intelligence
Chatting
No
Training more vent doctors
system should allow farmers to see all the veterinary service providers and make there own choice
Function that takes Pictures of the infection
remunders
No
No

4 Features to add

No
No
Not really
Increase of more veterinary services in the area Preventive measures to be implimented
Taking pictures of the sick animal and diagnose remotely
emergency calls GPS or navigation system quick response
Farmers should be taught how to use these systems
Show the biography of the veterinary doctor

5 More features

4.2.2 Under Questionnaires

Questionnaires were employed and this made it possible to collect the vital information necessary to understand user preference. The questionnaire was dispersed by means of an internet form that was sent out to internet enabled users around universities within the locality.

The form was created using Microsoft Forms, which was also used to distribute it, analyse the findings, and assist us in making judgments about our requirements. Utilising Microsoft forms, we were able to analyse the findings and come to a well-informed conclusion about what our needs should be. A link with the questionnaire was shared through social media to spread it as far as it could possibly go in the sample size.

Non probability sampling methods were used for the sampling approach, that is to say convenience sampling. The approach was random and respondents were chosen to be local veterinarians and students of Makerere university, College of Veterinary Medicine, Animal Resources and Biosecurity.

Response rate

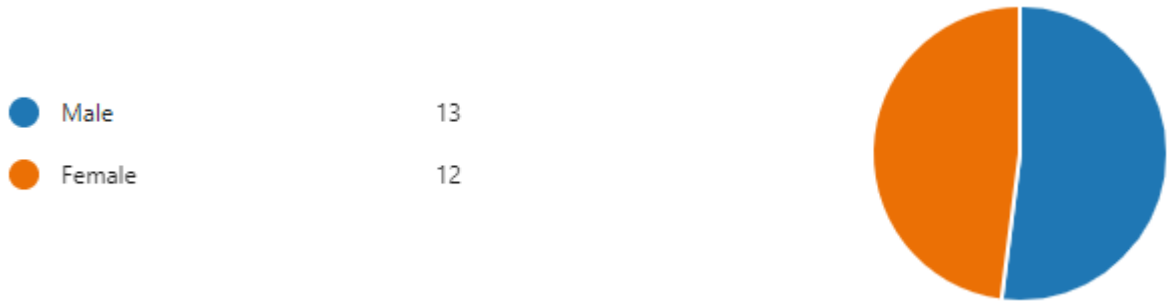
Responses were expected from 35 individuals. Over 25 successfully filled questionnaires were obtained resulting in a response rate of over 80% with an average time to complete the questionnaire of 5 minutes

Background of the respondents

Here, a detailed analysis of the background information of the respondents is provided.

Gender of the respondents

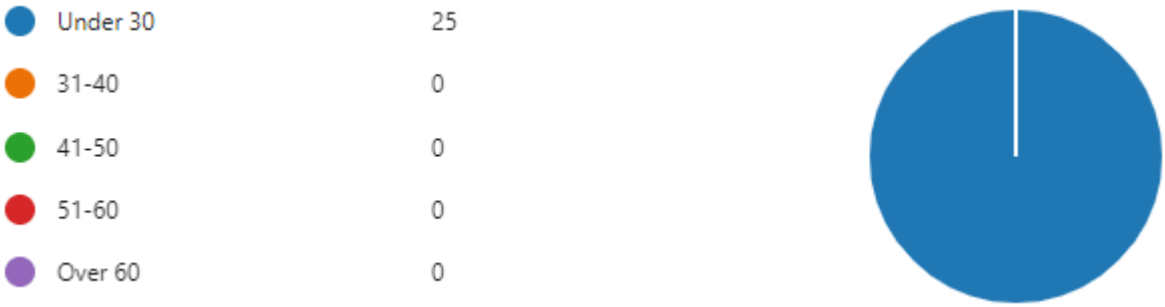
There is an almost balanced response rate when it comes to whether it is males or females.



6 Sex of Respondents

Age of the Respondents

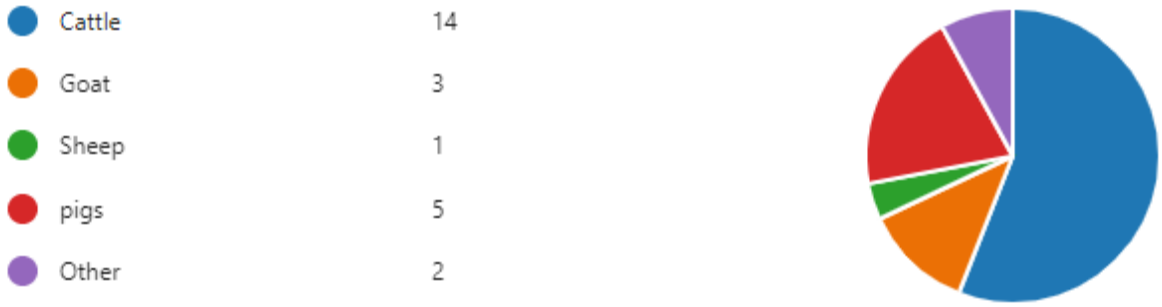
Almost all of the respondents were under the age of 30 since our sample size was mainly among university students.



7 Age of Respondents

Animals kept

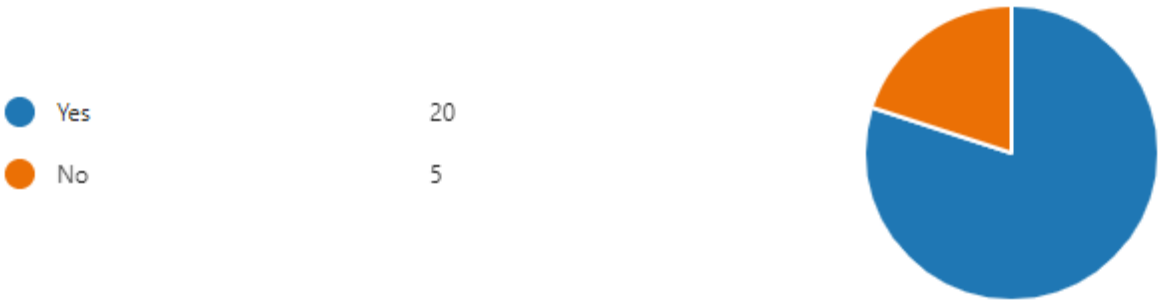
Majority of the animals kept were found to be cattle contributing to over 56% of the total animals in this study



8 Type of animals kept

Veterinary service availability

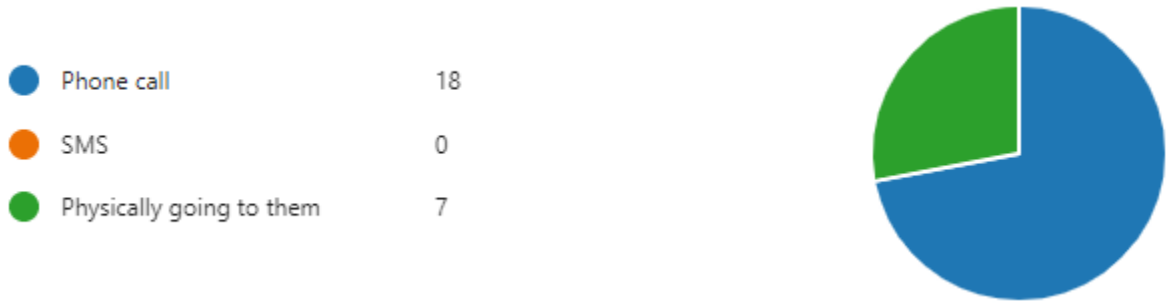
When asked whether the respondents had veterinary services in their area, majority agreed to having once in their vicinity



9 Vet service availability

How these services are accessed

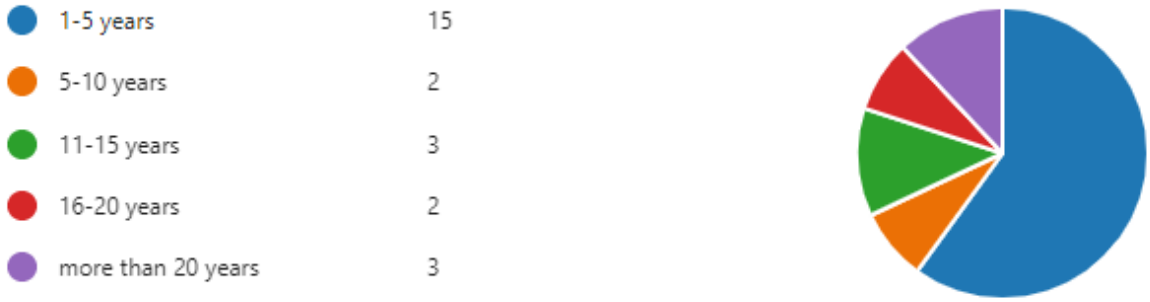
The larger number of the respondents sided with phone calls as the major way of communicating with their veterinarians. This means that phone calls were the primary way of setting appointments with their animal doctors



10 Mode of communication

Time spent in animal husbandry

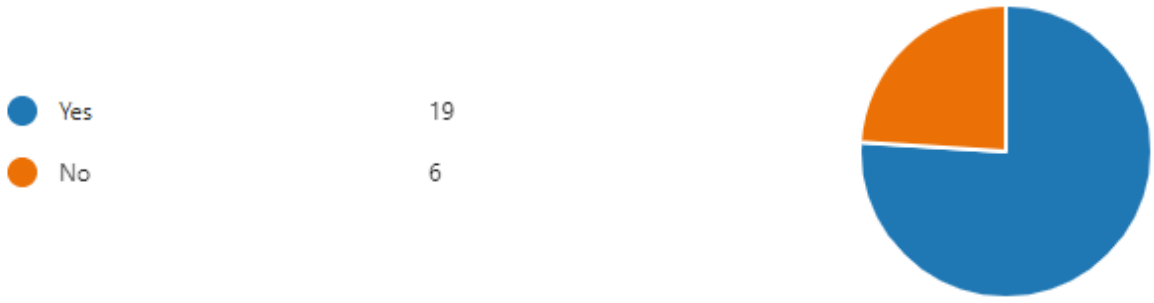
A larger portion of the respondents was new to farming. This is a positive outcome because newer farmers are more likely to try new technologies to see that their farming is more effective, that is to say VAIS.



11 Time spent farming

Internet access

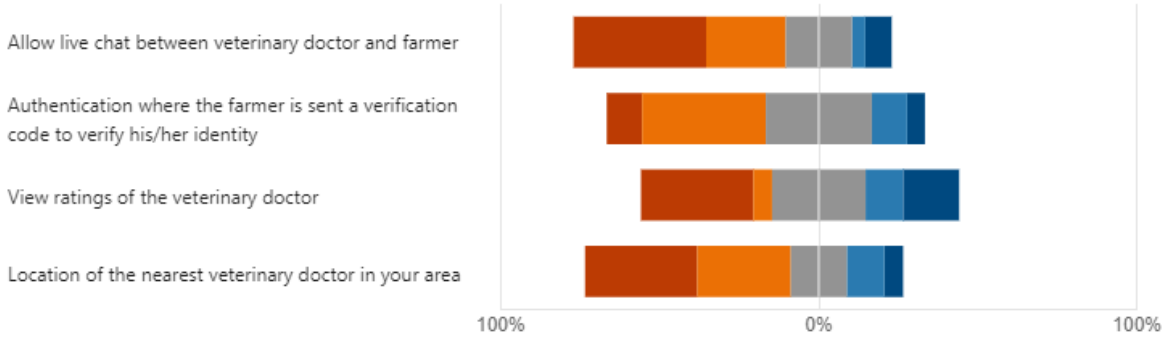
The system being web based, respondents were asked if they had access to reliable internet and majority agreed to having reliable internet.



12 Access to reliable internet

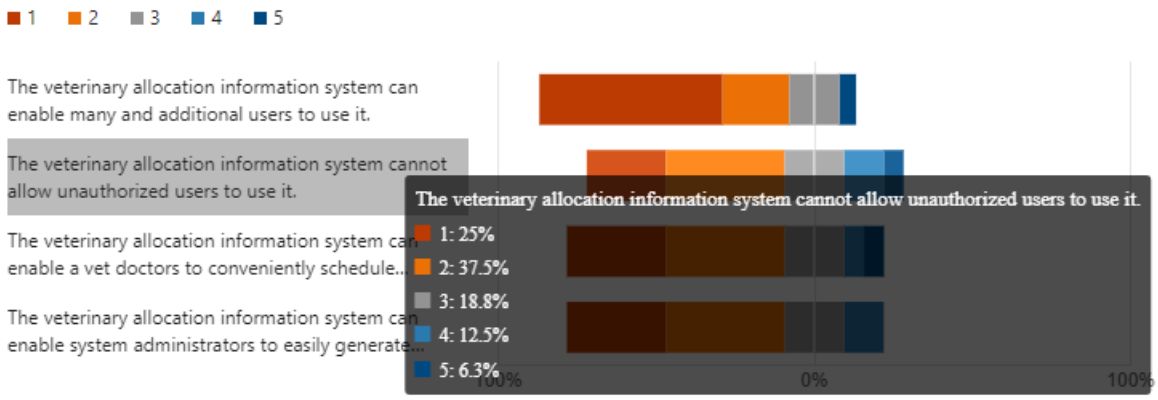
Preferred feature in the system

When asked which feature they preferred most on the system on the side of the animal owner, majority of the respondents positively rated the rating feature as shown below



13 Preferred system feature; Farmers

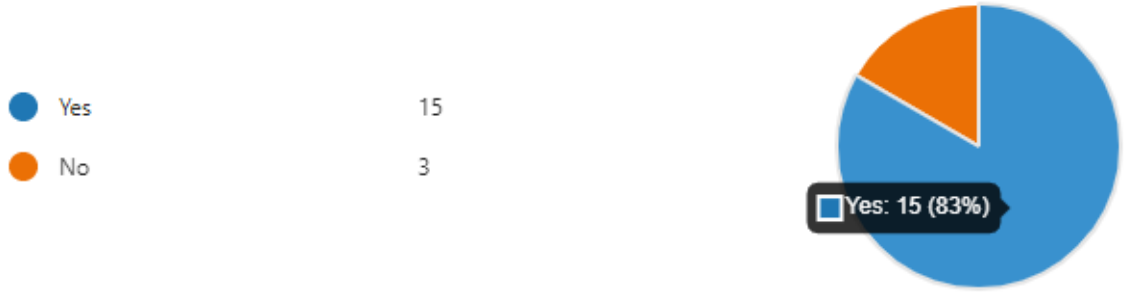
On the side of the veterinarians, they preferred that the system was able to show authorised and verified users.



14 Preferred system feature; Veterinarians

Implementation of VAIS

When asked whether VAIS would be a sound idea to be implemented, 83% agreed with this.



15 Whether VAIS should be implemented

Open ended responses

When asked to type input about where they operate from, diseases affecting their animals, challenges affecting them as they offer or access veterinary services and where their farms were located, these were their responses

Responses
Inaccessibility
Remoteness
Sunshine
Poor roads
limited access routes
Slow
transport
Poor roads
Tiredness
Transport

17 Challenges faced

Responses
Lyantonde
Gayaza
Bushenyi
Yumbe district
Mubende
Luwero
mityana
Mukono
Kakiri
Soroti

16 Location of farm

Responses
District
At the farm
Farm
Phone calls
Farms
Local veterinary services
clinic
Mukono
Kakiri
Field

19 Location of Treatment Area

Responses
Foot and mouth disease
Kalusu
Ticks
Ring warms
East coast fever
Goat mites
foot dieases
Swine flu
Skin diseases
Foot and mouth

18 Diseases affecting animals

Feature Suggestions

The users were also allowed to suggest features to add to the system and these were their responses.

Artificial intelligence
Chatting
No
Training more vent doctors
system should allow farmers to see all the veterinary service providers and make there own choice
Function that takes Pictures of the infection
remunders
Increase of more veterinary services in the area Preventive measures to be implimented
Taking pictures of the sick animal and diagnose remotely
emergency calls GPS or navigation system quick response
Farmers should be taught how to use these systems
Show the biography of the veterinary doctor

20 Features Suggested

4.2.3 Documentation Review

Documents from literature that had already been published about related topics were used. This helped get a better understanding of what to execute better. Various documents were reviewed and these included books, journals, blogs, written reviews, and an in-depth knowledge of how these systems operate was consolidated. Points of weakness were got and later improved on.

4.3 DETERMINING REQUIREMENTS OF THE SYSTEM

4.3.1 User requirements

The user highlighted the things that they wanted their system to be able to perform.

For the farmer

- A graphical user interface that was easy to use
- They wanted the system to be accessible from whatever internet enabled device especially mobile
- Users wanted to be able to see available ratings of different veterinarians.
- Users want to be able schedule their appointments
- Users wanted to see what services which vet provided at first glance of the profile

For the Veterinarian

- A graphical user interface that was easy to use
- Users want to be able to see their incoming appointments
- They wanted the system to be internet accessible from all locations as well.

For the admin

- The admin wanted the ability to review accounts. This includes pending, suspended.
- The admin wanted to be able to generate reports on users and schedules.
- Admin wants to be able to manage the users in this case being farmers and vets.

From the data that was provided during data collection, functional and non-functional requirements were also identified.

4.3.2 Functional Requirements

These are features that enable users complete their tasks. They include;

1. A user should see a summary of categories of services
2. A user can decide to create an account as a farmer or vet
3. A user can provide their phone to register and create an account
4. A user should get a verification code via sms
5. A user should be able to see the nearest service provider
6. A user should be able to message their respective service provider
7. A user should be able to schedule an appointment
8. A user should be able to view their schedule
9. A user should be able to edit the schedule
10. A user should be able to mark an appointment as complete
11. A user should be able to edit their profile
12. An admin can generate a report of all users on the system
13. An admin can see the total number of appointments completed
14. An admin should see the total number of appointments scheduled
15. A user should be able to report other users
16. An admin should be able to suspend users
17. An admin should be able to verify users

4.3.3 Nonfunctional Requirements

These describe how the system must behave and establish constraints on the services the system provides and include the following;

1. The system's password storage should use encryption.
2. The system should allow users to create and verify accounts completely on their own.
3. The system should utilize APIs to capture locations in real time.
4. To ensure that the data is secure while being transmitted over the internet, the system should employ the secure hypertext transfer protocol (HTTPS).
5. A user must be logged in to access the services
6. Only an admin can suspend users
7. Only an admin can verify users

4.3.4 System Requirements

The system requirements are the minimum specifications, hardware and software, required on certain devices to ensure that the developed system runs as smoothly, effectively and efficiently as possible. These are broken down and tabulated below;

Hardware Requirements

Component	**Specification**
Processor	Pentium or newer
Memory	1 GB
Hard disk	30 GB

2 Hardware Requirements

Software Requirements

Software	**Minimum Requirements**
Operating system	Windows 7 or newer
Browser	Firefox, Chrome, Safari, Opera
Database	MongoDB
Server	Apache, PHP Version 7 or newer

3 Software Requirements

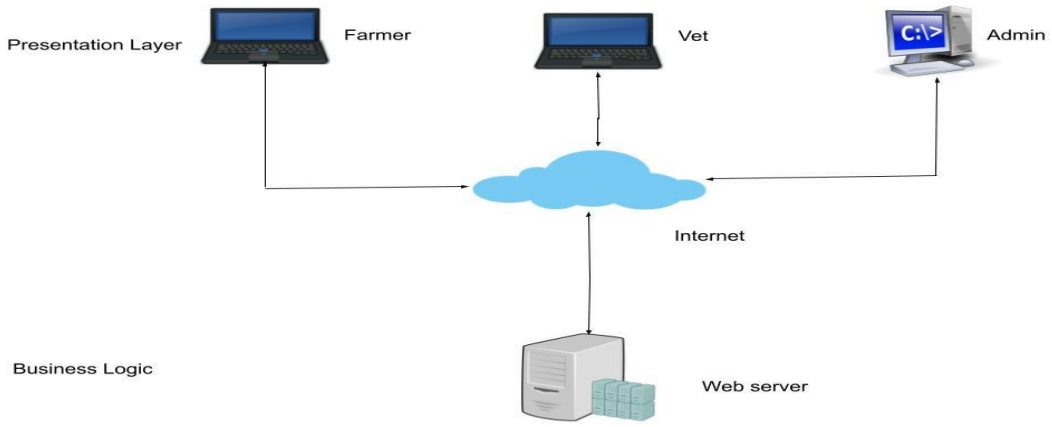
4.4 System Design

The system was broken down into individual parts, each of which was carefully analysed and addressed before going on to the following phase. The system's logical and conceptual parts were created using UML. The flow of system data, alterations, and the relationship between system components were designed using data flow diagrams (DFDs) and entity relationship diagrams (ERDs). Context diagrams were also used to highlight how external and internal entities interact with the internal software system. (Miro, n.d.)

4.4.1 System Architecture

This demonstrates how the allocation system is structured. A PHP web development framework, Apache, a MongoDB database, and other components make up the back-end engine that receives and transmits data from the front end.

To access the webserver where VAIS is located, the user must be connected to the internet. The user's queries from one of their internet-enabled devices are handled by a DBMS called MongoDB that is connected to the web server.

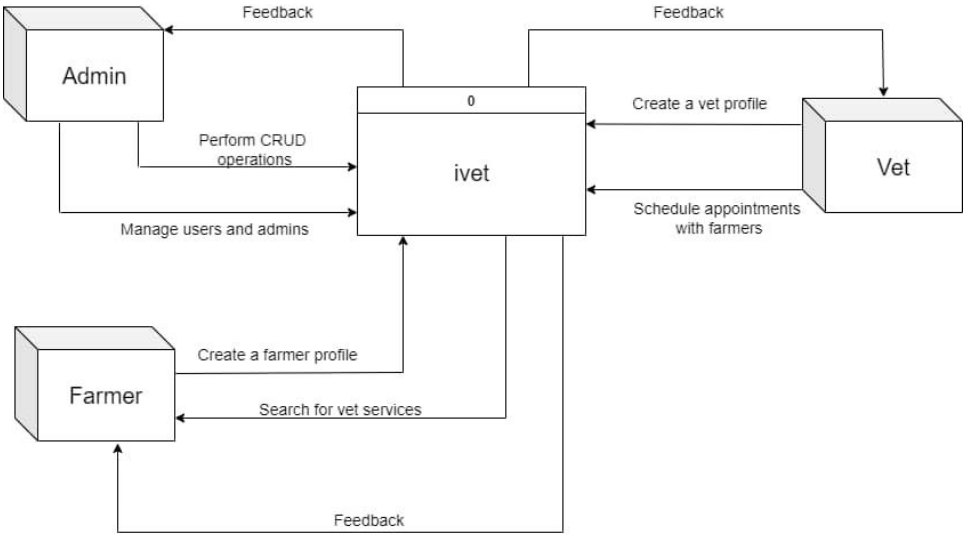


4.4.2 Process Modelling

This section illustrates how the system will send and receive from external entities, The Context diagram explains how external entities interact with the system including sending and receiving data. The level 1 DFD illustrates the major subprocesses identified in the system.

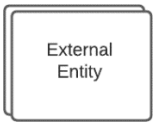
Context diagram

A context diagram is a high-level view of a system (Pedriquez, 2022). It only contains one process node that generalises the function of the entire system in relationship to external entities.



22 Level 0

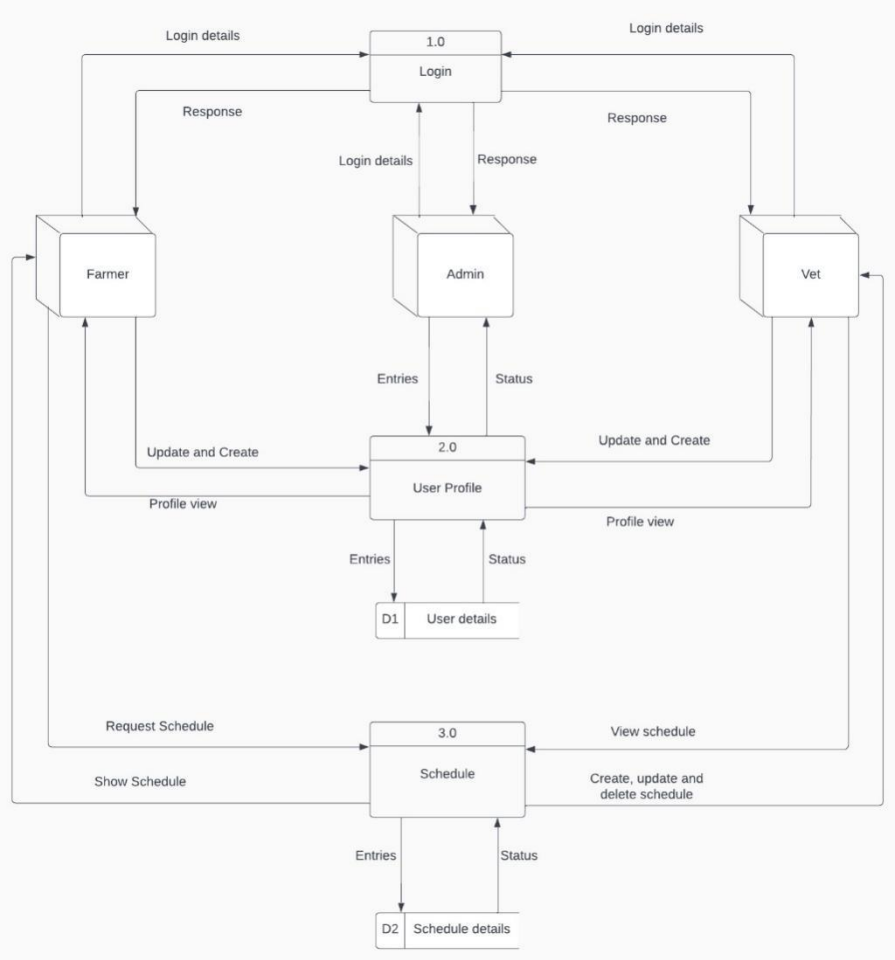
The symbols that were used in the data modelling process are highlighted below with their names and description of what they do in the model

Symbol	Element Name	Description
	**Process**	An activity that changes or transforms data flows. Since they transform incoming data tooutgoing data, all processes must have inputsand outputs on a DFD.
	**Data Flow**	The movement of data between externalentities, processes, and data stores is represented with an arrow symbol, whichindicates the direction of flow.
	**External Entity**	Also known as actors, sources or sinks, and terminators, external entities produce and consume data that flows between the entity andthe system being diagrammed.
	**Data Store**	A datastore does not generate any operationsbut simply holds data for later access.

4 Symbols of a context diagram

Level 1 Data Flow Diagram

Here the processes are shown in detail and how they interact with VAIS



23 Level 1

Data dictionary for the level 1 DFD

Process Name	Description
Login	Login Process is done by all actors involvedin using the system. They use credentials (Phone Number/email and password) to access the system.
User Profile	In this sub-process users of any kind can update their profiles, farmers can view vets' profiles, contact and report them
Schedule	In this sub-process, the vet and farmer can both view their schedule. The vet can edit, mark a schedule as complete and cancel it

5 Processes

Data store	Description
D1 User Details	Users' credentials are captured which are later used for authenticationinto the system. The data from this datastore is then used to give users their specific privileges of on the system
D2 Schedule Details	This stores details for all the Schedules. It includes details like the context of a schedule, its status whether its complete or not and who are the two parties involved in it

6 Data Store

Entity Name	Description
Farmer	Searches for vets who offer a certain service or services they are interested in acquiring
Admin (Administrator)	Responsible for maintenance and troubleshooting, system updates, andsecurity
Vet	Schedule meetings with farmers in order to offer them a service or services which are in demand

7 Entities

Dataflow	Description
Login Details	Data used to authenticate system users
Response	Feedback received by system user attempting to log in
Update	The admin updates user profiles by suspending user accounts
Update, Create and search	Farmers can create and update their profiles plus search for services they are interested in acquiring which can be produces a result of the vets' profile
Profile view	This is simply a user being able to view their profile
Entries	Details of freelancers
Status	Feedback from database queries
Request schedule	Users query for schedules which they are involved in

Show and view schedule	Data on user schedules
Update, create and delete schedule	A vet can perform these operations on a schedule they set up

8 Flow Dictionary

4.4.3 Data modelling

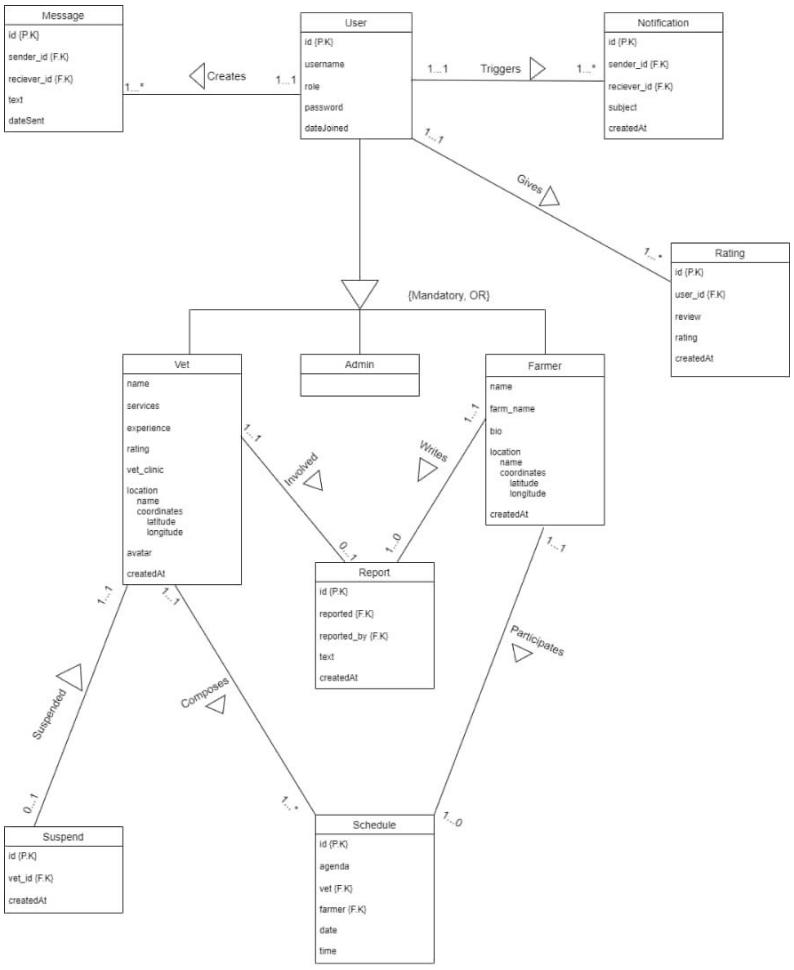
Data modelling was used to carry out analysis of the data objects and their relationship to the other objects. Data modelling involves a conceptual, logical and physical database design.

i) **Conceptual database design**

An ERD, which demonstrated the relationship between various attributes and how they would interact with the system, was used to create the conceptual database design.

Entity Relationship Diagram

This was designed in Microsoft Visio.



***24** ERD*

Data Dictionary of the ERD

The logical database structure's tables are detailed in depth, together with information on their constraints, field lengths, and attributes. Below are highlighted the data dictionaries for the various physical tables.

Column	Type	Required
user_id	ObjectId	True
username	String	
role	String	
password	String	

ii) **Logical Database design**

This represents the database in terms of tables of entities, attributes and their relationships.

Description of the tables in the logical database schema with their attributes, field lengths and constraints.

i) **User** (user_id {P.K}, username, role, password)

ii) **Message** (message_id {P.K}, sender_id {F.K}, receiver_id {F.K}, text)

iii) **Notification** (notification_id {P.K}, sender_id {F.K}, receiver_id {F.K}, subject)

iv) **Rating** (rating_id {P.K}, user_id {F.K}, review, rating)

v) **Admin** (admin_id {P.K}, user {P.K}{F.K})

vi) **Farmer** (user {P.K}{F.K}, name, farm_name, bio, location_name, location_lattitude, location_longitude)

vii) **Vet** (user {P.K}{F.K}, name, services, experience, rating, vet_clinic, location_name, location_lattitude, location_longitude, avatar)

viii) **Schedule** (schedule_id {P.K}, agenda, vet {F.K}, farmer {F.K}, date, time)

ix) **Suspend** (suspend_id {P.K}, vet_id {F.K}, timestamp)

iii) Physical Database Design

The physical model represents the actual design of the database. It deals with the conversion from logical design into a schema-level design that will be transformed into a relational database. It also involves defining keys and constraints.

Data Dictionary Contains relational tables, entities, attributes, and datatypes

Column	Type	Required
user_id	ObjectId	True
username	String	
role	String	
password	String	

9 Users

Column	Type	Required
message_id	ObjectId	True
sender_id	ObjectId	True
receiver_id	ObjectId	True
text	String	True

***10** Message table*

Column	Type	Required
notification_id	ObjectId	True
sender_id	ObjectId	True
receiver_id	ObjectId	True
subject	String	True

11 Notification table

Column	Type	Required
rating_id	ObjectId	True
user_id	ObjectId	True
receiver_id	ObjectId	True
subject	String	True

Column	Type	Required
admin_id	ObjectId	True

user_id	ObjectId	True

12 Admin table

Column	Type	Required
farmer_id	ObjectId	True
user_id	ObjectId	True
name	String	True
bio	String	True
farm_name	String	
location	Object	
name	String	
coordinates	Object	
latitude	String	
longitude	String	

13 Farmer table

Column	Type	Required
vet_id	ObjectId	True
user_id	ObjectId	True
name	String	True
services	Array	True
experience	String	
rating	Number	
vet_clinic	String	
location	Object	
name	String	
coordinates	Object	
latitude	String	
longitude	String	
avatar	String	

14 Vet table

Column	Type	Required
suspend_id	ObjectId	True
vet_id	ObjectId	True

15 Suspend table

Column	Type	Required
report_id	ObjectId	True
reporter_id	ObjectId	True
reported_by_id	ObjectId	
text	String	

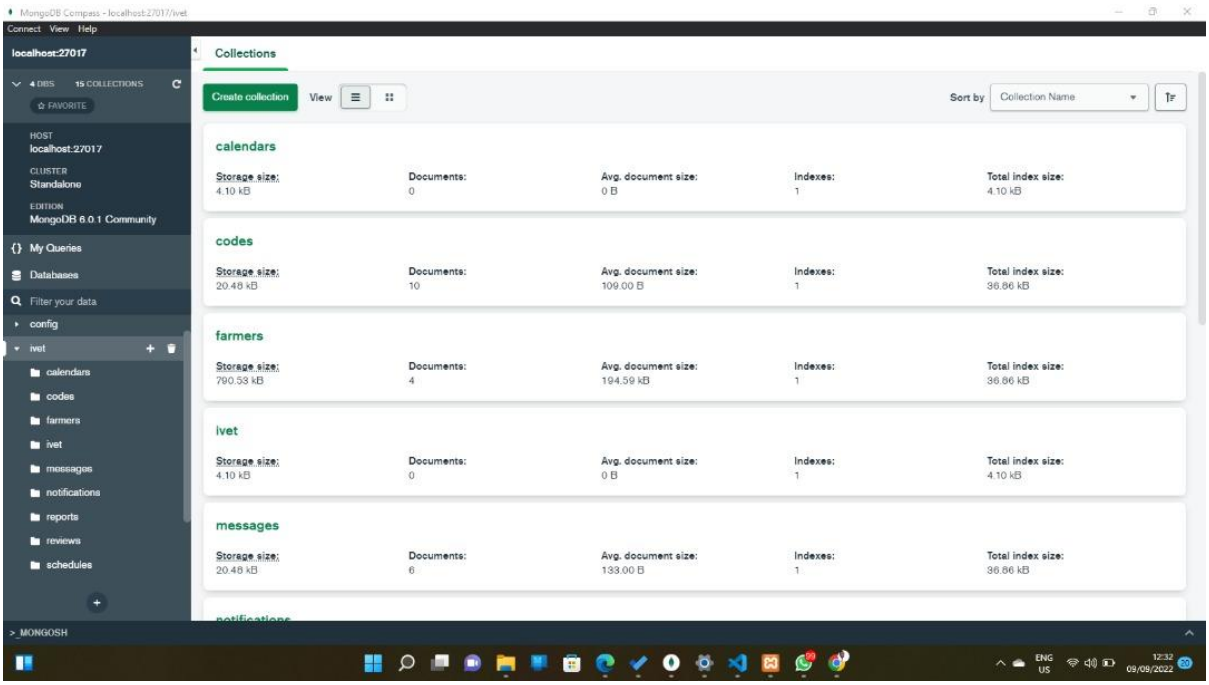
***16** Report Table*

Column	Type	Required
schedule_id	ObjectId	True
agenda	ObjectId	True
vet_id	ObjectId	
farmer_id	String	
date	String	
time	String	

17 Schedule Table

Physical Database design

The tables that are really physically present in the database are shown here.



25 Physical Database Design

CHAPTER FIVE
SYSTEM IMPLEMENTATION, TESTING AND VALIDATION

There were two steps to system implementation: system construction itself and system installation. In order to develop a system, a working prototype of the system had to using the technologies outlined in the paper, into production (programming languages). In this chapter, the results of system implementation, testing, and validation were presented

5.1 System Implementation

System implementation involved two major stages which were broken down into the construction of the system and installation. The frame work of the system compromised of 3 tiers, that is to say presentation, application and data tier.

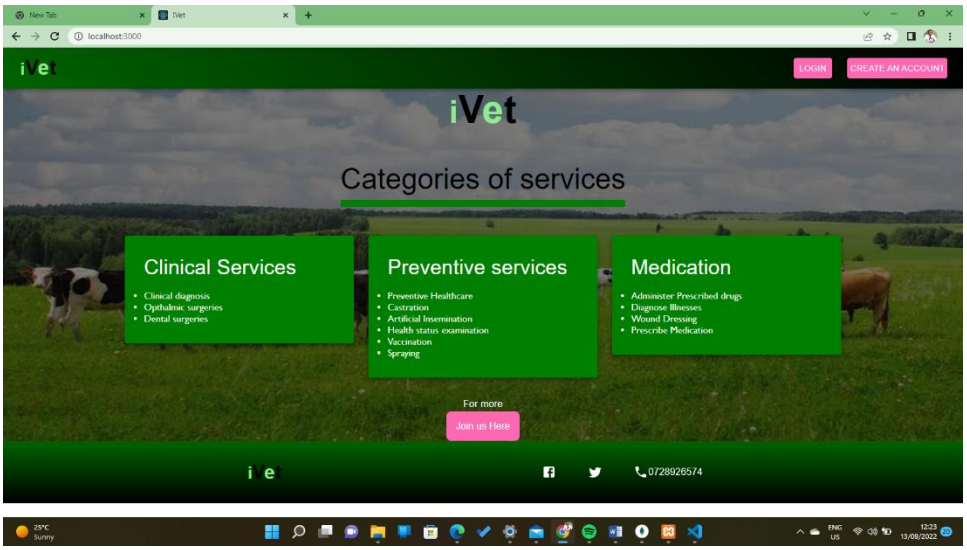
In the presentation tier, HTML, CSS and JavaScript were used since these are natively deployed in majority of the popular browsers.

In the application tier, PHP as a framework was used for the web development model.

In the Data tier, the programme for managing read and write access is the MongoDB Query Language (MQL) on the now popular MongoDB.

5.2 Application Modules

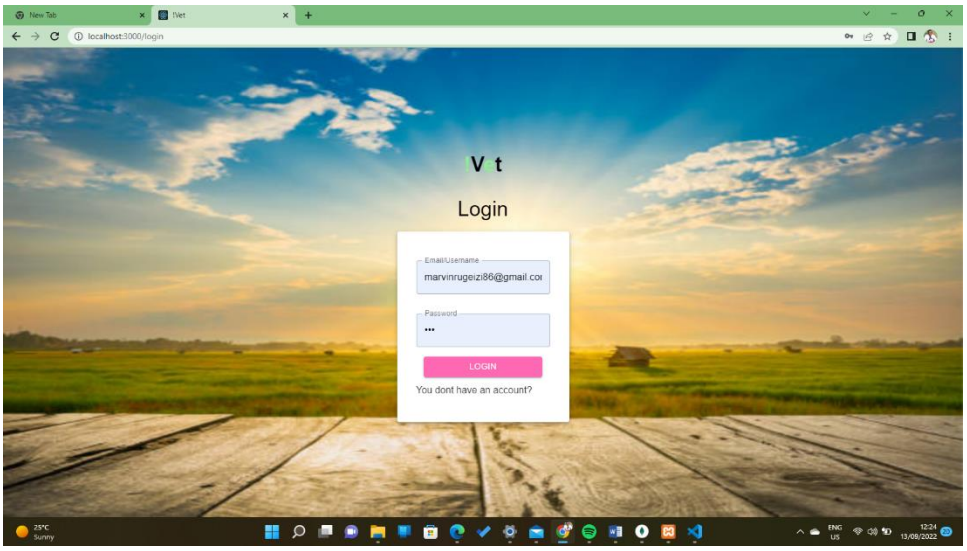
Landing Page



26 Landing page

This is the welcome page for anyone who visits the system

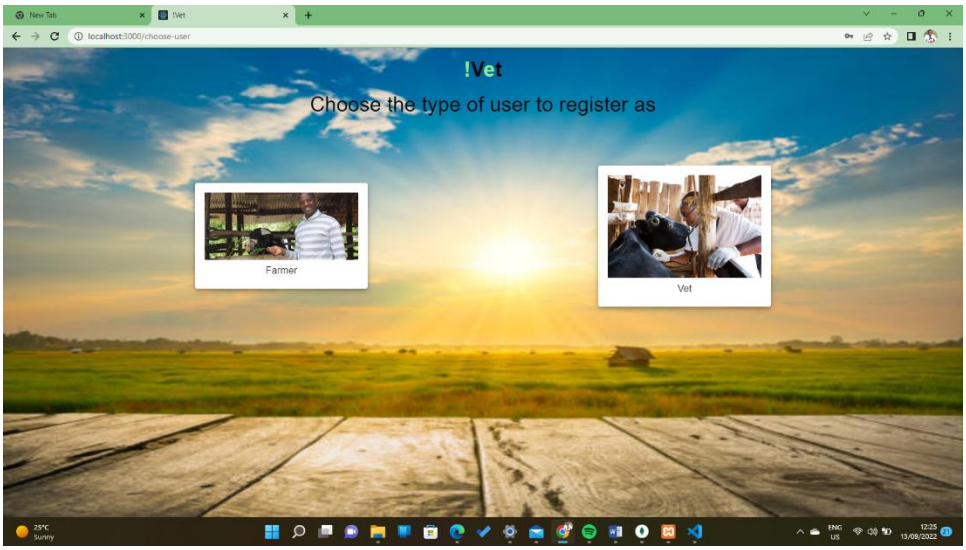
Login page



27 Login Page

This is the login page which is used by all entities requiring access to the system including farmers, vets, and system administrators. An option to create an account is provided on this page.

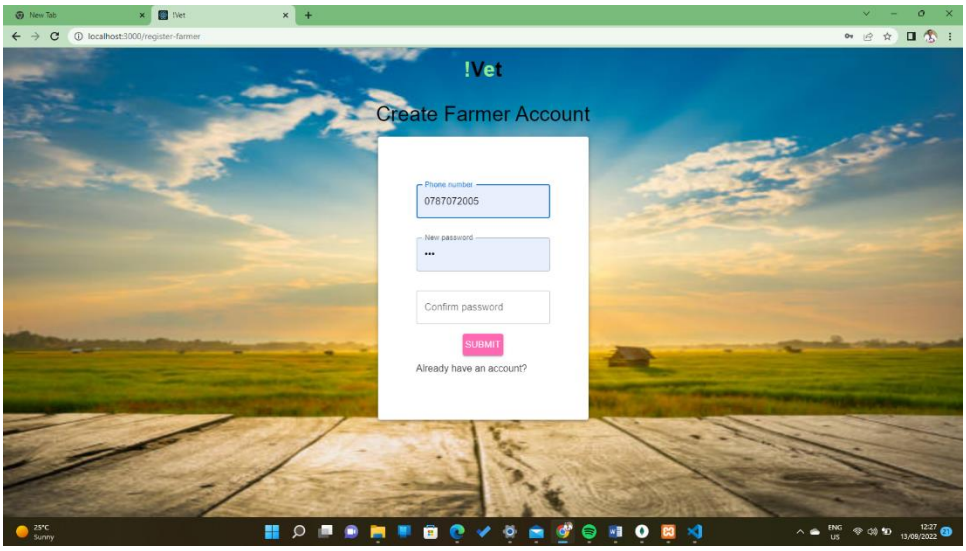
Choose user page



28 Select Type of User

This the page where a user chooses between a vet or a farmer to create an account.

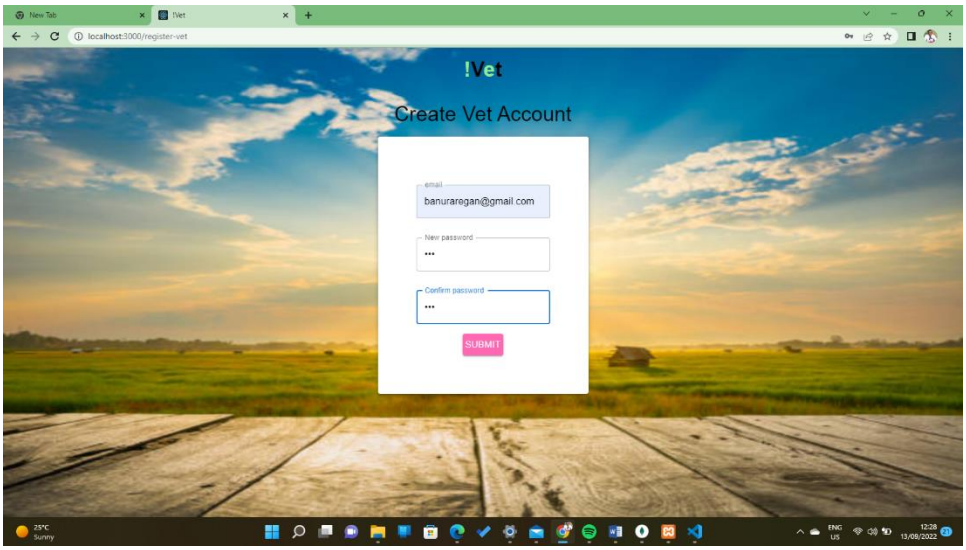
Create account (Farmer)



29 Account Creation Farmer

A user intending to join the system as a farmer creates an account from this page.

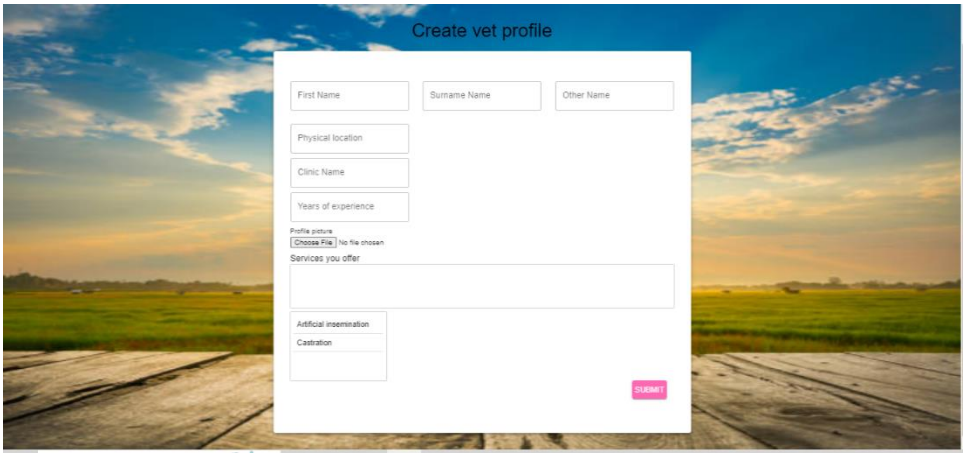
Create account (Vet)



30 Account Creation Veterinary

A user intending to join the system as a vet creates an account from this page.

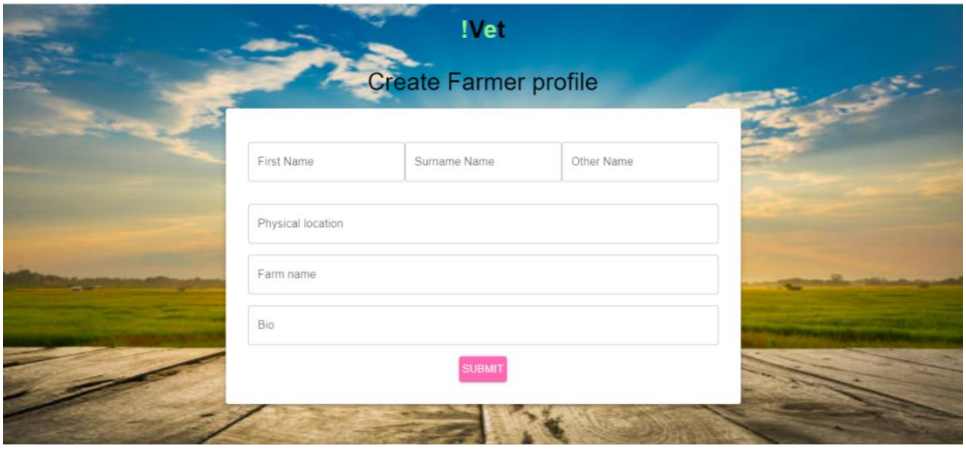
Create a profile (Vet)



***31** Profile Creation for Vets*

This the page where a vet creates their profile

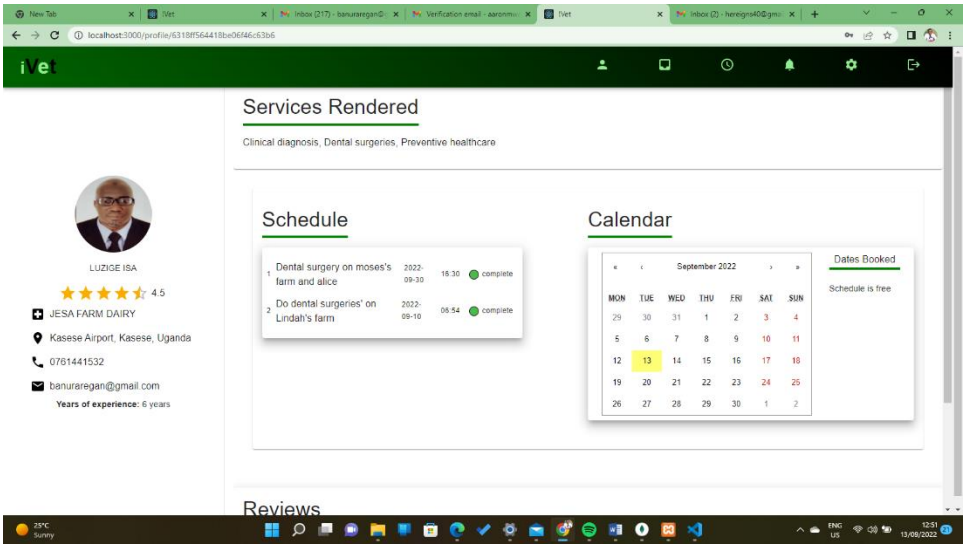
Create profile (Farmer)



32 Profile Creation for Farmers

This the page where a farmer creates their profile

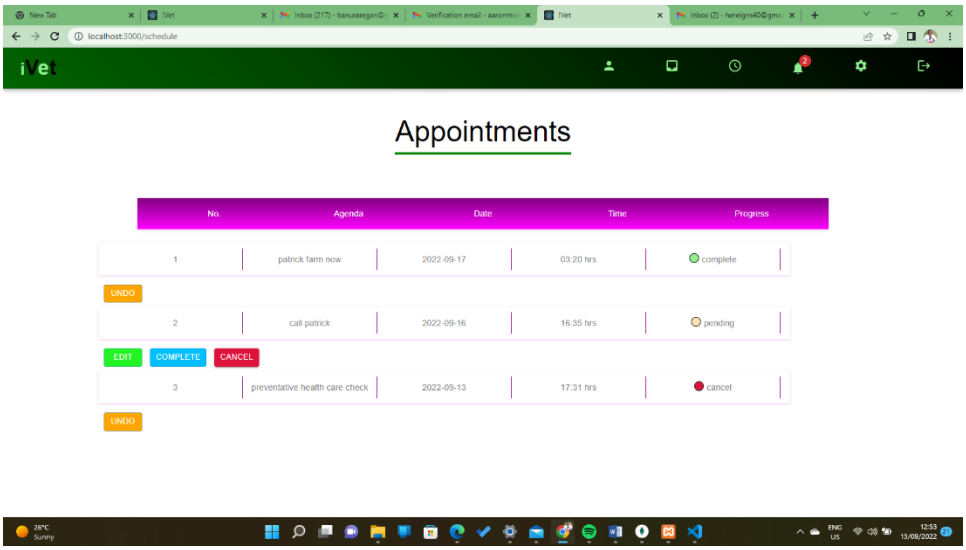
Vet profile



33 Vet Profile

This is the page which displays a vets profile

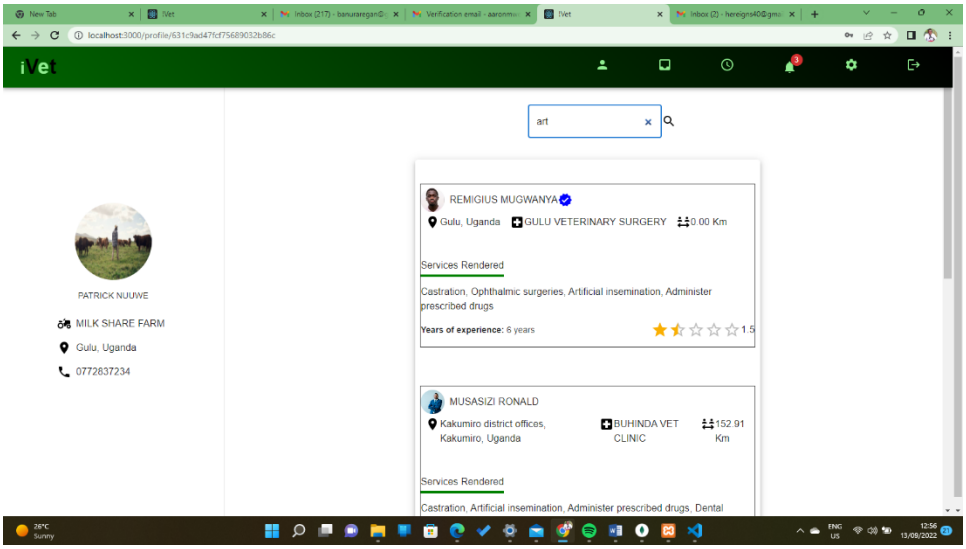
View schedules



34 Schedule Page

This is the page where logged in users can view schedules in which they are part of.

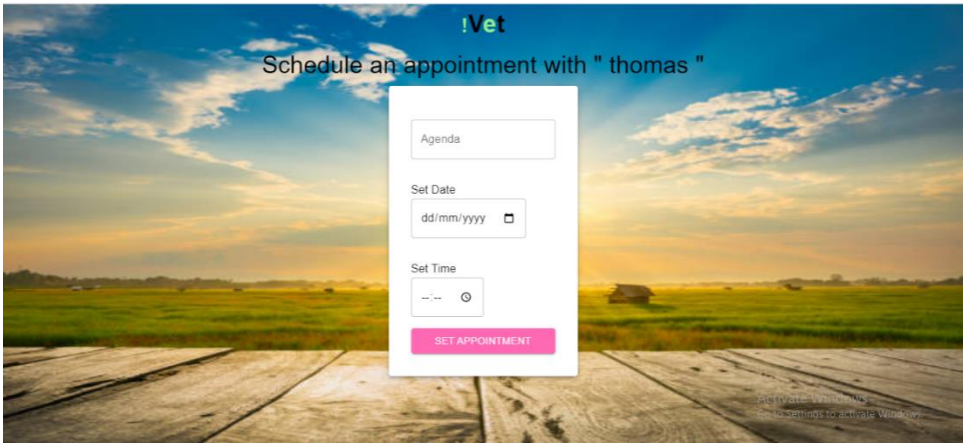
Search for services page



35 Search for services page

This is the page where farmers search for vets who can provide services, they are in need of acquiring

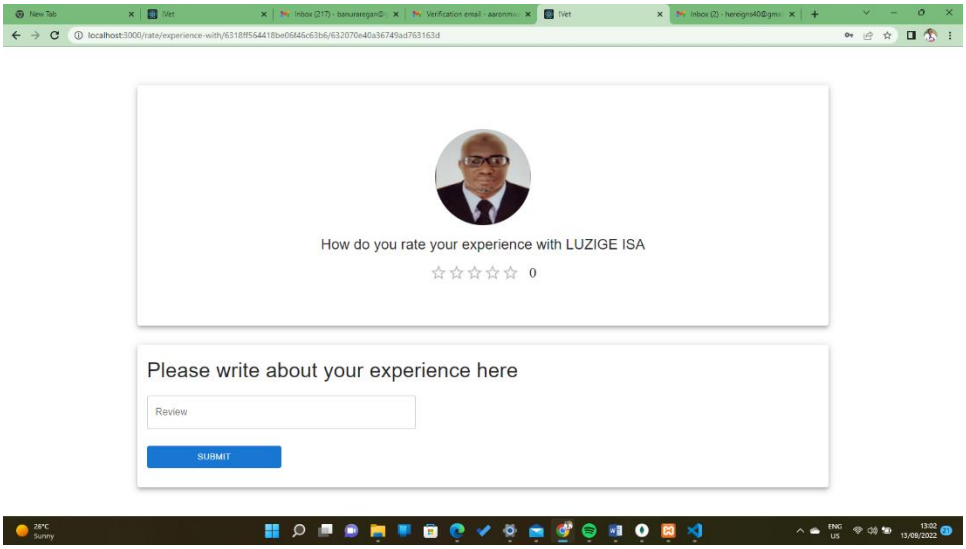
Create a Schedule



36 Schedule Creation

This is the page where a vet creates a schedule with a farmer

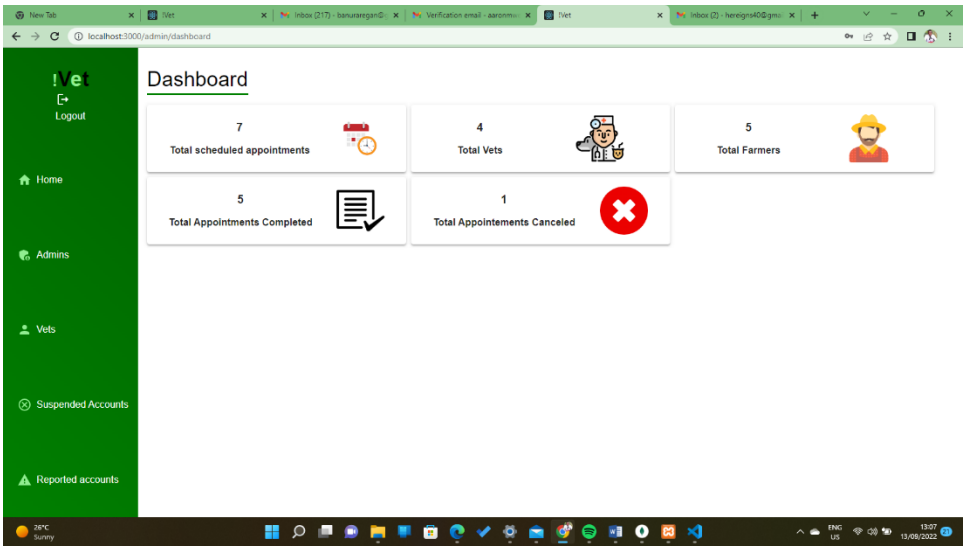
Review vet



37 Vet Review

This is a page where a farmer reviews their experience with a vet upon a schedule being marked as complete by a vet.

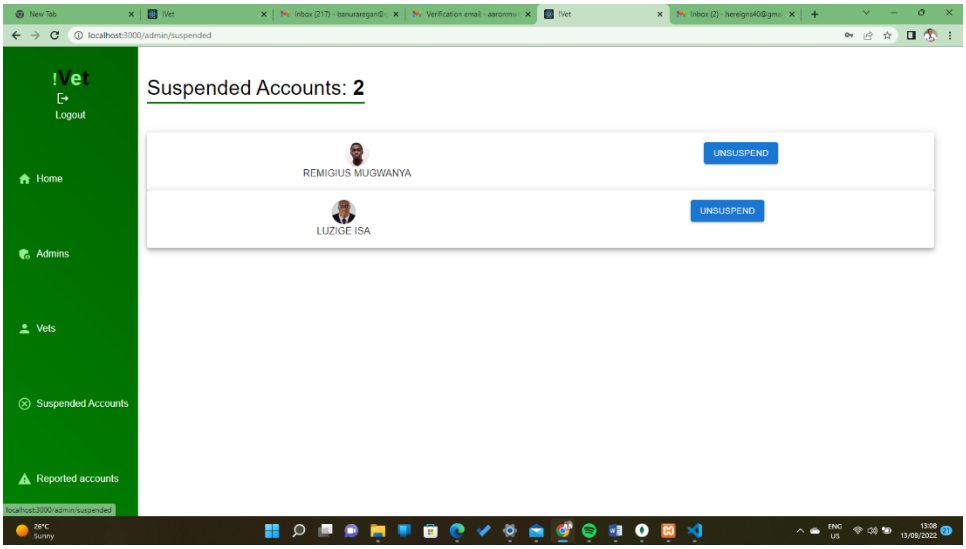
Admin dashboard



38 Admin Dashboard

This is the administrators view of the system from which they can generate system reports, suspend users and verify accounts.

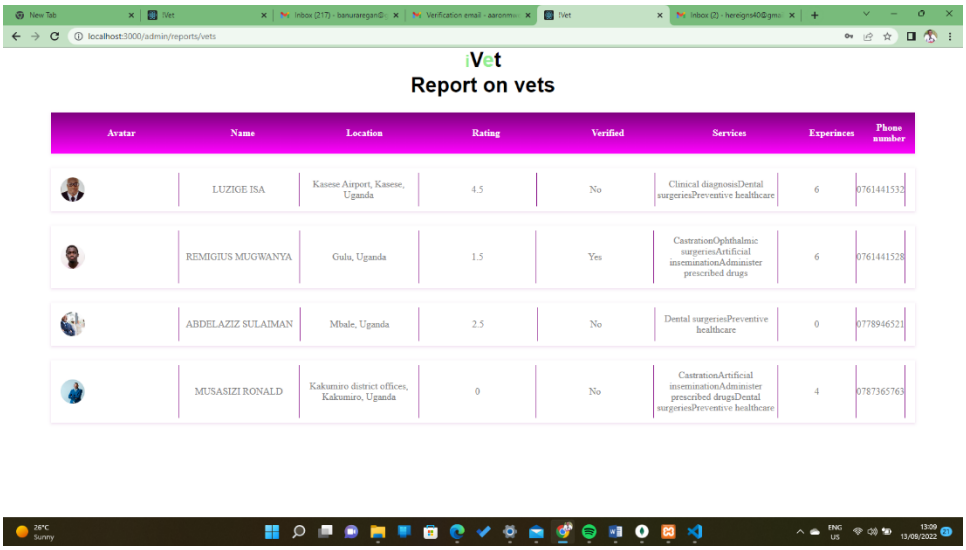
Suspended page



39 Suspended users' page

This the page from where a system administrator can view suspended users and even unsuspend them

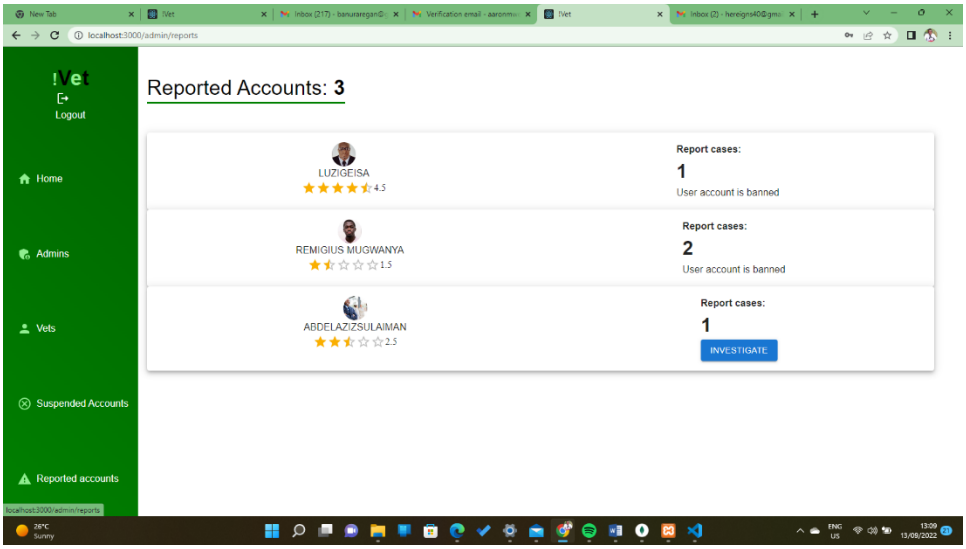
Generate reports



40 Generate reports

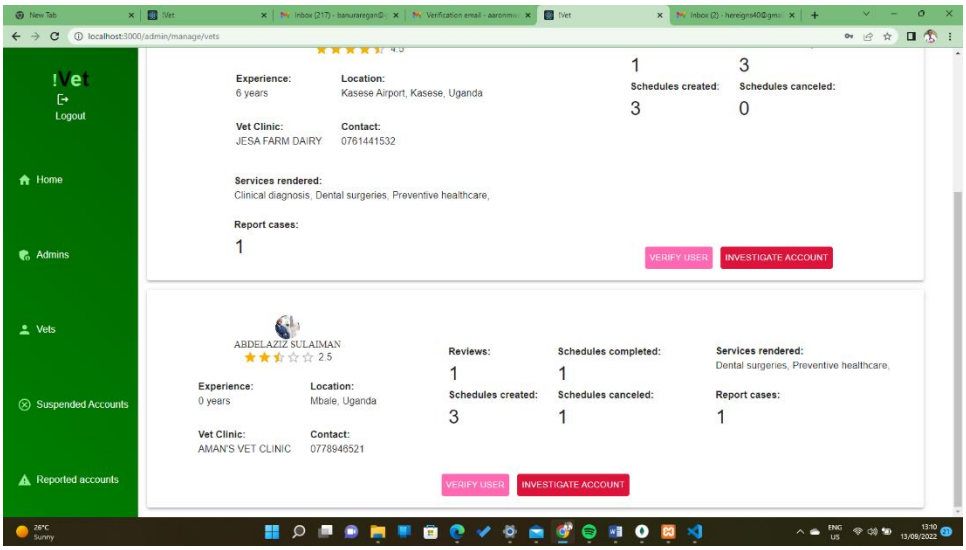
This is the page where a system administrator generates reports

Reported accounts



41 Reported Accounts page

Manage vets



42 Manage vets

On this page, the administrator is able to review the different veterinarians who are currently registered with the system.

5.3 Testing and Validation

5.3.1 System Testing

Individual system modules were subjected to unit testing as part of system testing, and they are functional. It was also able to aid in our comprehension of the functionality of code, which made it is reusable.

The system's components were put together to check and see if they fit together thanks to integration testing. the standards. A small number of users tested the system to make sure it delivered the desired results. Users interacted with the system and gave it ratings in accordance with their comments.

System testing represented the apex of this. We assembled a team to assess the various elements. The team evaluated the interactions between the various application components in the framework of the integrated, overall system.

Unit testing

Individual system modules were subjected to unit testing to make sure they functioned. To assess and confirm their functionality, many VAIS units were tested against the system's inputs.

Item Name	Test Description	Expected Results	Actual Results
Email	Left Blank	An error message that informs the user to fill in that field.	Error Message: Please fill out this field
	Type in wrong Email	Error message that tells the user that the email doesn't exist	Error message: User doesn't Exist
	Type in correct Email	No error is returned to the user	No error
Password	Left Blank	An error message that tells the user to fill in the field	Error Message: Please fill out this field
	Type In Incorrect Password	An error message that tells the user doesn't exist	Error message: User doesn't exist

18 *Login Page*

Item Name	Test Description	Expected Results	Actual Results
Email	Signing up with an Email used already.	An error message that tells the user that email already exists	User already exists
All fields	Any Item left blank	An error message that tells the user to fill out the fields	Error Message: Please fill out this field

19 *Sign up Button*

Item Name	Test Description	Expected Results	Actual Results
Submit	Category field not selected	The form reloads back on the user's profile.	The page loads without capturing
	Category Field Selected	No error message	Your report has been received and an investigation will be carried out immediately

20 Report User

5.3.2 Validation

Sample users were randomly selected to validate VAIS. Here, it was confirmed and assured that the system was carrying out its intended functions in a reliable and consistent manner. Users provided a report on the flaws in the system as it was intended. Based on the suggestions made by the sample users, the system was improved and redesigned.

CHAPTER SIX
DISCUSSION, RECOMMENDATIONS AND CONCLUSION

6.1 Introduction

The research study's final chapter is this one. It discusses judgments and restrictions of the system, issues that were observed, suggestions for additional investigation, and a conclusion for the investigation based on the results.

6.2 Discussion

This chapter serves as the research study's conclusion. It outlines the system's limitations and judgments, problems that were noticed, ideas for further research, and a conclusion for the investigation based on the findings. VAIS was assessed based on the predefined objectives and proposed functionalities that it could fulfil.

The main goal was to create a web-based system that enabled farmers have access to the best qualified and rated veterinarians closed to them so they could have access to the best medical care possible for their animals. VAIS is designed to be a user centred service to provide a platform for different farmers and veterinarians to safely communicate with each other freely.

The following software and tools were used to build the system: bootstrap, HTML, PHP, CSS, JavaScript, and MQL make up the framework. Consequently, open-source software technologies that are easy to use, the system is completely responsive and dynamic. The submission was benchmarking method, in which certain chunks of the application were executed and independently inspected, among other things, to identify and fix syntactic problems. Additionally, a number of parts were combined and evaluated as a whole, and for system validation, the system's prototype was developed.

As a result, while the outcomes of the study's evaluation indicated that the built system was capable of meeting its expected expectations, it also had a few shortcomings. These are covered in the following sections.

6.3 Limitations

Despite the fact that the researcher achieved the objectives of the project study, the project was faced with a number of limitations in this work. Due to the busy schedule, of the farmers at Kabanyoro were not able to keep their interview appointments with the researcher. The researcher was therefore not able to interview all the people who were relevant to the study. To implement the system, the research had to learn new technologies for mobile computing and this encroached on time for other activities in the project.

6.3 Recommendations

We made the following recommendations to enhance the system's functionality and use.

Sensitisation. The stakeholders must be educated and trained on how to use the system efficiently on their own as well as on its availability.

6.4 Conclusion

On a conclusive note, after proper evaluation and assessment of the developed system, it is evident that the system would provide better access to veterinary information and services to farmers and veterinarians to their patients in this case animals. It is therefore imperative that farmers and vets adopt the online allocation system to make sure they can easily communicate saving costs, time and vital resources.

We would want to thank everyone who has helped make our initiative a success this far.

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8.0 APPENDICES

Appendix A: Work Plan

Activity	Duration
Designing Data collection tools	7 days
Data Collection	3 weeks
Data analysis	1 week
System Design	2 weeks
System Development	10 weeks
Reporting	5 weeks

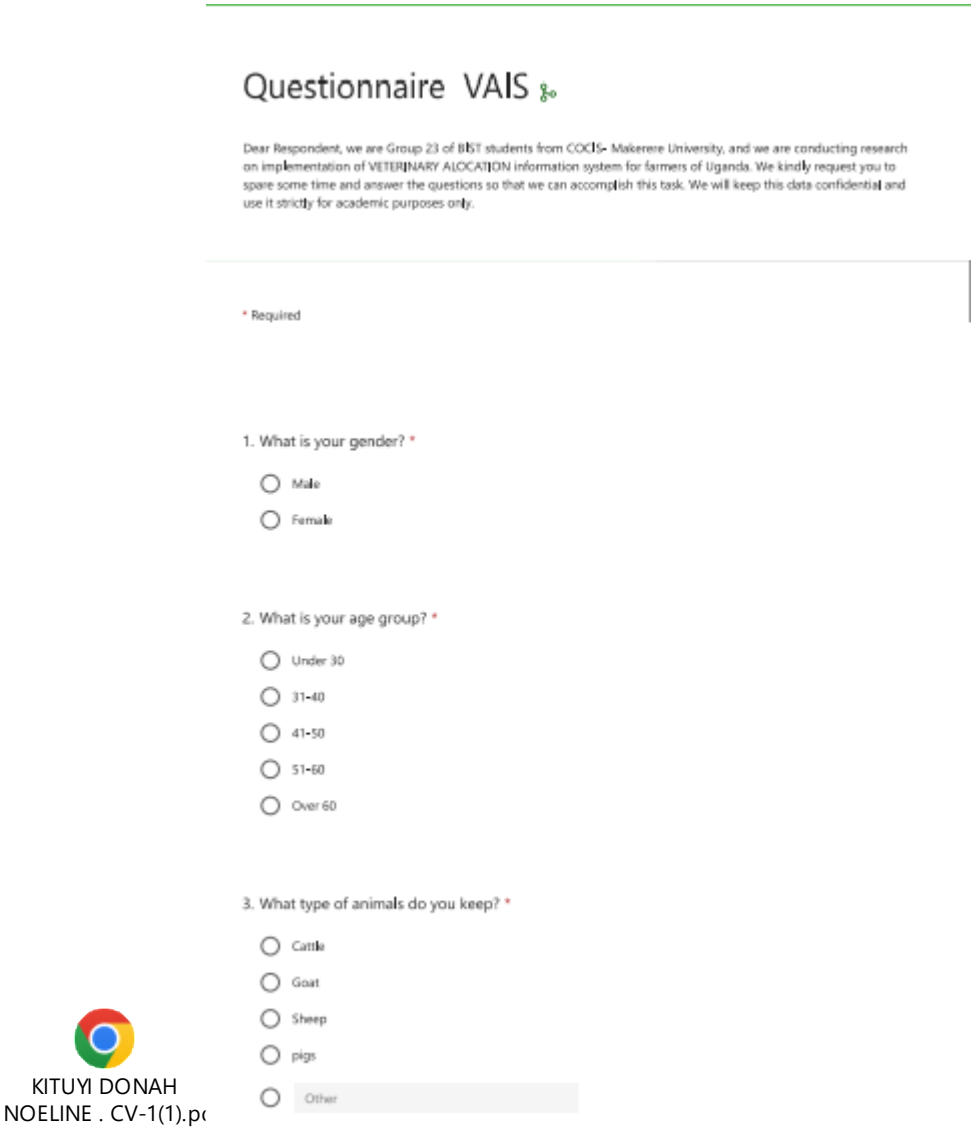
21 Work Plan

Appendix B: Budget

Item	Estimated Cost
Transport	30,000
Airtime and Data	35,000
Logistics	50,000
Printing	20,000
Miscellaneous	60,000
Total	195,000

22 Budget

Appendix C: Questionnaires



Questionnaire VAIS

Dear Respondent, we are Group 23 of BIST students from COCIS- Makerere University, and we are conducting research on implementation of VETERINARY ALOCATION information system for farmers of Uganda. We kindly request you to spare some time and answer the questions so that we can accomplish this task. We will keep this data confidential and use it strictly for academic purposes only.

* Required

1. What is your gender? *

- Male
- Female

2. What is your age group? *

- Under 30
- 31-40
- 41-50
- 51-60
- Over 60

3. What type of animals do you keep? *

- Cattle
- Goat
- Sheep
- pigs
- Other

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43 Questionnaire farmer page 1

4. Do you have a veterinary doctor in your area? *

- ◯ Yes
- ◯ No

5. How do you access them *

- ◯ Phone call
- ◯ SMS
- ◯ Physically going to them

6. How long have you been farming *

- ◯ 1-5 years
- ◯ 5-10 years
- ◯ 11-15 years
- ◯ 16-20 years
- ◯ more than 20 years

7. Do you have reliable internet access? *

- ◯ Yes
- ◯ No

8. Where is your farm located? *

9. What are the most common diseases affecting your animals? *

44 Questionnaire Page 2

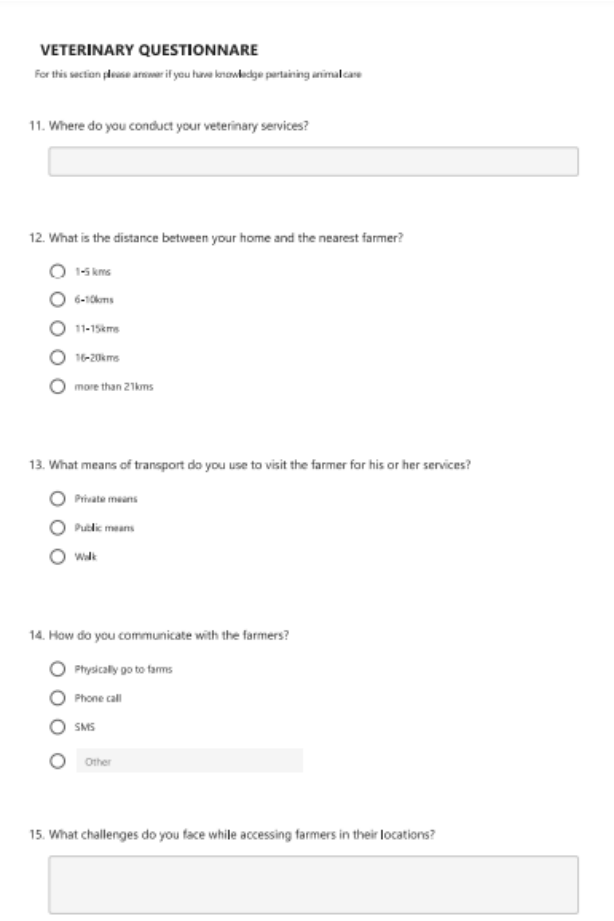
System Validation Questionnaire

Given Scale: Strongly Agree (1), Agree (2), Not Sure (3), Disagree (4) and Strongly Disagree (5); How likely are you to like the features of VAIS

10. Select your preference of a feature in our system

	1	2	3	4	5
Allow live chat between veterinary doctor and farmer	○	○	○	○	○
Authentication where the farmer is sent a verification code to verify his/her identity	○	○	○	○	○
View ratings of the veterinary doctor	○	○	○	○	○
Location of the nearest veterinary doctor in your area	○	○	○	○	○

45 Farmer system Validation



VETERINARY QUESTIONNARE

For this section please answer if you have knowledge pertaining animal care

11. Where do you conduct your veterinary services?

12. What is the distance between your home and the nearest farmer?

- 1-5 kms
- 6-10kms
- 11-15kms
- 16-20kms
- more than 21kms

13. What means of transport do you use to visit the farmer for his or her services?

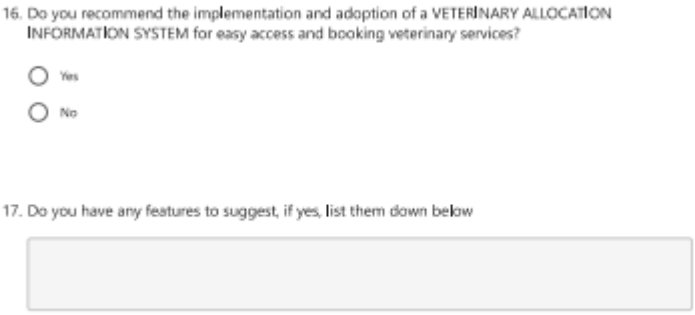
- Private means
- Public means
- Walk

14. How do you communicate with the farmers?

- Physically go to farms
- Phone call
- SMS
- Other

15. What challenges do you face while accessing farmers in their locations?

46 Veterinary Questionnaire



16. Do you recommend the implementation and adoption of a VETERINARY ALLOCATION INFORMATION SYSTEM for easy access and booking veterinary services?

- Yes
- No

17. Do you have any features to suggest, if yes, list them down below

47 Vet Questionnaire page 2

System Validation Questionnaire for Veterinarians

Given the Scale: Strongly Agree (1), Agree (2), Not Sure (3), Disagree (4) and Strongly Disagree (5); Give us your thoughts on the VAIS features

18. Please rate the VAIS features on the VET Side

	1	2	3	4	5
The veterinary allocation information system can enable many and additional users to use it.	○	○	○	○	○
The veterinary allocation information system cannot allow unauthorized users to use it.	○	○	○	○	○
The veterinary allocation information system can enable a vet doctors to conveniently schedule appointments with the farmers.	○	○	○	○	○
The veterinary allocation information system can enable system administrators to easily generate reports on the activities of system .	○	○	○	○	○

48 Feature Validation for Vets

Appendix D: Interview Guides

VETERINARY INTERVIEW GUIDE

Dear Respondent, we are Group 23 of BIST students from CoCIS - Makerere University, and we are conducting research on implementation of VETERINARY ALLOCATION INFORMATION SYSTEM for farmers of Uganda. We kindly request you to spare some time and answer the questions so that we can accomplish this task. We will keep this data confidential and use it strictly for academic purposes only.

1. How far is the nearest farm from your vet clinic?
2. Do you often do you get request for your services?
3. What method do you often use to contact your farmers?
4. Do you belong to the Uganda Veterinary Association?
5. What are the challenges faced during the appointment and delivery of your services?
6. How long does it take you to complete the whole process of administering your services?
7. How long does it take you to respond to an emergency?
8. Do you think veterinary allocation information system could ease the service accessibility and delivery processes?
9. According to your observation, do most of the farmers that you always chat/interact with own smart phones or computer?
10. The proposed prototype offers reports. What other features that could be included in future to improve the service delivery process?
11. The proposed prototype involves only three main stakeholders (veterinary Doctors, farmers and administrator modules). What other stakeholders do you think should be involved?
12. Any other comments, suggestion or challenge?

We are grateful for your assistance

FARMER INTERVIEW GUIDE

Dear Respondent, we are Group 23 of BIST students from COCIS- Makerere University, and we are conducting research on implementation of VETERINARY ALOCATION information system for farmers of Uganda. We kindly request you to spare some time and answer the questions so that we can accomplish this task. We will keep this data confidential and use it strictly for academic purposes only.

1. How far is the nearest office of the veterinary doctor from your home?
2. Do you often access veterinary services?
3. If yes, what method do you often use to access the veterinary services?
4. How do you always access the veterinary information and the services they offer?
5. How long does it take you to acquire these services?
6. Do you think a web application could ease the service accessibility?
7. According to your observation, do most of the citizens that you always chat/interact with own smart phones or computer?
8. If yes, do you and the majority of neighbors use android phones, windows phones, Nokia phones, blackberry, tablets or iPhones?
9. We are designing a web platform (a veterinary allocation information system) to enable farmers access the veterinary services; do you think this could improve the current way of accessing the appropriate veterinary services?
10. The proposed prototype offers reports. What other features that could be included in future to improve reporting and analysis process?
11. Any other comments, suggestion or challenge?

We are grateful for your assistance