FARMHUB-CONNECT; A WEB BASED SYSTEM FOR MARKETING AGRICULTURAL PRODUCTS

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A PROJECT REPORT SUBMITTED TO THE FACULTY OF ENGINEERING, DESIGN AND TECHNOLOGY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE / BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY OF UGANDA CHRISTIAN UNIVERSITY

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UGANDA CHRISTIAN UNIVERSITY

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DECLARATION

We, the undersigned, hereby attest to the originality and authenticity of this report, Farm Hub Connect. It stands as the culmination of our diligent research and analysis, undertaken with unwavering dedication. This report has not been presented elsewhere, nor has it been subjected to evaluation or recognition by any other agricultural entity or academic institution. Our collective efforts have been invested in crafting a comprehensive document that unveils insights and strategies to enhance connectivity and efficiency within the agricultural sector.

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PROJECT SUPERVISOR APPROVAL

I, Immaculate Kamusiime……. hereby approve and endorse the project report for FarmHub Connect. Based on the provided summary and achievements, I confirm that the project objectives have been met satisfactorily and align with the desired outcomes.

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ACKNOWLEDGEMENT

We would like to acknowledge the contributions of all the stakeholders involved in the conceptualization, development, and implementation of Farm Hub Connect. Special thanks to the farmers who have embraced this system as a means to showcase their produce and connect with consumers directly. Additionally, I express gratitude to the consumers whose support and feedback drive continuous improvement and innovation within the Farm Hub Connect. We are also grateful to the development team, whose dedication and expertise have brought the vision of Farm Hub Connect to life. Their commitment to creating a user-friendly and robust system has been instrumental in shaping the success of this endeavor. Furthermore, we extend appreciation to the agricultural communities, the university IT technical team and the teaching staff in general Mr. Solomon Opio, Ms. Mercy Nekesa and the heads of the computing department for walking with us through the journey, whose insights and guidance have contributed to the growth and sustainability of Farm Hub Connect.

Lastly, we would like to thank all the users of Farm Hub Connect for their trust and confidence in our system. Your participation and engagement are essential in realizing our shared goal of revolutionizing agricultural product marketing for the betterment of farmers and consumers alike.

ABSTRACT

Farm Hub Connect emerges as a pioneering solution in the realm of agricultural product marketing, bridging the gap between farmers and consumers in a seamless digital ecosystem. This innovative Farm Hub Connect system harnesses cutting-edge technology to streamline the distribution process, empowering farmers to showcase and sell their produce directly to a wide array of customers. At the heart of Farm Hub Connect lies its commitment to facilitating a direct and transparent connection between farmers and consumers. By eliminating intermediaries and traditional distribution channels, the system empowers farmers with greater control over pricing and marketing while simultaneously offering consumers access to fresher, higher quality products at competitive prices.

Farmers registering with Farm Hub Connect gain access to a user-friendly interface where they can create personalized profiles, showcase their products, and manage their inventory in real-time. Through intuitive tools and analytics, farmers can optimize their marketing efforts, track sales trends, and make data-driven decisions to maximize profitability.

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ABBREVIATIONS

CSS - Cascading Style Sheet

DFD - Data Flow Diagram

DML - Data modeling language

ERD - Entity relationship diagram

HTML - Hyper Text Markup Language

NGO's - Nongovernmental Organization

CHAPTER: ONE

1.1 Introduction

In this era where digital transformation and technological advancement is re-shaping the ways of operation of the industries inclusive of agriculture. The emergence of electronic systems has revolutionized the way agricultural products are marketed and sold. The advancement in technology has seen the transformation of marketing from the more traditional forms, to digital marketing where communication of the marketing content is delivered through digital mediums. Since the beginning of the 21st century, businesses have transformed the way of engaging its customers to enable them to get closer to what the customers need (Schutte, 2022). In marketing, the transformation to digital marketing has enabled business to deliver products or services quickly to the customer and get customer feedback immediately.

This report explores into the potential and prospects of farm hub Connect web system tailored specifically for advertising agricultural products. It also outlines challenges and opportunities that are associated with the development and implementation of farm hub connect offering strategic recommendations for maximizing its impact and ensuring its successful integration into the agricultural sector. Among the problem's farmers face to market their products (Nugroho, 2018) include;

i. Lack of market information network
ii. Long marketing chain
iii. Availability of goods that are seasonal

To reduce some of these problems, the development of Farm Hub Connect Web system that provides information as well as a marketing place for agricultural products will enable farmers and consumers encounter some of these challenges.

1.2 Background of the study

The agriculture sector plays a pivotal role in the global economy, providing food security and livelihoods for millions of people. However, traditional agricultural marketing practices are often constrained by geographical limitations, lack of market information, and intermediary exploitation.

Moreover, small-scale farmers, who comprise a significant portion of the agricultural workforce, face challenges in accessing wider markets and obtaining fair prices for their produce.

The advent of digital technologies has revolutionized various sectors, including agriculture. In recent years, there has been a growing trend towards utilizing online systems for buying and selling agricultural products. These systems offer numerous benefits such as increased market reach, accessibility, and efficiency. This background study aims to explore the rationale behind developing Farm Hub Connect system specifically tailored for advertising agricultural products.

In this context, the development of Farm Hub Connect system for advertising agricultural products presents a compelling solution. Such a system would include digital technologies to connect farmers directly with consumers, retailers, and other stakeholders in the agricultural value chain. By bypassing traditional intermediaries, farmers can gain better control over pricing, reduce post-harvest losses, and access a broader customer base since the main factor of the marketing success is market analysis that is dependent on market information's reality, Objectivity and inclusivity (Lashgarara, Mohammadi, Najafabadi, 2011).

1.3 Problem statement

According to Agrinet, 65% of Ugandan commercial farmers face a problem of lack of a sustainable market for their produce, mainly due to overproduction of the farmers produce that floods the market. This eventually leads to product loss and less profits

1.4 Objectives

The key objective of farm hub connect is Designing a web based system that connects farmers directly with consumers and retailers through an easy access online market enhancing farmer's market base and profit maximization. Other objectives include;

1) To Facilitate Direct Farmer-Consumer Interaction: Farm Hub Connect system will enable farmers to showcase their products directly to consumers, fostering transparency and trust in agricultural transactions.
2) To Enhance Market Access for Small-Scale Farmers: By providing an online system, small-scale farmers can overcome geographical barriers and reach a wider audience, including urban consumers and institutional buyers.

3) To Promote Fair Pricing Mechanisms: The system will incorporate features such as real-time pricing information, bidding mechanisms, and negotiation tools to ensure fair and transparent pricing for agricultural products.
4) Foster Sustainability and Traceability: Farm Hub Connect system can integrate features for promoting sustainable farming practices and providing traceability information to consumers, enhancing product quality and safety.

1.5 Scope of the study

Farm hub connect is comprised of aspects that are crucial for its successful implementation and operations. It involves a comprehensive market research to understand the dynamics of the agricultural sector including consumer preferences and existing online systems such ifarm , Isoko and iharvest . This enables farm hub to identify market gaps and opportunities to effectively position itself to attract both farmers and consumers.

1.5.1Technical scope

It includes the development of a user-friendly interface that caters to the diverse needs of farmers, buyers. This involves the designing of such as product listings, real time communication channels, market insights to ensure seamless transactions and user satisfaction, sms based tools and partnering with various farmer's corporations to reach farmers that will enable them get access to use of the system with the support from the technical team.

Farm Hub also delves into the integration of advanced technologies such as data analytics, and artificial intelligence (AI) to enhance the efficiency, transparency, and traceability of the operations on the system. These technologies can help in optimizing resource allocation, mitigating risks, and building trust among users by providing verifiable information about the origin and quality of agricultural products.

Further Farm Hub Connect employs data analytics tools to analyze customer behavior search behavior, farmer and consumer collaboration to track the performance and impact of the system.

Regular backups and security protocols are in place to protect customer data and prevent unauthorized access.

1.5.2 Geographical scope

Farm Hub Connect specifically targeted Ugandan market encompassing of the East, West, North and Central regions, starting with the central districts observed with stable network connections and accessibility as it expands and penetrates into remote districts of the country with the extension to network infrastructure in these areas. It focuses on connecting consumers with local farmers and producers, emphasizing the importance of supporting local agriculture.

1.5.3 Time scope

Farm Hub Connect platform operates 24/7, allowing customers and farmers view product listings, contact farmers, uploading and managing products respectively at their convenience. In addition, the platform provides real-time updates on product availability, pricing, ensuring that customers have access to the latest information.

Lastly, the scope encompasses ongoing monitoring, evaluation, and adaptation of Farm Hub Connect to evolving market trends, regulatory requirements, and user feedback. This iterative process ensures the system remains relevant, competitive, and aligned with the needs of its users, thereby fostering long-term sustainability and growth in the agricultural marketplace.

1.6 Feasibility and relevance of the project

a) **Market Demand**: Farm Hub Connect addresses the demand from both farmers and buyers who seek efficient and transparent ways to connect and conduct business.
b) **Technological Infrastructure**: The system utilizes modern web technology, making it accessible to farmers and buyers with internet access and basic computer literacy.
c) **User-Friendly Interface**: Farm Hub Connect offers an intuitive interface for farmers to list their products and Buyers can easily search for products, and communicate with farmers.
d) **Security and Trust**: Farm Hub Connect prioritizes security and data privacy, ensuring that sensitive information is protected.
e) **Value Proposition:** Farm Hub Connect provides value to both farmers and buyers by offering a direct and transparent marketplace, enabling farmers to access new markets and buyers to source fresh, locally sourced products.
f) **Competition:** While there are other systems facilitating similar connections between farmers and buyers, Farm hub connect focus on ease of access to the system by the the stakeholders, widening market and profit maximization.

CHAPTER TWO

2.1 Literature review

As technology continues to change the way businesses operate globally, marketing is not exempted from the technology shift and driven by more consumers embracing digital technology. From the late 1990s (Schutte, 2022) marketing entered a paradigm shift from the traditional methods of marketing products and services through printed media and billboards to digital technology. This has led to the development of digital marketing. What attracts a consumer towards a brand is no longer only the product or service that is offered, but rather a combination of factors. One of the most important factors for agricultural development is marketing of agricultural products. Information, as the most important facilitator and main core of the marketing system, has an effective role in increasing the marketing system efficiency. Today, farmers need access to updated and exact information in order to improve the quality and quantity of the agricultural products marketing. (Lashgarara, Mohammadi, Najafabadi, 2011) Information and communication technology (ICT), by accelerating the information delivery, have a key role in agricultural products marketing.

The agricultural sector is undergoing a transformation with the integration of digital systems, which offers promising solutions to traditional challenges faced by farmers. The adoption of E-market systems has revolutionized consumer markets, and their application in agriculture is still evolving (Jinenis et al., 2016). However, recent research indicates that electronic market systems hold significant potential to benefit farmers by enhancing market access through advertising their products online (Septiani, Utami, 2021) , improving efficiency, and facilitating knowledge sharing.

a. Event management

One key aspect of digital marketing in agriculture is event management, which encompasses the process of connecting farmers directly to consumers. By bypassing traditional middlemen, farmers can capture a larger share of profits (KOÇYİĞİT, Demiryürek, 2022). These systems facilitate transactions, enabling farmers to showcase their products to a wider audience and engage with consumers in real-time.

Virtual Marketplaces: Farm hub connect serves as virtual marketplaces where farmers can create profiles, list their products, and interact with potential buyers. This typically offer features such as

product catalogs, search filters, and messaging systems to facilitate communication between farmers and consumers.

Product Showcasing: Farmers have the opportunity to showcase their products through various multimedia formats, including images, and product descriptions. High-quality visuals and detailed descriptions help consumers make informed purchasing decisions and build trust in the quality of the products offered.

Marketing and Promotion. Marketing of products and services to prospective customers have evolved overtime as a result of the advent of the internet. Both online and offline enterprises use the internet to promote their products or services in forms such as text ads, pop up ads, banner ads and paid search placements (Amusat, Oyekumle, 2023). Farm hub connect incorporates these marketing and promotional features to help farmers attract customers.

Feedback and Reviews: Feedback and review mechanisms play a crucial role in event management on farm hub connect. Consumers can provide feedback on their purchasing experience and leave reviews of the products they've bought, which helps build trust and credibility for farmers and encourages future sales.

Analytics and Insights: Farm hub connect provides farmers with valuable analytics and insights in the market, customer behavior, and market trends. This data allows farmers to make data-driven decisions, optimize their product offerings, and refine their marketing strategies to better meet customer needs and preferences.

Farm hub connect involves in creating an engaging and interactive online environment where farmers can showcase their products, interact with customers, and facilitate transactions in a seamless and efficient manner. By embracing the power of technology and direct farmer-consumer sales channels, this empowers farmers to capture a larger share of profits and establish direct connections with their customers.

b. Usability features

(KOÇYİĞİT, Demiryürek, 2022) Emphasize the importance of user-friendly interfaces and intuitive navigation systems. These features contribute to the seamless integration of farmers into

the digital marketplace, ensuring smooth transactions and customer satisfaction. Some key features that make up farm hub connect include;

1. **User-Friendly Interface**: A user-friendly interface is crucial for farmers to navigate farm hub connect effortlessly. This includes clear and intuitive layout designs, easily recognizable icons and buttons, and consistent design elements throughout the system.

2. **Intuitive Navigation Systems:** Intuitive navigation systems help farmers quickly find the information or features they need within farm hub connect. This may include well-organized menus and search bars.

3. **Responsive Design:** This ensures that farm hub connect is accessible and functional across various devices and screen sizes, including desktops, laptops, tablets, and smartphones. Farmers should be able to use the system seamlessly regardless of the device they are using, with content and layout adjusting dynamically to fit the screen size and resolution.

4. **Streamlined Registration and Login Process:** The registration and login process are made simple and streamlined to encourage farmers to create accounts and access the system easily.

5. **Help and Support Resources:** Help and support resources, such as FAQs, tutorials, and user guides, provide farmers with assistance and guidance on using the farm hub connect effectively. These resources are easily accessible from within the system and offer clear and concise instructions to help farmers troubleshoot issues, learn about system features, and make the most of their experience.

a) Benefits of the web system

The Farm Hub Connect system offers a number of benefits to various stakeholders involved in the agricultural market. These include;

i. Enhanced Market Access: Farmers gain access to a wider market beyond their local vicinity. Through farm hub connect, they can showcase their products to a larger audience of potential buyers, including wholesalers, retailers, and individual consumers.

ii. Increased Efficiency: The system streamlines the buying and selling process, reducing the time and effort required for transactions. Farmers can upload product listings easily, while buyers can browse through a diverse range of agricultural products conveniently from their devices.

iii. Transparent Transactions: Farm Hub Connect promotes transparency in agricultural trade by providing detailed information about product quality, pricing, and origin. This transparency fosters trust among buyers, leading to more reliable transactions and reducing the likelihood of disputes.

iv. Fair Pricing: By eliminating intermediaries and enabling direct transactions between farmers and buyers, the system helps ensure that farmers receive fair prices for their produce. This fair pricing mechanism contributes to the economic empowerment of farmers and encourages sustainable agricultural practices.

v. Access to Information and Resources: The system serves as a centralized system for agricultural information, providing farmers with access to resources such as weather forecasts, market trends, and farming best practices. This knowledge empowers farmers to make informed decisions and improve their agricultural productivity.

vi. Community Building: Farm Hub Connect fosters a sense of community among farmers, buyers, and other stakeholders in the agricultural sector. Through features such as forums, discussion boards, and collaboration tools through our social media running platforms like twitter, Instagram and WhatsApp channels at Farm Hub Connect, users can share knowledge, experiences, and insights, leading to mutual support and collaboration.

2.2 Research gap

Despite the potential benefits, several challenges need to be addressed for the adoption of farm hub connect by farmers. Limited digital literacy and internet access in rural areas can be a barrier to participation (Jinenis et al., 2016). Other challenges include;

Limited Digital Literacy and Internet Access: In many rural areas, farmers may lack the necessary digital literacy skills to effectively use farm hub connect. They are unfamiliar with technology and digital marketing strategies. Moreover, inadequate internet infrastructure in rural

regions further worsens this challenge, making it difficult for farmers to access and utilize farm hub connect effectively.

Building Trust with Consumers: Establishing trust with consumers is crucial for the success of farm hub connect in the communities. Farmers need to implement robust quality control measures, provide accurate product descriptions, and ensure transparent communication with consumers to build trust and confidence in their products.

Infrastructure Limitations: Infrastructure limitations, such as poor road networks, unreliable electricity supply, and inadequate storage facilities, can hinder the adoption of farm hub connect by farmers. Without proper infrastructure in place, farmers may face challenges in transporting goods, storing perishable items, and fulfilling orders efficiently, thereby limiting their ability to participate meet customer needs. This encompasses long distances between the subjects of the process, insufficient development of the transport network, lack of distribution centers and their weak technical equipment, insufficiently. Also, for a more effective organization of product distribution channels, it is necessary to actively implement modern digital marketing technologies in the process of product distribution, which will help to form a customer base and develop long-term communications with potential customers (Nezamova, Olentsova, 2021)

Data Security and Privacy: Farm hub connect involve the exchange of sensitive information, including personal data. Ensuring the security and privacy of this data is essential to protect farmers and consumers from cyber threats, fraud, and identity theft.

Addressing these challenges will require concerted efforts from various stakeholders, including government agencies, technology providers, financial institutions, and community organizations. By implementing targeted interventions to improve digital literacy, infrastructure development, regulatory compliance, and cultural awareness, farm hub connect can become more accessible and inclusive for farmers, unlocking new opportunities for economic growth and sustainable development in rural communities.

2.3 Designing an effective system

Designing an effective system for agriculture required careful consideration of various factors, including digital literacy and trust-building. Limited internet access and digital literacy in rural areas

pose challenges to widespread adoption (Jinenis et al., 2016). Additionally, building trust with consumers requires robust quality control measures and transparent product descriptions (A Study on E Commerce Agriculture, 2023

Digital Literacy and Accessibility: One of the primary challenges in designing an effective system for advertising and showcasing agricultural products is ensuring accessibility and usability for farmers with varying levels of digital literacy. Many farmers in rural areas have limited experience with technology and require user-friendly interfaces, intuitive navigation systems, and clear instructions to use farm hub connect effectively. These Design considerations includes minimizing technical complexity, providing comprehensive onboarding and training resources, and offering support channels for users who need assistance.

Internet Access and Connectivity: Limited internet access and connectivity in rural areas poses a significant barrier to the adoption of farm hub connect by farmers. This involves optimizing farm hub connect for use on mobile devices, implementing offline functionality where possible, and incorporating technologies such as progressive web apps (PWAs) to improve performance and accessibility in low-bandwidth environments.

Trust-Building and Transparency: Building trust with consumers is essential for the success of farm hub connect. Farmers need to establish credibility and transparency in their online presence by providing accurate product descriptions, high-quality images, and detailed information about their farming practices.

Security and Data Privacy: Security and data privacy are paramount concerns in farm hub connect, particularly when handling sensitive information such as personal data.

Localization and Cultural Sensitivity: Agriculture is deeply rooted in local cultures and traditions, and designing an effective farm hub connect system required sensitivity to the cultural preferences and practices of farmers and consumers in different regions. Localization efforts included adapting the currency, and content to suit the preferences of local users, as well as incorporating features that cater to specific agricultural practices and market dynamics whereby Understanding the unique needs and preferences of the target audience is key to designing a system that resonates with users and fosters adoption and engagement.

CHAPTER: THREE

3.1 Methodology

According to the Oxford dictionary, methodology is defined as a system of methods used to investigate the concept or theories in a particular area of study or activity. In this chapter, we describe the research methodology used for this project; explain how to design the proposed application, elaborate the procedures and process used in designing the application and data collection as well as provide methods on how to analyze the collected data

3.2 Research methodology

Based on Clarke, R.J (2005), he explains that there are four (4) main ideas when constructing research; exploring ideas, enquiring an issue, solving a problem and making arguments that induces us to turn into external help. He also described that in doing research, there are two major research approaches; qualitative and quantitative methods.

Hofmann explains that qualitative approach is a constructive, naturalistic and interpretive perspective which is to use to gain insight into a problem, issue or theory. It is also used to study social and cultural phenomenon which includes structured and unstructured interviews, focus groups, case study, and diary accounts and so on. For research and information gathering, author uses methods like interviewing experts to get their understanding and requirements and comparative studies on previous work of other authors in validating the feasibility and reliability of this project.

Furthermore, a quantitative approach is traditional, experimental and empirical advances to study natural phenomenon. He explains that quantitative methods are including surveys, laboratory experiments, econometrics and numerical methods like mathematical modeling. In regard to farm hub connect a combination of qualitative and quantitative research methodologies were more suitable. These included interviews, user testing, surveys using google forms respectively.

Figure 1: One of the farmers interviewed

3.3 Development methodology

In software engineering, development methodology is known as software development life cycle (SDLC). Based on McConnell, SDLC have few stages to improve better planning and management in developing the software. It is also considered as a subdivision of systems development life cycle. There are common development methodology approaches such as waterfall, prototyping, iterative and incremental development, spiral development, rapid application development, extreme programming and agile methodology.

For farm hub connect, we decided to use agile development methodologies such as Kanban to emphasize iterative development, continuous feedback and adaptability to changing requirements. This allows frequent releases of usable features which can be valuable for testing and gathering user feedback in the development process. In addition, agile methodologies promote collaboration

among cross functional items which is essential for integrating various aspects of marketing and user experience design hence the success of farm hub connect

3.4 Project phases

Table 1: Project phases

Phase	**Description**
Project initiation	Defining project objectives, stakeholders and scope
Project planning	Developing a detailed project plan including timelines, resources and risk management
Requirement gathering	Gathering and documenting requirements from stakeholders (Farmers and buyers)
Design	Designing the system architecture, UI/UX and data base schema
Development	Implementing the backend functionalities and frontend components
Testing	Conducting unit and usability testing
Deployment	Deploying the system to the production environment
Training	Training farmers and sample population as the potential buyers on the system usage
Maintenance	Providing ongoing support, maintenance and integrations

3.5 Key milestones

Table 2: Project milestones

Milestone	Description	Timeline
Project kickoff	Initiating the project, defining goals and stakeholders.	Week 1
Stakeholder feedback	Gathering requirements from farmers and potential buyers	Week 2
UI/UX design	Creating wireframes, prototypes and designing user interface	Week 3
Data base design	Designing data base schema and relationships	Week 4
Backend development	Implementing the backend functionalities	Week 6-7
Front-end development	Developing user interfaces and pages	Week 8-9
Testing	Testing functionality and usability of the system	Week 10
Deployment	Deploying the system to the production environment using vercel	Week 11
Feedback	Allowing users to leave reviews using google forms	Week 12

3.6 System design and development

In today's rapidly evolving technological landscape, the effective design and development of the system play a pivotal role in shaping the success of the system Whether it's crafting robust software solutions, architecting scalable infrastructures, or engineering innovative products, the process of system design and development forms the cornerstone of modern-day innovation and competitiveness. This report aims to delve into the fundamental principles, methodologies, and best practices essential for navigating the intricacies of system design and development, offering insights into how these processes can be utilized to drive efficiency, resilience, and excellence in today's dynamic agricultural business environment.

3.6.1 System architecture design

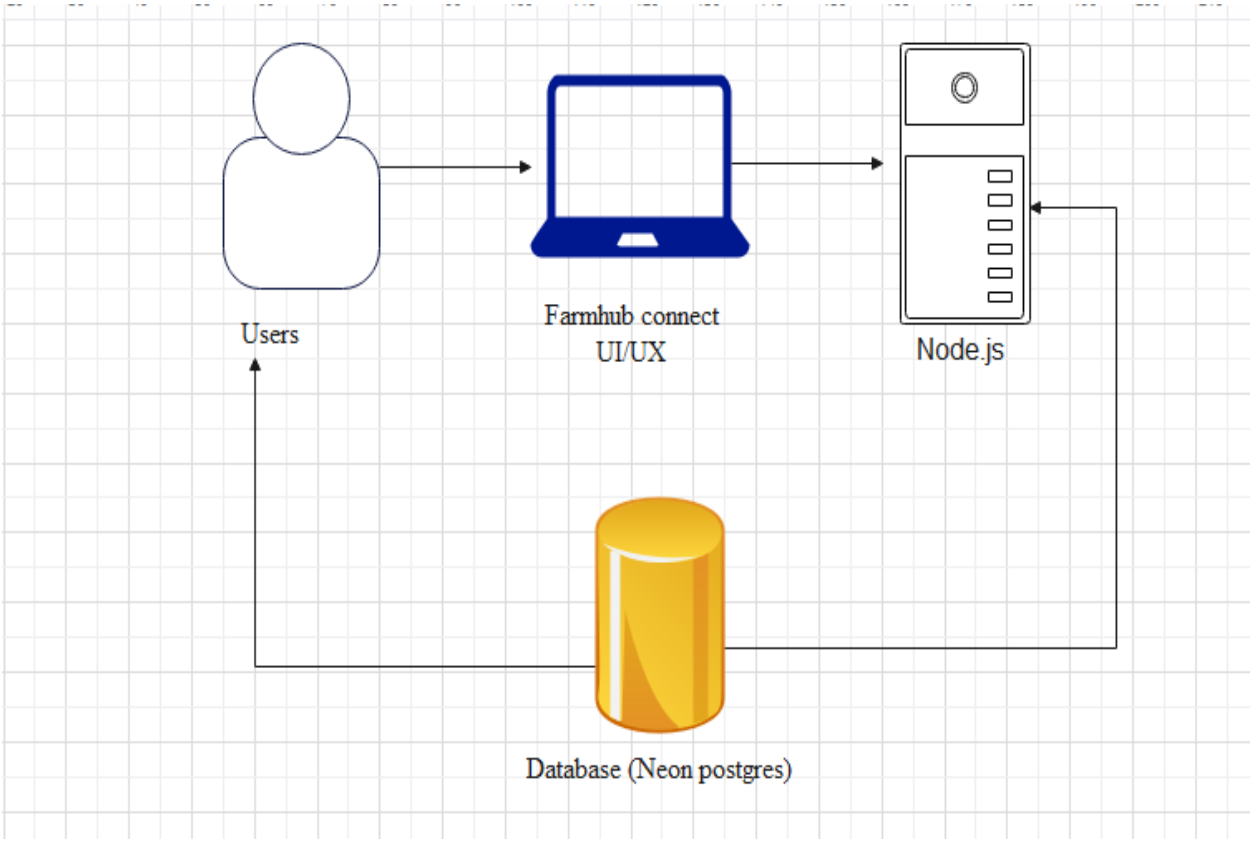

Figure 2: The system architecture

3.6.2 Component breakdown

1. User interface

- ✓ Homepage: The home page features the products, how to use the system and navigation links.
- ✓ Product listings. The grid view of displaying agricultural products with images and product descriptions.
- ✓ Search bar. This allows users quickly to search for products of their choice.

2. Backend Components

- ✓ Authentication System: Handles user registration, login, and authentication processes securely.
- ✓ Product Management: CRUD operations for managing agricultural products, including adding, editing, and deleting products.
- ✓ Search and Filtering: Implementing algorithms for efficient product search and filtering based on user preferences.
- ✓ Database Management: Designing and maintaining databases to store product information, user data, and order details.
- ✓ Server-Side Validation: Validating user inputs, enforcing business rules, and ensuring data consistency.

3. Infrastructure Components

- ✓ Web Server: Hosting the web application and serving web pages to users.
- ✓ Database Server: Storing and managing the application's data.

4. Third-Party Integrations

- ✓ Social Media Integration: Allowing users to share products on social media systems and leveraging social media for marketing.
- ✓ Analytics and Tracking: Integrating tools like Google Analytics to track user behavior, conversions, and other metrics.

3.6.3 Data flow diagram

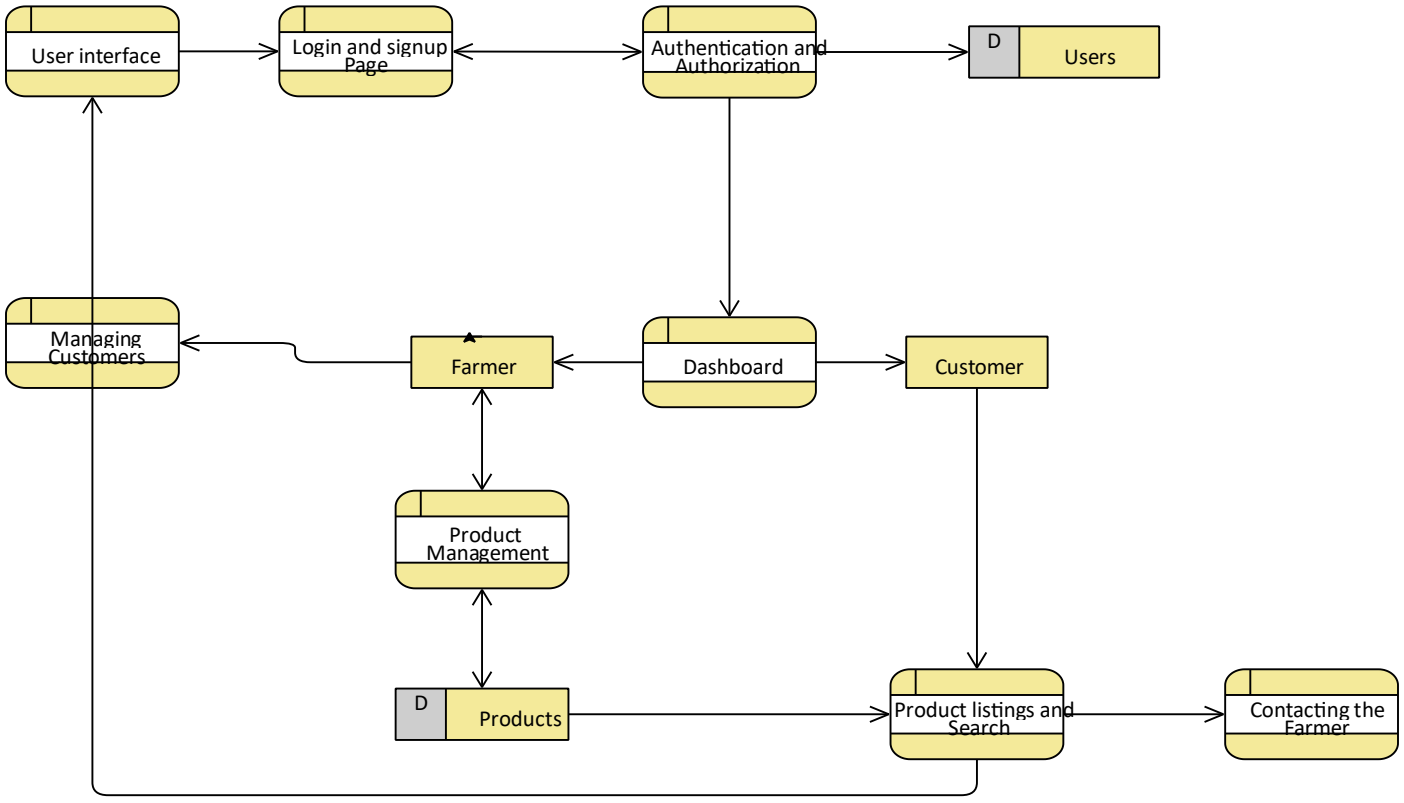

Figure 3: Data flow diagram

3.6.4 Entity relationship Diagram (ERD)

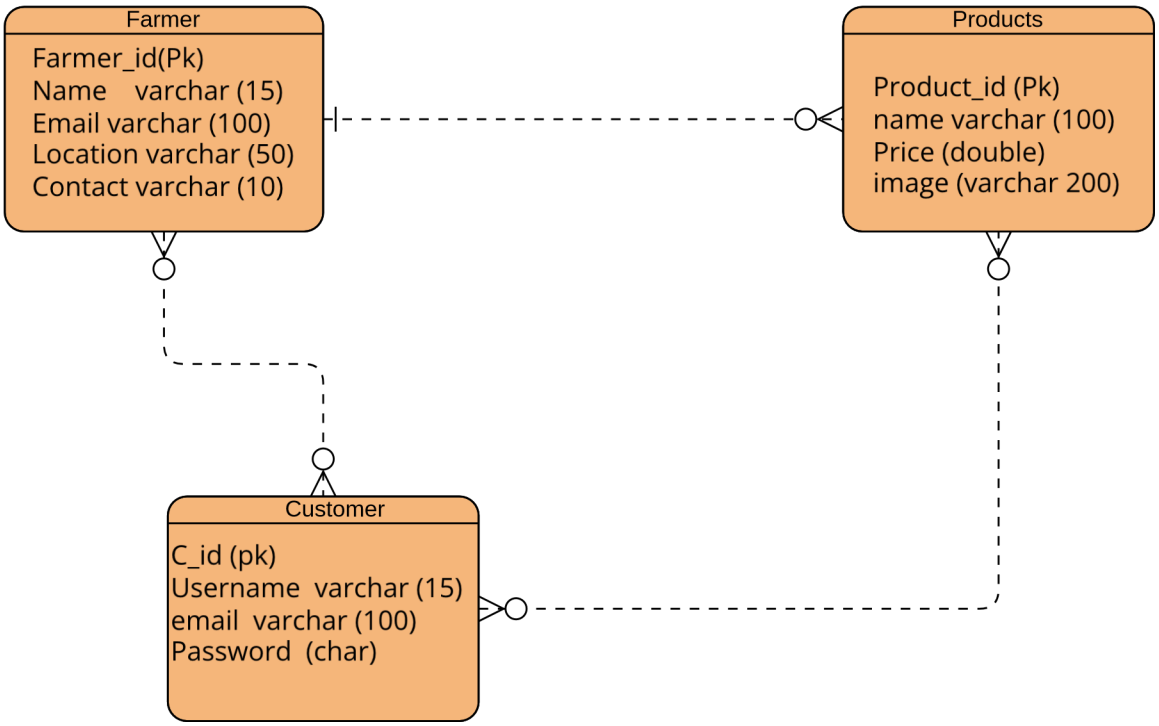

Figure 4: The Entity relationship diagram for Farm hub Connect

The ERD diagram above lays out the relationship between the three entities engaged in the use of the system for effectiveness and meeting user needs.

1. A Farmer can upload more products on the system in which the relationship between the farmer and the products is one to many.
2. A customer can view more than one product and on the other hand a product can be viewed by many customers which implies a many to many relationships.
3. One customer can contact many farmers which is implies a one to many relationships as represented respectively in the ERD diagram above.

3.6.5 User interface overview

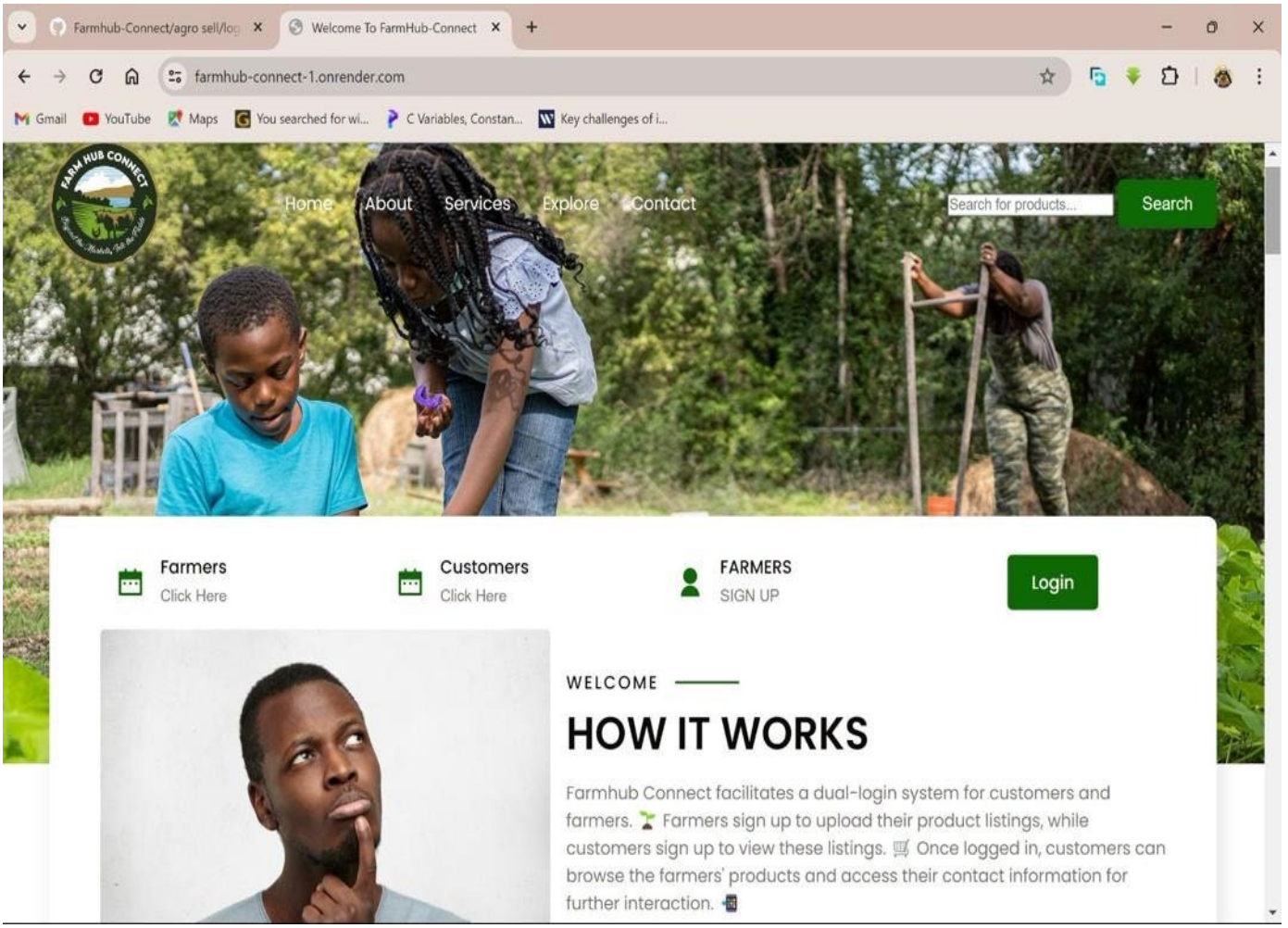

Figure 5: The system Home page

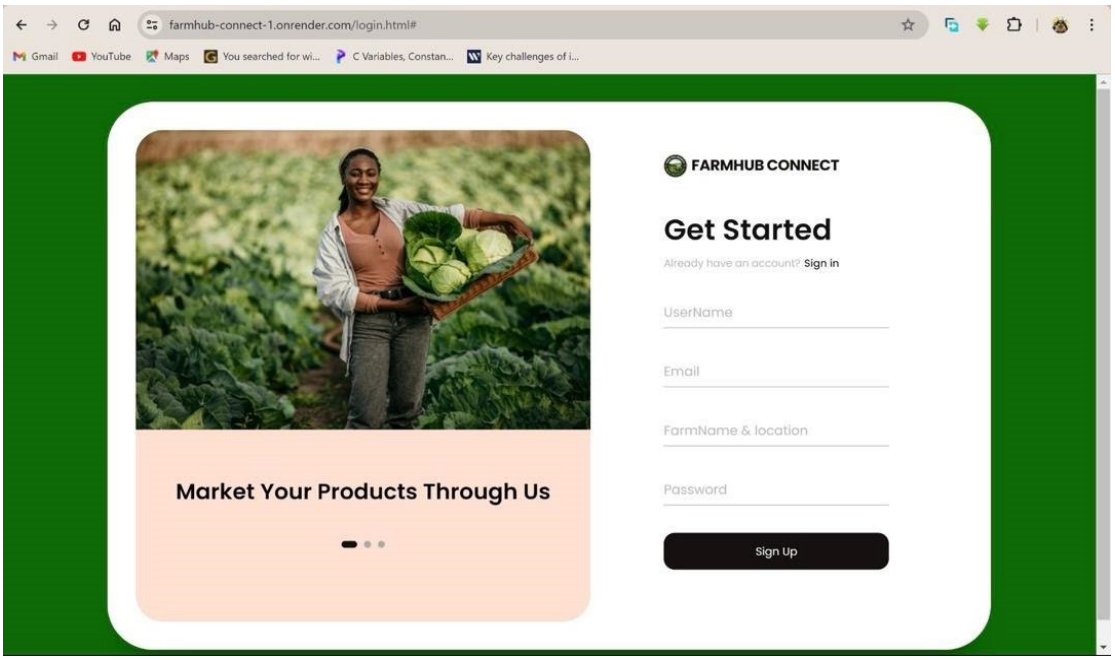

Figure 6: Signup page

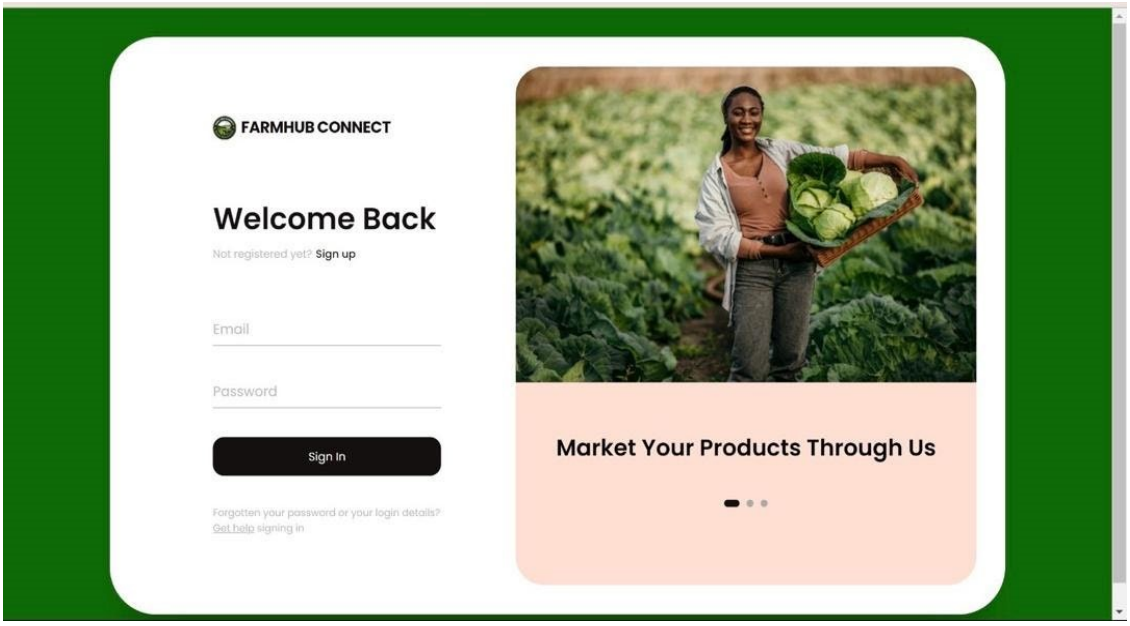

Figure 7: Login page

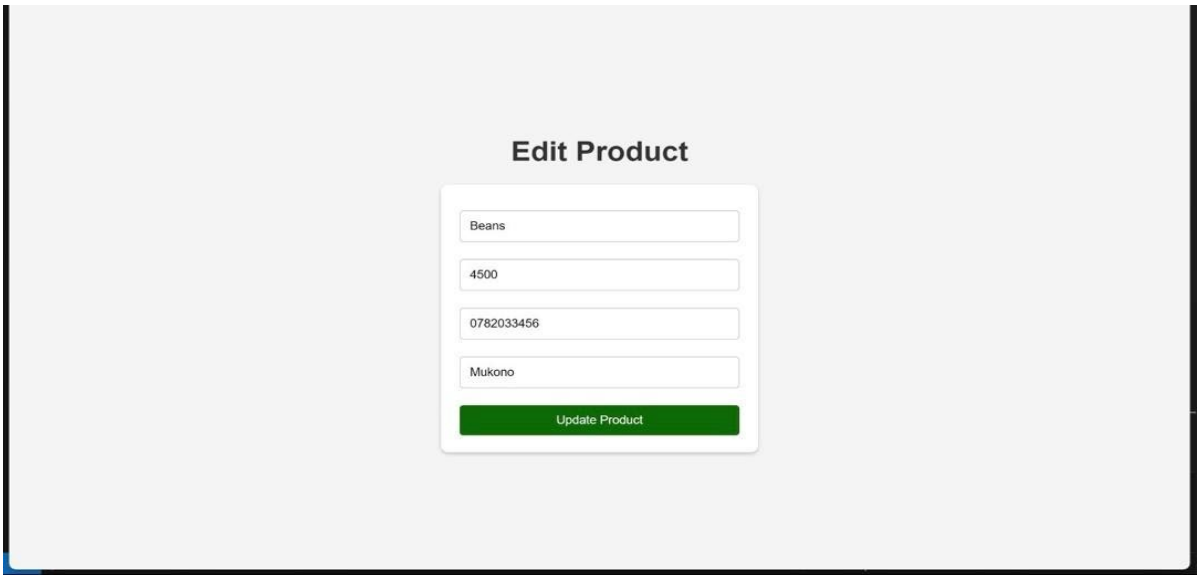

Figure 8: Farmer's page for uploading Product

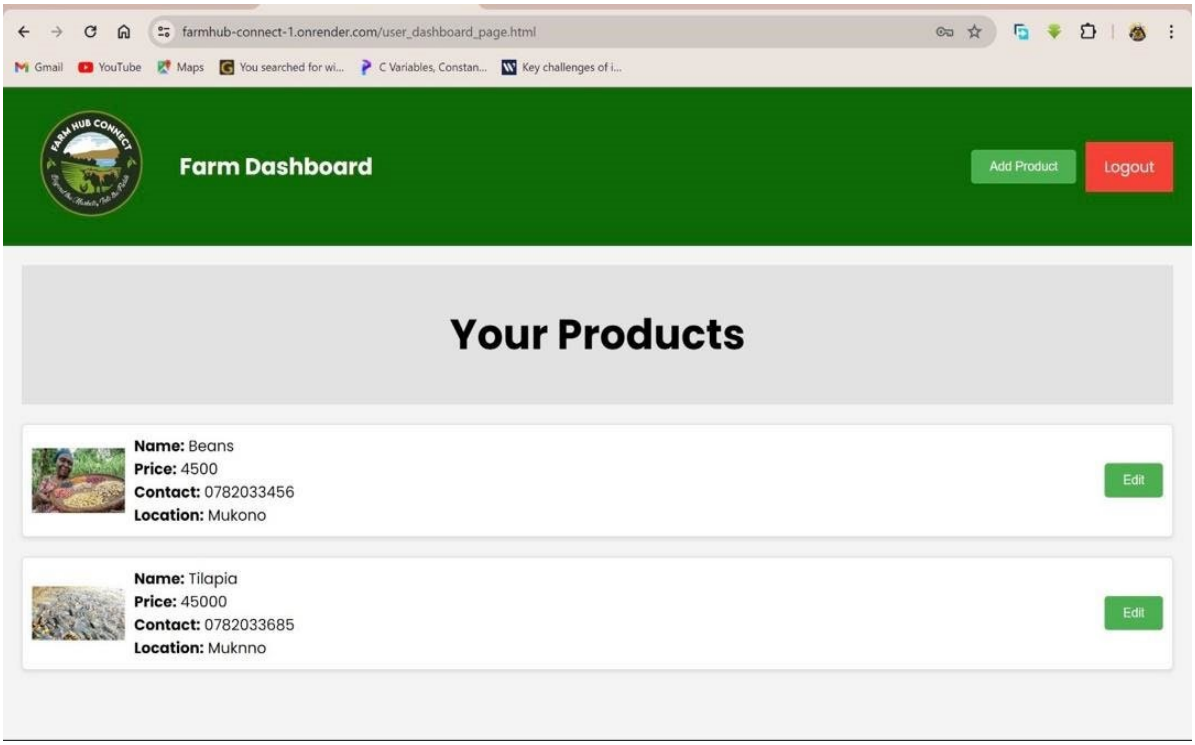

Figure 9: CRUD page

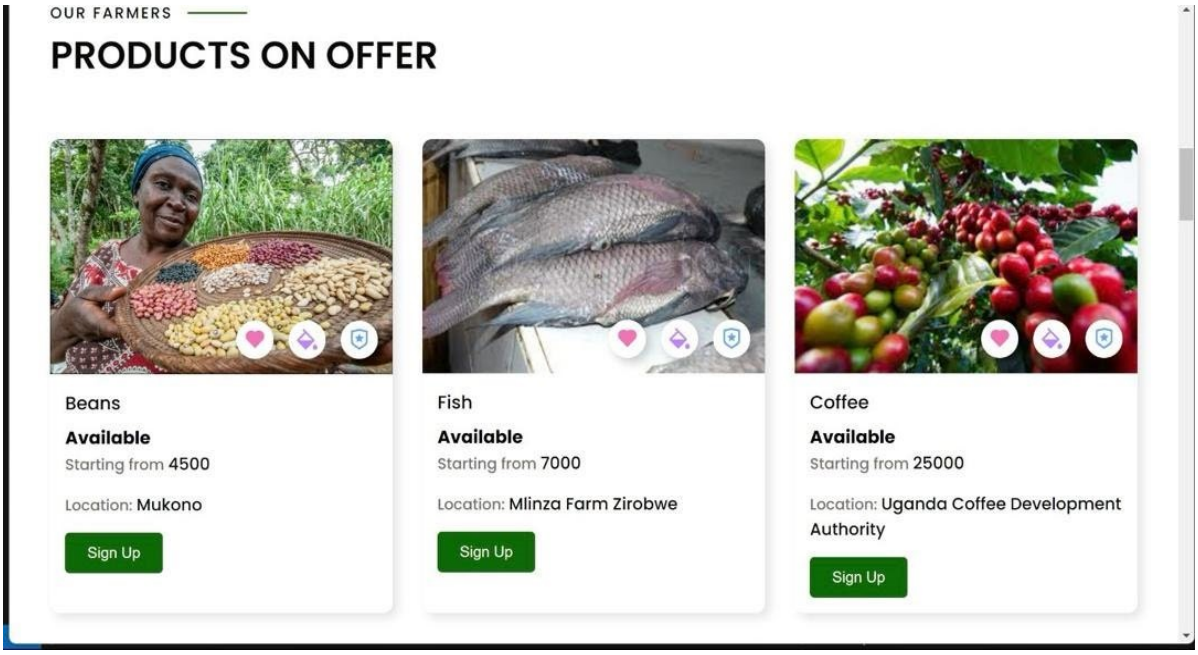

Figure 10: Product listing

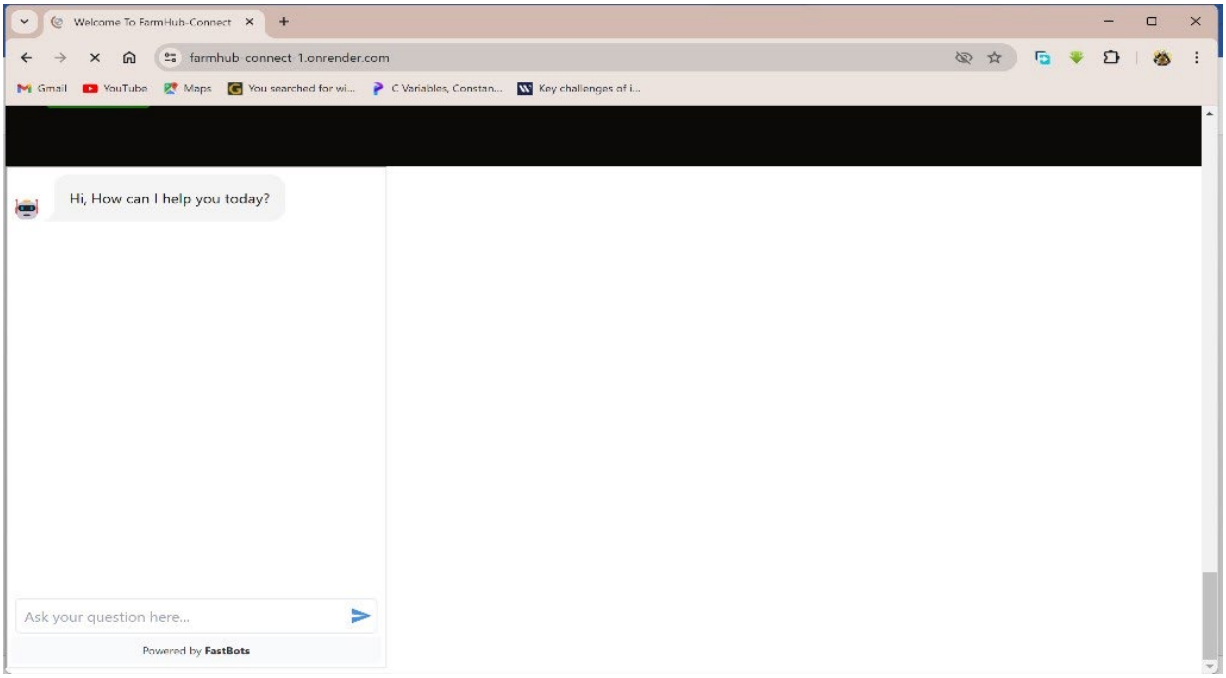

Figure 11: Price Projection using Artificial intelligence model

3.7 Implementation

The implementation phase involved translating the design specifications into functional code. Key activities included;

Frontend Development with HTML, CSS, and JavaScript

- Farm Hub's frontend development utilizes HTML, CSS, and JavaScript to create interactive and visually appealing user interfaces.
- HTML provides the structure of web pages, CSS is used for styling and layout, and JavaScript adds dynamic behavior and interactivity.
- The development team follows responsive design principles to ensure a seamless user experience across different devices and screen sizes.

Backend Development with Node.js

- Farm Hub's backend is developed using Node.js, a server-side JavaScript runtime environment.
- Node.js enables asynchronous and event-driven programming, making it suitable for handling concurrent requests and real-time communication.
- Express.js, a web application framework for Node.js, is utilized for building RESTful APIs and handling routing and middleware.

Database Management (Neon)

- Neon methodology is adopted for database management in Farm Hub.
- This methodology emphasizes simplicity, flexibility, and scalability in designing and managing databases.
- Neon's schema-less approach allows for dynamic data modeling, facilitating efficient storage and retrieval of data without rigid schema constraints.

Figure 12: Neon Database for capturing users and products data

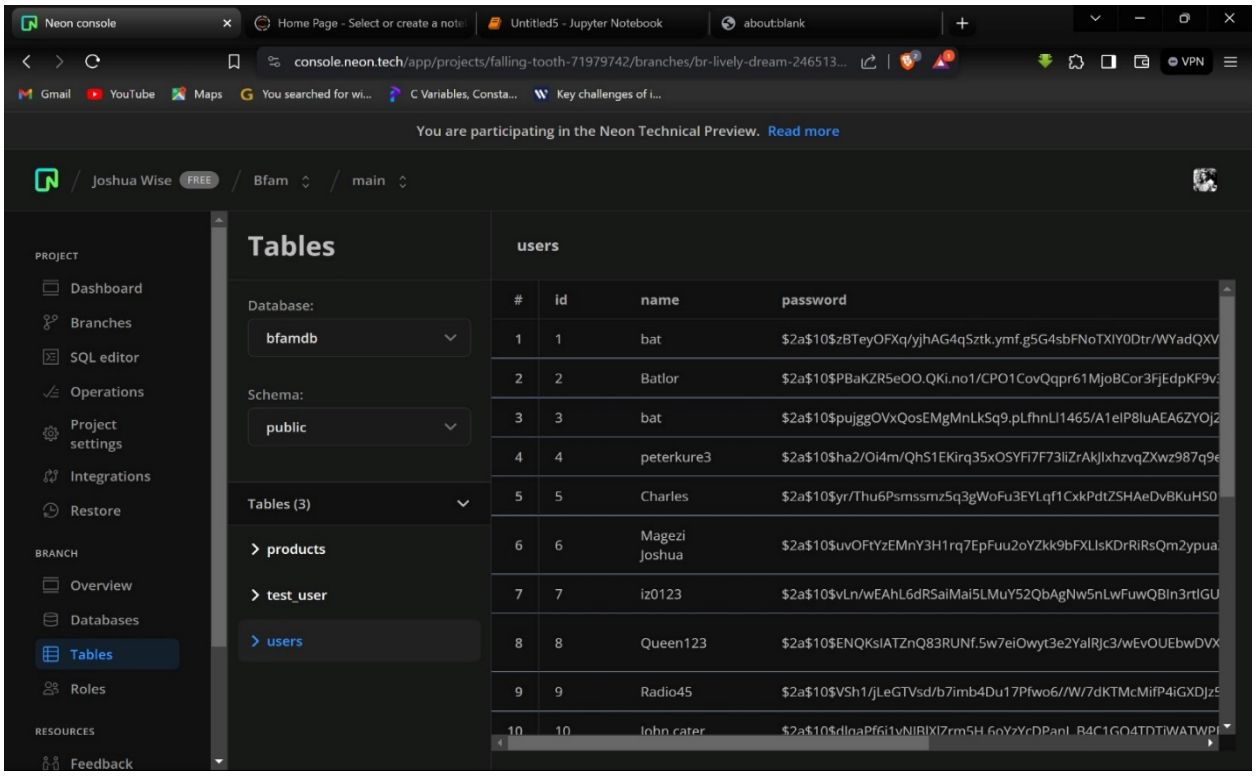

Figure 13: Neon Database for capturing users and products data

Hosting and Deployment with Render and Vercel:

- Farm Hub's backend is hosted on Render, a cloud system for hosting and managing web applications and services.
- Render provides automatic scaling, built-in HTTPS, and continuous deployment from Git repositories, ensuring reliability and scalability.
- The frontend of Farm Hub Connect is hosted on Vercel, a cloud system for static site hosting and serverless functions.
- Vercel's global CDN and automated deployment workflows streamline the process of deploying and serving static assets, ensuring fast and reliable performance for end-users.

3.8 Testing and evaluation

Farm Hub Connects interface is well-designed and user-friendly web system connecting farmers with consumers seeking agricultural products. Its intuitive interface and seamless functionality contribute to a positive user experience, with users expressing high satisfaction with the website's performance and ease of use. The system's commitment to content quality ensures that product

listings are accurate and accompanied by high-quality images, fostering transparency and trust among users. Additionally, Farm Hub Connect employs robust marketing strategies and proactive customer support to engage users and address their needs effectively.

The system demonstrates a sustainable business model that supports local economies and promotes environmentally friendly farming practices. By facilitating direct collaboration between farmers and consumers, the system empowers small-scale producers to reach a wider audience.

CHAPTER: FOUR

4.1 Results and discussion

The implementation of the farm hub connects yielded several net worthy results;

1. **Increased Market Access**: Farmers reported a significant increase in market access due to the system's ability to connect them directly with buyers.
   The usage of mobile marketing technologies web technologies helps small and medium scale enterprises to enhance their sales promotion methods with the goal of increasing product and service sales (Mutiu,Ojonukpe,Chinedu, 2023)
2. **Enhanced Transparency**: The transparency of transactions improved, as buyers could view detailed product information and directly communicate with sellers.
3. Improved Profitability: Farmers experienced higher profitability by bypassing traditional intermediaries and receiving fair prices for their products.
4. **User Adoption**: The system achieved high user adoption rates, with both farmers and buyers embracing the system for their agricultural marketing needs.

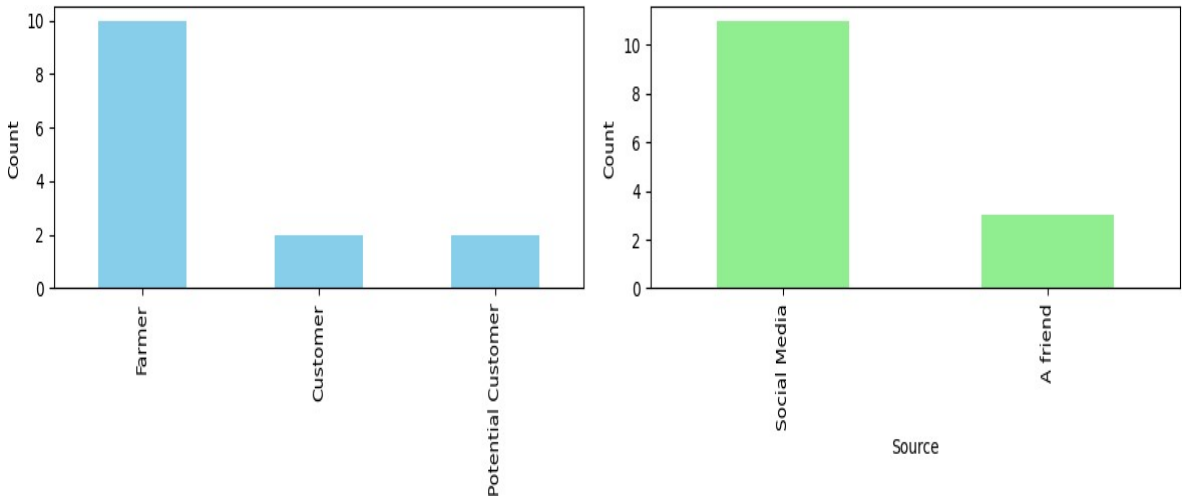

Figure 14:Count of farmers, customers and potential customers (Generated from google forms)

4.2 Discussion

The results indicate the successful achievement of the project objectives in enhancing agricultural product marketing through the web system. The following points merit further discussion:

a) Impact on Farmers: The direct access to markets provided by the system has empowered farmers, particularly small-scale producers, by enabling them to reach a wider audience and negotiate better prices for their products. According to AS Amusat Advertising media engender a wider reach of agricultural products and services to potential customers and clients. Yet agricultural products and services are rarely advertised in the media.
b) Benefits for Buyers: Buyers benefit from the system by gaining access to a diverse range of agricultural products directly from producers, thereby ensuring product quality and traceability.
c) Technological Challenges: While the implementation of the system was largely successful, certain technological challenges were encountered, such as optimizing system performance under high traffic and ensuring data security.
d) Future Enhancements: There is potential for further enhancements to the system, including the integration of advanced features such as predictive analytics for demand forecasting and mobile applications for on-the-go access.

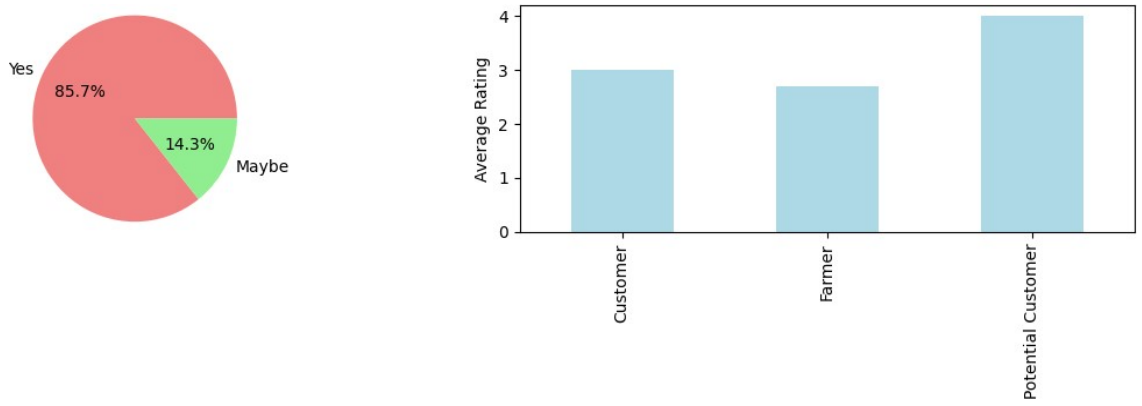

Figure 15: Percentage of respondents and willing to recommend the use of the system and average rating of user experience

CHAPTER: FIVE

5.1 Conclusions

In conclusion, developing a web system for advertising agricultural products presents significant opportunities to connect farmers with customers, streamline transactions, and enhance the agricultural marketplace. Through the functional and non-functional requirements outlined, such a system can offer a comprehensive system for farmers to showcase their products, enable customers to discover and purchase goods conveniently, and foster communication and trust between all stakeholders involved. However, several key considerations should be taken into account to ensure the success and effectiveness of such a system.

Prioritizing user experience and accessibility is crucial. The interface should be intuitive and easy to navigate for both farmers and customers, ensuring seamless interactions and transactions. Additionally, implementing responsive design principles will enable the system to adapt to various devices and screen sizes, enhancing accessibility for users across different demographics.

Secondly, security and privacy measures must be robustly implemented to safeguard user data and financial transactions. Utilizing encryption for data transmission, implementing strong authentication mechanisms, and adhering to industry standards and regulations regarding data protection will instill trust and confidence among users, encouraging continued engagement with the system.

Furthermore, scalability and performance optimization are essential for accommodating potential growth in user base and product listings. Employing scalable architecture, efficient database management techniques, and proactive performance monitoring will ensure that the system can handle increased traffic and maintain responsiveness even during peak usage periods. The key findings of the project include:

a) Successful Development: The project successfully developed the Farm Hub Connect Web system, providing a user-friendly system for farmers and buyers to connect and transact directly.
b) Improved Market Access: Farmers experienced increased market access and profitability, while buyers benefited from access to a diverse range of agricultural products.

c) Technological Challenges: Despite encountering some technological challenges, such as system performance optimization and data security, the implementation of the system was largely successful.

The project can be considered successful in meeting its objectives of improving agricultural product marketing through the web system. The system has demonstrated its effectiveness in addressing the challenges faced by farmers and buyers in accessing agricultural markets.

5.2 Challenges faced

Time Constraints. Farm Hub-Connect project faced time constraints as it was conducted amidst ongoing academic commitments, including course work. As a team, we had to carefully budget our time to ensure the study was completed on schedule.

Financial Constraints. Financial limitations were encountered during the Farm Hub-Connect project, as it required resources such as printing, typing, and information gathering. The fact that we are students, we had limited access to funds, which posed challenges to the smooth progress of the project. Despite this, the team managed to seek alternative funding sources and implement cost-effective solutions to mitigate these constraints.

Limited Access to Advanced Software. Accessing the latest software programs for designing and implementing Farm Hub-Connect presented a challenge. The research team lacked the financial resources to acquire expensive proprietary software and may not have had access to institutional licenses. Nevertheless, the team explored open-source software alternatives, enabling them to effectively develop FarmHubConnect despite this limitation

5.3 Recommendations and future work

Continuous iteration and improvement are necessary to adapt to evolving user needs and technological advancements. Regular feedback collection from users, monitoring of system analytics, and agile development practices will enable the system to evolve iteratively, addressing emerging challenges and seizing new opportunities in the dynamic agricultural market landscape.

Based on the findings and experiences gained from the project, the following recommendations are proposed for further improvement and future work;

a) Continuous Improvement: The Farm Hub Connect Web system should undergo continuous improvement based on user feedback and emerging technological advancements.
b) Expansion and Scaling: Consideration should be given to expanding the system to cover a broader geographical area and scaling it to accommodate a larger user base.
c) Integration of Advanced Features: Advanced features such as predictive analytics for demand forecasting and mobile applications for increased accessibility should be explored to enhance the system's functionality.
d) Overall, the Farm Hub Connect has laid a solid foundation for improving agricultural product marketing through innovative technological solutions, and there is potential for further development and expansion in the future

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APPENDICES

Appendix 1: Farm Hub Connect Questionnaire form

USER FEEDBACK QUESTIONAIRE FORM

Basic Information (Tick the appropriate)

What is your role in Agriculture?

Farmer ☐ Consumer ☐

How long have you been involved in the buying and selling of agricultural products?

Awareness and Interest

How often do you use digital online applications to purchase or sell and advertise your products ?

Have you ever tried to use Farm Hub Connect web system for Agricultural products?

Yes ☐ No ☐

If yes what components of the system interest you most and meet your needs?

Needs and Expectations

What are the main challenges did you face in buying or selling agricultural products through traditional channels and ever used online platform if any that you tried to use?

What features and functionalities do you expect from the system?

How do you envasion farmhub connect addressing your needs and overcoming the challenges you face in the process of buying or selling/ advertiising your agricultural products.

User experience

What are your expectations regarding the use of the user interface and ease of use of the system

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Quality assurance

Are all features of the system functioning as expected?

Yes ☐ No ☐

Do you find the informastion on the system accurate and up to date?

Yes ☐ No ☐

Are the product descriptions, images, and prices helpful in making informed decisions?

Yes ☐ No ☐

Market access and Expansion

Do you believe that farmhub Connect would provide a better access and easy market for Agricultural products?

Yes ☐ No ☐ Not sure ☐

In what way do you think farm hub connect could contribute to the exmpansion of market opportutinities to farmers?

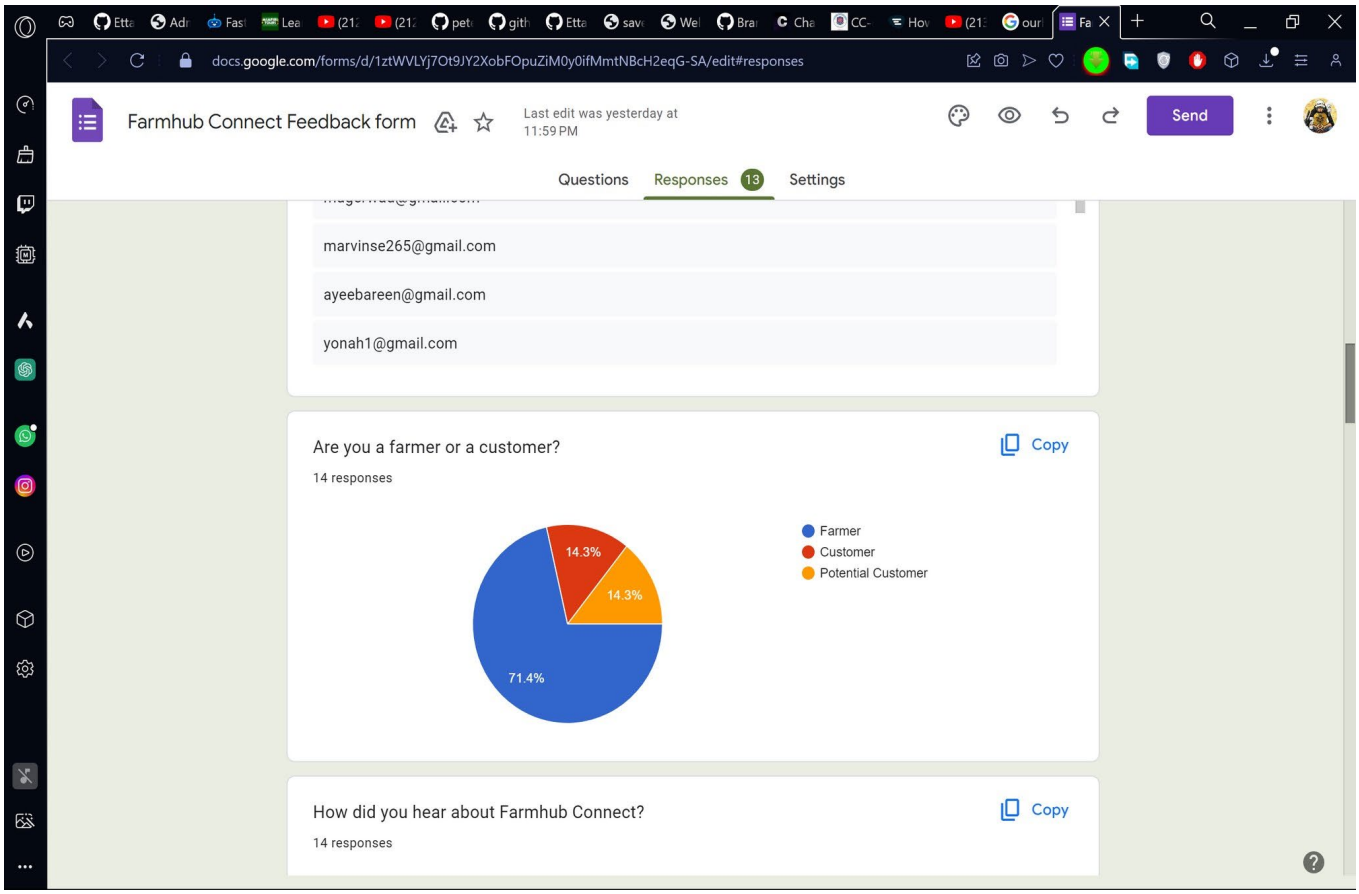
Suggestions

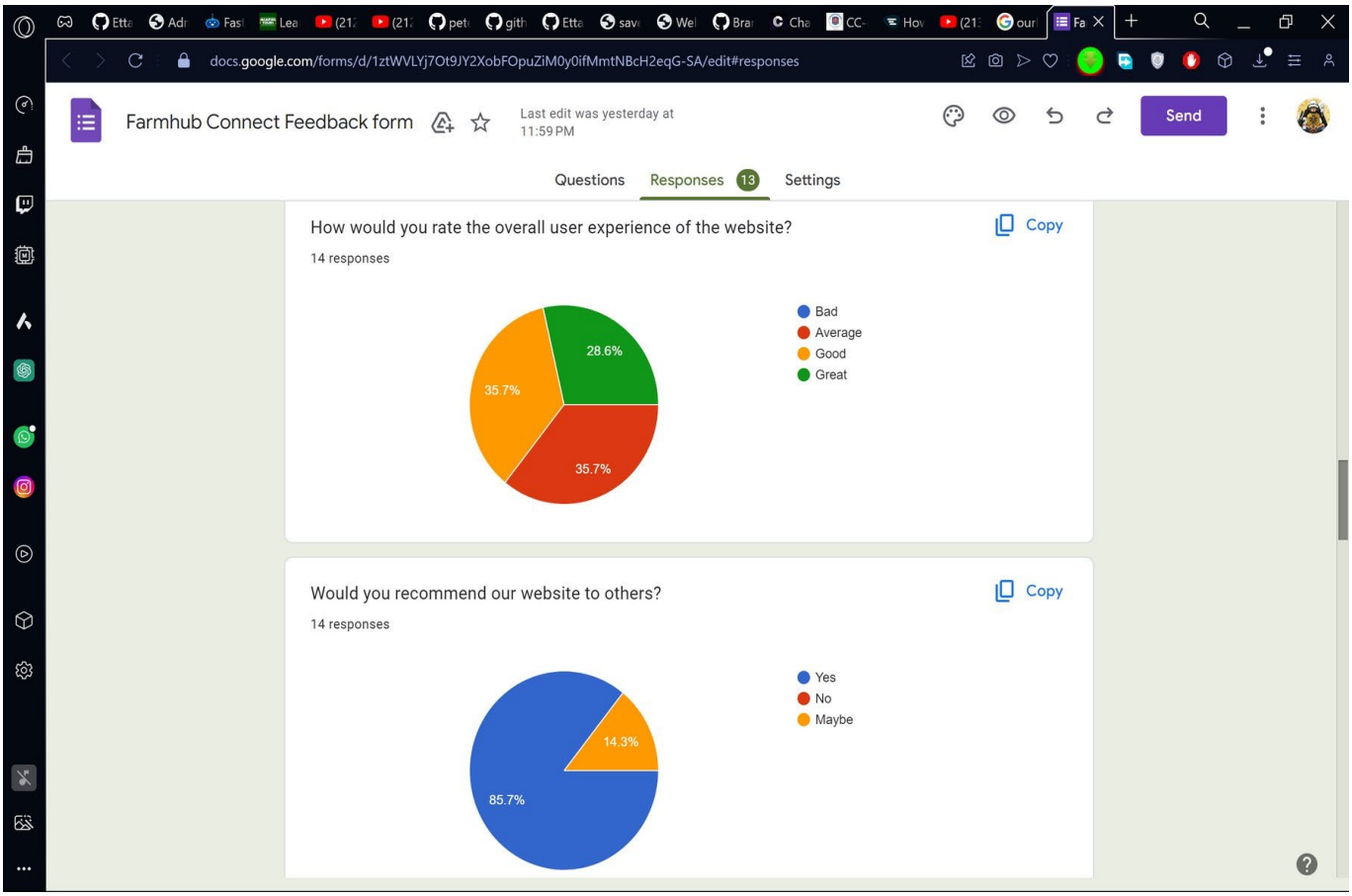
Any specific suggestions for improving the sytem to improve and reach a bigger audience?

Are there any additional features or functionalities you would like to see included in the system?

Thank you for taking the time to provide your valiable feedback . Your insights will be instrumental in shaping the development of the system to serve the needs of the Agricultural communitty?

Appendix 2: Farm hub connect google forms feedback




docs.google.com/forms/d/1ztWVLYj7Ot9JY2XobFOpuZiM0y0ifMmtNBcH2eqG-SA/edit#responses
Farmhub Connect Feedback form
Last edit was yesterday at 11:59 PM
Send
Questions
Responses 13
Settings
How would you rate the overall user experience of the website?
Copy
14 responses
28.6%
35.7%
35.7%
Bad
Average
Good
Great
Would you recommend our website to others?
Copy
14 responses
14.3%
85.7%
Yes
No
Maybe