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A Mobile Electronic Commerce Application for Agricultural Products in Nigeria

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Abstract

Mobile electronic-commerce applications have become ubiquitous assets in all facets of life, including buying and selling. This has made it easy for many organizations to take advantage of the applications and leverage cost-saving features to place businesses on mobile applications. The study deals with the benefit to farmers getting agricultural products sold at the best price online and equally prevents teeming customers from buying agricultural products at outrageous prices in market places. A simple linear regression technique was used to analyze the data collected from seventy (70) respondents. The research findings indicate that about 79% of the total respondents agreed that consumers need an e-commerce app for selling agricultural products, and the graph signifies a low decrease in R^2 value of 0.2113 (21%) with a slope of 3.08x (where y-value is the dependent variable and x is the independent variable). It was also revealed that 74% of the respondents agreed that the Android operating system offers more device variety and customization options for both farmers and consumers, and the graph shows decrease in R^2 value of 0.2115 (21%) with a slope of 10.69x (where y-value is the dependent variable and x is the independent variable). The development of the platform follows a system development life cycle approach using Android Studio SDK, Flutter, and XML for the client side, and on the server side, PHP and MySQL were used as scripting languages and databases, respectively. The platform is supported by the Android operating system because of its current high market share and usability.

Keywords: Ecommerce, Application, Agriculture

1.0 Introduction

The agriculture area in Nigeria is viewed as a significant supporter of monetary development and improvement. This area satisfies the food needs of the populace as well as gives unrefined components to industry other than giving excess to send out. This area has demonstrated incredible potential to help the country's economy both now and in future if due thought is provided to tackle rising issues. Sensible horticultural development and improvement depend on how concerned different accomplices, especially farmers who are confronting a few dangers in ranch creation and showcasing of their homestead produce, are enough tended to. Consistently, farmers need to bear esteem decrease in their produce because of helpless foundation and post-gather rehearses. Besides, successive food overflows and lacks have included the need to modernize the showcasing framework system so objective circumstances can be dealt with. Advertising can be characterized and grasped in different ways; however, normally it is perceived as a spot or region where purchasers and venders accumulate and interface for purchasing and selling labor and products (Tsokar, 2021).

Mobile applications have an incredible ability to solve real-life problems. Problems are mainly based on two factors: time and money. The problem encountered was to create a platform for the farmers where the produce from the farms can be easily sold at better rates, pooling or sharing of the transport to take the produce to the markets, and to help farmers take precautions based on the forecast of weather. Since it is a mobile application, it is supported by smart phones, which are easily accessible to the users (Tekade *et al.*, 2021).

Statement of the Problem

Farmers and consumers in Nigeria are facing a lot of problems. They cultivate crops and other agricultural products (fruits, rice, maize, vegetables). They want to sell their agricultural products according to the market price, but for lack of knowledge, they sell huge amounts of products for small amounts of money to the brokers, and customers directly approach the brokers. Because of this, farmers are losing money, and on the other hand, consumers are buying agricultural products at an expensive price. In 1999, according to a publication by the Central Bank of Nigeria, production of yam was 2.1 tons (67% of the world population) and cassava was 33.1 million tons (highest in the world and 20% of global production). Coconut: 33 million tons, and sweet potatoes: 1560,000 tons. The production estimates for major crops in thousands of tons are millet 5,457; corn, 5777; rice, 3399, etc. Despite all these productions, there have not been effective marketing means that will yield adequate benefits to farmers. Some of the e-commerce applications developed have compatibility issues and do not have voice recognition features or an official support team. This application developed makes use of voice and text to assist farmers and consumers, including people with disabilities, in Selling/buying agricultural products to customers with no broker; customers can directly contact farmers. Farmers can sell their own products retail or wholesale according to their level of production.

Objectives of the Study

i. To analyze the existing system and define the requirements and prototypes of the new system.
ii. To design the user interface where farmers and customers sell/buy their agrarian items utilizing mobile applications
iii. To implement the design so that farmers ensure greater profitability through direct farmer to end user or consumer communication

Significance of The Study

The following are the summary of the significance of the study.

i. Create a platform to purchase agrarian items through mobile applications
ii. Give a platform to clients to purchase agricultural items from farmers using the web.
iii. Help farmers ensure greater profitability through direct farmer/consumer communication.

Scope and Limitation of the Study

This research is limited to the design of a mobile E-commerce platform for marketing agricultural products in Nigeria.

Literature Review

A study conducted by Lilavanichakul (2020) reveals that the digital platform has enabled larger visibility into both domestic and international supply chains of agricultural products. The Relationship between sellers (i.e., farmers, agricultural cooperatives, and SMEs) and buyers is closer and more easily connected (Sathirathai & Nakavachara, 2019). In Thailand, agricultural products are available in six different marketing channels under four e-commerce platforms. Four e-commerce platforms consist of social media, an agricultural e-marketplace platform, e-retailers, and an e-fresh market. In general, a main supply chain in Thailand is farm products sold via collectors or middlemen and then sold via supermarkets and fresh markets. Supermarkets and fresh markets play major roles in the distribution of agricultural products. During the digital era, new digital platforms have emerged and connected farmers to end-users. Hence, supermarkets and fresh markets have to adopt new services (i.e., ordering via applications, delivery, and chat box) and offer multi-channels on both offline and online. The role of players in agri-food supply chain includes smallholder farmers, agricultural cooperatives,

collectors, e-commerce providers, retailers, traditional markets, and end-users. Another important player is logistic service providers, operating in two systems: on-demand delivery (i.e., Skootar, Lalamove, LINE MAN, GRAB Express, and Deliverer) and third-party logistics (i.e., Kerry, Thailand Post, SCG Yamato Express, FedEx, and DHL). A financial service provider is also a key player in e-commerce platforms. Two types of e-payments are payment gateways (i.e., 2C2P, PayPal, Omise, TrueMoney, AliPay, and WeChat Pay) and mobile payments (Mueller, 2001).

In recent years, a number of agricultural e-commerce service providers under Business to Business (B2B), Business to Customer (B2C), and Customer to Customer (C2C) platforms have been launched in Thailand. These e-commerce service providers deliver farmers and SMEs by offering a new way of selling their produce and reaching a new market opportunity, one important movement towards digital agricultural markets is implemented by government institutions or the public sector, such as DGT Farm, offering the e-marketing platform to match farmers and consumers. With a great potential for e-commerce in the agricultural sector, many e-commerce service providers in the private sector have been established; however, most e-commerce service providers are in the start-up phase, as well as requiring funding sources and building trust in security for internet users (Nakavachara & Sathirathai, 2019).

The development of e-marketplace by the private sector is more diverse and creative than the platform developed by the public sector. For example, in the success business, Freshket is the first B2B e-marketplace platform for fresh food suppliers and restaurants that provide trading services to farmers to have stable demands and restaurants to get fresh products. Many success cases on farmers adapting digital channels to strengthen farmers' bargaining power and avoid the middlemen. Tankhun Organic Farm sells organic chicken meats via multi-channels such as Facebook, LINE, HealthMe (e-marketplace), and Lemon Farm (e-retailer). Another success case is the SookJai farmer market in Nakhon Pathom province, located close to Bangkok, which was established for a group of farmers who want to sell organic products. This farmer group uses Facebook to promote their market and connect directly to consumers. During the COVID-19 pandemic in Thailand, the lockdown restriction has caused serious damages to the agriculture sector and the shortage in distribution of agricultural products. Thai consumers turned to home cooking and local farm products to ensure the safety and where the foods come from. Under the outbreak, Thai farmers have adapted the direct-to-consumer channel via Facebook, LINE, and e-marketplace to boost sales of unsold products. The growth of specific group e-marketplace platforms (i.e., Chula Marketplace and Kaset Marketplace) and online delivery service providers (i.e., Kerry) have boomed to cope with the lack of connection between farmers and consumers. In addition, the revenue shares between online and offline have become the potential business model for farmers and reduce market risks (Apichaya, 2020).

According to Sushil *et al.* (2006), agriculture e-commerce is a situation whereby buying and selling of agriculture products and services are carried out electronically with the use of computer systems linked together over inter-network protocols and standards. The various parties involved in the electronic business dealings agree to conform to the norms, rules, and regulations guiding the industry. A typical scenario in commercial transactions in most countries today would include business dealings through physical contact. This method has been in use for some time, and its relevance is not in doubt. The use of computer systems has brought about improvement and efficiency over the previous manual operations such as payroll processing, stock inventory analysis and control, and scientific processes. In the same vein, agricultural e-commerce is going to change the way agricultural products are purchased by any method of using electronic communications and computer technology to conduct agricultural business so that trading partners can share a wide range of communications and data. Agricultural e-commerce transforms the way agricultural products are sold and the way farms interact with each other and customers through communication channels. In other words, this technology is a subject of the larger world of both information technology and agriculture.

Furthermore, agricultural e-commerce enables good trading possibilities by supporting different business models such as multi-supplier, e-sales, and several types of auctions. The discourse on mobile technologies in agriculture is part of a wider debate

on ICT and mobile technology in development, which has received significant attention over the last ten years. Enthusiastic studies find mobile phones do have a multi-dimensional positive impact on sustainable poverty reduction and identify accessibility as the main challenge in harnessing the full potential. More critical political economists contest the assumption that technologies are autonomous forces or independent variables causing change in every domain of human life. Pointing to the importance of socioeconomic, cultural, political, and institutional factors, they believe rather that ICT reinforces existing dependencies and call for the examination of crucial matters of control, cost, selection, and utilization (Silarszky *et al.,* 2008)

2.0 Methodology

Research Approach

The methodology adopted for this study is based on System Development Life Circle (SDLC). The SDLC is a conceptual model which includes policies and procedures for developing a system throughout their life circles. It is used by analyst to develop an information system.

The developed system started with project planning by determining the users of the system and the aims and objectives of the system. After these, extensive research was done to determine how to design an effective system as well as to review the current system. Then, the design was with an initial prototype of the system and then refined it based on their suggestions and specifications. Phases of analysis, design, and implementation were performed iteratively until users and designers agreed on a final system specification. A simple linear regression technique was used to analyze the results collected from respondents.

Simple Linear regression is a statistical method that models the relationship between a dependent variable (y) and independent variable (x) using a straight line. The goal is to create a linear equation that best predicts the value of y based on the value of x. the simple linear regression equation is:

$$y = \beta 0 + \beta 1x + \mathscr{E}$$

Where:
y is the dependent variable.
x is the independent variable.
β 0 is the intercept of the constant.
β 1 is the slope coefficient.
$\mathscr{E}$ is the error term.

Sources of Data

Two methods of investigation aimed at data collection was used in order to have better understanding of both customer and system requirement, these are:

i. ***Observation****;*

Observing the procedure of the current system in use will go a long way to ascertain what response some of the farmers will give for various reasons on selling their farm products. Seeing things physically based on how they are done will provide more perspective and a better understanding of the current system procedures. Observing the current system will also create avenues for researchers to understand how things are done, whether rightly or wrongly, which will also aid the development process and be able to make good recommendations based on the new system requirement.

ii. ***Interview*****:**

Interview to farmers and customers was conducted to have a concise view of the developed system in different perspectives to:

i. Help in getting the information on how the current system works
ii. Assists in obtaining necessary data needed to make this project a reality. In every system development project, Data is the most important factor to consider.

Requirement Specification of the Proposed System

Systems are design to contain features needed by the users. These features are called requirement specification which surface after comprehensive study of an existing system. The developed system fulfills the following requirements.

i. Make fast transaction across the globe
ii. Make use of many payments modes
iii. Make online sales
iv. Use a database for data storage
v. Create Convenience in buying and selling of agrarian products

System Database Design

Mobile base information system is an application that supports Android operating system. The application consists of SIGN UP PAGE where users (that is farmers and customers) create account using phone number or username and password and registers their details which will be stored in MySQL database. LOGIN PAGE will allow users to gains access to the application by identifying the user credentials which are typically some forms of "username" and a "password. The E-commerce application platform was designed and implemented using Android SDK version 4.2 while MySQL was used to design the database in MYSQL server for storing the farmers and customers inventory. Figure 1. explains the proposed system

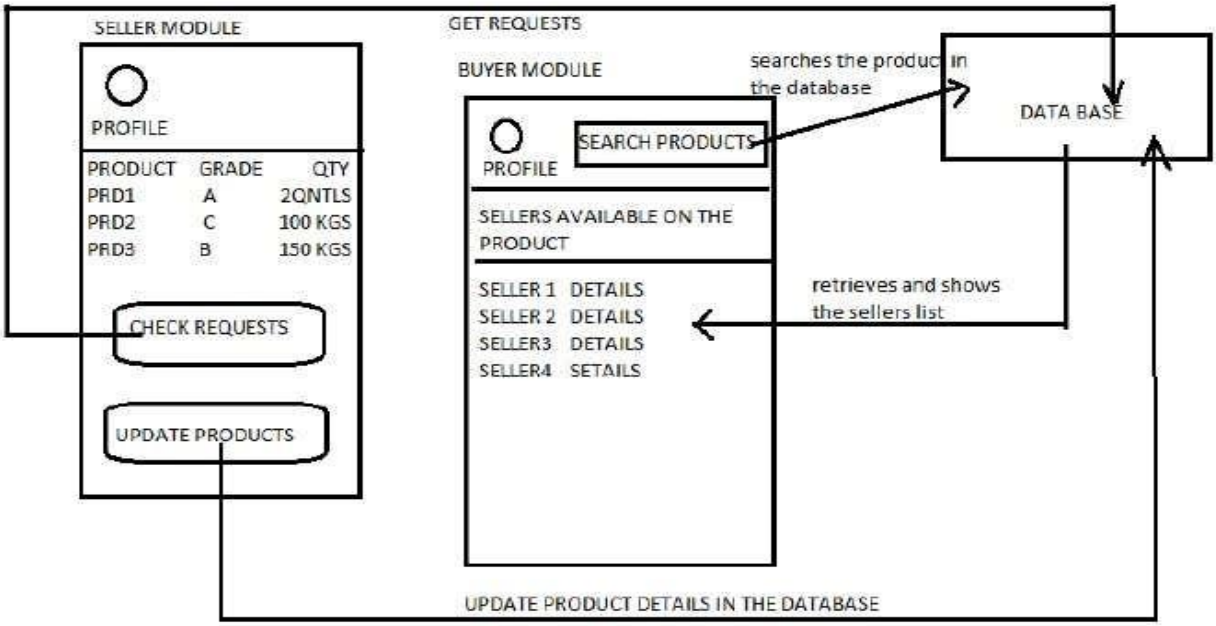

Figure 1: System database design

3.5.1 Data flow

Figure 2 shows Data flow diagram of the proposed system.

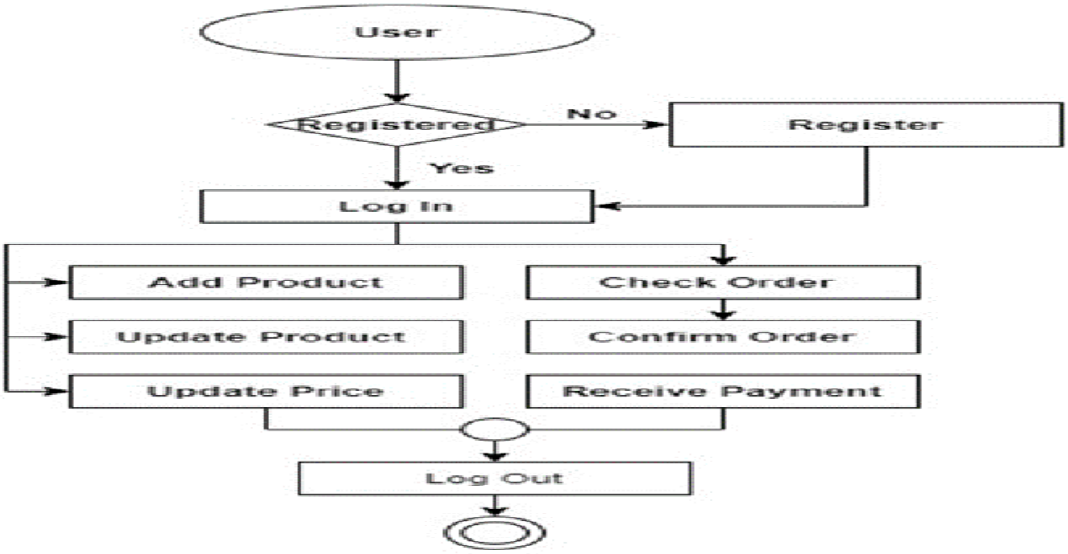

Figure 2: Sellers Data Flow

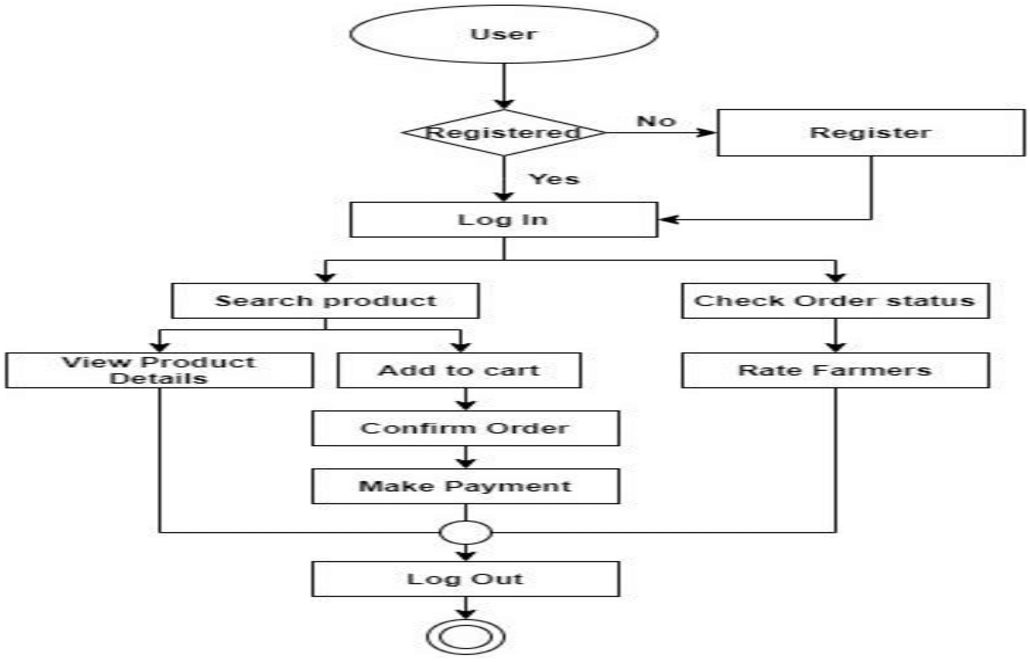

Figure 3: Buyers Data Flow

3.6 Database Design

The task involve here is to develop the corresponding database design specification. All information system create, read, update and delete is stored in database. A file is a collection of similar record, A database is a collection of interrelated files. The database application that will be use is MySQL which is a relational database.

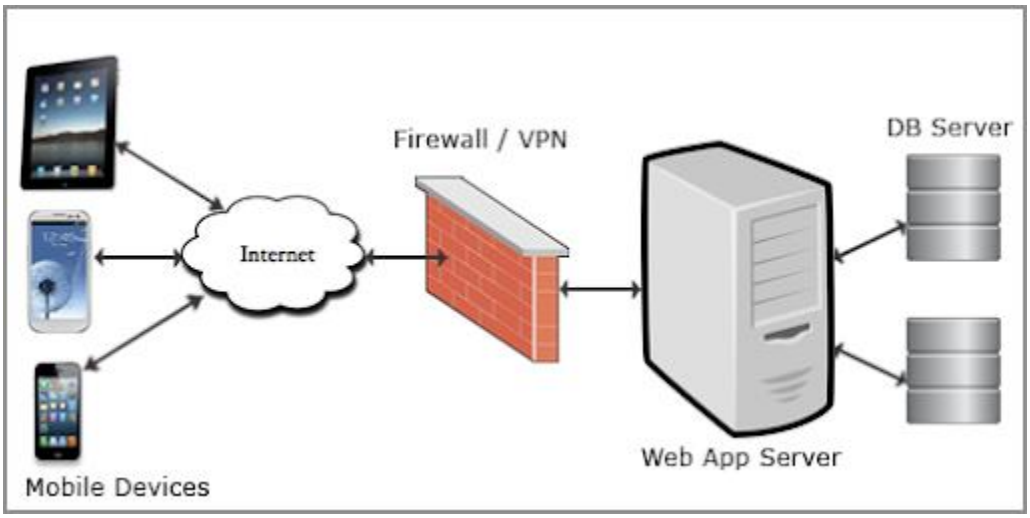

Figure 4: Database Design

The design of the database consists of six 6 tables viz

i. **Shopping cart table:** This table is used to hold cart information. It consists of five fields or column, these are card ID, Item ID, cost ID, Quantity and price
ii. **Category table:** The category contains product categories available in the market.
iii. **Customer table:** It's a table that maintains registered customers information such as CustomerId, Last Name, Middle Name, Country, State, Address, Phone Number, Sex, E-mail, Password, Zip Code.
iv. **Item Table:** This table contain information about an item. It consists of item Name, Item price, item image, item Quantity and category ID
v. **Order information table:** This table contains information about order made by customers. It consists OrderId, CustomerId, ItemId, quantity, Price, Date, and Address
vi. **Past Order:** This is a table that maintains information that has been fulfilled. This table contains CustomerId, ItemId, quality, price, date and address.

RESULTS/SYSTEM IMPLEMENTATION AND TESTING

System Implementation

In developing the mobile application, some specific tools were used to develop the module that accepts users' request on the server. To implement the client application, Flutter and Android Software Development Kit (SDK) were used. Whereas server-side, scripting language-PHP and MySQL were used to develop server module and database respectively. XML was used to specify the configurations and values of the application to

be developed. The emulator was used to test and check the performance and validity of operation of the proposed Mobile-ecommerce platform. Errors discovered in the development were debugged and a retest occurred.

Register New Users

New users of the application must first create an account while existing users must login using their username and password. Figure 5 shows the registration panel of a new user. The mobile ecommerce platform has been developed in such a way that; it provides user-friendliness that is Graphical User Interface (GUI). For instance, if a user forgets his/her password, he/she needs not to create a new account. All that is required is to click on 'Forget Password', key-in the username and click on 'search' then the password will be recovered. The interface that manages this operation is shown in Figure 6.

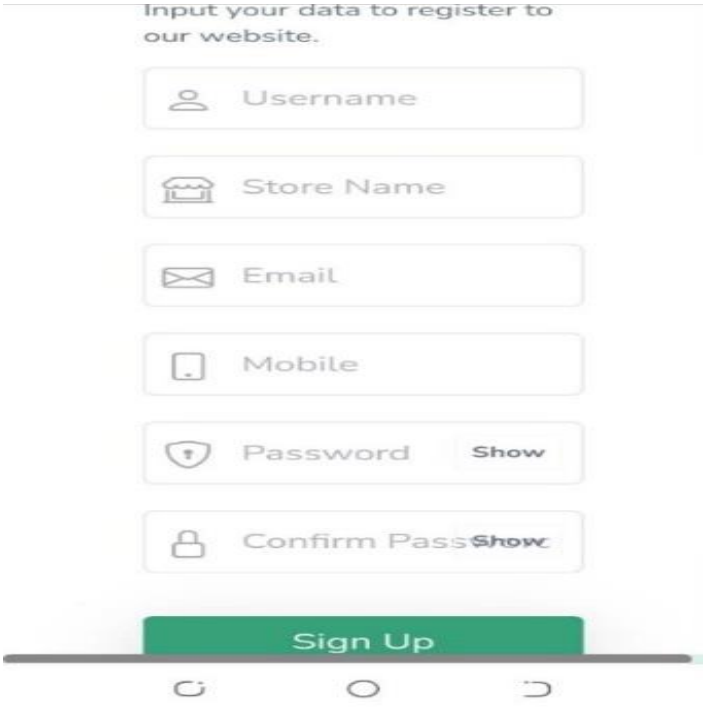

Figure 5: Register New users

Forgot password

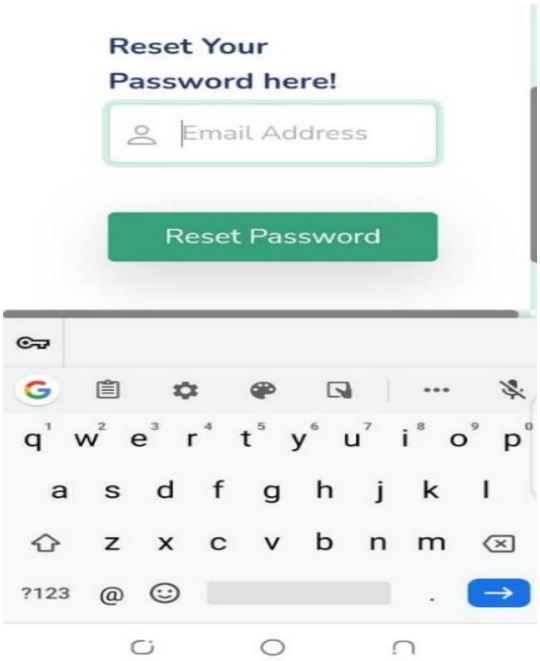

Figure 6: Forgot Password

Sellers login

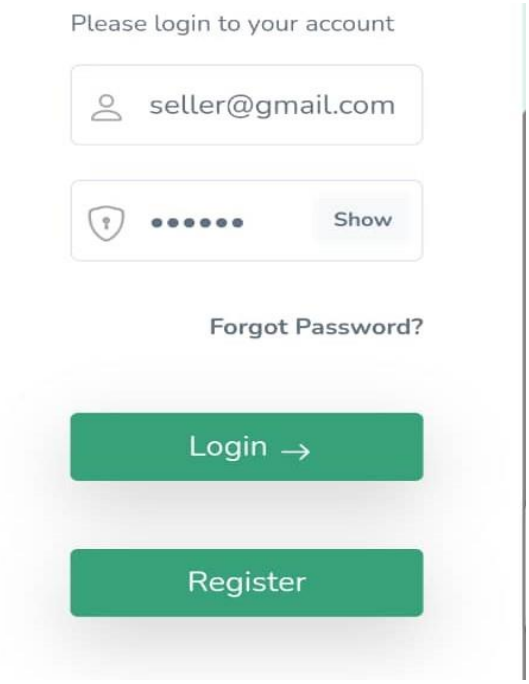

Figure 7: Sellers Login

Add new products

The interface in Figure 9 below provides fields where Farmers input the details of the product they want to sell.

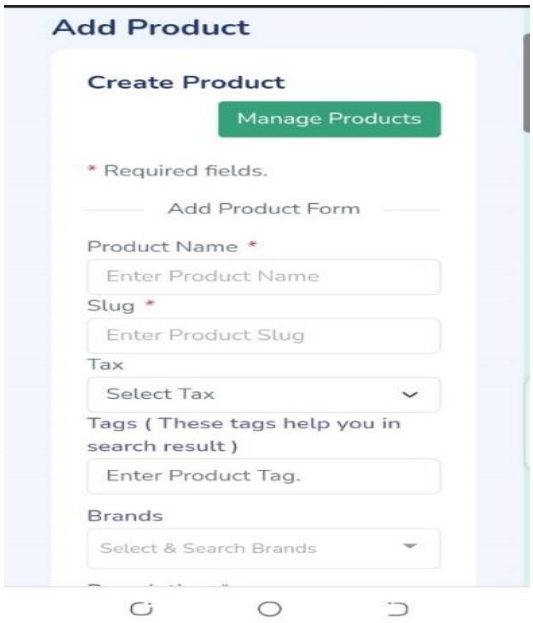

Figure 8: Add new product

Description of the new product

Here sellers (farmers) can upload the image of the product they want sell and it will be available for buyers to see. See figure 10.

Figure 9: Description of new product.

Buyers login

Customers are to login in figure 10 after they successfully registered using valid credentials.

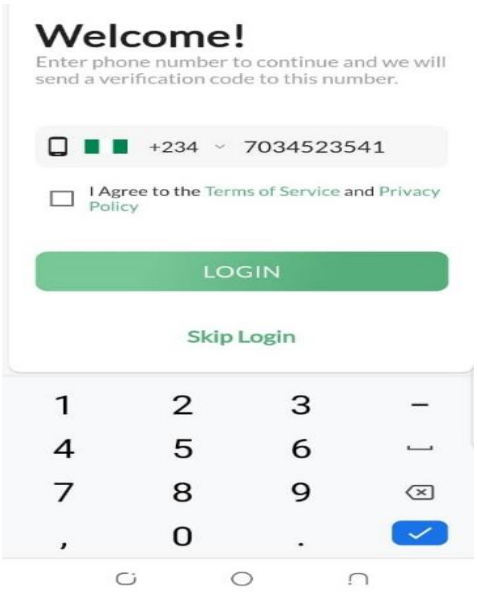

Figure 10: Buyers login

E-market place platform

The figures below 11, 12, 13 and 14 show various categories of agricultural products available in the E-market place.

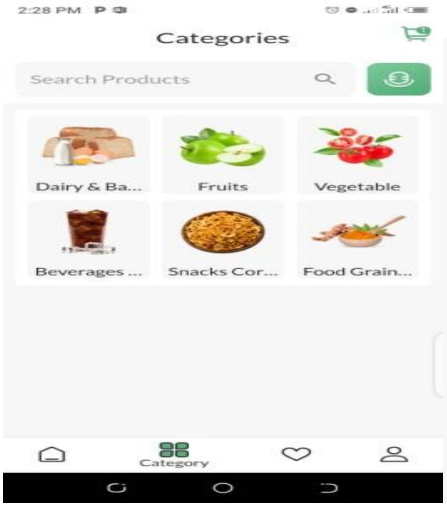

Figure 11: Categories

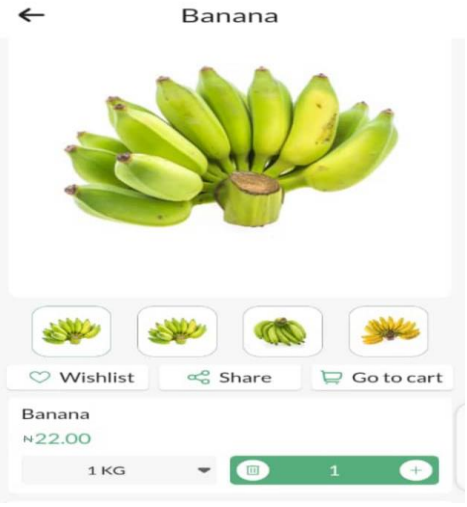

Figure 12: Agric Product

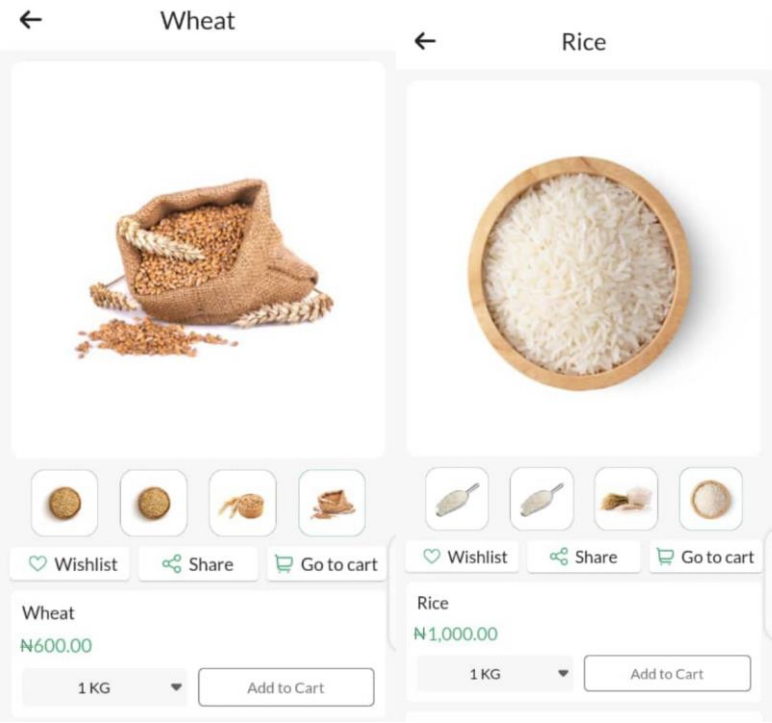

Figure 13: Agric product **Figure 14: Agric Product**

Search products

Here in Figure 15 and 16 sellers/Buyers can search agricultural products using text and voice

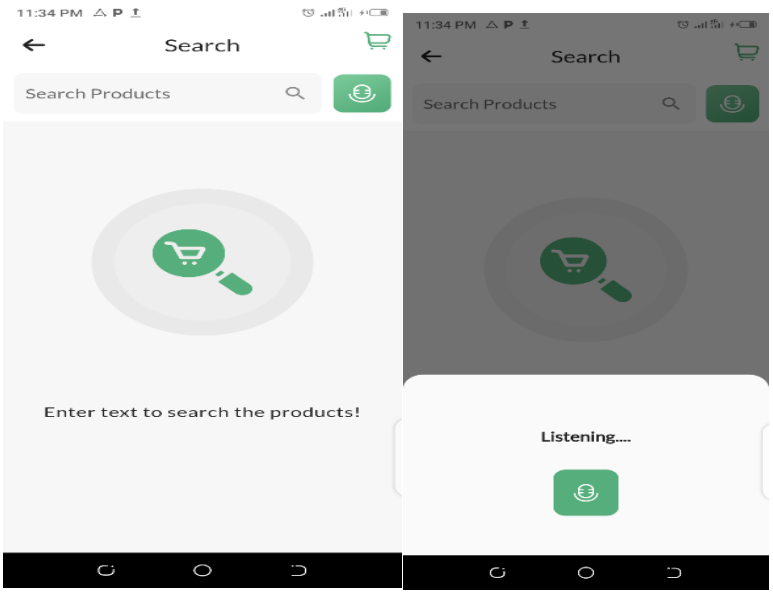

Figure 15: Text Search **Figure 16: Voice search**

Add to cart

This allows customers to save items to their carts so they can continue buying. Then complete the checkout process later on in the process. The figure 17 below shows the add to cart interface.

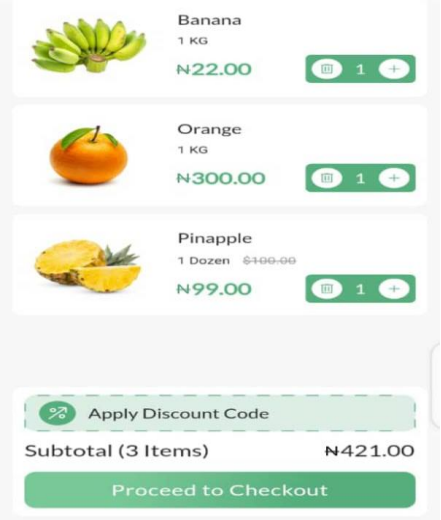

Figure 17: Cart

Checkout

This is where buyers are expected to key in their contact details for delivery of agricultural products they ordered**.** The interfaces are shown in figure 18, 19 and 20.

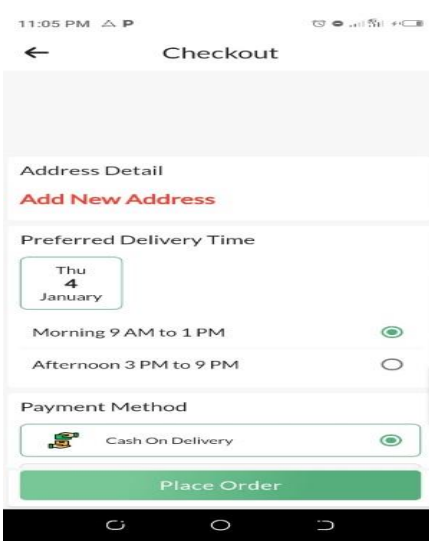

Figure 18: Checkout

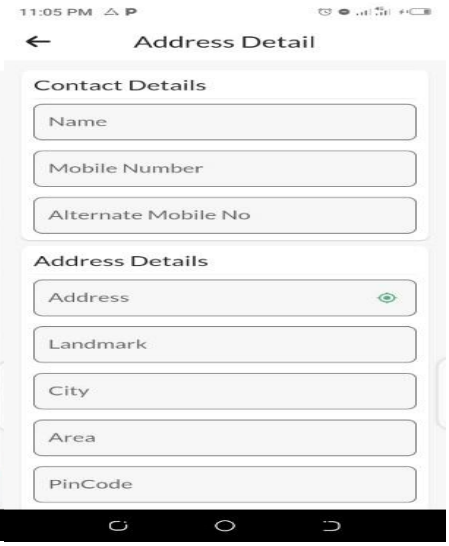

Figure 19: Address Details

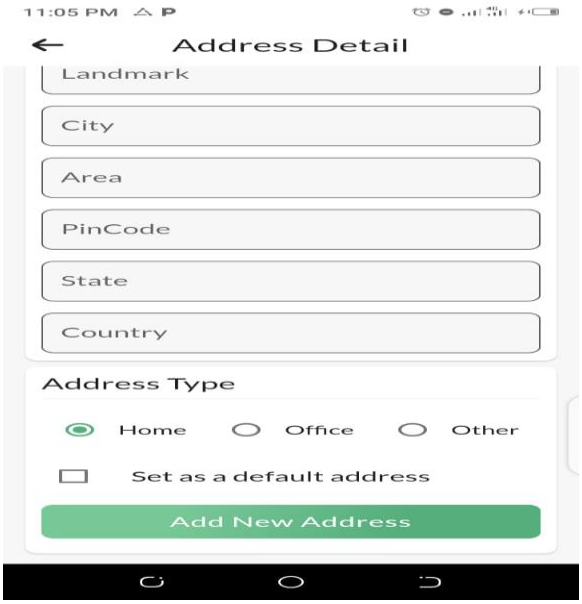

Figure 20: Address Details

Research interview analysis results

Simple percentage and simple linear regression technique was used to obtain the percentages and graph below respectively.

Do you think e-commerce app for marketing Agric products is useful?

Table 1: Usefulness of E-commerce app

S/N	Description	Respondents	Percentage
1	Agreed	51	73%
2	Disagreed	19	27%
Total		**70**	**100%**

From table 1 above, it shows that 51 of the respondents with 73% agreed with the statement that the e-commerce app is useful for marketing agricultural products, while 19 of the respondents with 27% disagreed with the statement. In conclusion, utilizing an e-commerce app for marketing agricultural products can be highly beneficial. It provides a convenient platform for farmers to showcase and sell their products directly to consumers, widening their market reach. Additionally, it enables consumers to access a diverse range of agricultural products with ease.

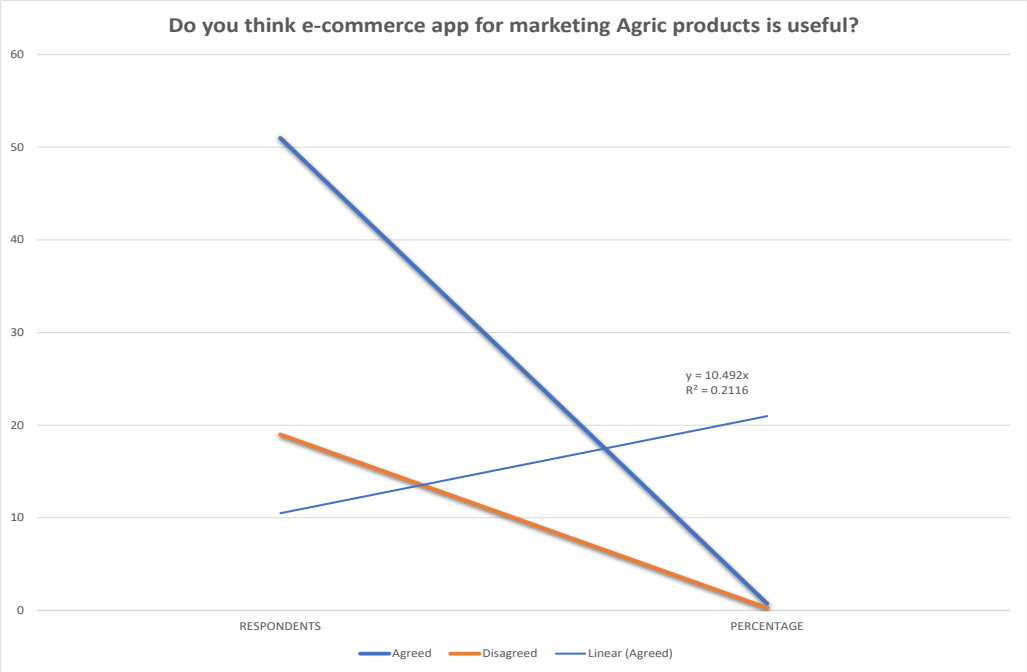

Figure 22: Usefulness of E-commerce app

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What type of Operating System do you need?

Tabe 2: Operation system preferred by consumers

S/N	Description	Respondents	Percentage
1	Android	67	96%
2	Ios	3	4%
Total		**70**	**100%**

From table 2 above, it was revealed that out of 67 total respondents, representing 96% agreed that the Android operating system offers more device variety and customization options, while IOS, with only 3 respondents representing 4%, indicates that IOS provides a more controlled and integrated experience when using it. In conclusion, it shows that in the 24th century, farmers, both rural and urban, preferred to use the Android operating system than IOS.

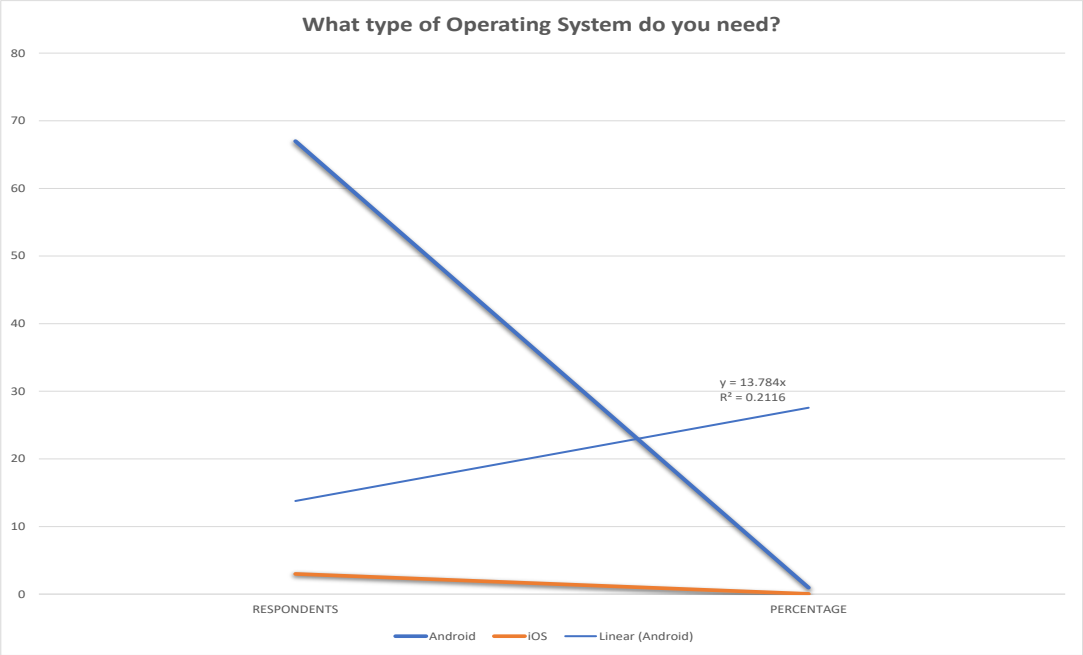

Figure 21: Operation system preferred by consumers

Conclusion

The design and development of this mobile application reflects that mobile phones are powerful enough as tools for e-commerce. Users can have nearly the same experience as they would have if they are using their personal computer and this experience comes anywhere and anytime. Thereby making farmers have more profits; customers can also benefit from the portability of the mobile application.

Recommendation

Further study can therefore be channeled towards comparing the performance of the mobile application for agricultural products platform with the existing ones in terms of users' experience, satisfaction, scalability, usability, market relevance and security so as to know where further improvements need to be made to the already developed platform.

Contribution to Knowledge

Mobile agriculture e-commerce application has contributed to knowledge by improving market access and transparency, optimizing supply chain, promoting financial inclusion, disseminating agricultural information, enabling data driving decision making and supporting sustainable agricultural practices.

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