Mobile App Technology for Rural Farmers in Africa

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ABSTRACT

Farm operation in recent times has faced the challenges common to crop and livestock production and distribution which have reduced the productivity of most farmers. This is mostly seen in rural areas where farmers depend largely on traditional methods of farming for their farm operations such as ranching, dairy farming, raising livestock, etc. Presently, people are embracing technology and using it in their businesses. Mobile App technology is an innovation that will help farmers; but statistically, most rural farmers do not use farm mobile App technology for various reasons ranging from lack of knowledge to system complexity. Therefore, the motivation behind this paper is to educate farmers and encourage them to use innovative technology to effectively manage farm operations and increase productivity. This paper is accomplished using software development methodology (Incremental model) due to its simplicity in operation; and works well for smaller projects, with clearly defined stages that are documented. The incremental methodology is a model that involves the breakdown of activities into linear sequential phases, where each phase depends on the complete execution of the previous one, peculiar to its objectives; with a language choice of Java, and Spring Boot which is a fully object-oriented programming language. The results obtained show that this App can accurately and effectively manage farm operational activities and optimize planning objectives in terms of production and distribution which would significantly improve decision-making by farmers and promote an efficient market system for farmers.

Keywords: *Farmer, Operation, Mobile App, Information System, and Technology.*

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1. INTRODUCTION

Agriculture plays a significant role in every economy. It contributed to over 21.9 percent of the national GDP of Nigeria in 2019 (National Bureau of Statistics National Bureau of Statistics (NBS), 2019) and provided employment opportunities to about 70 percent of the nation's population in 2018

(Urama and Nfor, 2018). Agriculture and its allied activities are powerful ventures to explore and expand StatisticsTimes.com (2016). But it should be backed with powerful tools and technology, including good connectivity and e-mobility. This technology could help to improve the delivery of services. Technology as we all know it has revolutionized our existence on earth. Anupam and Balakrishnan (2018) admits that Mobile-based applications are nearly on the verge of replacing computer-based services due to their cheaper cost and easier integration with various cellular services.

Kumar and Agrawal (2020) depicted that in the modern era of spontaneous generation and dissemination of information, mobile technology has become the world's most widely used method of transmitting information in various forms like voice, pictures, video, data, etc., around the world. In effect how the organization of knowledge for practical purposes of mobile phones spreads through and appears during consideration in our lives and multiple supplementary things in which it is used – like access to the internet, audio-visual recordings, and financial transactions thereby making the mobile phone a global instance of information transfer with relevant value.

The mobile app has become an opportunity where the farmers can express their opinion and as well serve as a medium for getting the necessary information and knowledge used in solving farm-related problems. The movement of Agro-information and connectivity to farmers has been significantly changed by smartphone apps. To operate and execute agricultural activities, accurate, brief, timely, and trustworthy information is needed by farmers (Kumar and Karthikeyan, 2019).

Numerous features, including internet access, audio-visual recording, and financial transactions, are available on mobile phones, which have grown to be the most significant kind of communication technology in the world. A farmer can access all the solutions and information in just one touch through a platform created as mobile app. Mobile applications (mobile apps) therefore are software programs designed to run on mobile devices such as smartphones and tablets (Costopoulou and Karetsos, 2016). Generally, they are made to supply almost the same service to users that are capable of being reached on laptop computers (PCs) and desktops. Developing nations including India, Kenya, Uganda, South Africa, and Tanzania have seen improvements in their agricultural output due to the adoption of mobile phone applications (Qiang, Kuek, Dymond and Esselaar, 2012).

Baumüller (2017) declared that agriculture has the inherent capacity for coming into being and getting to the limit within which it can accomplish a purpose and help people owning a piece of land below 50 acres that are sold or rented to someone else for cultivation purposes in the countryside as opposed to the city through the use of the mobile application. Affordability, wide ownership, voice communication, and instant, and convenient service delivery are mobile phone advantages. Hence, a global sudden uncontrolled increase of mobile apps, made easier by gradual changes in mobile phone networks and equally through the multiplication of results given routines and mobile phones decreased prices (World Bank, 2012).

The main advantage of mobile apps is that it enables farmers to assess information easily from relevant information databases. Such information related to plant and animal diseases, loan schemes, market prices, weather forecasts and advisory services can be conveniently obtained from back-end databases to which the mobile app connects over the Internet. To receive all this information, many farmers rely on SMS which is a one-way communications service. However mobile apps will provide a two-way communications service and dynamic information necessary for day-to-day farm operations.

In a recent study, Asa and Use (2017), mobile phone has become one of the fastest-growing ICTs that have found usefulness in extension service delivery for improving agricultural productivity and accelerating development programs in rural areas. Aker, Ghosh and Burrell (2016) pointed out that some African states have recorded increased yields since they embraced mobile app technology. Karthikeyan (2018) acknowledges that Android apps on the expert system in five crops (paddy, banana, coconut, ragi, and sugarcane) and cattle developed by Tamil Nadu Agricultural University (Coimbatore, India), contains a decision support system, crop doctor for diagnostics of pest and diseases and an information system to provide knowledge for better farming.

Farmers have enjoyed limitless assistance through the support of mobile technologies. For example, buyers and sellers are connected through mobile and internet-based technologies in Uganda while SAP (German Software Company) is piloting a supply

chain management system for small producers in Ghana. However, most of these M-services are barely scratching the surface of what is technologically possible (Baumüller, 2017). Timely access to information decision-making in agriculture and related sectors with common characteristics require no special importance or significance. The search of this for having information transferred to farmers on time and in a manner that saves cost has become an option.

The organization of knowledge of mobile phones for the practical purpose was taken for granted by countryside farmers; not recognizing the sufficient ability it gave them to acquire knowledge of agriculture. Due to limited access to information and communication for decision-making, rural farmers in developing nations face considerable challenges from both the competition in the global market and the reasons driving significant global change outside of their control. Hence for decision-making, information about the market like sales coordination, product movement, and distribution is of high importance. Also, it has been observed that there is no knowledge sharing and end-to-end experience between producers and consumers because of the inability to obtain information and the low understanding rate of the farmers.

Mobile phone technology in rural areas is undergoing very quick progress through a sequence of stages resulting from poverty reduction and an increase in economic growth due to its high importance. In communicating advanced scientific and actual agricultural operations, the mobile phone is always an indispensable device for social network operations as well. Farmer knowledge, thus gathered, based on practice can be exchanged within them using the internet and mobile networks, which can as well be used to provide market information on agriculture.

Farmers and persons with a legitimate interest in farming have enjoyed the advantages of the advancement of current rendered assistance and usage of mobile phones based on their introduction to agriculture. The assistance that began as messages at an instant of time has come into being by having multiple modes, combined use of media (sound, text, and video), and M-agriculture applications for smartphone usage.

In developing countries and all over the world as well, mobile phone technology has speedily extended in one or more directions. Also, in developing countries, mobile phone services should be in use to improve productivity, consequently increasing agriculture and making agricultural information accessible. Individuals entrusted with the right or legal stake in agriculture could equally use mobile phones which are normally used by friends and families for communication as a tool for business in agriculture.

Apart from excavating the soil, there is more to farming. Therefore, farmers require understanding to achieve a bumper harvest under given circumstances through the right selection of seed varieties; the best time suitable for planting, and the best customary way of farming so as to make the product have the best price.

1.1 Objectives

Farmers' information needs have greatly increased in the last half century because of sophisticated production technologies and the increase in the need of having effective financial planning and control. There is need to deploy Mobile App Technology at rural areas. This motivated the researchers.

Other specific objectives are as follows:

1.To propose a system that will help farmers achieveservice delivery and promote agriculture at rural levels.

2.To develop a system that will serve as a central database for rural farmers

3.To provide direct access/contact between the farmers, the people and government

4.To develop a system that will equip farmers with quality information on regular basis.

2. METHODOLOGY

Due to its software development process, which breaks down requirements into many isolated software modules development cycles, the incremental model was chosen in the context of this study. This approach treats each module as a separate project that goes through the stages of the Software Development Life Cycle (SDLC). Analysis, design, implementation, testing and maintenance are therefore steps in incremental development.

Here are the various steps of incremental model phases:

1. Requirement Analysis**:** Firstly, the requirements are identified by the product analysis expertise. From this, the analysis team understands the functional system requirement, making this phase extremely important in software development under incremental model.

2. Design and Development: Here, success is recorded in the Software Development Life Cycle (SDLC) in incremental model, system design functionality and development method. Style and development phase are used by incremental model when software develops new practicality.

3. Testing: Performances of existing and additional functionality are checked at this phase. The objectives and ways which the system operates are tested using various methods.

4. Implementation: At this phase, the last coding in design and development are done, enabling the system development coding phase. Products made here are improved and used as replacement of the later version of the system.

2.1Analysis of the Present System

Using this software development model, it was easy to analyze the present system which farmers are using in their day-to-day operations. This aims at objectively evaluating the existing system which involves a manual system of farming that is predominantly adopted and practiced by most farmers. The application and adoption of a manual system of farming have not yielded much in many aspects such as productivity, efficiency, and in terms of expansion to be able to meet up with the current demand for agricultural products or produce both family wise, community, nation, and the world at large due to the mode of operation.

This existing system is predominantly centered on crop production and livestock farming, with the use of crude tools for farming practices and making it labor-intensive. Its farm records are operated with paper and pen. There is a lack of communication devices that serve as a means of updating information as regards farming operations and the market. Based on this analysis of the present system, the following problems were identified:

1. Inadequate Information: This is one of the major problems that exist in Nigeria's agriculture sector in which rural farmers are also undersupplied of this fact. To start with, there is more to farming than just digging the soil and planting crops. Farmers need to be acquainted with how to select the right seed variety in order to have optimum yield.

2. Poor Research and Record Keeping: The best way to solve a challenge is to trace the root cause of that problem, which is the importance of keeping records both for present and future unforeseen circumstances. Sometimes documents that provide information about present and past events of the farm are kept without care or consideration, if at all available. Also, evidence pointing to a possible solution of perfect conformity to facts about activities of the farm and its information are equally not readily available; hence sufficient information for faming purpose like market prices are precise to the matter at hand resulting to an inclination to alteration of farm figures with rural farmers as a case study.

3. Finance**:** Farmers which are above average in number are mainly in rural areas where they are common and always considered family (subsistence) farmers when carefully weighed. This is a result of the unavailability of funds that are needed to modernize farming. Irrespective of agriculture's quality of greatness and noteworthiness to the domestic economy, most farmers in rural areas are poor and do not possess the finance to acquire the necessary needed technology that will improve farm practice.

Regrettably, establishments like banks and other financial institutions that are anticipated with the confidence of fulfillment to make this problem less severe are not meeting up to expectations. This is a result of the lack of funding required to modernize agriculture. Despite agriculture's magnificence and importance to the national economy, the majority of farmers in rural areas are poor and lack the resource to purchase the essential technology to advance farming methods.

4. Lack of Modernization and Poor infrastructure**:**The inability to gain access to this has

hindered so many productive strides in this part of the world; either through information or by direct contact with extension workers and equipped with the technical know-how or the right education about new techniques. The observed and identified problems existing in this current system would be a stumbling block towards achieving a tremendous breakthrough and becoming so attractive to encourage individuals, groups, and other interested organizations to invest because it's also like an oil boom that would yield a great dividend.

2.2Use of Mobile Technology in farming

In Nigeria, the mobile phone organization has effects in a specified way that is largely important in the country's advancement socio-economically, by bringing forth the stage for millions of citizens that have been prevented from being included from the following services: exchange of information, digital inclusion, market, innovation, good governance, and finance (Baumüller, 2016; Ogunniyi & Ojebuyi, 2016).The benefits have not been fully maximized by farmers due to the non acceptance of mobile technology by farmers which is highly unfortunate (Chhachhar, Chen, & Jin, 2016).

Using mobile phone technology in agriculture, economic development and reduction of poverty is guaranteed. Based on the Pew research centre Pew Research Center (2016), the use of the internet in Nigeria is on the increase. The internet was accessed 21 times a day by 38% of Nigerians in 2014 and further increased to 58%. Also, it was forecast that by 2019, the number of Nigerians using smartphones will increase from 11 million in 2011 to 23.3 million in 2014 (Statista, 2018).

In developing countries, there is still a common digital divide because of the effects of social and economic inequalities irrespective of the increase in internet and smartphone usage (Ohemeng, & Ofosu-Adarkwa, 2014). The number of mobile apps that support the productivity of agriculture in Nigeria is on the increase, regardless of more whose web versions are running but are still at the production stage. Some of these apps include; Growth Enhancement Support Economic Wallet (GESE-Wallet): created for the provision of soft loans, education of farmers on farming methods that improve productivity, seed tracking, and disbursement of fertilizer by the Federal Ministry of Agriculture and Rural Development, Nigeria that created it (Uwalaka, 2017).

Examples of such apps are.

1.Agrikore**:** connects farmers, agro-dealers, commodity traders and insurers on a transparent and honest process for every stakeholder (Okoroji, 2019).

2.Verdent: provides general agricultural guidance and market information (Uwalaka, 2017).

3.Probity farms: connects farmers to market andensures that the daily comparison between the market, food crops prices and the livestock are also used for farm management (Uwalaka, 2017).

4.Cellulant: for redemption of subsidized seed andfertilizer vouchers in partnership with government of Nigeria and farmers (Uwalaka, 2017).

5. Whatsapp and Telegram: to promote exchange of information and ideas through creation of informal groups (Uwalaka, 2017).

6**.** Banking App: for on-the-go easy financial transaction (Uwalaka, 2017).

In development and proposition of these apps, farmers in rural areas are seriously considered because they do not benefit enough from these apps because of their system of operation.

2.3Data Flow Diagram of the Proposed System

This depicts flow of information in the proposed system. It is generally known and referred to as DFD. DFD shows the graphical illustration of flow of information in items of input and output in the system. It creates a better understanding of the system.

2.4Use Case diagram

In n a proposed system, specifications that are feasible to individuals or subsystems are captured via identification of modeling of the use of cases as represented by the construction of the use of case diagram. Here, actors are known as the "individuals or subsystems" that relate to identified used cases while non-members and members are identified actors in the proposed system. Hence the farmers are included (but not limited) in the proposed system

and identified as specific actors. The case diagram is used to represent modeled used cases.

2.5 Database Design

This is how data is structured in this system. It is presented in a tabular form (relational database). This will give access to accurate information relating to farmers' needs and makes it easy to maintain, improve data consistency and reduce cost relating to disk storage. In this design, many data types are supported by MySQL through its statement and functions including password system and verification host-based enablement. In design, its uses functions as the backend of that system which stores the data structure and the main data. MySQL's easy-to-use ability, speed, reliability, and simplicity are the factors that made it to be chosen for database implementation. Also, Java and spring boot were used to create the front-end interface for data transfer and retrieval.

Examples of database tables in this design:

Table 1 is the authentication page. This allows only authorized user(s) access to the entire system. when the user 's identification and password have been entered correctly.

This table is used to erase a farmer / farm from the system. A list of farms /farmers that were created will be seen on this page. To delete a farm/farmer, the farm and farmer ID fields on the form would have to be filled out and one clicks on the ***"Delete farm button"***. Thus, the basic course information will be completely erased.

2.5.1 Sample Database Implementation

This is some database sample codes which was implemented using MySQL server. The choice of MySQL server is based on security and efficient storage facility.

```
$sql = "CREATE DATABASE IF NOT EXISTS `marf`";
mysqli_query($conn, $sql);
mysqli_select_db($conn, " marf ");
mysqli_query($conn, "CREATE TABLE IF NOT EXISTS `farmer` (
    `farmer_id` INT UNSIGNED NOT NULL AUTO_INCREMENT primary key,
    `farmer_name` VARCHAR(50) NOT NULL,
    `farmer_email` VARCHAR(50) NOT NULL,
    `farmer_phone` VARCHAR(50) NOT NULL,
    `farmer_gender` VARCHAR(50) NOT NULL,
    `farmer_address` VARCHAR(50) NOT NULL,
    `farmer_password` VARCHAR(50) NOT NULL,
    `farmer_reg_date` DATETIME NOT NULL DEFAULT CURRENT_TIMESTAMP
  );");

mysqli_query($conn, "CREATE TABLE IF NOT EXISTS `farm` (
    `farm_id` INT UNSIGNED NOT NULL AUTO_INCREMENT primary key,
    `farmer` VARCHAR(50) NOT NULL,
    `farm_image` VARCHAR(50) NOT NULL,
    `farm_location` TEXT NOT NULL
  );");

mysqli_query($conn, "CREATE TABLE IF NOT EXISTS `contact` (
    `id` INT UNSIGNED NOT NULL AUTO_INCREMENT primary key,
    `email` VARCHAR(50) NOT NULL,
    `subject` VARCHAR(50) NOT NULL,
    `message` TEXT NOT NULL,
    `date` DATETIME NOT NULL DEFAULT CURRENT_TIMESTAMP
  );");

mysqli_query($conn, "CREATE TABLE IF NOT EXISTS `crop` (
    `crop_id` INT UNSIGNED NOT NULL AUTO_INCREMENT primary key,
    `crop_image` VARCHAR(50) NOT NULL,
    `crop_name` VARCHAR(50) NOT NULL,
    `crop_amount` VARCHAR(50) NOT NULL,
    `crop_description` TEXT NOT NULL,
    `farmer_id` VARCHAR(50) NOT NULL
  );");

mysqli_query($conn, "CREATE TABLE IF NOT EXISTS `livestock` (
    `livestock_id` INT UNSIGNED NOT NULL AUTO_INCREMENT primary key,
    `livestock_image` VARCHAR(50) NOT NULL,
    `livestock_name` VARCHAR(50) NOT NULL,
    `livestock_amount` VARCHAR(50) NOT NULL,
    `livestock_description` TEXT NOT NULL,
    `farmer_id` VARCHAR(50) NOT NULL
  );");
?>
```

2.5.2 Entity Relationship Diagram

Entity relation diagram (ERD) is a conceptual and representational model of data used for entity framework and infrastructural representation. Its elements include entities, relationships, and attributes. Consequently, ERD is a data modeling technique that illustrates information system entities and their relationships graphically.

In this design, the Entity Relationship Diagram is shown in Figure 3.

From Figure 3, two tables are available: such as the Farm table which provides farm information and attributes like farm name, address, and the farmer's username, and password, and the farmer login table which provides attributes like farmer's ID, username and password having the farmer's login ID as the primary key. In the login, the existence of the username and password are verified when the farmer logs in to the system. The above farm table and farmer login table are related because of having both farm ID which is regarded as foreign key in the farm login table (where the username and the password of the farmer are automatically saved when a farm is registered by the site administrator.

This shows ER diagram of contents which are singly managed to discover content assessment, security, and publically accessed as well. Contents ERD also enables users to access the content account links by associating them with menus that will give users links to their accounts.

3.CHOICE AND JUSTIFICATION OF PROGRAMMING LANGUAGE

Program is a set of instructions written by a programmer in a particular programming language, which enables processes to be performed by a computer. Programming language is the language used to write a computer program. Some of the programming languages are Basic, FORTRAN, etc. The choice of programming language in this design is Java, and Spring Boot, and they are object-oriented programming languages (OOP).

Object-oriented programming language is a modern programming language that is used in innovative applications. Java and spring boot are chosen because they are easy to understand. As Object-Oriented Programming Language (OOP), they are easier to impede security features in this design because they are very easier to modify the application which will help to meet the recent trends in our society. The program for the new system was coded using a programming language that is scalable, flexible, and more suitable for web applications.

4. REQUIREMENTS FOR SYSTEM DEPLOYMENT

1. Training Requirement

In choosing a trainee for the implementation of this system, the principal record officer and staff will be involved in the training. This is because this group of people will be in the operation of the new system. These selected staffs are taught how to manipulate and operate the computer and the new system designed. These selected staffs are also given a procedural manual (user's guide) so as to aid them in the operation of the designed system. This is because documentation makes the system to be open to all users, and if the system is not well documented, it becomes difficult for effective and productive usage.

2. File Conversion

This is where the manual system will operate simultaneously with the computerized system. With this procedure, the current basic data is processed by the several results which were checked against one another. This is to ensure the feasibility of the system after implementation. An appropriate mode for file conversion to the new system is to be adopted. The mode of file conversion adopted here is the parallel changeover, which is the concurrently running of the old and new systems for some time to compare the outputs of both systems and then carry out amendments where necessary. It also helps to ensure the efficiency and feasibility of the new system regarding measuring its functionality.

This mode of file conversion and changeover system will last for the duration of six months due to its cost-effectiveness. We believe that before the proposed time elapsed, the users of this management system would have gotten used to the system.

5. EXPERIMENTAL RESULTS

The new system was commissioned to verify if it conforms to conventional software behaviours and validated to ensure that it also met the needs and

specifications of the user. This software was tested in line with the design objectives to validate that it meets the need for which it is designed. Below are the verification and validation details of the software.

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1. Verification: This software was verified to ascertain that it conforms to conventional software behaviours. This was done by running the new system on various versions of the Microsoft Windows operating system and on 32bit and 64bit CPU configurations and it responded in line with conventional software behaviours.

2. Validation: The new software was validated, and it met the needs of the user because all the software specifications and requirements were implemented; hence the software is fully functional, appropriate, and efficient.

3. Usability:In specific contexts and with a product to a reasonable extent, users achieve efficient, satisfied, and specific effective goals. The system should be designed in a way it should be error-free, efficient, and easy to learn, and from the end user's perspective.

4. Maintenance:Easy modification of the system is necessary towards making changes to its functions and features, consequently adding new functions to the system in the future based on the easily extensible functions of the system.

5. Dependability:For the fact that the system is to be used by non-IT experts, the need for the dependability of the system is very important; hence robust and fault tolerant. System security should equally be given high priority due to web assessment of the subsystem to secure the school's sensitive data.

6. TEST DATA

Here, test samples are presented from real case studies and user information is captured by the system during user study test to put the systems integral modules and functionality to verification. At completion, the expected performance of the system is examined by capturing the user data at the input area of the system (GUI).

6.1 Introductory Screen

This serves as the welcome screen. It is from this point that the farmer starts to navigate to other pages and shows the App basic features. It also provides brief information about the App (Mobil App for Rural Farmers).

6.2 Login Page Test Data

For validation of users account, test data in need of user's login information are made available to the system. Through the click of "submit" button, a valid input test is made by operating the user password and the username on the input area. Access to the system is granted or denied when valid and invalid login values are submitted respectively. On these three user categories, this test is conducted.

i. Admin login

ii. Operation login

iii. Client support login

In order to ensure error free system, valid boundary values like disagreements of upper and lower cases are resolved. The login page test scenario of an admin is shown in the figure below.

6.3 User Registration Test Data

For the test of system performance, test data of a new user (farmer) registration were made available to the system. The registration page test scenario of a new user is shown in the figure below where a valid input test was concluded at the click of the "submit" button, hence having the user information saved and submitted to the system database after capturing the new user information at the input area of the registration page.

6.4 Report and Query Test Data

For paper check of system functionalities, queries and searches test data are made available to the system. A search result of a registered user is shown in the figure below.

7.TEST RESULTS AND DISCUSSION

The software expectation is analysed by the result from the new system. Graphical illustration is used in showing these results in the figure below.

From the above table authentication page, the whole system is accessed by only approved users by inputting correctly the username and password. The relationship information between the user (farmer) and his farm is stored using a registration table. Consequently, the basic course information of the farm/farm ID will be absolutely erased from the system at the "click" of the "delete" button through the use of this table.

The system's three (3) user categories namely: admin login, operations login, and client support login came out positive with respect to the user login scenarios conducted test. Therefore, access to the system is either granted or denied when valid or invalid login values are submitted respectively. This is possible by resolution of the boundary value disagreement of the upper and lower case, thereby creating a system that is error-free.

8. CONCLUSION AND FUTURE RESEARCH

The use of information technology tools that are easily accessible, farmer-friendly, and generally inexpensive in agriculture has dramatically altered the farming system. Mobile app technology is a recent technological innovation that is transforming agriculture and making it a prime sector of importance. Now the farmers are in a position to take informed decisions well in advance, which has not only helped in amplifying the production but has also made agriculture risk-free to a larger extent.

With further developments and community involvement, mobile technology will ultimately pave way for more prudent and climate-resilient smart agriculture. Moreover, most farmers don't have access to this technology, limiting themselves from the benefits of mobile app technology.

In the future, we recommend that to make agribusiness productive, smooth, and respectable, it is important that, it be linked to recent technologies. This technology can be used directly in agricultural growth. Although this technology is in a juvenile phase in our rural areas, its advantages can be seen in the near future. Also, since the system will be on the cloud, we, therefore, suggest more studies on cloud security and privacy issues related.

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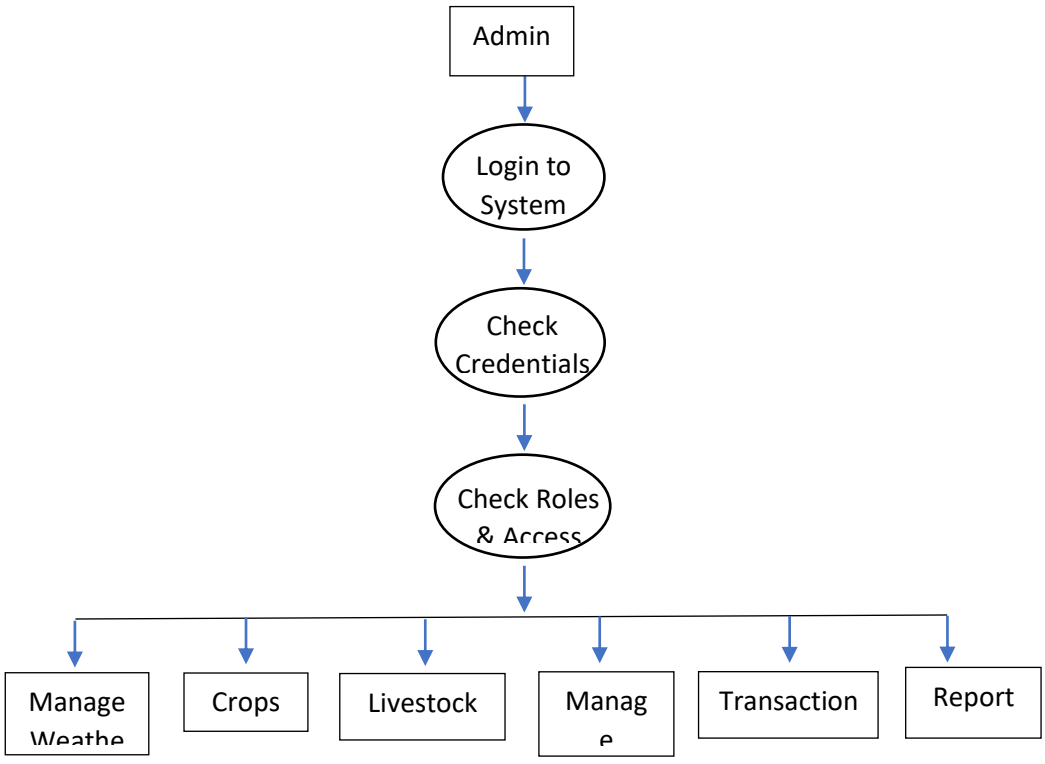

Figure 1: Data Flow Diagram of the Proposed System

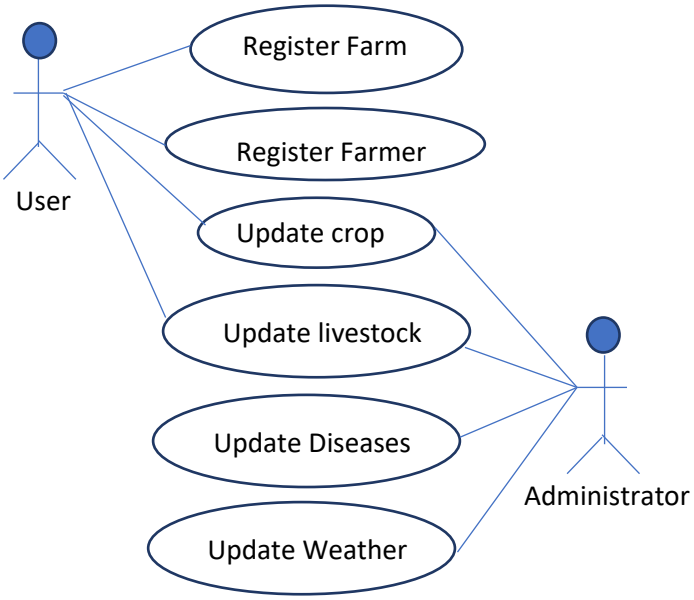

Figure 2: Use Case Diagram

Table 1: Security

S/N	Field Name	Data Type	Size
1	Person ID	String	10
2	User Name	Varchar	20
3	Password	Varchar	20
4	Confirm Password	Varchar	20
5	Reset Password	Varchar	20

Table 2: Registration

S/N	Field Name	Data Type	Size
1	Registration ID	Int	6
2	Farmer ID	Varchar	20

3	farm title	Varchar	50
4	First name	Varchar	25
5	Surname	Varchar	25
6	User name	Varchar	25
7	Address	Varchar	20
8	Telephone	Varchar	12
9	Email	Varchar	35

The Registration table is used to store the relationship information between each user (farmer) and his farm.

Table 3: Delete an Existing Course

S/N	Field Name	Data Type	Size
1	farm ID	Int	6
2	Farm Title	Varchar	35
3	Farmer' Name	Varchar	90
4	Date	Date	09
5	Password	Varchar	15
6	Comment	Varchar	6

Farm creation and Farmer login ER Diagram

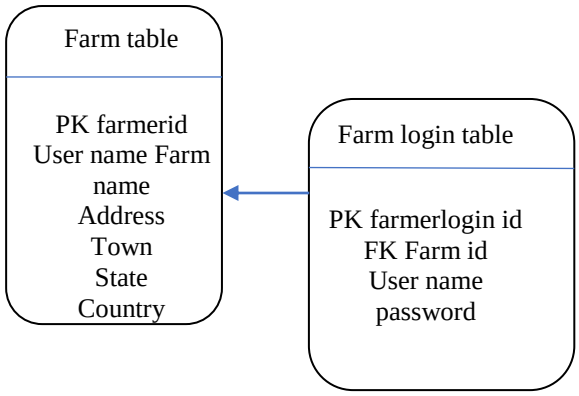

Figure 3: Farmer creation and User login ER Diagram

Content Entity Relationship Diagram

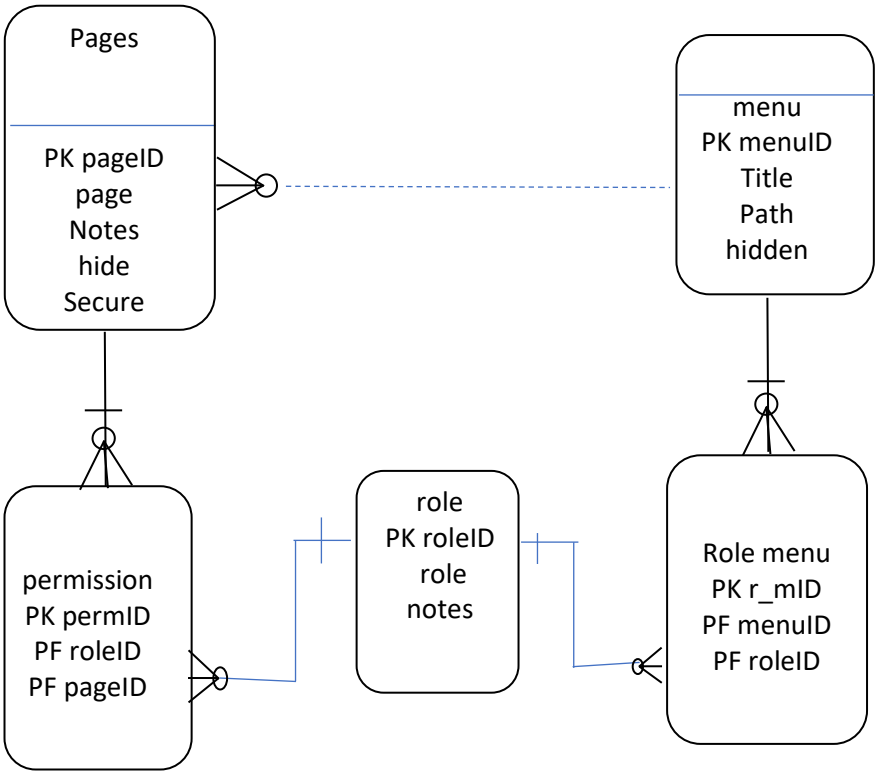

Figure 4: Content Entity Relationship Diagram

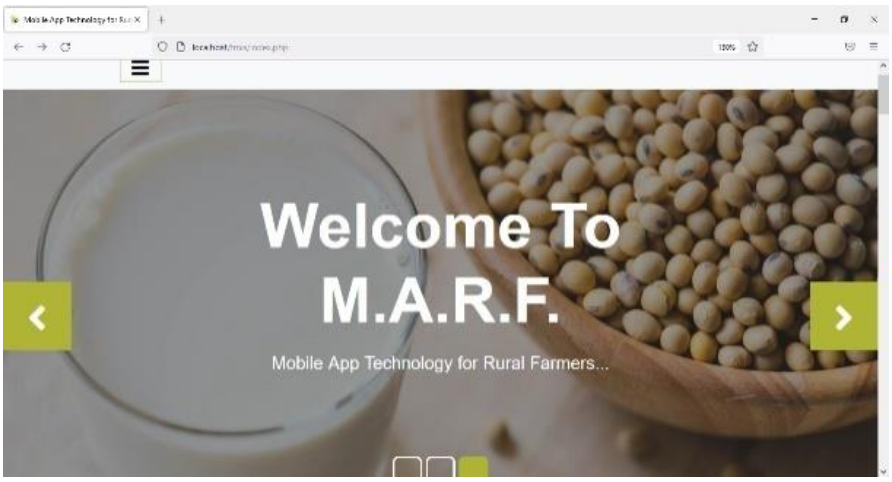

Figure 5: Introductory Screen

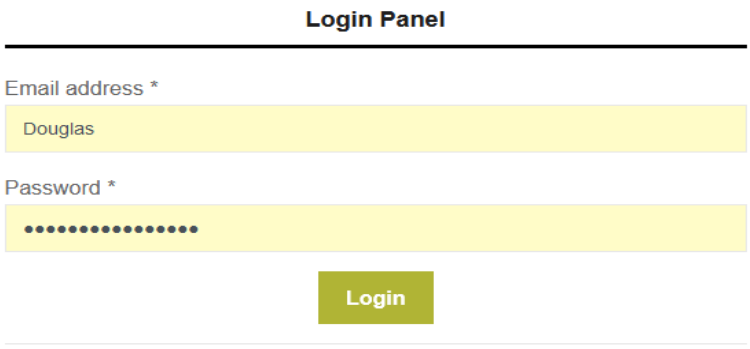

Figure 6: Login test data

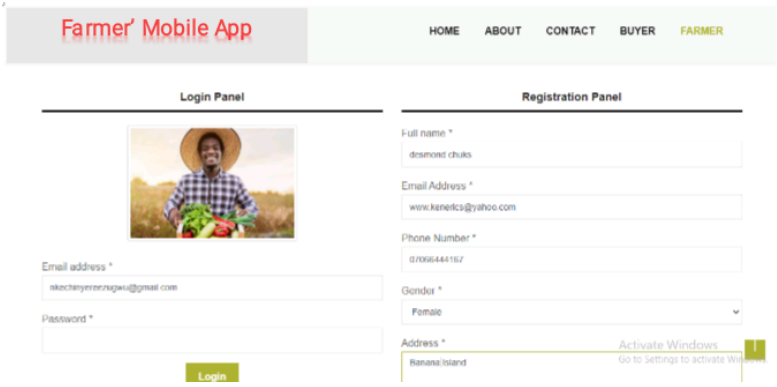

Figure 7: User Registration test data

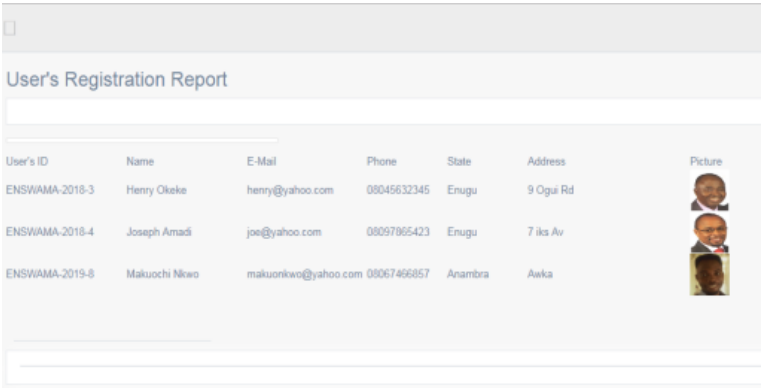

Figure 8: Report and Query test data

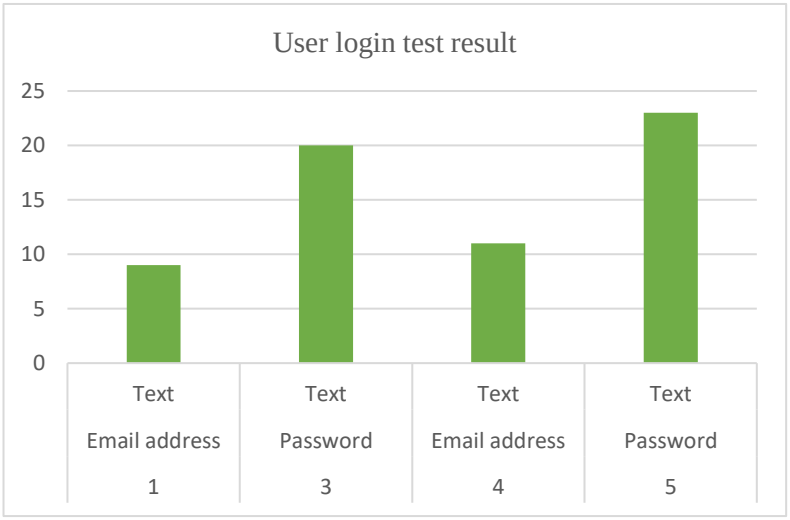

Figure 9: User login test result

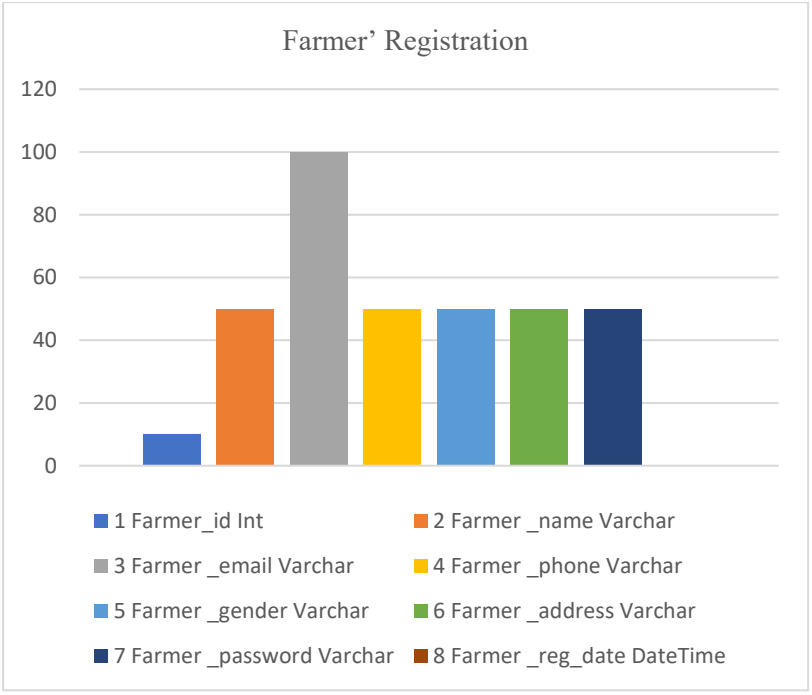

Figure 10: Farmer' Registration

All the details of the farmer such as name, address, email-id, contact number, account number, and location of the farm were captured in this result.

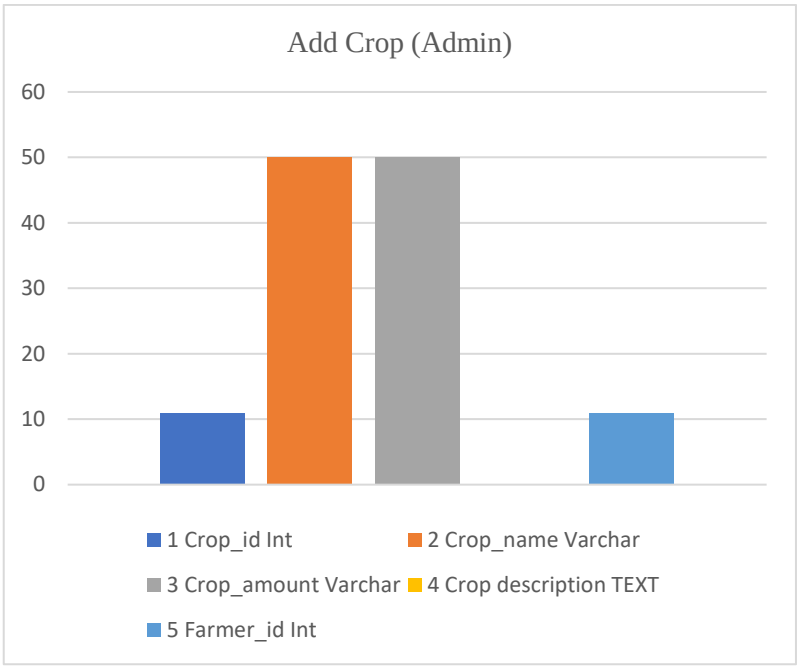

Figure 11: Add Crop (Admin Section)

All the details of adding crop by farmer such as date of adding, crop id, crop name, and range of crop price would be available in this table.

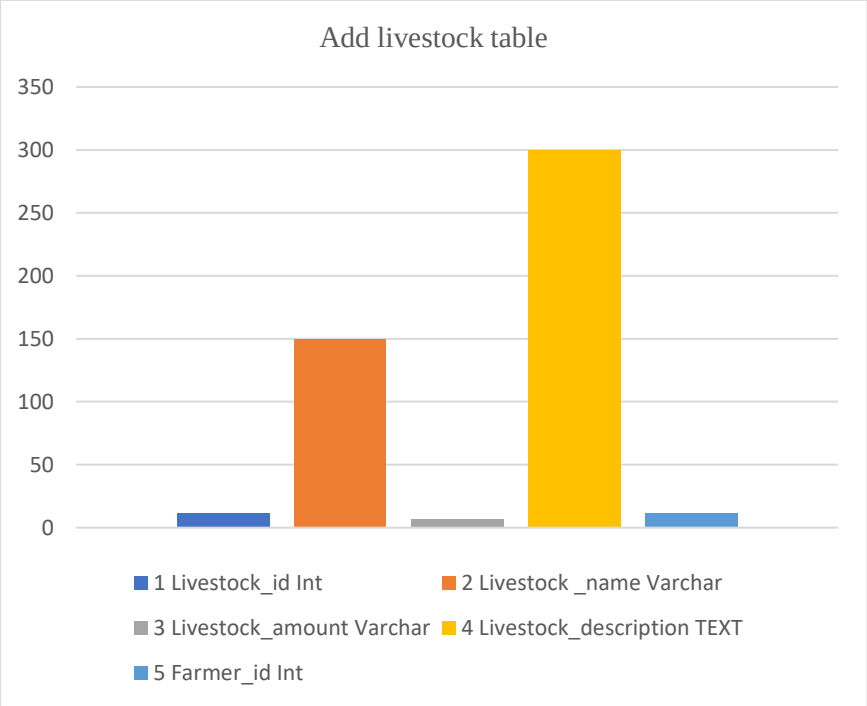

Figure 12: Add livestock

All the details of adding livestock by farmer such as date of adding, livestock id, livestock name, and range of livestock price would be available in this table.