An Android Based Farm Products Information System and Extension Services

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ABSTRACT

Smallholder farmers who cultivated most of the agricultural products are faced a wide array of problems, including access to adequate information, services and key value chains. Access to inputs and credits, paucity of information on modern farming techniques and lack of coordination along the agricultural value chain from farm inputs to sale of farm produce are some of the challenges facing these farmers. The proliferation of mobile phones in the society has changed business processes in every human endeavor including Agricultural sector. In this paper, we present an android based platform for agricultural farm product management and extension service delivery that can assist farmers and government extension agents in their day-to-day activities. Mobile application for the design of agricultural farm management and extension service brings the usefulness of Information Technology to the doorstep of rural farmers who wish to leverage on mobile technology to enhance their efficiency and increase farm yield. The system was developed with REACT NATIVE, a JavaScript framework for building native apps. React Native is an open-source mobile application framework created by Facebook, Inc. PHP was used in designing the Application Programming Interface (API) which serves as an intermediary object between the Database and the Android device for swift exchange of data. The software is connected to a database named AgroAPPDB created using MySQL DBMS. The platform provides a robust extension tool that government extension agents can use to interact with farmers and also provide a seamless agricultural value chain channels to farmers.

KEYWORDS: Android, Mobile phones, Peasant Farmer, Reactive Native.

1. INTRODUCTION

Globally, the agricultural sector has been regarded as the major drivers of any country's economic growth. It employs a higher percentage of the entire population, directly and indirectly and contribute immensely to the Nation's Gross Domestic Product (GDP). It serves as the source of food, revenue and employment opportunities for the citizen especially the rural dwellers. Without a strong agricultural base, a nation will be crippled and always struggle to sustain its economic growth. This is primarily because it will not be able to meet the food demands of developing countries and the associated raw materials required by industries. Agriculture plays a vital role in human development. Agriculture is also regarded as the main foundation of any economy. Sran et al. (2020) describes Agriculture as the most veritable tools to eliminate poverty and hunger in the World. The authors argue that technology has been playing important roles in the agricultural sector of developed economies.

Agriculture is the back bone of any economy. For a successful impact in the economy, farmers need access to adequate agricultural information and knowledge in timely, complete and quality manner. The conventional practice for disseminating agricultural information is mostly through farmer-to-farmer visits, extension officers and farmers'own knowledge (Sanga et al., 2014). Munyua et al. (2009) reiterate that important information on best practices, modern technologies, post-harvest handling and value-addition are crucial in boosting productivity. Also, factors such as access to quality inputs, markets, technology and loans are some of the challenges facing the farmers (Salami et al. 2010).

Agricultural extension services delivery describes a system that creates access for farmers, their association, and other market stakeholders to information, knowledge and technologies (FAO,2010). Over the last few decades, agricultural extension services have been dominated by both print and electronic media, television, magazines, newspapers etc. However, the introduction of social media as a form of ICT has avail the farmers a better tool for wider reach. (Henze & Ulrichs, 2016) claimed that farmers have been bewildered by the ineffective dissemination and adaptation of generated knowledge, practices and technology to help stimulate resilience to recover from shocks and stress. The authors claimed that the traditional extension services have been ineffective to achieve the transformation from crop farming production to productive intensive farming practices embracing modern agricultural technologies. The problem of low agricultural

productivity is often associated with low adoption of improved agricultural technologies, including better cultivars, fertilizers, pesticides, and practices (Aker, 2010). Similarly, incomplete reporting and challenges of adopting technology platform that are community driven have been identified as the major problem in the effective coverage of extension services. Furthermore, the conventional extension service delivery through physical contact has many setbacks due to poor communication, deplorable condition of roads, paucity of funds and language barrier have been identified as the key challenges to efficient and timely dissemination of research update to agriculturalist. Traditional extension service has failed to meet the needs of peasant farmers, especially in remote regions, the procedure is time consuming, expensive and has shown limited results in terms of adoption of improved agricultural technologies.

Information and Communication Technology (ICT) has played a huge role in the transformation of agricultural sector. Ekundayo & Olupitan (2016) posited that agricultural system couple with ICT could support to reduce the issue of unemployment and little agriculture and low agricultural yields to a manageable minimum. The introduction of mobile phone-based agricultural services are enhancing and increasingly offering solutions to solve challenges as normal extension services are grappling to fill the knowledge gap and drive structural changes (Henze & Ulrichs, 2016). Arpit et al. (2015) hold that increasing penetration of mobile networks in India presents an opportunity to make useful use information more widely available. The authors further explain that websites provide platform for farmers to communicate with other farmers, extension officers and other agencies across long distance. Islam & Grönlund (2010) reiterate that with the extraordinary surge of mobile communication technology in recent years, proof shows the use of widely and easily available mobile phones in farming. Islam & Grönlund (2010) submit that an ideal agricultural market information service can enhance market transparency, efficiency and competitiveness and increase farmers' welfare.

This study aims to develop an Android mobile app to comprehensively address the need of smallholder farmers through dissemination of proper information, management, and techniques and dynamics of labour market.

2. REVIEW OF RELATED WORKS

Different studies have been conducted related to the adoption of Mobile applications in agricultural sector for extension service delivery and farm produce information management system. Ekundayo & Olupitan (2016) in their work, proposed a mobile application for poultry and piggery, this provides information for commonly known livestock's diseases. The mobile application known as Poultry and Piggery Farm application (PPFA) was developed on android platform for livestock disease management (Poultry and Piggery). The app allows farmers (poultry and piggery farmers) to diagnose their livestock based on the suspected symptom(s) and also provide prompt treatment in accordance to the system suggestion.

The Kenyan app, Farm drive, connects peasant farmers to loans and financial management tools via their mobile phones. It reduces the main data gap that prevents banks from lending to creditworthy smallholder agriculturist. Aribe et al.(2019) propose a mobile application, Ma-Ease, for corn production and Management. The focus of the researchers is to help the Department of Agriculture to disseminate information. The apps help farmers in disseminating information, awareness, knowledge, and technology in corn farming.

Sran et al. (2020) developed a knowledge-based mobile application, "Farm-n-pedia". The app is designed and developed for the Indian farmers using Android mobile devices to address the requirements of the farmers' community and provide a way to increase their agricultural productivity. The software provides accessibility and personalization, which is long desired by the farmers. It also enables the users to access any information they want from all around the globe, get personalized expert guidance, know about the latest farming techniques and technology, and increase agricultural productivity.

Arpit (2015) designed an android application that promote e-governance by providing continuous information relating to agriculture like weather forecast, crop prices, news, government helplines, and an inventory database manager. The system is divided into two components; Arduino based mobile robot to perform field operations like ploughing, seed sowing over Bluetooth channel and an Arduino based system fixed in the field comprising a wireless sensor network (WSN) of soil moisture, pH and temperature sensors.
Purushottam et al. (2019) propose the application of data mining methods to provide information on crops, soil, fertilizer and pesticides. The research work leverage on the utilization of information mining to give suggestions to ranchers to crops, crop data, and distinguish proof suitable manure.

In the work of (Yahaya et al,2018), the authors present a framework for a text-to speech translation on Android Devices based on Natural language extension processing (NLP) and text-to-speech synthesizer to deliver real-time agricultural update to farmers by agricultural extension service workers as speech is the

3. METHODOLOGY

System Architecture

System architecture describe the conceptual model that defines the structure, behavior, and more views of a system. An architecture description refers to a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviors of the system (Paul, 2014). The architecture of a robust system for android based Agricultural product information management system and extension service is presented in this research work. The proposed system consists of both Web and Mobile components, the web components handle the administrative part while the Mobile application interface with the farmers and other stakeholders. The system provides platform to farmers to access information about plantation, harvesting, prevention, cultivation, and the best period for farm practice.

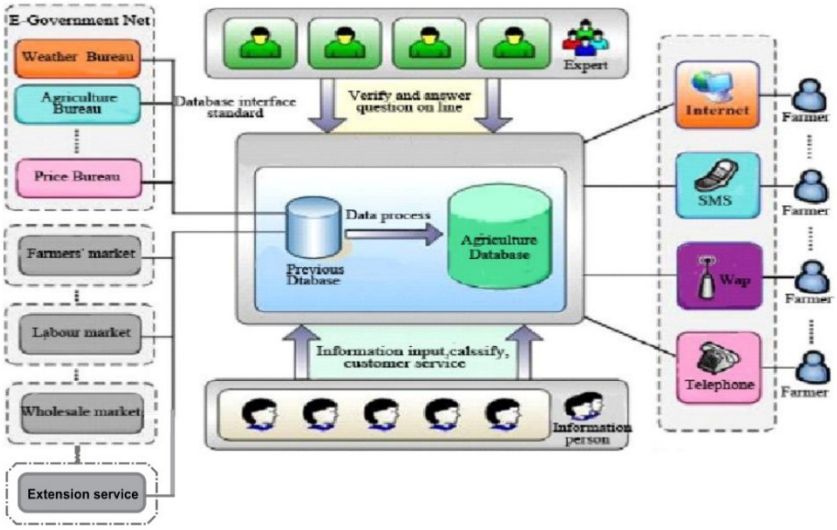

Fig. 1: An Adapted Architecture for Android based Farm product Management system (Shubham et al.2015)

Entities used in the architecture and discussion

The proposed architecture as in Figure 1 consists of four entities: User, Government Net, Database and Knowledge base (expert). They are introduced as follows: The user comprises of the mobile phone or web which can query the system. The knowledge base consists of different experts' knowledge on different area of farming and extension services. The government Net component handles or contains every module from the government.

4. OVERVIEW OF THE SOFTWARE

This software consists of two major modules, these include:

- User (Farmer) module
- Admin module

User Module

This module provides user the access to the services offered by the system. This module also allows registered farmers to log in to the system, and as well allow them to post their farm products on the platform.

Admin module

This module is managed by an extension officer who have access to the major components in the software system.

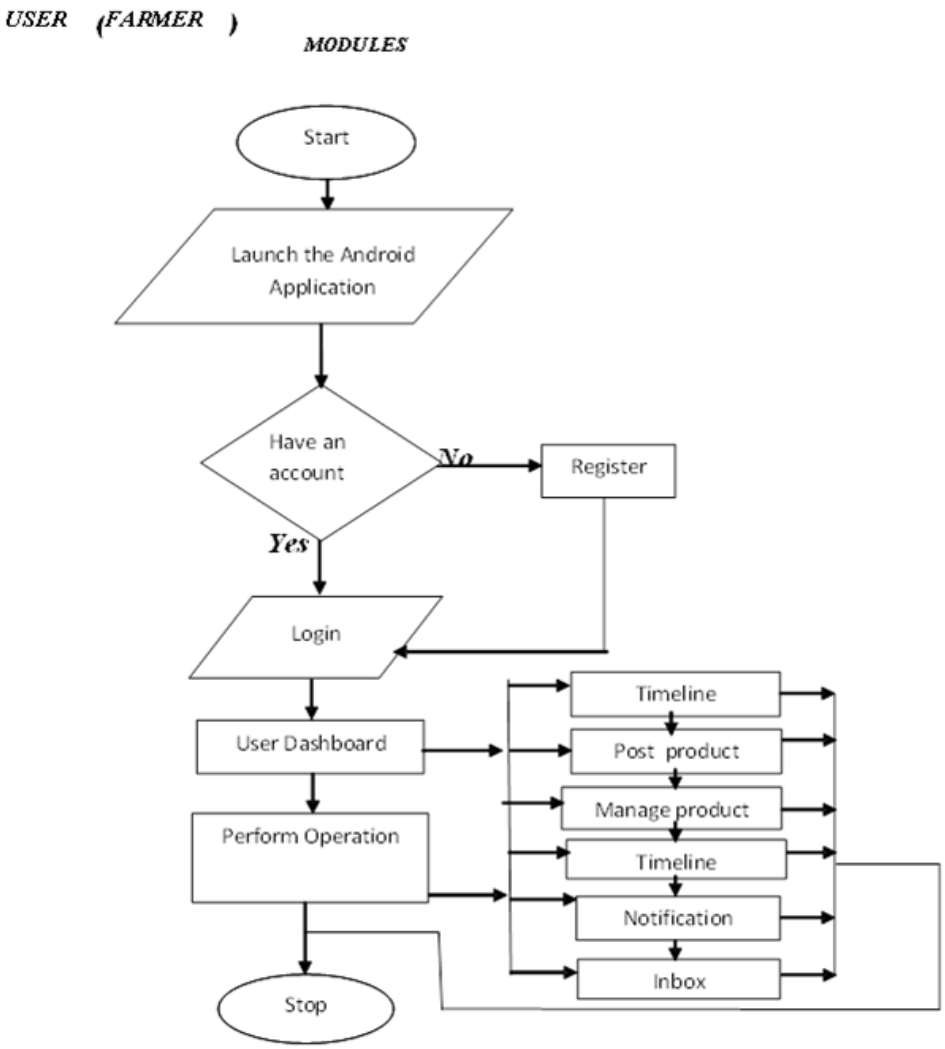

Fig. 2: Flow diagram of user (farmer) module

Diagram in Figure 2 illustrates the flow diagram for the algorithm referencing how the farmer will navigate or use the proposed system.

Programming Language used

This phase of the project describes the realization of the proposed system design or technical specification. involves putting the system functionality into action. It discusses the implementation and the testing of the designed system for the purpose of verification and validation of the various programs or function modules.

Software requirement

The system was implemented using a JavaScript Language framework known as **REACT NATIVE** developed by the Facebook Developer for the purpose of simplifying the development of Hybrid software that can work on both iOS and Android devices.

- **React Native**: is a free-source mobile application framework created and owned by Facebook. It is used to develop applications for android, IOS and UWP by enabling developers to use React along with native platform capabilities. React Native does not use HTML. Instead, messages from the JavaScript thread are used to manipulate native views.

- **PHP** was used in designing the Application Programming Interface which serves as an intermediary object between the Database and the Android device for swift exchange of data. The software is connected to a database named **AgroAPPDB** created using MySQL.
- **MySQL (My Structure Query Language)**: The type of database used for the software is a relational database that allows for interaction and connectivity of the data in the tables of the database.
- **HTML (Hypertext Markup Language)/CSS (Cascading Style Sheet)**: This defines the structure and layout of a web document by using variety of tags and attributes. They are used in developing and creating of the web pages that run on the web browser. They were used in developing the interface of the system and the front page.

5. WEBSITE MODULE

This section describes the different modules embedded in the Website components of the software system.

Admin dashboard

This administrator dashboard is the index page of the control panel for the web module content management system. It gives user access to the different components in the software system. The administrator logs in into the system to access the different menu.

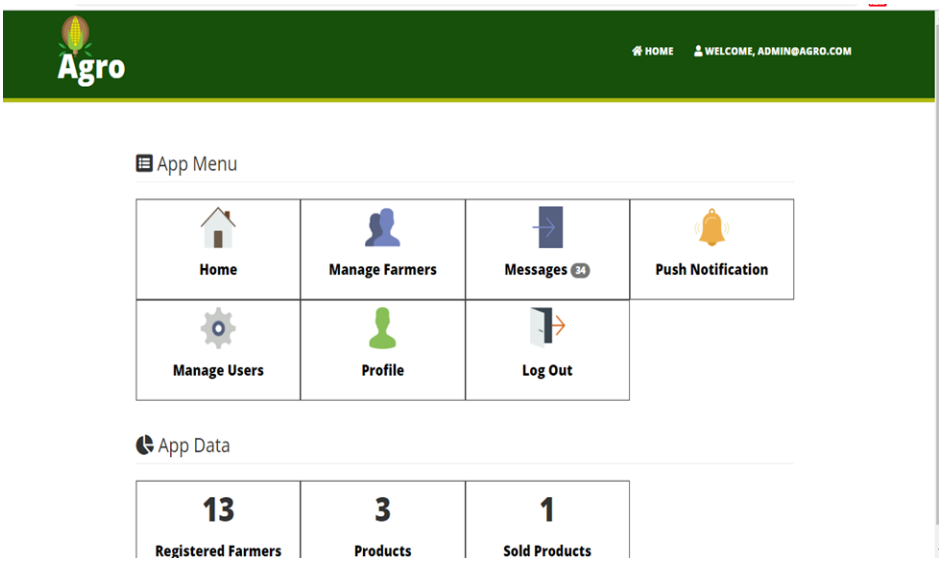

Fig. 3 Administrator dashboard:

Messages posting page

This page provides thee messaging platform for the administrator. The Administrators can send messages to the farmer to communicate ideas or new innovation

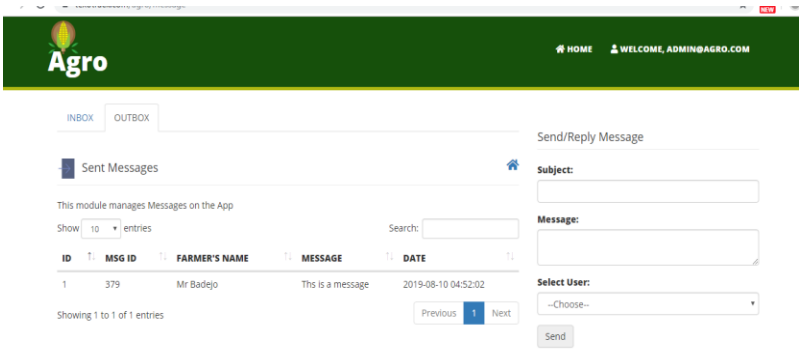

Fig. 4: Message Posting Page

Push Notification

This is a module used for interaction with the farmers via notification system. Administrators can send notification messages to the farmer to communicate recent updates.

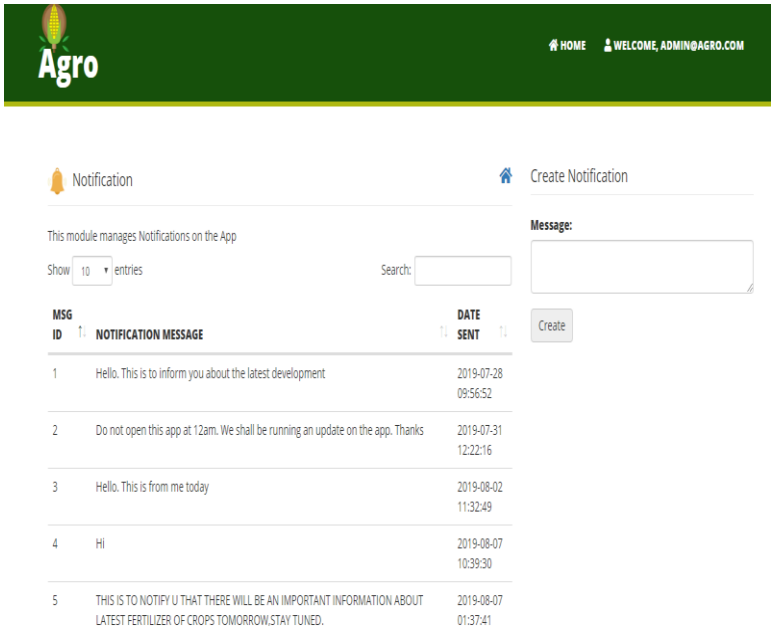

Fig. 5: Push Notification

6. MOBILE APP MODULE

This section describes the different modules integrated in the mobile components of the software system.

Login Page

This page provides platform for users to register and login to the mobile app. This shown in Figure 6.

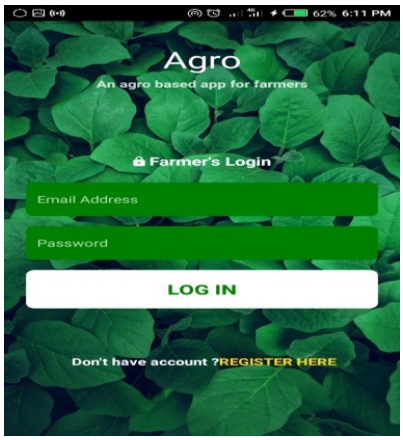

Fig. 6: Login Page

Product Posting Page

This page is used by the farmer to post farm product to the marketplace. Farmers can upload images of the products and also give relevant information about the product on this page. This is shown in Figure 7.

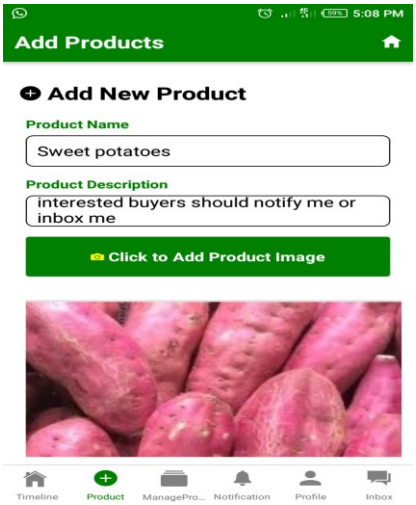

Fig. 7: Product Post page

Farm produce page

This page displayed all the published farm produce and their descriptions.

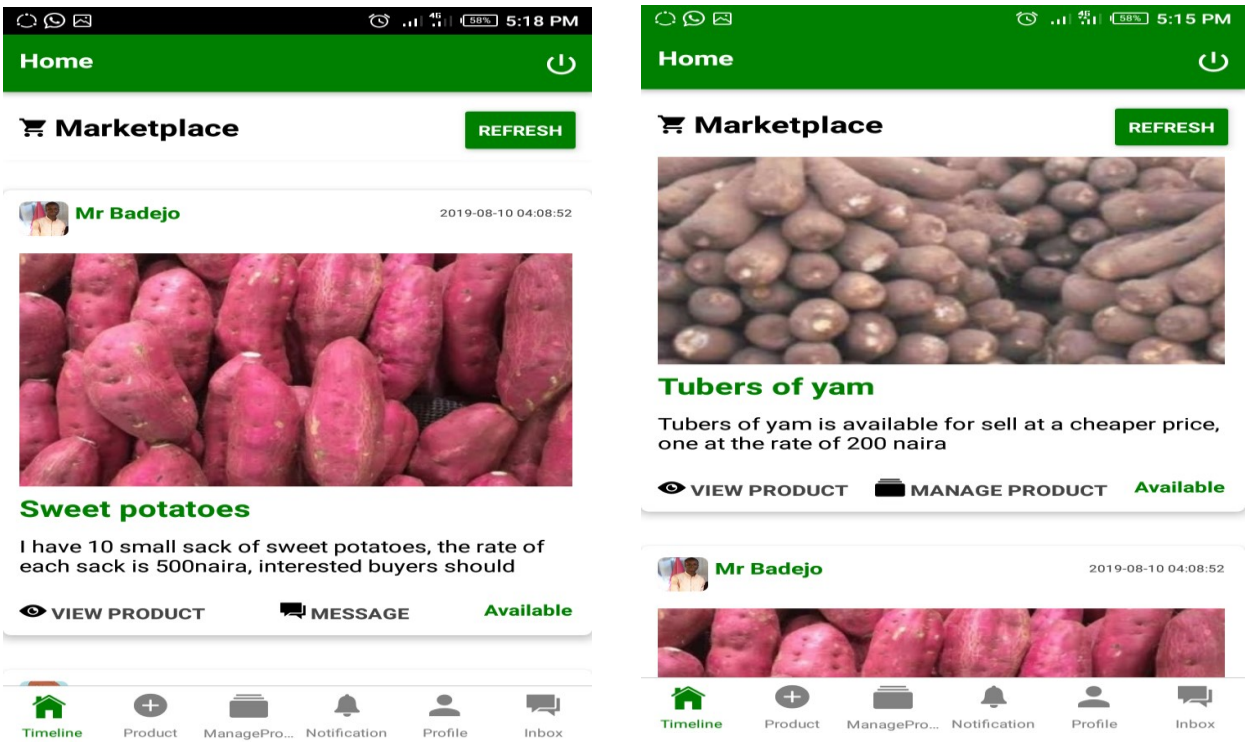

Fig. 8: Farm produce page

Extension Service Notification Page

This page displayed information on the latest techniques including fertilizer application, available land for farming and overall farm land management.

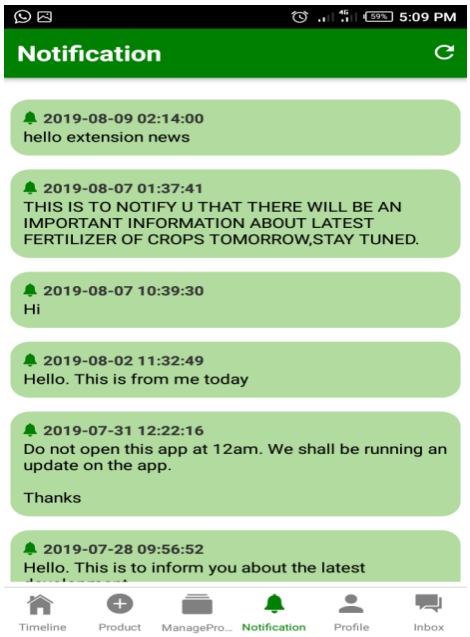

Fig. 9: Extension Service Notification Page

7. RESULTS AND DISCUSSION

This section describes the entire process of program implementation. It covers areas such as input interface, output interface, menu interface, system testing, system maintenance, writing and testing of the computer program, routines that make up the new system to function very well and for it to achieve its objectives.

Figure 3 shows the administrator dashboard where the various administrative decisions take place. This is the page that admin of the software systems gets access to when he logs into the system. This page gives access to the manage farmers, push notifications and to edit and make changes to already added information. The admin can also view the list of the farmers and extension agents available on the system and send a message to them when it is necessary.

Figure 6 allows new users without an account to register with their email and password and the sign in to gain access to the application functions. Figure 8 displays the different farm produce that have been added by the system administrator. When logged into the application, the user can add farm produce, can see the notification and also share the app for others to download and install. Figure 9 displays the message notification posted by the extension officers to the farmers. With this functionality, the extension agents can push and send messages to various farmers on the modern farming techniques, including fertilizer application, available land for farming and overall farm land management.

Performance goal

Currently we are evaluating our project. We are working with local farmers in the Community for testing purpose. The responses have been positive and encouraging. However, based on the output generated, it can be inferred that this proposed system is efficient, easy to use and makes Farm Products Information System and Extension Services being present everywhere at once. The search activity on the mobile phone and notification to the farmers make the proposed system flexible, efficient, and reliable. The mobile app is user-friendly and less cumbersome to use for Non-tech-savvy users.

8. CONCLUSION

In this paper, the design and development of a mobile application for farm products management system and extension service was described. The system which consists of both mobile and web parts connects farmers directly to the retail market for the procurement of agriculture produce and it also avail farmers platform to network with other farmers. The Android app facilitates its users both farmers and Extension agents to access the service any time anywhere without sophisticated hardware and software installation. The system allows farmers to acquire knowledge on modern farming practice and also improve extension services to farmers. This will improve the productivity of crop by notifying farmers about various activities at appropriate time, as timely performing of these activities plays an important role crop productivity. Similarly, it will help farmers to sell their product in global market and earn remarkable profit. For future work, an iOS version of the system will be designed to facilitate user interactions on multiple platforms.

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