A Mobile Based Market Information System

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Abstract. Effective market information systems help to reduce information asymmetries, increase competitiveness, and improve efficiency in the marketing network. Thus, lack of dissemination of market information and the bargaining capability of the traders across the agricultural supply chain is a major concern among small holder farmers in Nigeria. The advent of mobile phones serves as a great tool for awareness and information dissemination to people. A Mobile Based Market Information System is presented in this study. It serves as a means of enhancing farmers marketing strategy by providing market visibility for transacting business both within and outside the region. The proposed system employs Google map API which shows the location of the registered markets. The system was implemented using JavaScript, PHP/MySQL and Phonegap/Cordova. XAMMP database server was used for data management. The application was tested and validated by 50 respondents, the results returned high acceptance rate, high perception on usage and ease of use.

Keywords: Mobile application · Market · Information system · Agriculture · Mobile phones

1 Introduction

The introduction of Information Communication Technologies (ICT) have provided new ways, and techniques of disseminating information among people in the society and has led to developments in all sectors of Nigerian economy. Mobile phones as part of the inventions of ICT, has brought significant changes in the agriculture sector [1]. The use of mobile phones by farmers has helped them in getting recent information on ways to improve their agricultural techniques from crop plantation to marketing of farm produce to the consumers. Mobile technology has also aided the increase of network among larger communities most especially among farmers in a topical region on exchange of ideas and experience regarding agricultural farming. The rate of adoption of mobile phone technology in developing countries is increasing with attendant benefits to the society [2].

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According to Poulsen [3], one of way of incorporating ICT into agriculture is establishment of Farmers' markets which serve as a means of bringing producers together with consumers under direct marketing alternatively known as Food Networks. This was done for several reasons: to allow producers to find markets for their produce and also retain the profits resulting from the sale of their products, and to enable the consumers get fresh products directly from the production unit at an affordable price [4]. This system has several advantages such as providing avenues for producers to sell their produce to consumers which in the process enhanced the production growth, minimizes food wastage and also increased income rate [5].

Thus, ICT offers the potential to increase the information flow among agricultural stakeholders hence increasing the transparency of agricultural exchange in agrarian economies such as Nigeria. It was observed that markets in most developing countries often fail because smallholder farmers who form the majority of agricultural producers are discouraged [6]. The failure of agricultural markets for farmers often results from lack of access to information between farmers and buyers which leads to setbacks in agricultural growth [7]. Consequently, majority of farmers sell their produce in local low-paying markets rather than traveling to distant markets with a good purchasing power [8]. One of the way of providing solution to such is the use of mobile phone by farmers to help them in increasing market participation through access to information on available markets and prevailing market prices. Also it helps the consumers to have the knowledge of available markets where agricultural produce or any items for human use can be purchased at a very reasonable price.

Considering all of the identified issues faced by farmers, this research proposes a Mobile Based Market Information System that will provide farmers with available agricultural markets within and outside their region. Not only will this make selling easier but it will also boost income. The proposed application is not limited to farmer's markets alone, but also for different kinds of goods that can be gotten in a market, (cosmetics, wares, electronics, IT, etc.). A Google Map and Geographical Information system (GIS) is embedded to the application which serves as a location based and positioning system for determining the location of users (traders).

The rest of the paper is organized as follows: the related works on agricultural marketing, mobile marketing and integration of ICT tools in agriculture are described in Sect. 2, Sect. 3 describes the research methodology of the proposed mobile application. In Sect. 4, the implementation process and evaluation of the proposed mobile application was described. The conclusion ends the paper in Sect. 5.

2 Related Works

The impact of ICT on Agriculture and marketing of Agricultural products is discussed in this section.

2.1 The Impact of ICT on Agricultural Market

Recent efforts to improve market access by smallholder farmers have been directed to mobile technology which has recorded rapid penetration in Africa [9]. The innovation

of mobile phones has facilitated access to information by farmers to help them increase their bargaining power and control over external events [10]. For instance, in Tanzania, the adoption of mobile phones, under the five project of the Agricultural Marketing Systems Development Programme (AMSDP), has virtually transformed agricultural business through the way producers access vital market information [11].

A study by [12] in Uganda on the impact of mobile phone coverage expansion on market participation revealed that there is great record of market participation, and higher income rate among banana farmers which resulted from the use of mobile technology.

Similarly, in [13] a study on the use of mobile phones by 134 younger agricultural entrepreneurs resulted into expansion in their market due to high and fast rate of accessing information which in turn led to profit increase after two years. Also, Aker [14] discovered that mobile phones has positive effects on the welfare of traders and consumers in Niger by increasing traders' profits up to 29% and reducing average consumer grain prices by 3.5%. [14] also reported that the use of mobile phones enabled traders to utilize markets extensively and to reach out to more customers.

Lastly, [15] carried out a study in a small community in Morocco, the result showed farmers are inspired by the growth of agriculture, increased market orientation, and diversification from low-value crops into higher-value with corresponding higher income rate because of the mobile phones usage. Similarly, it encouraged farmers to engage directly with wholesalers by getting better understanding of prices and penetrating larger and more distant markets.

2.2 Marketing Agricultural Products

In this section, some of the study on marketing of agricultural products and e-commerce was reviewed.

Yang [16] conducted a research on the live broadcast marketing management of e-commerce with the consideration of agricultural products. The author considered the growth of online commerce of agricultural products as related to China. It was stated that this was still being explored and developing with existing problems that should be addressed. Wang and Wang [20] considered agriculture as a major means of development for rural communities using the online-to-offline (O-2-O) marketing approach. Ambika [17] considered marketing and irrigation as a major problem of agriculture. The authors observed that farmers are unaware of recent trends and then presented a website for marketing agricultural produce without a mediator or middle man. The platform makes the leasing of agricultural tools easy as well as educates farmers on current trends in the field. Beyond the support given on marketing, farmers could get awareness on irrigation practices in order to increase yield.

Radosavljević [18] proposed an approach to efficiently place agro-food product as a major strategic objective for economic development in Serbia. They stated that quality food produce is on high demand and it requires a strategy for meeting them as quickly as possible. The authors conducted an in-depth analysis of several channels with which customer demands are met and stated that technology operations should be exhibited to ensure fast, flexible and efficiency in the agricultural supply chain.

Liu and Walsh [19] considered the improving standard of living in China and its immense interest in health, agriculture and nutrition. Products in these areas are considered highly demanded and profitable. The authors stated that despite the immense number of e-commerce websites for agricultural products, a number of them are difficult to use. They analysed the problems of developing e-commerce for agriculture products. They proposed that the legislative mechanism should be improved and more specialized systems need to be considered.

None of the study considered using mobile technology with geo-location technology to improve or advance agricultural business. This research puts some of the problems identified and employs effective approach for enhancing agricultural based marketing.

3 Methodology

Mobile Based Market Information System is an application that supports Android operating system. This application uses the GPS function and Google map, available in most of Android phones. With this application installed on mobile phone, first step is for the user to launch the application and register their details which is stored in the database server. This application will send co-ordinates from their mobile phones to Server using GPS to determine their location, and then check the database to determine the markets found within their region. The development of the mobile application is developed with the consideration of the following key entities:

Users
Users consist of registered traders which can also be farmers and an administrator. Traders are the end users that make use of the mobile phone to interact with the application through Internet.

Interface
The interface is the tool for different users to communicate with the system. This include android platform, text message (SMS), and Internet.

Middleware
This acts as an intermediary between the core system and the user interface. This includes SMS gateway, GPRS gateway, and cell tower. The SMS gateway enables sending and receiving of text message to users. The GPRS and cell towers enables sensing and detection of user's location from location target to the application server. This enables the application to show the user's location when it is being launched and then display the markets within the region.

Core System
The core system is the key elements in the entire design which includes the database server, application server, web server. The database server enables storage of individual users, and market information and scheduled web contents. Getting a timely message on market information requires the server to send automated alerts to users.

3.1 Design Process Modelling

The design process for the mobile application is illustrated graphically by showing the interactions between the users and the application. It shows how the information flow is conveyed in a systematic and standard manner. Some of the models used are case diagram, sequence diagram, class diagram.

Use Case Diagram

A use case diagram is a representation of a user's interaction with the application. It shows the relationship between the users and highlight the key activities to be performed by each users of the application system in a diagrammatic way which is represented either circles or ellipses. Figure 1 shows the use case diagram for the proposed mobile application. Figure 2 shows the class diagram for the proposed system. The sequence diagram that shows the steps of employment for the mobile application is shown in Fig. 3.

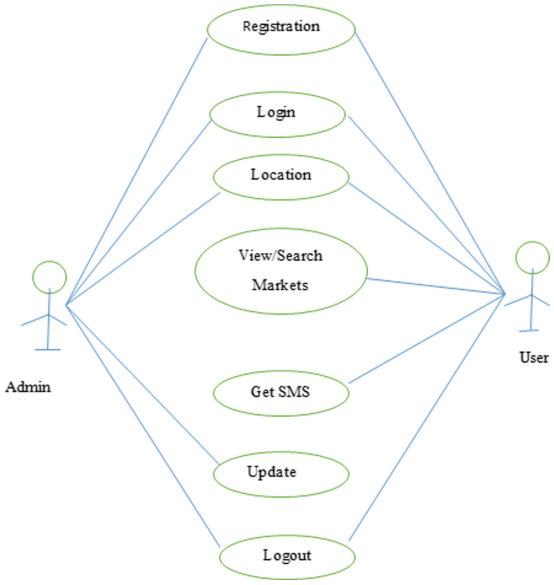

Fig. 1. Use case diagram for the proposed mobile application.

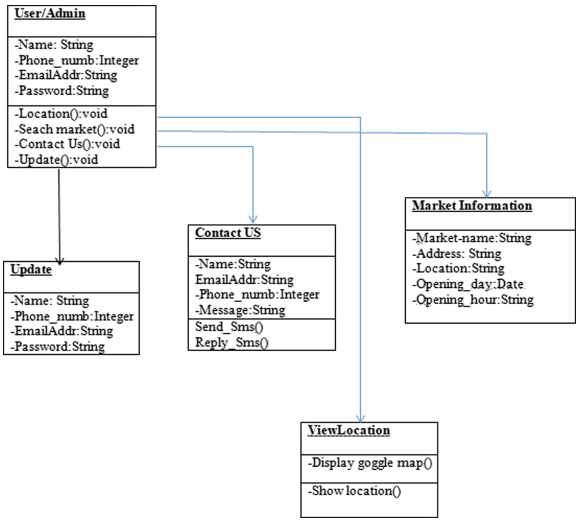

Fig. 2. Class diagram for the proposed mobile application

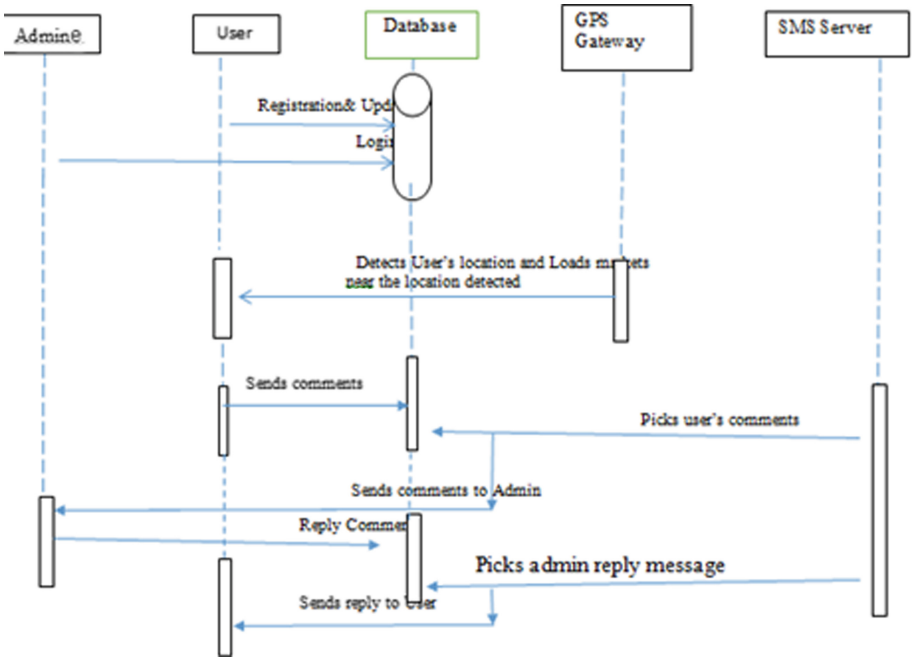

Fig. 3. Sequence diagram for the proposed mobile application

4 Result and Discussion

4.1 Implementation

The application is designed from a user point of view. This application supports graphical user interface which enables the users to interacts and accomplish their task with ease. The design was simple and understandable. The database used is MySQL where all the information related to markets and users is stored. PHP was used as a server side scripting language to connect the application with the database and files located on the XAMPP Server. GPS and Google map was integrated into the application to enable locations and market search. Figure 4 shows the market search page of the mobile application. It enables the user to search for markets within and outside their region and then return the registered markets in Google map. Figure 5 shows the feedback page that enables users give their perception of the mobile application.

Fig. 4. Search page and result of the mobile application

4.2 Evaluation

The proposed application was evaluated using questions raised through user perception questionnaire based on the Technology Acceptance Model (TAM). Four factors from TAM were used, which are:

1. Perceived Usefulness (PU): To access users perception of the usefulness of the Mobile based Market Application System
2. Perceived Ease of Use (PEOU): To determine what degree of ease is associated with the use of the mobile application.

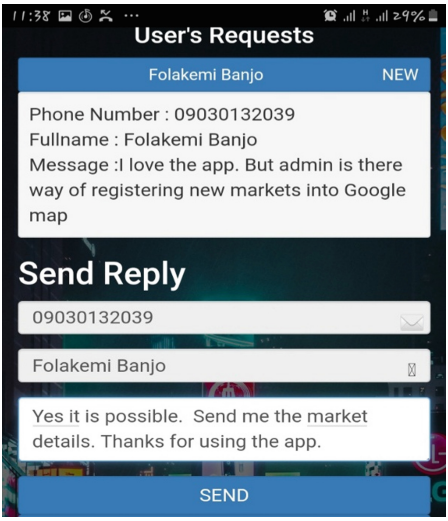

Fig. 5. Feedback page and result of the mobile application.

3. Attitude towards Using the Mobile Application (ATTD): This is to determine if the use of the mobile application is a good approach of making market search.
4. Behavioral Intention (INT): It is used to determine the degree to which a user plans using the mobile application in carrying out their trading activities.

Overall Usability Results

A total of 12 questions were formulated and measured on a 5-point Likert scale. This questionnaire was administered to 50 respondents which are 23 males and 27 females. The overall usability feedback of Mobile Based Market Information System from respondents is analyzed below in Table 1, which showed 4.52 mean score for perceived usefulness, 4.45 mean score for perceived ease of use, 4.67 mean score for attitude towards usage, and 4.59 mean score for behavioral intention coupled with the overall average mean score of 4.55. This indicated the overall acceptance of the application by both genders in the society. Table 1 shows the overall usability response and further analyzed in Fig. 6.

Table 2 shows the responses of users regarding the perceived usefulness of the mobile application with a mean of 4.52. Which means larger percentage of the respondents agree to the usefulness of the mobile application to carry out their trading activities.

Three items were used to measure the Perceived Ease of Use (PEOU) TAM construct, as shown in the table above. Further investigation of participants' feedback for PEOU suggests that MSMS App is convenient to use (Table 3).

Attitude towards the usage of the app (ATTD) was measured through three questions; findings indicated agreement on participants' idea to use the application, with good mean score of 4.67 and the average of 5.00 (Table 4).

In conclusion, from the user's responses, it was observed that the Intention of Users (INT) about the MSMS application regarding the usage of the application was highly

Table 1. An overall usability result from the evaluation of the mobile application.

Statements	Overall mean	Overall median
Perceived Usefulness (PU)	4.52	5.00
Perceived Ease of Use (PEOU)	4.45	5.00
Attitude Towards Using the Application (ATTD)	4.67	5.00
Behavioural Intention (INT)	4.59	5.00
Overall Average	4.55	5.00

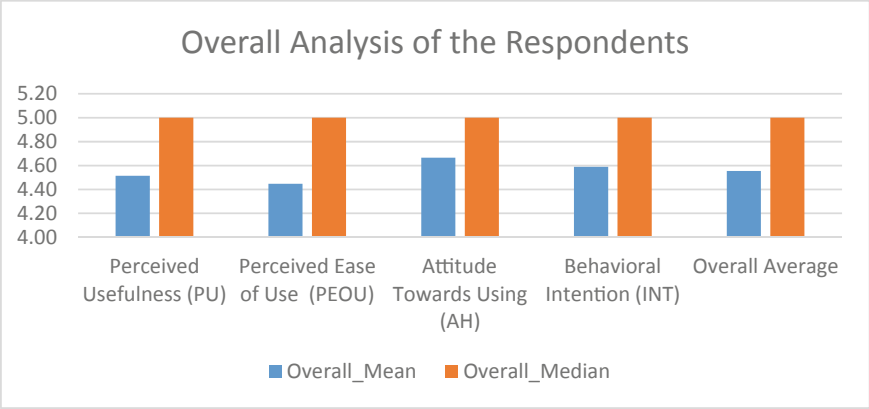

Fig. 6. Chart showing the user perception evaluation result of the mobile application.

Table 2. Evaluation of users about the perceived usefulness of the application

Factors	Questions	Mean	Median
PU	1	4.46	5.00
	2	4.48	5.00
	3	4.52	5.00
	4	4.60	5.00
Overall (PU)		4.52	5.00

encouraging with mean score of 4.59 and average of 5.00 compared to other constructs. This indicated that the application is generally perceived as a useful tool to small holder farmers and other potential users as seen in Table 5.

Table 3. Evaluation of perceived ease of use

Factors	Questions	Mean	Median
PEOU	5	4.30	5.00
	6	4.42	5.00
	7	4.62	5.00
Overall (PEOU)		4.45	5.00

Table 4. Evaluation of user's attitude

Factors	Questions	Mean	Median
ATTD	8	4.64	5.00
	9	4.52	5.00
	10	4.84	5.00
Overall (ATTD)		4.67	5.00

Table 5. Evaluation of users intension

Factors	Questions	Mean	Median
INT	11	4.66	5.00
	12	4.52	5.00
Overall (INT)		4.59	5.00

5 Conclusion

This study describes the development of a mobile phone based market information system on the Android operating system. This mobile application serves as easy aid to access different food markets, it provides a platform for traders to get market related information such as where to carry out trading activities, connect to buyers and/or retailer, obtain other logistics for transportation, etc. This will help farmers and other traders predominantly in Nigeria to prevent the restriction being faced about marketing of products and inadequate market information. This further alleviates the limitation of farmers and traders to local markets only. It thus connects farmers to regional and global markets where food produces could be sold at wholesale directly and at competitive process determined by the farmers. The adoption of the application will help the farmers to know the markets to take their produce to for selling, likewise inform the trades of the available markets to do exchange at a cheaper rate and high quantity. This will increase the farmer's profits,

encourage the involvement of women and youths, and ensure food local and national food security. The application is designed to ensure good output, portability, productivities as well as reliability. It can be easily handled at high speed of operation and cost effectiveness. A well-developed menu driven and user friendly system for promoting an easy interaction between the user and the application was designed. This system from validation prove to be highly flexible, economical, efficient and hereby recommended for use.

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