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Exploring Local Content Using Mobile Application to Boost Broadband Demand and Foster Socio-Economic Gains for Local Farmers in Nigeria

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Internet technologies has influenced every aspect of our lives today, including the agricultural sector. To access the internet content, the device has to be subscribed with internet broadband service. Broadband band as a telecommunication in which group of frequencies are combined to transmit information. The more the internet services utilizations, the higher the broadband usage. One major factor that contributes to a poor Internet distribution network in Nigeria is low user demand for Broadband services, low level of digital literacy and most important lack of access and awareness about the Socio-economic potential of Broadband. Internet services can be accessed using different internet local content ranging from simple mobile application to a large internet of thing devices. This research work, investigate and create a relevant local content App that can be used by the local farmers of northern Nigeria in marketing their product online so as to boost their businesses and achieve socio-economic gains, there by eliminate middle men. The research started by conducting a survey using questionnaire to get the input of the farmers. The finding was, since most of the farmers are using mobile phones, having an easy to used mobile application will assist the farmers in marketing their good and strengthen their relationship with their customers. Allied to this, an agile software development method was adopted in developing a mobile web-based application to be used by the farmers. The developed system was tested, evaluated and the feedback were received by the stakeholders.

Keywords: Broadband, local content, mobile App, middleman

1.   Introduction

Internet benefits both developing and non-developing countries as it serves as an important communication medium, a repository and distribution system for information, knowledge and culture [1]. As the Internet economy has grown, many applications now require higher data transmission speeds including simple applications such as social networks and websites, hence high-speed internet access (Broadband) is viewed as necessary in order to fully utilize the internet's potential [2]. Now a days most people browse on the internet using their mobile phone, and this phones are preinstalled with number of developed applications for different purposes. To access the internet content, the phone has to be subscribed with internet broadband service.

Broadband as defined as telecommunication in which groups of frequencies are combined to transmit information. Because of the wide band of frequencies, information can be multiplexed and sent to different paths concurrently enabling more information to be transmitted in a given amount of time [3][4].

Unfortunately, in many regions of the world, Broadband is unevenly distributed across rural and urban areas, with significantly lower access in rural communities. For example, even though there are currently six submarine cable landings in Nigeria which provide up to 9Tbits/s of combined internet access capacity, the fact that all the landings are in Lagos, seriously limits maximum transmission speed in other parts of the country due to inadequate distribution of the network [5]. To the fact that, only very small population of Nigerians, especially those living in rural and semi-urban areas would be willing and able to pay or subscribe for Broadband.

It is widely acknowledged that content is key and central to what the Internet represents to the average user, the content available for use over the Internet has a direct role in increasing the use of the Internet for the local population and local consumption. Also, agriculture is a key

sector that creates jobs for the Nigerian economy and agricultural communities are typically rural and rural areas are generally the last to benefit from infrastructural amenities.

Most of these communities interact and get information through radio, television and other public announcements methods, however, the common problem across these information sources from these communities is the lack of enough information source that can create sufficient locally relevant content such as new farming techniques, weather updates, availability of livestock and seed crops, online marketing options and marketing products to consumers directly without the inference of middle men and so on. If there is a system that can enable this community to have their own content, affordability and adoption of Broadband services can be significantly improved.

This research work explores a relevant Local Internet Content which help sub-section of the population by conducting a survey. The outcome of the survey lead to the system development of a mobile app, which when put to use, will encourage the use of internet of things devices by the local farmers. This increase in use of internet of thing devices has great potential to boost agriculture in Nigeria [6].

The rest of the paper is organized as follows. Section 2 Related Work, Section 3 is the research methodology, Section 4 is the result and discussion, Section 5 is the system development, Section 6 for conclusion and lastly the Section 7 for recommendation and feature work.

2.   Related Work

Agriculture, particularly the local farming is experiencing lot of challenges that require the information and communication technology (ICT) intervention to be addressed. It was argued that [7], improvement in market activities such as buying and selling, exchange of relevant information among farmers, networking of agricultural sector among others are some of the area that need prompt intervention of ICT. Pointing out further that, more research and innovations are needed to boost agricultural activities and thus promote socio-economic wellbeing of the local farmer through the use of ICT innovations.

Internet local content (e.g. mobile or web-based application) have success story in developing areas, it assist investors such as banks, business, hotels in managing their activities. [5] argued that internet local content drive

individuals towards connectivity in developed market and content help to inspire investment and encourage local creators to take part in the digital economy. [6, 7]

Several studies [1, 8, 9] suggested that rural communities have very different information and communication needs and the lack of locally hosted content can have significant impacts on the entire internet ecosystem in a country [1].

In the study   [8], the authors proposed a successful pilot system whereby an existing system of PC kiosk set up by sugarcane cooperative was replaced by using mobile phone based kiosks to perform same function. The development of Warana Unwired thought to consider additional services in addition to the existing system whereby farmers are more comfortable with SMS based system. But the result of the system showed that short-terms gain is so insignificant for farmers in the area and could not alter their lives dramatically.

Likewise, [9] proposed an information kiosk system for rural areas to create and access locally relevant content. The voikiosk (a voice based system) was developed that is easy to be used by the less-literate people where information can be accessed via phone set in order to provide a cost effective solution More than 900 users used the system over a period of four months with approximately 2000 calls. Creating the content in the voikiosk is either by recording of an advertisement by a villager or by recording of other messages by the kiosk operators or Agriculture experts. About 87% of the calls were for accessing the content on the voikiosk system while 13% calls only were made for creating the content.

The study [10] showed results from an extended field study of Avaaj Otalo, (AO), and a voice application for small farmers in rural India. Avaaj Otalos most popular feature was a voice forum used to ask and respond to questions and to browse others questions on a range of agricultural topics. AO was the first experience with an online community for the farmers, it allow farmers to have access to timely and relevant agricultural advice and as such it became a lively social space with the emergence of norms, persistent moderations and a desire for structured communication with an accredited experts and open discussion with peers. However, making user-generated voice content easier, navigating and searching for specific information were still open problems.

The work of [11] analyses data from various agricultural survey on why internet availability

and broadband usage is not equally distributed around geographical location between urban and rural areas. It was observed in the research that, majority of farms has internet access but only few use the network as the integral part of their management. The research pointed out the different in likelihood of broad band use with the likelihood of broad use with likelihood of broadband provision. The result indicate that, the availability of the broadband and socio-economic characteristic of the farm operator contribute to the adoption of internet in their farm activities.

The [12] evaluates a study through the use producer survey, the level of internet use, motivation and degree of access to broadband and willingness to pay to fund broadband infrastructure. The results showed that only producers who were younger and farm larger farms were willing to pay and support broadband infrastructure. Mostly this is attributed due the lack of proper awareness and the availability of relevant local contents.

3. Research Methodology

To investigate an internet local content that will benefit the local farmers, a quantitative research method using survey approach was adopted. The survey was conducted through questionnaire which is administered to the local farmers within Sokoto metropolis to take in their input. The questionnaire comprises of six (6) section numbered A to F. first section contained questions about farming type, Section B contained questions about farmers-customers relationships, Section C contained questions about farmer-suppliers relationships, Section D contained questions about farmer-government relationships, Section E contain questions about farmer-farmer relationships and lastly Section F contains question regarding technological device/gadget they are much conversant with. Considering the fact that, the whole aim of this research is to develop a platform that can be used to boost the economic gains of farmer's through the utilization of internet services in the process of advertisement and selling of their farm products there by promote broadband demand. Based on the outcome of the survey and the suggestions from the respondents, an agile software development method was used in developing web application using HTML, JQuery Mobile and SQLite technologies which is later integrated and converted using PhoneGap bridging framework to a native mobile application for a particular mobile platform and which can be easily converted to support multiple mobile platform.

4. Results and Discussion

The key stakeholder of the proposed system are the farmers and customers. Famers are the main beneficiaries of the system. They produce the farm products and willing to sell them to their customers. The type of questions ask to the farmers during the survey mostly centred on the type of farm product produce, how they market the product, their relationships with customers and government agencies and more importantly their willingness to adapt the idea in the proposed web-based mobile application to patronized their good.

Customer on the other hand, are the end consumer of the farm products produce by the farmers. The types of questions mostly centred on their relationship with farmers and the middle-men while buying product, their views were also obtained regarding their willingness to accept the proposed system that eliminate the middle-men.

The questionnaire was administered within Sokoto metropolis and few local government of the state (e.g. Shagari and Sabon-birni), 50 questionnaire were distributed out of which 30 was successfully completed. 20 copies were partially completed. The responses are summarized as follows:

Farming types

The popular farming type in the northern Nigeria are: Cereals, groundnut, fish and poultry faming. The summary of respondent are shown in the fig. 1 below. 75% of the respondent are farming for domestic use while 25% for marketing.
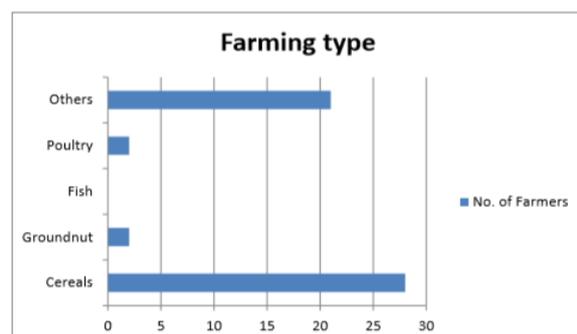

Fig. 1. Farmer's responses on farming type.

Farmer-Customer Relationship

Farmers usually market their farm produce in the market place, if they get customers on time they sell it direct to the customers but whenever the market is tough they sell to the middle men at low price 80% of the respondent sell directly to customer, 20 % to the middle men.

Farmer-Bank Relationship

99% of the farmers don't have bank account; they believe that the little they are earning is not worth opening a bank account. Only those that transport their farm produce to the other parts of the state get account numbers of their friends so as for them to deposit the money after selling their farm produce due to the insecurity of the country.

Farmer-Government Relationship

75% of the farmers pay their taxes to the government agencies annually but there are not enjoying any support from the government. They only get information on government schemes through the local media that only few of them heard about Federal Government initiative called E-wallet but none of them have account for the scheme.

Farmer-Farmer Relationship

Our local farmers interact with the their farmers so as for them to support one another if the need arise, that why they collaborate with one another for group purchase of farm inputs, real-time sharing of marketing price information and coordination of produce transport and above all they share information on farming techniques, weather report, market price and marketing opportunities which some of them get through the local media.

Users View on the Purpose System

Most intended users express their appreciation when they had the requirement of the proposed system. Showing that, the system will greatly assist them by eliminating middle men and provide a securely means of selling and buying farm produce without massive movement of cash that reduces the problem of thief among other related importance. However to users it is going to be more cost spending as farmers need to possess a mobile phone and subscription to be able use the app effectively.

Based on the outcome of the survey, the research considered it necessary to develop a mobile application which can help in marketing their product.

5.   System Development

a. System Functionalities

To gather the requirements for developing the system, the following scenario are extracted from the interaction with the farmers through the questionnaire.

Eliminate Middle-men: Middle-men influence the process of buying and selling of farm product. They contribute to increase or decrease in the price of market good. The proposed system should eliminate the intervention of middle-men in the process of buying and selling farm product as well as between farmers and their suppliers.

Reduce financial Risk: Often farmers do encounter financial risk due cash involvement in the process of buying and selling of their farm product. They may occur through thief, or loss of cash. The proposed system should handle buying and selling through farmers and customer's respective bank accounts by handling the payment online.

Facilitate access to Government Initiatives: A lot of government initiatives do exist for farmers like E-wallet. But many local farmers don't have means of benefiting from these initiatives. The proposed system should provide a link that can connect formers to other related government website and medium that enable them to view and access the initiatives.

Access to News and Related Sources of Information's: large number of organizations both national and international bodies are available to offer financial and educational assistant to the farmers. Such organizations disperse their service through online and communication Medias. Farmers need such awareness and knowledge to enable them benefit from those organizations. The new proposed mobile application provides a news forum that enable farmers to have access to sources of information to broaden their knowledge and experience in their field.

Display of farm product to Customers: Different farmers produce many varieties of farm products. Those products need to be displayed to Customers for them to see what they want buy. The application displayed the products pictorially to all app users to see for buying. The pictures and specifications for the products should be clear, real and genuine so as to eliminate deceive.

Handle Transactions: The application should enable farmers and customers carry out buying and selling of farm produce through an online mobile application. This typically most involves payment of money through online banking system. The proposed application enables customer to make an online payment either through bank tellers or by direct deduction of money from customer's bank card. All transaction should be safe and secured.

Based on the scenarios and user stories obtained above, the requirement of the system is

been analysed showing possible actors and use cases in the system using the diagram in fig. 2 below
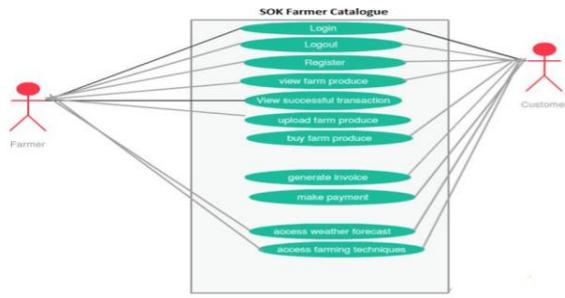

Fig. 2. Use case diagram for the system

b. System Design

Unified Modelling language (UML) class diagram and sequence diagram are used for data design and process design of the system respectively.

Data design using class diagram

In this system, five classes are identified which include: farmer, customer, supplier, farm-produce and transaction. Fig. 3 below shows the class diagram indicating the relationships between the classes and the multiplicity of participations.
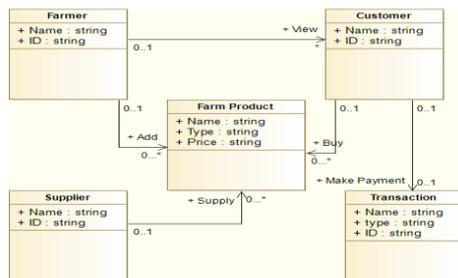
Fig. 3. Class diagram for the system.

Process Design using the sequence diagram

A sequence diagram is also called as event diagram, a dynamic model that shows the interaction of objects [13]. Two most important scenarios for this system are the process of buying farm-produce and that of making secure transaction of the product bought, Fig.4 and Fig. 5 respectively present these sequences of actions in a sequence diagram.
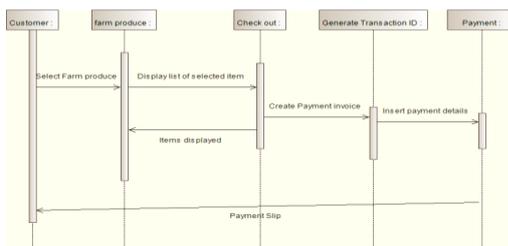

Fig. 4. Sequence diagram showing the process of buying farm produce by customer.

To buy any farm-product online with the new system, a customer has to navigate through the available items then select the product to buy. The customer checkout after selection that could allowed the generation of payment invoice before making payment for delivery.
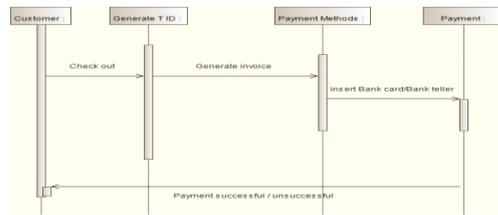

Fig. 5. Sequence diagram showing the process of making payment in the system.

The transaction is was handle by the system either through a bank card or bank teller. Upon successful deduction of the money by the system, the items with payment slip are sent to the customer's provided delivery address.

c. User interface design

A user interface (UI) is meant to allow and enable users to control and operate the system

Mobile devices require a simple UI and other design decisions in order to work within the constraint imposed by the device hardware. The constraints may include among others; memory, battery life, ability to adapt to different screen orientations and bandwidth usage. Taking this into consideration, therefore, it is necessary to keep the interface simple.

d. System implementation

In this section described some of the important implemented interfaces for the system which includes: home page, upload farm product, buying farm product and payment page.

Home Page

The first accessible page for the system developed using PHP, JavaScript and CSS. The page has some links which enable access to other pages such as link to farmer and customer registration, login and some useful link that linked farmer to the pages that they can access some useful information about farming. Fig. 6 show the main page of the system

Fig. 6. Home of farmer social network

Farmer Upload Farm-product page

Immediately when a farmer successfully log in, he/she access the link that will enable them upload or view their farm produce. The upload farm produce page allow farmer to add new product that he/she want offer for sale. The page is designed to allow the farmer to upload the image of the product, and specify the price of the quantity. Once the farmer added a new product this will be added in the database carrying the id of the farmer which enable adding the product to page of the farmer as well as storing the information that is retrieve if the product is to purchase by the customers. Fig. 7 shows the upload farm product page for the system.

Fig. 7. Upload farm produce page

Farm Produce Selection Page

Customers need to view the available products and make a selection for buying. This page displays all the available products each with product name, price, image, farmers name and with the link for buying if the customer is interested with the product. The functionalities of this page is implemented in such a way that it enables customer to make a multiple selection of the product. An addtocart function served as a basket for a user to select as many as possible which are then sum up for the customer. A check out link is available to allow customers to clear their produces after selection. Fig.8 shows the list of available farm produce page.
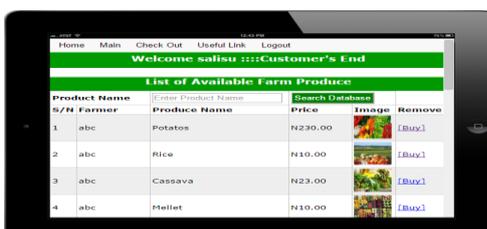

Fig. 8. Farm Produce Selection Page.

Payment Page

When a customer generated an invoice for the product(s) he/she wanted to buy, they make a payment at the back to respective account numbers. The payment was implemented such that, it allow only a single teller details to be submitted. This help to make sure each farmer has been paid into the account. Fig. 9 shows the payment page for the system.

Fig. 9. Payment page

e. System Testing and Evaluation

To ascertain the functionalities of this system, after the system is been exposed to unit and integration testing by the developers, a black box testing for users is also done. Black-box testing is a method of software testing that examines the functionality of the system based on the specifications from the requirement of the system. To achieve this form of testing a usability questionnaire proposed by John Brook (1986) aim to evaluate the practicability of any system was adopted. The questionnaire comprises of ten (10) questions shown in Fig. ranked from 1-5 from strongly agree to strongly disagree, which are to be answered by the users of the system. The advantage of system usability scale (SUS) is that, it is comparatively quick, easy and inexpensive, while still being a reliable way of evaluating usability. To get the SUS score of one participant in the testing you must sum-up the scores you receive for 10 questions, then multiply the sum by 2.5, to make the scores on a scale of 0-11. The score doesn't represent a percentage, but a sum of these new numbers [14]. Table 1 summarizes the SUS score of 10 users whom participated in the testing.

Table 1. System Usability Scores for ten (10) testing

S/N	Farmer	Actual testing score(x)	SUS Score (x*2.5)
1	F1	30	75
2	F2	27	67
3	F3	31	77
4	F4	26	65
5	F5	27	67
6	F6	30	75
7	F7	24	61
8	F8	27	65
9	F9	26	65
10	F10	29	73
SUS Total			**690**

Fig. 10. System Usability Testing Questionnaire. Source: adapted from [14]

6. Conclusion

This research involved a survey that explore a relevant internet local content that can be used by the local farmers in marketing their product online. The work developed an Internet-based mobile application which enables farmers and their customers to carry out their business transactions without the interference of middlemen so as to boost the broadband demand in the northern part of Nigeria as well as help farmers in marketing their good online. The mobile application is developed using web technologies. The system developed was tested by individual users of the system as well as software expert. It was found out in this research that, when mobile apps services like the one developed were utilized efficiently can increase the socio-economic wellbeing of local famers as it eliminates middle men and some of the challenges faced with the manual ways.

7. Recommendation and Future Work

In order to utilized full potential of broadband in Northern part of Nigeria, it is recommended that, the means from which farmers could be able to advertised and sell their farm product online should be adopted. Web applications and website are the most appropriate. The web applications should be easy and efficient for less literate farmers in ICT to use and trust. The application should be available in form of mobile app that can easy run on a simple mobile phone that most farmers can afford and use. Similarly, this research pointed some of the areas that can be used to educate farmers a means of improving their farming activities such as the use of new improved varieties, obtaining loan form from government and non-governmental organization. This is by providing a link and sources of information that can help farmers in their farming activities. It is therefore recommended that government should adopt the use of this kind of online medium to support farming activities.

This piece of work can be expanded in term of access to farm products and their delivery and made available in the form of mobile app. Similarly, the functionality of the system can be improved through the integration of google map in order to enable customers to access the location of farm products they bought as well as the location of the customers for an easy delivery of the goods. Using the same framework for this development, an application for Tourism can be developed to enhance broadband utilization in our local communities.

Acknowledgement

Conflict of interest

The authors declare no conflict of interest.

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