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The Use of SMS Mobile Phone Technology to Improve the Food Supply Chain in Zambia

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ABSTRACT: The Food Supply Chain in Africa is characterised by problems that include drought, famine and poor transport infrastructure, which makes food scarce and expensive. Traders travel long distances and spend a lot of time on the quest for food, making the cost of doing business very high. We studied the feasibility of using short message service (SMS) to help mitigate the high cost of doing business by incorporating the use of ICTs in the Food Supply Chain. A mobile application was developed that a cooperative could use to manage the trade processes between the cooperative and traders. This application uses the GPRS/GSM technology to exchange information between the cooperative and the traders. The cooperative enrolls the traders on their system and processes their orders appropriately. This application will reduce the cost of doing business, as it will cut the costs associated with transportation for both the traders and their commodities, and the exposure to risks that are associated with access to poor transport infrastructure. The application leverages the use of mobile phone which is very popular means of communication among farmers and traders all over the world. This mobile application is developed using NetBeans Integrated Development Environment, MySQL database and Java development kit for windows. This application will go a long way to reducing the cost of doing business among the farmers and traders, who may be remotely located.

KEYWORDS: SMS, Food supply Chain, traders, cooperative, GPRS/GSM, farmers, mobile phone

I. INTRODUCTION

The food supply chain has become very important in the world than ever before, because it supports the existence of mankind. It is for this reason that food should be available on demand in places of need and at the right price. In most developing countries such as those in Africa, the food supply chain is mired by problems associated with drought, famine and poor transport infrastructure. This results in shortages and poor quality of food, and in worst cases starvation and hunger. Of course, the cost of food becomes high when this happens. This paper discusses an innovation that can mitigate some problems that affect the food supply chain in developing countries. This innovation involves the use of mobile phones as a tool for trading. According to the survey that was carried out in Lusaka and Livingstone in Zambia, it was found that more than 90% of the traders that are involved in food trade at the markets, use mobile phones in their business. They use them for voice communication and mobile money transactions. The main purpose of this study is to develop a mobile base solution that can be used to mitigate the problems that affect the food supply chain. This solution should be able to reduce the costly activities associated with travel and transportation of produce. This solution should be used by cooperatives as they are owned by farmers, to tap into markets for their produce. Usually small scale farmers grow their produce under very difficult conditions while traders buy their produce at very exploitative prices. As such, there is little gain in farming. But when farmers create food value chains[1] through the formation of cooperatives, gain is realised. That is the main benefit of forming cooperatives.

Paper is organized as follows. Section II covers the literature review, which describes the innovations that have been implemented using ICTs in the world and in some African countries including Zambia. Section III covers the related works in SMS mobile innovations. Section IV explains the functionality of the system together with the context architectural diagram. Section V presents the methodology. Section VI presents the results of the prototype application.

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development. Section VII presents the benefits of the proposed application are discussed. Lastly, Section VIII presents conclusion.

II. LITERATURE REVIEW

A number of innovations involving the use of ICTs, that are used to solve real life problems, are being used all over the world today[2][3]. These include systems that are covered in the field of commerce[4] and trade, m-commerce, m-health[5], m-agriculture, etc. Popular e-commerce platforms include eBay[6], amazon, etc., which are online shopping platforms and can be accessed from anywhere in the world, using the internet[7].

In Africa, internet connectivity is still underdeveloped and is expensive in areas where it can be accessed. Other platforms that are less expensive are used. These are the GSM and GPRS platform that are offered by the mobile telecommunication providers. On this platform, the short message service (SMS) is used as alternative to voice as it is cheaper. The SMS platform is being used in m-health[8], M-commerce, m-agriculture to enable communication among people, especially, in remote areas[9].

In Kenya, a mobile application called M-Pesa is used as an e-cash platform which enable exchange of cash between people who may not have bank accounts[10]. People are able to exchange e-cash using their mobile phones[11]. There is a provision to redeem cash at any kiosk that offer the service. M-Pesa has grown to cover the whole of East Africa

RapidSMS is a free and open sources system that was developed to leverage the mobile technologies[12]. The system has an administration office that is operated by a medical centre. This medical centre exchange information with field workers using SMS on their mobile phone. Rapid SMS is currently being used to provide m-health services to mothers and children in Malawi, Zambia and Kenya[8]. RapidSMS is also being used in India.

In Agriculture, the Zambia Farmers Union is using an SMS mobile application to link farmers and traders in all districts in Zambia. These application only provides contact information of the farmer and location and indicative price of the agricultural produce. The other transaction are done outside this platform.

III. RELATED WORKS

SMS platform is very popular in Africa due to the cost of the handset that an SMS can be sent on. As such a number of a number of service provider centric services have been developed have been in use for some time now[13].

- FrontlineSMS is a platform used to offer SMS based mobile services to the poor and is widely by NGOs..
- Commcare, is a free open source service that is used in Tanzania and is based on Javarosa which targets community health workers who make door to door calls to patients in their communities. Commcare helps the health workers of their program or assignment of that particular time. The mobile phone is used for the exchange of information.
- In South Africa, Project Masiluleke utilises a free-to-end user SMS based service. Praekelt Foundation developed it to prompt HIV positive patients to make follow-up visits to the health clinic, amend appointments, change addresses and make lost follow ups. The AIDS counselling is also offered on this platform.
- In India, Reuters Marketlite offers agricultural information to farmers.

IV. APPLICATION

The application which is being proposed uses an SMS mobile application to link a cooperative to traders. The cooperative is operated by farmers who grow various agricultural produce, and it is administrated by the cooperative. Through a cooperative, the produce is transported to the trader, after payment has been made. The trader through the SMS decides to inquire or buy a produce, or make a balance inquiry on his account. The trader need to enrol with the cooperative and deposit some money into his trading account on the system. The cooperative has internal arrangements for transport and insurance so that the produce can be transported in an expeditious manner with and option of insurance cover on the produce.

Below are the keyword that can be used on the mobile phone in order for the trader to process a transaction. All that a trader need to do is to send the keyword to the system phone number such as 0971198851,

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- Send “balance”
- Send “buy”
- Send “inquire”
- Send “search P [product]” e.g. “search P gold chick”
- Send “search pc [product category]” e.g. “search pc chicken”

When the keywords are sent, the system will respond automatically through an exhaustive menu that will be displayed on the phone.

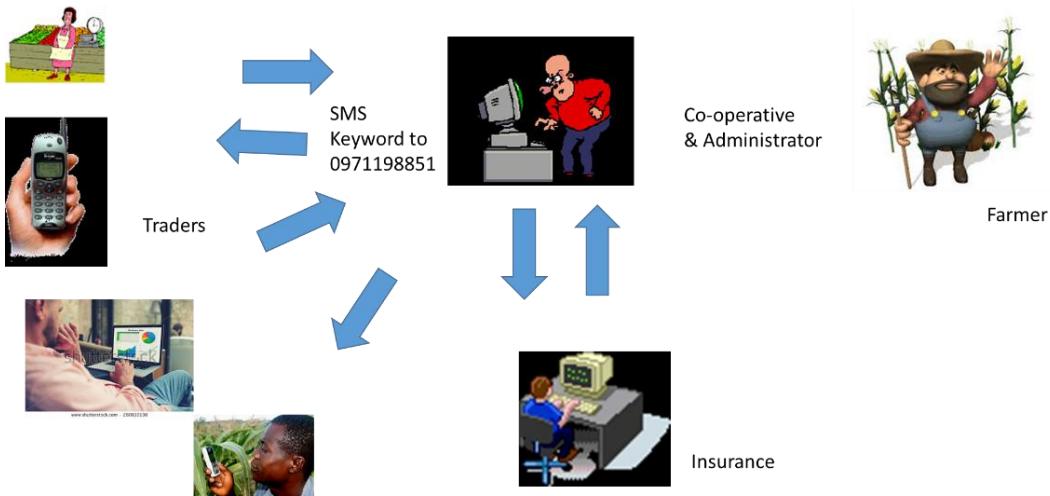


Figure 1. Context Architectural Diagram of the Trader System

The context architectural diagram of the proposed system is shown in figure1. The system is designed to handle multiple transactions from a number of traders simultaneously without dropping the connection with a trader in the middle of a transaction.

V. METHODOLOGY

The System Requirements Document is developed. This is the document which define the actors of the system and their roles. It also defines the requirements of the system.

The system uses the SMS on GPRS/GMS mobile phone. There is no need to program or install any applications on the phone as SMS is built-in. On the other hand, a server at the cooperative office has to be programmed to run services for the trading application. In this case, the system is developed using NetBeans Integrated Development Environment, MySQL database and java development kit for windows (jdk-8u51-windows-i586). These were installed on an HP laptop computer, which was running Windows 8.1 64Bit, on an AMD A6-5200 APU microprocessor with a Radeon HD graphics. It had 8GB of RAM. A modem is attached to it and has a number that the traders can send texts to in order to perform their transactions.

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VI. RESULTS

The system has a login screen the system administrator or user can access, in order to gain entry into the system. The access levels have been included in order to define the roles of each user. Figure 2. Shows the login screen. The administrator manage the produce and users of the system. These functions include the following;

1. Add a trader
2. Remove a trader
3. Add a product or product category
4. Update the credit accounts
5. Generate reports

The other category of the system user is the standard User who is restricted to managing products only.

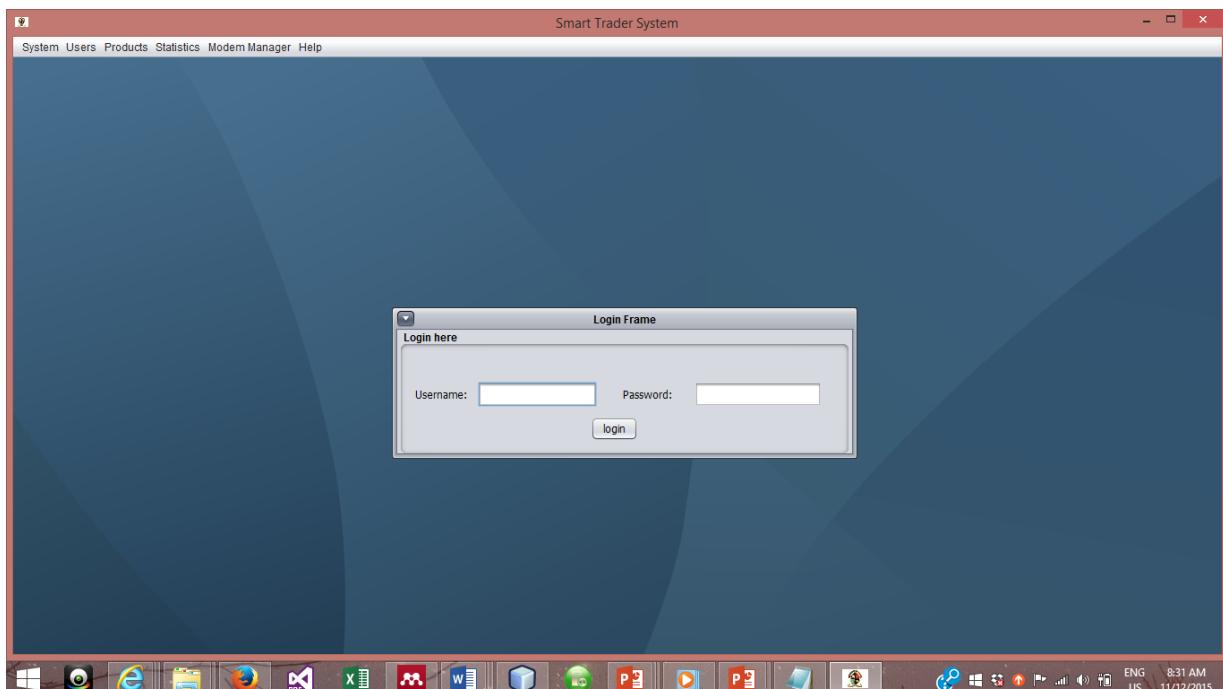


Figure 2. Login Screen for the administrator and standard user

The significance of having a standard user is for the owners of the system to have full control of the system. The system users cannot have access to financial records, while system administrators can. This is a way of safe guarding the system against frauds by unauthorised users of the system.

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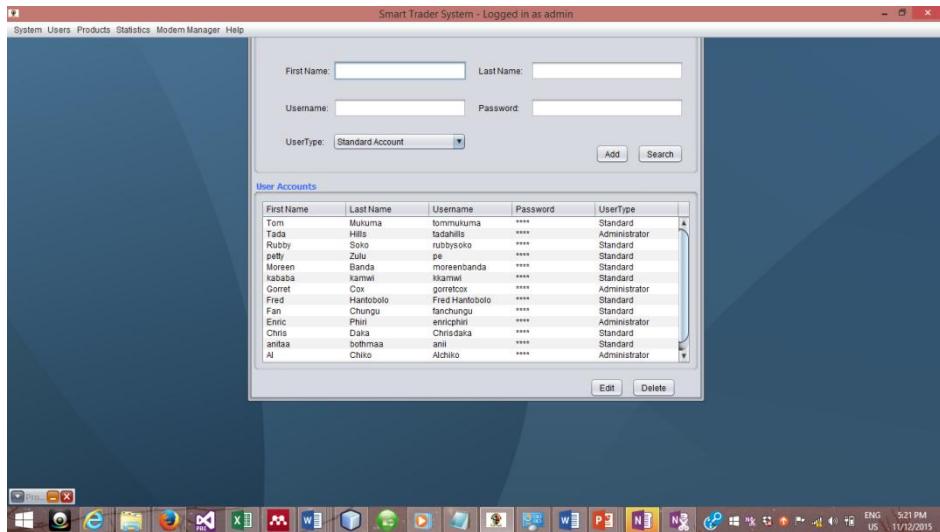


Figure 3. The add, search, delete and edit window for the administrator

The screen that the administrator uses to perform the add, search, delete and edit user functions, is shown in Figure 3. The administrator can add an administrator or a standard user on the system. The screen is used to create access credentials to the users of the system. All users of the system have accounts on the system which are password protected. This helps to protect the system against abuse and fraud.

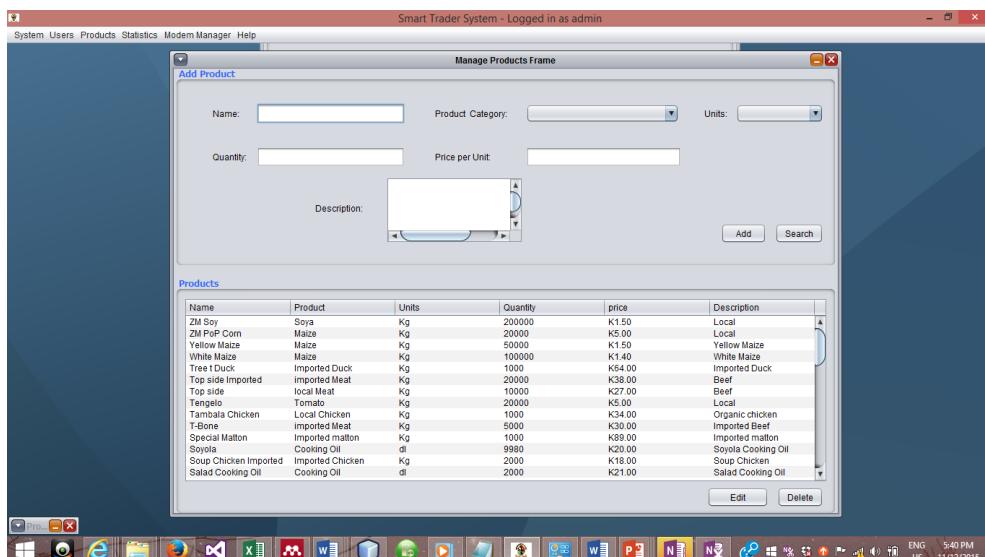


Figure 4. Manage product Screen

Produce can be added, edited, searched and deleted on the system using the window, shown on Figure 4. The system Administrator or user can perform these functions by filling the fields on the screen appropriately. The information that need to be filled in include, name of produce, Product category, unit of measure, quantity, unit price and a description of produce. The perimeters that are captured using this screen, are used for accounting of all produce and transactions which take place on this system.

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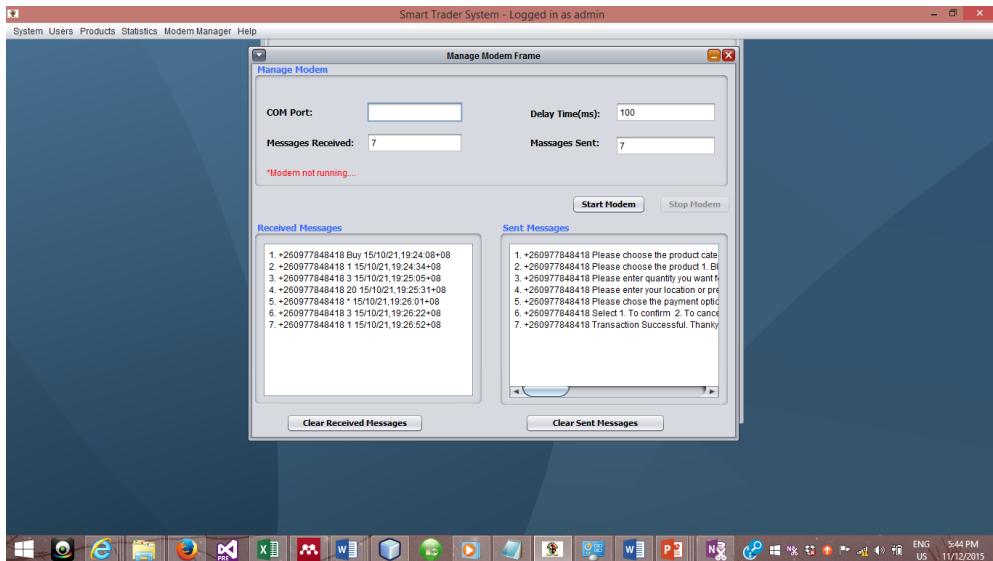


Figure 5. Manage modem screen

The modem which is the gateway between the server and the GPRS/GSM network is monitored using the window shown in figure 5. This window can be used to control the modem by way of starting it or stopping it. The window can be used to view or delete the sent and received messages.

The system has a number of functionalities which include the generation of reports among other things.

VII. DISCUSSION

This Trading application will be a valuable asset to the trading fraternity as it will reduce the cost of doing business[9] for the traders, who will no longer need to travel great distances in order to gather the food commodities. It will also help to improve the food supply chain as the traders will be assured of the availability of food at their points of need.

This application will help to achieve the following:

- reduce risk of getting involved in road accidents[14] as the survey that we conducted showed that 30% of respondents, travel in order for them to access the produce.
- reduce the risk of losing money as 92% of the respondents, as indicated in the survey that we conducted, travel with money on themselves
- working is an industry where the food supply chains is well defined with no more uncertainties as the availability of food will be assured.
- The application will give rise to food traceability[15], [16], food safety[17], [18] and food security[18] to the African nations and the region as a whole.
- reduce the cost of doing business

VIII. CONCLUSION

We have implemented a trading system which is based on SMS on the mobile phone. This GPRS/GSM technology that is being used support the lower mobile phones and these are the ones that most of the small scale traders have access to. The system will encourage the growth of the food supply chain in Zambia and Africa as a whole.

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BIOGRAPHY

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