Mobile Based Application for E-Services and E-Payments: a Study Case of Habari Node Public Limited Company in Arusha, Tanzania.

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Abstract:

Technology is being involved in different sectors to improve service delivery. Habari Node PLC (Public Limited Company), located in Arusha, Tanzania, offers Internet Services and various additional ICT-based business solutions. The company has a website that is used to provide information related to the services they provide with their cost. However, the current website is not mobile user-friendly and is not integrated with an electronic payment to pay for those services because the fees are currently paid manually. This study aimed to develop a Mobile Based Application for E-services and E-payment which will allow the user to access all information related to the services provided by this company and be able to perform e-payment to the subscribes services. The payment will be made through mobile money or credit card, depending on the customer's choice.

Keywords: E-services, E-payment, Mobile Application, E-Wallet, Internet Banking, Payment systems.

I. Introduction

There have been significant advancements in Information Communication and Technology (ICT) worldwide. The devices and tools used to access data 10 years back are no longer the same as they are now. ICT has revolutionized the way individuals work and allowed the business to reach out to new markets and consumers [1]. People are forced to adopt new technologies in the ICT industry in order to fit well in the fourth industrial revolution. As a result, numerous websites and Blogs were created to assist users in accessing information. Many of the installed websites are not mobile-based, making it difficult for consumers to navigate when their only alternative is to use a mobile device. With the rise in the number of mobile devices users, different companies and institutions that were previously relying on their websites or blogs to reach users/customers began to consider implementing mobile-based applications that can be downloaded from the Google Play Store for Android smartphone users or the Apple App Store for iPhone users. Also, we must remember that the number of devices connected to the Internet increases daily as an internet connection becomes affordable and reachable.
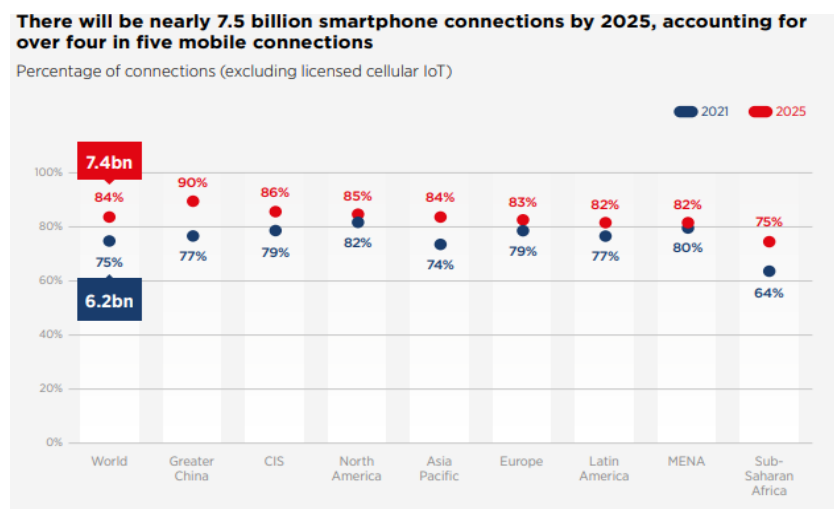
Fig.1. Smartphones Connectivity growth

See Fig.1)the projection made by the GSMA Intelligence displays how in 2025, 7.5 billion smartphones will be connected to the Internet [2]. When we consider the growth in smartphone connectivity (see Fig.1), the number of devices connected to the internet

increase daily. To reach more people, companies and organizations should develop different mobile applications to allow them to sell goods and services and share company information through their mobile devices. In addition, some mobile-based applications can be used without an internet connection. However, others still need an internet connection to allow the accessibility of data stored on cloud servers. Currently, Habari Node PLC is using a website platform as a source of information about services provided to the customer and additional helpful content about the company. However, the company has two problems related to customer service attainability and payments. The first problem is that the website is not mobile based. When a customer tries to view the website on his phone, the website's size is not compatible with the mobile device screen, and as a result, not all website content can be viewed by the user. Secondly, the service payment procedures make it a challenge to the customer. This process involves the customer coming to the company to collect the invoice and deposit the money to the provided company's Financial Accounts.

In this case, a mobile-based application for e-service and e-payments is implemented to be a solution for clients and Habari Node PLC since it lays out all of Habari Node's services to the client through the mobile application. Additionally, the consumer can complete payment transactions without moving from one location to another. Instead, the client is able to carry out all these actions while sitting in one spot and accessing the mobile application through his mobile device.

II. Literature Review

I have reviewed several papers by using a scoping review to find the gaps into those papers and find the solution into the proposed mobile application which will be a solution to the adoption of e-services and e-payments in the current society. The papers show how e-services and e-payments helped in the rising of the African economy as well as making life easy. A lot of writers did research on the use of e-services or digital services. It was found that in the United States and South Africa that mobile-based payment services give a portable and secure solution to users. In addition, users found benefits in accessing different services like health, education, etc., through the mobile application payment systems [3]. Even though the adoption of mobile services payment applications threatened traditional bank ways and foreign exchange bank laws, this adoption contributed to the gross domestic product growth [4]. During the literature review of this study, different e-payment methods were reviewed and a research was done which brought some challenges in the usage of those systems.

2.1 E-Payment Methods and their limitation found during the Research.

E-payment Gateway- is one of the e-payment software services that connect the service provider networks with the retailer, and it allows the customers to make payments through these. When the customer makes a request to the merchant to pay for a service or good, the merchant will use the application on his terminal to send the payment request to the e-payment provider; at the end, the e-payment will send the request to the service provider to be paid to the service provider in order to be paid. But still, managing the security of the user's payment information is problematic because it is mainly attacked by hackers who want to get unauthorized access [5].

Internet Banking- was reviewed as the safest type among the types of e-payments; [5]it involves online banking where you can pay for any product or service of your choice by using the money stored in your bank account. This does not require the use of a credit or debit card to perform the payment through internet banking; you must provide your bank user id as well as the password to finish the process. The bank provides a mobile application for the user to access internet banking purposes, or the user can access it through the bank website. Though this is considered a perfect e-payment system, the challenge with this method is that you can't integrate it into your e-commerce system for payment purposes.

The E-check- also was reviewed; [5]it is done by the purchaser entering the bank routing number and the account number of company or merchant in the online purchasing or order form; the details will be then forwarded to the person who is in charge of processing the completion of the transaction and will deposit the full or net amount to the merchant bank account. The challenge with this e-payment method is that sometimes the purchaser writes a wrong e-check to the merchant, which may cause a significant loss.

The E-wallet- is a prepared account that stores the user's financial details for future payments, this type of payment includes PayPal, Apple Pay, and Google Pay. It allows the customer to perform prepayments and bank transfers in order to cover online payments. PayPal has more than 200 million active users because it works on all devices which have internet access. The process starts with the customer opening a bank account and installing an e-wallet application on his gadget. The e-wallet permits the purchaser to pay the merchant, send money to other wallets with the same banks or different ones, receive money from different e-wallet accounts as well, perform cash in and cash out, and also help the customer to pay his bills [5].

Unified Payment Interface(UPI)- this is a payment method that is used in India. To use it, the user must do bank account registration, have a smartphone connected to Wi-Fi or internet connection, and lastly, the user should have the UPI App of Bank on his mobile device. Then, the user creates the virtual payment address(VPA) to make transactions [6]. The limitation with this kind of payment is that the sender and the receiver of money should hold a VPA to make any transfer. The limitation of this kind of payment is that the sender and the receiver of money should hold a VPA to make any transfer.

Bitcoin- Satoshi Nakamoto brought this idea in 2008; it allows the user to send and receive payments immediately without any involvement of the financial institutions, government, or any other third party to participate in that transaction. Transactions that are done by using bitcoin are not controlled by the government though there are some rules and regulations to follow if you want to use Bitcoin. Bitcoin got high usage because of its transparency and is not supervised by any institution. However, it is not supported by

many governments to be used in their countries because it can not be regulated and supervised by the central banks, which makes its usability not grow as intended [7].

P2P-Paid- This is a wireless mobile payment method that allows the user to perform payments on mobile phones through the wireless Bluetooth connection or perform any related operations over the server. This was developed in 2004 as a research system prototype at the University of San Jose State [8]. The limitation of this work was that the author needed to specify at which distance the Bluetooth network could work since the highest power device can only work at 100 meters distance [9] ,This distance will be between the server and the device owner. Therefore, it always requires the user to be within distance to stay connected without interruption.

Smart Cards Based Electronic Payment System- these are Plastic sized cards with memory chips, and in some cases, they are made with a microprocessor embedded to increase the storage capacity. In addition, some smart cards allow the user to enter the PIN (Personal Identification Number) as a kind of security or even use the encrypted key related to a secret key in the user's processor. This card was taken as a highly secured card because it permanently anonymous transactions of the user, but the only limitation it has, is the transfer of money depending on how much money is saved on the smartphone to be used. [10].

III. Methods

3.1 Area of Study

In this paper, the study area is based on the e-services and e-payments systems, whether mobile-based or web-based. There are multiple services that can be accessed by customers through the mobile app or website. Among them, we can say e-health services, e-government services, e-taxes services, e-commerce services, etc. Not all the listed services are free, which means there is a specific price you have to pay in order to access them; that is where e-payment comes in. E-payment allows the payment of the service or product without the need to move from one place to another, the payments are made through the payment system, and the customer will be able to access the service he paid for. This study was carried out at Habari Node PLC, Arusha. It involved the development of a mobile-based application for e-services and e-payments for Habari Node PLC customers and potential customers.

3.2 System Development Approach

Agile development methodology will be used to implement the proposed system because it allows delivery of a working software increment and welcomes changes in the requirements even late in the development for the customer's advantage. Since E-services and E-payments mobile application is going to be mainly used by customers, I used the Extreme Programming language model (see Fig.2.) to deliver the final product increment.
This model was chosen because it allows the requirements to be removed and added or changed throughout the development process according to the customer's need services payments and also shared with me the challenges the customers complain about.
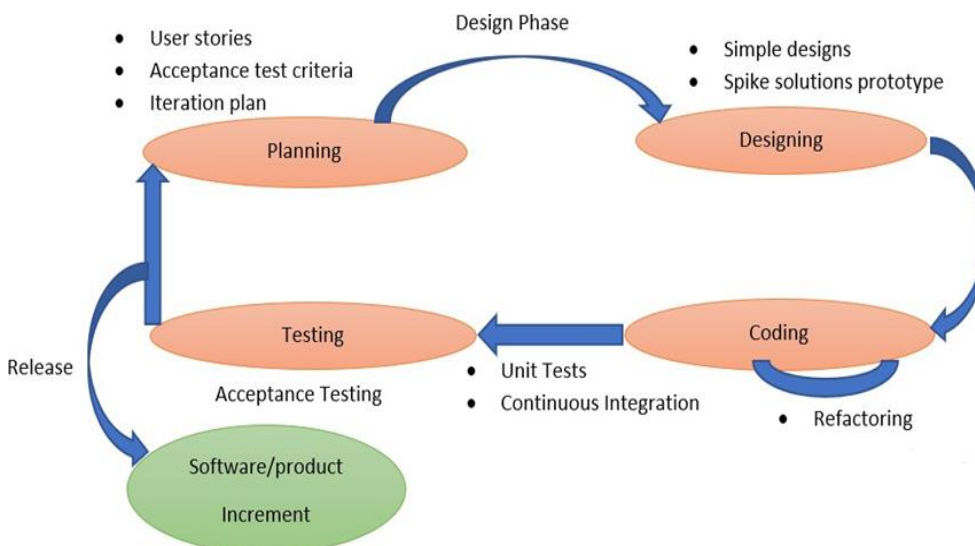

Fig.2. Extreme Programming model.

3.3 Data Collection

The requirements gathering process from Habari Node PLC customers was needed to develop the above mobile application. The gathered data are going to be used during the implementation of the mobile application because this application will be for customer's use. There are two methods that were used during data collection:

3.4 Qualitative Method

This method was carried out by conducting interviews and observation. I did an interview with the Habari Node CRM officer, where she shared with me the procedures that customers undergo, from registration to service attainability. From there, I managed to get

some of the customer's complaints, which can be solved by the mobile-based e-services and e-payments application. Also, I managed to interview the Finance Manager, who elaborated on the procedures for them.

3.5 Quantitative Method

This method was carried out by distributing questionnaires to Habari Node customers. Habari Node has about 2500 customers; the data sampling showed that the survey has to be done to about 300 customers. Two hundred seventeen (217) customers replied to the questionnaire. The purpose of this survey was to find customers' challenges in accessing Habari node services and performing payments for those services and also if the proposed mobile application will solve the stated challenges. The collected data state that 87.2% of the responded customers confirmed that the proposed mobile application would be a solution to their challenges, 9.3% of the responded customers stated that they would confirm after using the proposed mobile application, and the remaining percentage responded as No.

IV. Results and Discussion

4.1 Requirements of the proposed Mobile Application

After the data collection phase, data analysis was carried out, and the collected data were classified into functional and non-functional requirements to start developing the proposed mobile application.

Table 1. Proposed System Functional and non-functional requirements.

| Functional Requirements	Non-Functional Requirements
1. A new user must be able to register with his username, phone number, email, and password and log in with the confirmed username and password.	1. Maintainability- The mobile application should provide support/modification or reconfiguration at a particular time or when required.
2. The phone number verification must be carried out each time the user login when he has logged out of the mobile app.	2. Performance- The system should respond to user queries as expected and be able to handle multiple users as well as multiple queries.
3. After user registration and login for the first time, the next login will only require the phone number verification for security purposes because multiple users can have the same usernames, and even passwords are more likely to be hacked nowadays.	3. Security- The system should allow users to be authenticated with phone verification each time they access the mobile application. There should not be a user's pin system capturing while performing payment.
4. The application must allow the user to update his account details when needed.	4. Usability- The system must be simple to be used by any user.
5. The user should be able to get new offers or any other information related to the Habari Node or his account through the notification symbol in the menu.	5. Compatibility- The Mobile Application must be able to function on a mobile device with an Android OS or IOS.
6. The user should be able to view Habari Node services and subscribe to any of his choices.	
7. The subscribed services must be moved to My Subscriptions so that the payment process can be carried out.	
8. The payments must be carried out through mobile money like Mpesa, Halopesa, Tigo Pesa, Airtel Money, Master cards, or Visa Cards. It will depend on the customer's choice.	
10. Hover technique will be used to automate the existing USSD sessions in the application's background, and the user will be asked just to put in the pin to confirm the payment. This technique prevents the customer from typing the USSD code.	
11. A payment receipt must be sent to the customer's email after the transaction.	
12. The customer should be able to send feedback to Habari Node and get the message confirming the payment.	
13. The customer must be able to contact Habari Node employees through calls, email, WhatsApp, Facebook, etc. Directly from the application.	

14. Once the phone number verification is attempted and failed three times, the user account will be locked, and the user has to contact Habari Node for further actions.	
15. Once the system is idle for a specific time, The user must be logged out of the application.	
16. The user account will be locked after two attempts of entering the wrong mobile money pin during service payment.	
17. Each account should be registered under a different phone number.	

4.2 Design of the system

Functional and non-functional requirements helped me design different designs for the proposed system. System designs help to understand how the system will function, the processes, and the users of the proposed system. We have the conceptual and use case diagrams among the architectural designs included in this paper.

4.2.1 Conceptual Diagram

The Conceptual Diagram (see Fig.3) will give an overview of the system processes. The mobile-based application for e-services and e-payments will have three kinds of users. The system admins, the customer, and Habari node Employees. All the users will be authenticated before accessing this mobile application though users will have different privileges. The system admin will be able to make any changes on the system in the back end when needed. The customer, as well as the Habari Node employee, will just view the services, perform payments, give feedback, and perform other multiple operations he is authorized to perform.
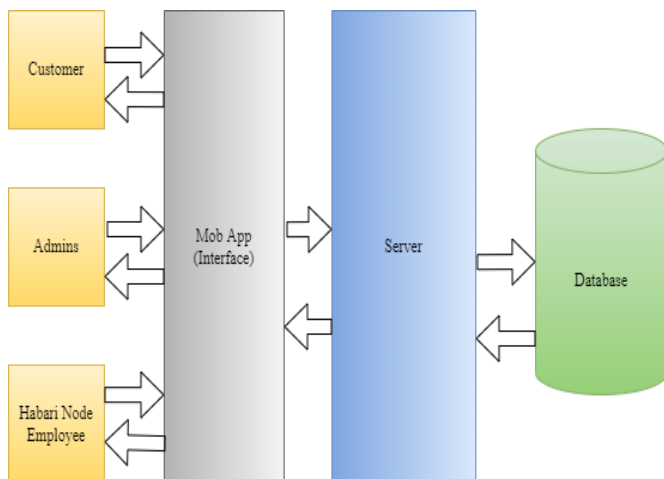
Fig.3. Conceptual diagram of the proposed system.

4.2.2 Use Case Diagram

The use case diagram (see Fig.4) shows what the system will do, which means all the functionalities of the system will be summarized in the Use case diagram. By the use of symbols and connecting lines, the actors will be linked to the functionalities they will be able to perform on the system, and the actor can have one or more than one functionality.
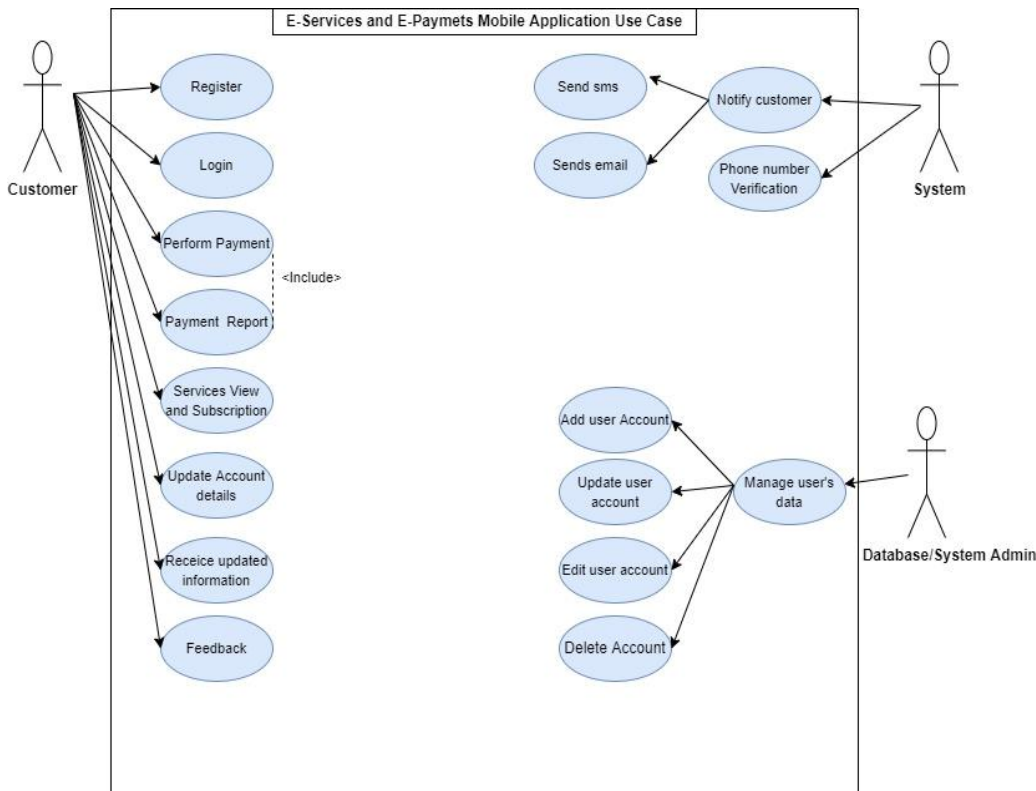
Fig.4. E-services and E-payments mobile application Use Case diagram

4.3 Developed Mobile Based application for E-services and E-payments.

According to the data collection, we came up with customer requirements, and the system was developed to fulfill the customer's needs. The developed mobile application has the registration interface, home interface, etc.

4.3.1 Registration and Phone Number Verification Interface

The registration interface (See Fig.5) shows the page which the customer or any other user will use to register to the mobile application. The user will have to enter his name, location address, email and the email. After that the user will be required to enter the phone number (see Fig.6) and the user must choose the country code. After entering the phone number, a onetime password will be sent through the message for verification for security purpose. The phone number verification will be required each time the user logout from the system. Once the one-time password (OTP) is entered three times failing the system will warn the user from entering the wrong OTP and be locked from proceeding with any The registration interface (See Fig.5) shows the page the customer or any other user will use to register to the mobile application. First, the user will have to enter his name, location address, and email. After that, the user will be required to enter the phone number (see Fig.6), and the user must choose the country code. After entering the phone number, a one-time password will be sent through the message for verification for security purposes. The phone number verification will be required each time the user logout from the system. Once the one-time password (OTP) is entered three times, failing, the system will warn the user to enter the wrong OTP and be locked from proceeding with any subsequent action.
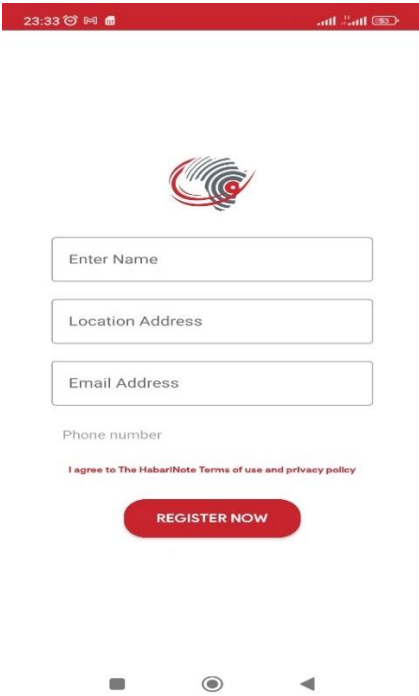
**Fig.5. User Registration Interface Interface**
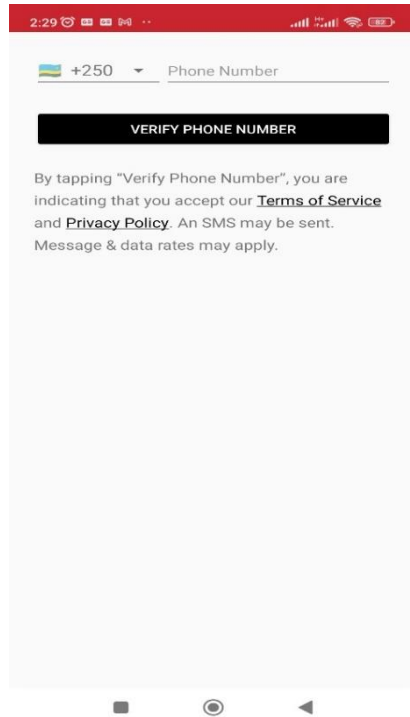
Fig.6. Phone number verification

4.3.2 HomePage, Subscription list, payment and payment options Interfaces

After the user has registered and verified the phone number correctly, the homepage interface will be displayed (see Fig.7) with multiple services that Habari Node offers. The user will choose the service of his choice, and immediately that service will be added to the subscription list (see Fig.8) from My subscriptions. Once the user clicks on the subscribe now button, the payment page will be displayed (see Fig.9), and the user will choose to either pay through mobile money or by using a credit or visa card. (See Fig.10) shows different mobile money service providers the user can choose to perform the digital payment. The user will not be asked to run any USSD code; after selecting the mobile money to pay with, he will be asked to enter his mobile money pin, which for security purposes, will not capture by the system. Once the payment is made, a payment receipt will be sent to the user's email confirming the payment of that particular service.
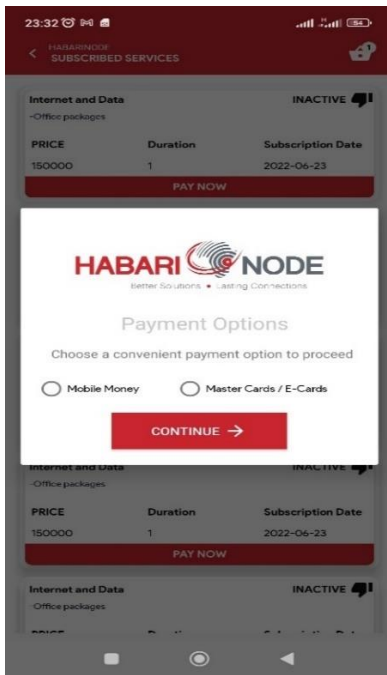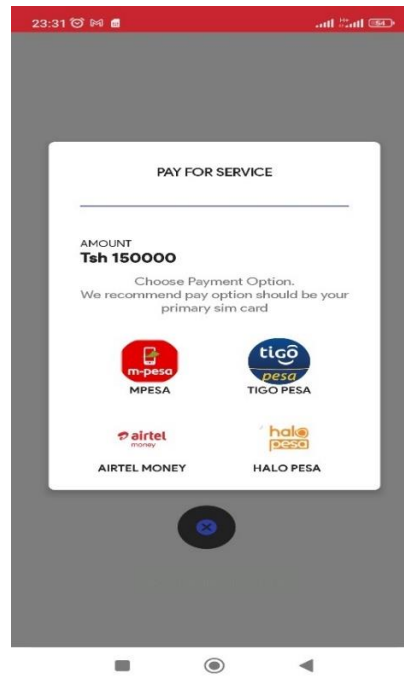

Fig.7. HomePage of the developped Mob. App.
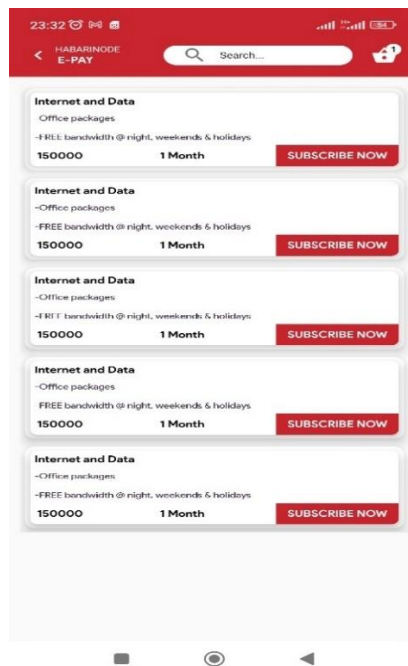
Fig.8. Services Subscription list

Fig. 9. Payment Interface

Fig.10. Payment options Interface

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V. Conclusion and Recommendation

Mobile devices have been advanced and can perform many tasks a personal computer can carry out. For that reason, using a mobile device gives a person information about any service he wishes to know. Multiple internet service providers have mobile money services which allow the customer to send, pay or receive money without moving from one place to another; it can be a tangible product or an intangible service. This technology allows people to perform any transaction on the internet without needing a third party; only the device needs to be connected to the internet connection. Though multiple countries fear using electronic payment due to different experiences of fraud, multiple security solutions were developed and used to avoid that internet fraud. This study advises the implementation of different mobile applications which can be used in e-commerce and e-payment to make the purchasing process simple and fast. Mobile subscribers will grow to more than 5 million in 2025 [2], , and as the number of mobile device owners increases, the number of connected devices increases. This brings good opportunities to business owners and companies using mobile applications to sell or advertise their goods and services. With the advance of the ICT, many selling transactions expect logistics to be done through a mobile application. This will help small businesses to overgrow, and it will also avoid inequity and fights for customers at markets; also, the customers will have more information about the goods or services and pay by choice without any convincing, which is unnecessary. As it was found that security is a high risk while using electronic payment, different measures and techniques must be developed by the researchers to make the e-payment or e-commerce a safe process for everyone.

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