

Mobile Banking Framework in the Ethiopian Context

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Abstract

This research aimed at providing a comprehensive mobile banking framework tailored to the Ethiopian context. To do so, assessment on the existing banking service coverage in Ethiopia has been conducted. Based on the assessment on banking reports, related literature and own experience, Ethiopia remains as one of the under-banked economies. The current practice of opening of new branches is not profitable and the penetration rate is slow to reach the mass market.

In this paper, assessment on the various initiatives taken by the National Bank of Ethiopia (NBE) regarding electronic fund transfer proclamation formulation, the requirement set for local banks to implement core banking system and to do seamless interbank transactions is discussed. The operating environment – legal framework and favorable conditions, mobile infrastructure provided by ethio telecom and the future expansion plan, and the experience of other countries' mobile banking business models are explored to adopt for the local context.

Survey was conducted to identify the most needed mobile banking services to take as an input to propose the mobile banking framework. Based on the data collected from local banks, balance inquiry and fund transfer services stood out as the basic services to be availed.

The proposed mobile banking framework consists of mainly three layers. The presentation layer uses the various mobile technology options as a means to access the mobile application. The business layer shows the mobile banking services. The data layer deals with the underlying data to be maintained. In addition, there is an integration service component for interbank transaction. Finally, an algorithm is designed and a prototype is developed for selected mobile banking services.

Keywords: Banking Framework; Banking Services; Mobile Banking Requirement

1. Introduction

Ethiopia is an under banked country and a lot needs to be done in the banking sector to mobilize resources and to assure sustainable development. There is a big gap between the banking service coverage and the banking service demand by the society. In today's world, there are many banking channels – bank branch, ATM, Internet, and mobile to avail banking services. However, all banking channels are not cost effective for developing countries due to high initial investment requirement. 67% of the world population has mobile handsets which make mobile the largest consumed electronic device in the world [1]. According to Juniper research, the amount of mobile payment transaction is expected to reach 630 Billion USD by the year

2014, with half a billion mobile money users globally.

In this paper, an effort is made to look into mobile banking challenges and requirements with a mobile banking framework tailored to the Ethiopian context. The rest of the paper is organized as follows: Section 2 presents the background information regarding banking services and related efforts. Section 3 assesses related works in mobile banking to learn from prior works. The proposed solution is detailed in Section 4. Section 5 deals with the prototype developed as a proof of concept. Finally, concluding remarks are given in Section 6.

2. Background

Ethiopia is a country with an area of 1.1 million square km and about 78 million population [2].

According to the 2008/2009 annual report of the National Bank of Ethiopia, the total number of bank branches across the country is 636 for all the thirteen Banks [3]. This number may increase as four additional banks are being established and some of the existing banks are opening new branches after the report was released. As of writing this paper, there are seventeen banks, among which three are governmental and the rest are private. Most of bank branches are concentrated in the capital city, Addis Ababa and some regional cities. However, comparing the population and the geographic area coverage, the people-to-bank ratio shows that Ethiopia remains as one of the under banked economies [3]. Actually, this is a critical problem in African countries in which only 20% of African families have bank accounts [2].

Currently, branch expansion is very limited in number and yet branches in different areas are not interconnected. As a result, a customer is obliged to appear in person in a specific branch where s/he has opened account(s) to get banking service. Cash is still the most dominant medium of exchange and electronic payment systems are at an embryonic stage [2]. The conventional banking service, which requires appearing in person at a branch, cannot fulfill the growing customer demand.

In the future, the competition between banks will be towards reaching the unbanked through various electronic channels mainly through mobile. Mobile banking service is promising to reach the unbanked. Mobile banking is a subset of e-banking in which customers access a range of banking products like saving accounts and credit instruments via electronic channels [4]. Recent reports show that mobile phone has better penetration than bank expansion. It is estimated that 2.6 billion people in the world do not have access to formal financial services and yet one billion of them have mobile phones [5]. Besides, prices of both handsets and air-time are decreasing from time to time.

In addition, currently, there are other encouraging initiatives that support the introduction of mobile banking in Ethiopia. The “Payment and Settlement proclamation- proclamation No. 718/2011” includes provision for transaction originated from mobile devices, the establishment of a company called

EthSwitch to provide interbank transaction services, and NBE’s enforcement for implementing standard core banking software are the major ones.

Therefore, to provide such innovative services, we need a mobile banking framework that is suitable for our country. However, associated with mobile banking, there are a number of challenges such as security and lack of comprehensive legal framework that governs the transaction, use of local language, and related issues.

3. Related Work

The literature review in this section briefly shows the various mobile banking business models, security concerns, usability, and related issues. There are two well-know mobile banking business models – additive model and transformational model [5]. In additive model, the mobile phone is merely another channel to an existing bank account. Transformational models focus on providing banking services for the unbanked, who are largely low income people. In transformational model, a bank extends its branches through retail outlets so that mobile banking customers can deposit and withdraw cash at retail outlets (also called agents) [5, 6].

Depending on the nature of the organization providing the scheme, Dermish *et al.* distinguished between bank-based and non-bank-based mobile banking models [5]. For instance, MPESA of Kenya and smart money of Philippines are mobile banking services operated by telecom companies. Wizzit mobile banking solution of South Africa is operated as partnership between the Standard Bank and the MTN- mobile operator.

In some researches carried out on mobile banking adoption, emphasis is given for the impact of social and cultural factors such as perceived credibility, facilitating conditions, perceived elicitation and demographic factors to adopt mobile banking by consumers [7, 8]. In [9], Zarifopoulos and Economides exerted an effort to come up with MoBEF (Mobile Banking Evaluation Framework) which is focused mainly on Internet websites that provide mobile banking services.

In addition, consumers may hesitate to use mobile banking service for security reasons. The security

concern emanates from the nature of mobility and the inherent weakness of wireless infrastructure. Takada and Koike in [10] proposed to use image as password instead of text passwords. Emmanuel in [11] came up with secure framework for SMS-banking services which is focused on security aspect of SMS mobile banking.

Although mobile phone penetration is better than the conventional banking service to reach the unbanked in developing countries, there is a challenge of using mobile banking applications easily by the poor [12]. According to Medhi [12], non-text designs like spoken dialog and rich multimedia are strongly preferred over text-based for such users.

Mobile banking is becoming as one component of disaster recovery solutions [13]. Mobile banking is not only a choice which is convenient for day-to-day financial transactions but also relatively easy to restore a basic banking service from natural or manmade disasters [14]. All these literatures do not show a comprehensive mobile banking framework except discussing a certain part of it in brief.

4. The Proposed Solution

This paper came out with a comprehensive mobile banking framework tailored to Ethiopia. The framework is designed taking into account the extensibility of services, scalability of the application, and usability and security in mind. In order to come up with the architectural framework, it is crucial to determine the architectural significant requirements. Therefore, both the functional mobile banking services requirements and non-functional requirements are identified using survey method. The proposed mobile banking framework is depicted in Figure 1.

The functional requirements are obtained from the survey questionnaire distributed to six commercial banks. The non-functional requirements are partly obtained from the survey and the rest are derived from the application's nature. For instance, it goes without saying that a mobile banking application shall be secure, scalable, available and responsive. Interoperability is also found to be important as there will be interbank transactions that deal with heterogeneous environments.

The framework is composed of three layers. The presentation layer facilitates the interaction between customers and the system. This layer empowers a customer to use the various mobile technology options and local languages while interacting with the system. To bring substantial value to the unbanked, the use of multimedia and local languages on mobile devices is important.

The middle layer represents the various Mobile Banking services offered by the system. Researchers categorized services into two forms [15]. The first classification is based on the nature of the interaction and operations performed as Transactional and Inquiry services. The second classification is based on who initiated the service (the service owner or the consumer), and how information flows (i.e., pull and push). A pull transaction is one in which a mobile phone user requests a service. A push transaction, on the other hand, is one in which the bank sends information based on a set of rules. There is also Bank Entity locator service to locate a nearby bank branch, agent or ATM.

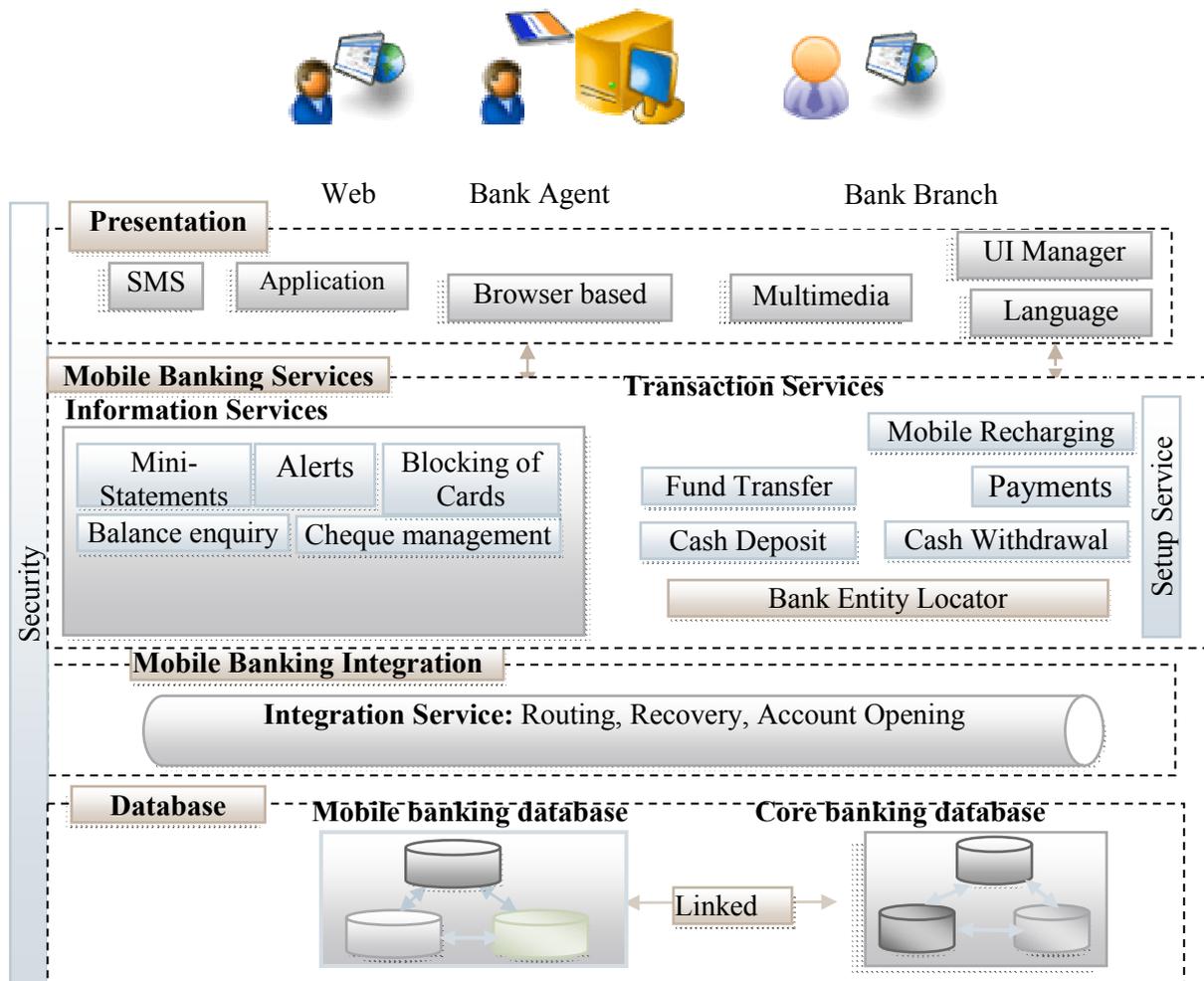


Figure 1: Mobile Banking Framework

The integration service is a platform for building enterprise-level service operation execution. In the mobile banking context, this service is responsible to let customers to transact through without being restricted to a specific bank. That means the service allows interfacing with a standard third party system in order to allow interbank mobile transactions. In this context, banks form a federation to allow customers of a member bank to transact seemingly. The database layer is responsible to maintain the data need of the framework. In our framework, there are mainly two types of databases, i.e., mobile database and core banking database. These databases are distributed and heterogeneous in model, structure, format, etc. Depending on a particular business scenario, a database can be distributed for scalability, availability, and performance reasons.

5. Prototype

After defining the mobile banking requirements and come up with the architectural framework, two

databases – mobile banking database and core banking database - are created. A prototype is developed using Microsoft Visual Studio 2008, C# as a development environment. The designed framework is comprehensive and challenging to implement all functionalities within this short period. Therefore, only a small SMS application as shown in Figure 2 is implemented as a proof of concept. In addition to the Microsoft Visual Studio, a trial version of Ozeking SMS gateway was used. The SMS gateway serves as a medium of exchange of messages between the application and the mobile network. The application mainly shows the balance inquiry and fund transfer services. The transfer service is designed and implemented in such a way that when there is insufficient fund in a given mobile account, the transfer is carried out from the usual banking account linked to that mobile.

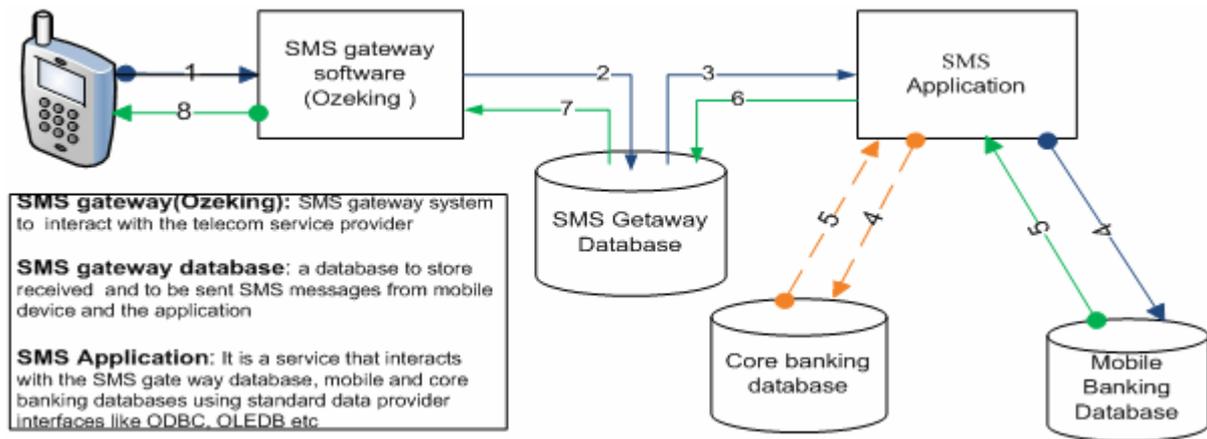


Figure 2: SMS messaging design with databases

The SMS Gateway database uses two tables namely, inbox and outbox to store incoming and outgoing messages. When a message is sent from a mobile as depicted in the mobile banking framework designed in Section 4, the media of communication with the mobile banking system could be through SMS, or a small application to be deployed on each mobile device (like J2ME) or through Internet (WAP). The prototype is focused on SMS because all mobile devices are capable of processing SMS although there are security concerns since the SMS messages are transported as plain text.

When SMS is received from a customer, the SMS Gateway software inserts the message into the SMS Gateway database - the inbox table. The mobile banking application monitors continuously the inbox table and picks the message and based on the request type, it will connect to the mobile database. After processing the request (be it balance inquiry or fund transfer service), the message to be sent is placed in the outbox table in the SMS Gateway database to be sent by the SMS Gateway software to the customer. If the mobile banking application does not get the information corresponding to the incoming message from the mobile database, a request will be sent to the core banking database in case the customer has bank account and is registered for mobile banking service. Note that since the application runs as a service on a computer and handles incoming and outgoing SMS messages, it has no graphical user interface to be shown.

6. Conclusion

As per our assessment, there is no mobile banking service provided so far in Ethiopia although there are some efforts here and there to introduce the technology. A research in the area is almost nonexistent. Therefore, we found designing a mobile framework to reach the unbanked essential. In order to come up with the appropriate framework, the local banking practice and operating environment are assessed. The mobile banking services survey was conducted from six local banks. In addition, related work review has been made. Finally, a comprehensive mobile banking framework is designed. As a proof of concept, a prototype is developed for balance enquiry and fund transfer services on SMS platform.

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