Självständigt arbete på grundnivå

*Independent degree project - first cycle*

Datateknik
*Computer Engineering*

**Title**  Mobile Apps for Ethiopian Commodity Exchange

Israel Bekele Balcha
MID SWEDEN UNIVERSITY
Department of Information and Communication Systems ()

Examiner: Dr. Ulf Jennehag, ulf.jennehag@miun.se
Supervisor: Barac Filip, fillip.barac@miun.se
Author: Israel Balcha, isbe1001@student.miun.se
Degree programme: International Bachelor’s Programme in Computer Engineering, 180 credits
Main field of study: Computer Engineering
Semester, year: Winter, 2015
Abstract

In the African continent the mobile phones are already contributing their share in the development of the continent. Specially in Ethiopia, in one direction, the users of mobile phones are increasing each year and most importantly the small scale farmers who contribute 85% of the country’s population are using these devices to trade their surplus products in an efficient manner and better deal thus earn good profit. In another direction, Ethiopia has set up its own Commodity Exchange in 2008 so that farmers and traders could buy and sell commodities in an efficient and transparent manner. Taking into consideration both of these developments carried out to encourage smooth trade and modern marking strategies, this project has a target to come up with mobile applications for the Android mobile platform and iPhone users in the first phase of implementation. Accordingly, the app developed will help to get real time Ethiopia commodity Exchange (ECX) market prices, commodity related headlines, weather forecasts and other relevant news. It will contribute to standardize the way ECX is performing to link up different parties specially farmers who make up majority of the country’s population and support the economy of the country in a great deal with the traders. Although the mobile app developed does not have an aim to bring in significant change into the existing system at the current penetration of Smartphone in the country, it helps to disseminate information in standardized manner as in big commodity exchanges and besides, we believe in the future it will be the convenient and widely used means to reach the traders with necessary information.

Keywords: Android, Apple, iOS, ECX, Web Services, RESTful, SOAP, CBOT, BM&FBOVESPA, UCX, AFET
# Table of Contents

Abstract.........................................................................................................................1  
Table of Contents...........................................................................................................2  

1 Introduction.............................................................................................................5  
1.1 Background and problem motivation.................................................................6  
1.2 Overall aim..........................................................................................................6  
1.3 Scope....................................................................................................................7  
1.4 Concrete and verifiable goals.............................................................................7  
1.5 Outline..................................................................................................................7  

2 Theory.......................................................................................................................8  
2.1 Existing System....................................................................................................9  
2.2 Mechanisms Used For Disseminating Real Time Information.........................10  
2.2.1 Electronic Tickers..........................................................................................11  
2.2.2 SMS Services.............................................................................................11  
2.2.3 Interactive Voice Response Service............................................................11  
2.2.4 Mass Media..................................................................................................11  
2.2.5 Information Center.......................................................................................12  
2.3 Drawbacks in the Existing Dissemination Mechanisms.....................................12  
2.4 Who Benefits from the Apps............................................................................12  
2.5 How ECX apps can make a difference as compared to the existing system? 13  
2.6 What Factors might impair the Utilization of the Apps..................................14  
2.7 Related Works....................................................................................................14  
2.7.1 CBOT/CBT...................................................................................................15  
2.7.2 BM&FBOVESPA.........................................................................................16  
2.7.3 AFET............................................................................................................17  
2.8 Technologies.......................................................................................................17  
2.8.1 Android........................................................................................................17
2.8.2 Web Services ................................................................. 18
2.8.3 Web Application Technologies ......................................... 19

3 Methodology ........................................................................... 20
3.1 Front-end .......................................................................... 22
3.2 Back-end .......................................................................... 23
3.3 Survey ............................................................................. 23
3.4 Tools and Technologies ....................................................... 24
3.4.1 Tools .......................................................................... 24
3.4.2 Technologies ................................................................. 24

4 Design and Implementation ......................................................... 26
4.1 Apps Design ..................................................................... 27
4.1.1 BPMN Diagram ............................................................ 27
4.1.2 Use Case Diagram ........................................................ 28
4.1.3 Class Diagram ............................................................. 29
4.2 Interfaces ......................................................................... 30
4.3 Database and Web Services ............................................... 31
4.4 Web Application ............................................................... 32
4.4.1 Security ...................................................................... 32

5 Results .................................................................................... 33
5.1 Android Application .......................................................... 34
5.1.1 Active Transactions ...................................................... 34
5.1.2 Monthly Trend ............................................................. 35
5.1.3 Language ..................................................................... 35
5.1.4 Major Currencies ........................................................ 36
5.1.5 Regional Capital Cities .................................................. 37
5.1.6 Commodities ............................................................... 38
5.1.7 News ........................................................................... 39
5.1.8 Commodity grade Description ...................................... 40
5.1.9 Widget ......................................................................... 41
5.1.10 Administration ........................................................... 42
5.1.11 Observations and Feedback from Target Customers........43

6 Conclusions........................................................................................................44
   6.1 Contribution and Impact............................................................................44
   6.2 Ethical Deliberations.................................................................................44
   6.3 Future Work...............................................................................................45

References...........................................................................................................46

Appendix A ...........................................................................................................47
   Questions .........................................................................................................47
1 Introduction

In the 21st century the social interactions are largely supported by electronic devices, for example computers, smartphones, telephones and faxes. However, very recently the trend is taking a different direction. Smartphones are taking the task of all other devices, and in effect smartphones are becoming main stream devices in both the developed and the developing world. According to the survey by Gartner Inc[4], the global sales of Smartphone has already surpassed feature phone in the second quarter of 2013. In Ethiopia, there is no formal survey carried out in the area, however, we are witnessing an increase in the demand of smartphone every year.

A few brands control the majority of world smartphone market and among the most widely used devices Samsung’s and Apple’s product lead the market [3]. In Ethiopian smartphone market, commonly used smartphone are products of Samsung, HTC, iPhone, Blackberry, other less known Android based smartphone and locally assembled smartphone are quite widely used. Moreover, as in the case with the fact that few brands control the global smartphone market, Google’s Android Mobile platform and iOS are the most widely used mobile operating systems.

Smartphone serve multipurpose although the core purpose has originally been to carry out the tasks of the feature phones. They could be used as internet browsing device (act as mini computers). Moreover, these devices could serve a unique purpose depending on the kind of app installed. For example GPS, games, social apps, bus and train schedule apps, and so on.

As far as the economic activities are concerned, the current state of Ethiopia could best be described as a 'country undergoing a huge shift socially and economically for a better tomorrow'. There are promising beginnings in all sectors of the economy with the possible future high economic and social values. Ethiopia Commodity Exchange market could be the perfect example for this. Ethiopia Commodity Exchange (ECX) was launched in 2008 carrying an aim to modernize and standardize the commodity trade in our country. Since its establishment, the ECX is gaining acceptance by the wider public and as a result of initial successes
some African governments are taking this as a model to begin their own commodity exchange. However, as compared to similar markets in the developed world, the ECX could be considered at its infancy with regard to the size of customers from total community of traders in the country as well as the types of commodities traded currently. However, it is believed the strategy gains huge momentum and finds its place as an influential body in commodity trade in Ethiopia as the number of users of mobile phone increases.

1.1 Background and problem motivation

The aim of this project is to add additional and better means of information dissemination to the customers. The existing means of information dissemination carry out the intended task well enough to support existing number of customers. However, language barrier (because Ethiopia has many languages), poor telecommunication infrastructure as well as inconvenience and user unfriendliness could discourage many new comers and existing users from participating within ECX.

Using the SMS, users need to remember symbols and commodity grade codes as well as little knowledge of English language and alphabet is beneficial; however, the apps have all the information and descriptions for the codes, real-time information, market trends and so on in local languages (Amharic, Afan Oromo and Tigrigna). Moreover, as compared to the SMS based Services, the apps provides the necessary information in a very user friendly manner and so these issues demand for consideration of mobile apps besides the existing means.

1.2 Overall aim

The overall aim of the project is to develop mobile application which could bring the real-time information to the concerned people. The mobile application could help to get all the existing report that currently exist and could be extended to include some more tasks. Using this apps customers could follow the activities going on the ECX octagonal trading floor and able to retrieve history of commodity market trends. In addition, the app brings weather information and currency exchange rates for major currencies.
1.3 Scope

In this project the development tasks has been done in collaboration with ECX ICT department to deploy the apps made. So some of the tasks on the server side such as development of Web services on ECX database is expected from ECX. This part of the project is not within the scope however for the sake of keeping project time plan it would be possible to work with them depending on their need. In the requirement gathering stages of the project, it is learned that ECX wants to gather price quotes for commodities from remote parts of the country. However, in this phase of the project it is only required to work on dissemination. Therefore, in this project price quote gathering is not part of the implementation.

1.4 Concrete and verifiable goals

In this project work the objective has been to come up with a mobile application which could serve the strategy of ECX in a better way and thus contributes to development of the economy.

The concrete goals of the project are the following:

The first goal of this project is to develop Android app for ECX commodity market and add extra features such as weather forecast for major cities in Ethiopia as well as currency exchange rates.

The Second goal is to evaluate the impact of the introduction of these apps on the existing system and the consumers.

1.5 Outline

In the first chapter introduction to the bachelor thesis has been presented. In the second chapter, theoretical aspects of this project have been presented. In the third chapter the methodology of the project implementation has been explained thoroughly. The forth chapter describes the designs and implementations of the project work. The fifth chapter describes the results of the project and the sixth chapter presents the conclusion and future work.
2 Theory

Smartphone prove the possible mobility and thus high availability as compared to mobile devices such as laptops. Many important applications for example, games, banking applications, social applications, photo and video tools, which have a high social value are coming into the market. The current trend seems that all the traditional desktop applications are migrating onto smartphone. Moreover, when we come to developing countries such as Ethiopia powerful devices such as smartphone could have a potential to enhance the socio-economic development. Until recently the number of users of smartphone has been very few as compared to feature phone users due to the high cost of the smartphone and due to the fact that the manufacturers do not take into consideration the demands of our society. Nevertheless, currently more and more Ethiopians are using smartphone (for example global brands: Samsung and iPhone) and others less known smartphones are common to find even in the poor and remote parts of the country. In the current market small scale farmers could buy smartphone as cheap as 60 USD (which is less than 1200 ETB).

Smartphone could play a crucial role in the development of economy of a country especially in those developing countries where poor communication and transportation infrastructure contributes much to losses and less incomes. Many agree that the increase in the users of mobile phones will have a great impact on Millennium Development Goals (MDG) as well as on the Grow and Transformation Plan (GTP). In this project is aimed to develop mobile app for the Ethiopia Commodity Exchange. The app serves customers (smallholder farmers, importers, exporters and businessmen) in the remote areas to get updated list of commodity prices using their mobile network. The app does also disseminate hourly weather information for main cities in Ethiopia and commodity related news, for example, foreign currency rate for major currencies of the world.

The Ethiopia Commodity Exchange is a spot exchange established in Addis Ababa, Ethiopia. More than 200 different commodity grades are traded by the ECX members or their authorized representatives through
open outcry trading mechanism. ECX offers an integrated warehouse system from the receipt of commodities on the basis of industry accepted grades and standards for each traded commodity by type to the ultimate delivery [1]. Warehouses are located in 16 places distributed all around the country where surplus production exists.

Commodity trade is carried out daily on the standard sized octagonal trading floor. As shown in table 1 Coffee and Sesame session are daily but grains are currently traded once in a week. Commodities are assigned standard grades called contracts. So the number of grades for one kind of commodity could reach a multiple of hundreds, for example, Coffee grades are more than 300.

Table 1. Trading Sessions [1]

<table>
<thead>
<tr>
<th>No.</th>
<th>Session</th>
<th>Days</th>
<th>Starts</th>
<th>Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grains</td>
<td>Wednesday</td>
<td>9.00 AM</td>
<td>9.30 AM</td>
</tr>
<tr>
<td>2</td>
<td>Sesame</td>
<td>Daily</td>
<td>10.00 AM</td>
<td>11.00 AM</td>
</tr>
<tr>
<td>3</td>
<td>Local Coffee</td>
<td>Tuesday, Wednesday, Thursday</td>
<td>11.30 AM</td>
<td>12.30 PM</td>
</tr>
<tr>
<td>4</td>
<td>Export coffee</td>
<td>Daily</td>
<td>2.00 PM</td>
<td>6.00 PM</td>
</tr>
</tbody>
</table>

2.1 Existing System

The ECX uses information communication technology (ICT) to create a favorable environment for the buyers and Sellers of commodities. The idea and thus the company wouldn’t have gained praise and initial success, had there been difficulty in information dissemination. The expansion of mobile network plus the installation of electronic tickers and also the use of IVR service has contributed a lot to reach market data right to the doors of participants. However, the fact that number of users of modern technologies of Information Communication (for example, mobile phone, Internet and So) is still a big challenge to expand the dimension and increase the number of traders currently.
At core of strategy of the ECX is dissemination of the up-to-date market information to the participants— the farmer, commodity dealers, processors, exporters and importers. The more ECX reaches concerned community with up to date market data the more successful it gets and contributes immensely in the stabilization of local market. As shown in Figure 1 the existing system uses more than five mechanisms to disseminate market data.

![Figure 1. Existing Means of Disseminations Market and related information](image)

### 2.2 Mechanisms Used For Disseminating Real Time Information

The ECX Market Data strategy involves harnessing the power of modern information and communication technologies (ICTs) to empower all market actors, including smallholder farmers to access markets more efficiently and profitably. The key market dissemination channels at ECX are rural based Market Information Tickers, mobile phone Short Messaging Service (SMS), Interactive Voice Response (IVR) service, Mass media (TV, Radio, and Newspaper) and Website [1].
2.2.1 **Electronic Ticklers**

The ECX Electronic displays display real-time (under 4 seconds) prices of all commodities traded on its platform. The Displays are currently installed on 200 strategic places around the country.

2.2.2 **SMS Services**

ECX uses SMS services to disseminate market information and intelligence. SMS services provide the community from every corner of the country within mobile network coverage with an easy steps to access market prices, commodity related news headlines, weather forecasts, and other relevant market information. The SMS services plays very crucial role in the dissemination of market information and related data. Currently the number of SMS message from ECX members have gone well above 2 million per month.

2.2.3 **Interactive Voice Response Service**

The ECX Interactive Voice Response (IVR) system is a fully automated telephone based system that allows stakeholders to access price information 24/7. The IVR system has been the most favorite of all the mechanisms due to the fact that stakeholders need to memorize little and offers menu of local languages (Amharic, Oromiffa and Tigrigna) besides English. However, due to the poor telecommunication infrastructure and quality, many have turned to the SMS services.

2.2.4 **Mass Media**

ECX announces market information on daily basis via radio, television and newspaper.

- TV- ETV broadcasts ECX market up to date three times a day
- Radio –National Radio stations, FM Addis and regional FM radio stations broadcasts ECX market updates four times a day.
2.2.5 Information Center

ECX information center provides a variety of market information, for example, daily domestic and international prices, market trends, production and weather forecast, market related news and events. So on.

2.3 Drawbacks in the Existing Dissemination Mechanisms

The content of market data is available in English language except in IVR, Mass Media and other less relevant mechanisms.

The reliability on IVR for market information retrieval is in question because of poor infrastructure and quality.

Important reports and market trends could only be retrieved from a computer or in person from the office.

The existing system has not yet implemented a way to reach the concerned people with weather information though there is a need to do in the future.

Market information and foreign currency exchange rates are related since there are importers and exporters participating within the ECX market. However, the existing system does not support a way to retrieve updated currency exchange rates.

2.4 Who Benefits from the Apps

The App has been developed taking into consideration the knowledge of end users about usage of electronic devices such as smartphone. Market data could be retrieved in local languages and enough help as well as documentation has been prepared. Therefore, considering the increasing number of users of smartphone and other similar devices in our community, there is no doubt that ECX App will soon be the valuable tool for information dissemination. The Information includes market data and the reports, Weather information and foreign exchange. Moreover, based on the interest of ECX, there is still a need to add some more extra features, for example, collecting price quote from remote clients.
The ECX App could serve a list of groups of clients in our country as well as abroad.

1. The general public
2. The business community (exporters and importers)
3. The smallholder farmers
4. Ethiopians living abroad or a person residing abroad temporarily for business or medical matters.

2.5 How ECX apps can make a difference as compared to the existing system?

1. The existing system has been made so that the end users could take advantage of the easiest and most convenient means to obtain market data. However, the infrastructure issues and language barriers have put a little challenge on them. For example, IVR, which has been favored by most customers at the beginning of the service, fails to serve the demand of the customers and so customers have turned their faces to SMS services. The ECX App could play the role of IVR: List of grade codes with description in local languages and self-help means to find out intended information.

2. The existing system does not have mobile applications to disseminate information to the public. It has been mentioned in chapter one that this days smartphone are getting mainstream devices so it is worth to consider applications of such a kind.

3. The existing system only uses SMS in English language. Furthermore, recalling the codes is a challenge for many clients though the codes have been made as easy as possible. ECX apps are the best alternative to deal with such challenges.

4. The existing system uses electronic tickers, SMS and IVR among others for information dissemination. However, the usage of ECX app mean to bring all these mechanisms on a small handheld devices for a price which is so little and quite affordable by end
users. As a result of this, we are able to increase the availability of information and robustness.

5. The existing system does not have a way to collect market prices from different part of the country (i.e. commodity prices from traditional markets). Furthermore, unable to find the market price of commodities in different parts of the country means different prices in some parts of the country where the flow of information is slow. The apps will provide a way for remote markets to push commodity prices and ECX can get the prices on a daily basis.

2.6 What Factors might impair the Utilization of the Apps

In Ethiopia there is no formal survey on the distribution of smartphone and other similar handheld smart devices such as tabs however one can observe that the users of smartphone is increasing rapidly. Observation could be made on the shops that sell mobile phone in Addis Ababa and major cities. Every year the demand of smartphone is on rise.

Therefore, one obstacle that would possibly encounter right after the deployment of the app could be small number of users in remote parts of the country. Further, the other obstacle would be difficulty with usage of smartphone itself. However, these two issues are obstacles that could not find a place after a few of years. In this regard if we are convinced that these obstacles will surely be encountered right after the implementation, then in this project we are at least building a better mechanism for market information retrieval for future customers. However, if we come to find out that there is no significant impact arising from the aforementioned problem, then it means the ECX app will be the best alternative even in the current distribution of mobile devices.

2.7 Related Works

Due the very nature of commodities, most of the commodity market across the globe does not trade for physical settlement and delivery within a trade date or within few periods after trading. Commodity traders usually exchange commodities in the form of listed future contracts. Commodity Exchange markets provide a place of whole or
processed forms, grains and seeds that are important source of nourishing food for the communities. Commodity markets provide an efficient means of trade for agricultural products. Therefore, most countries have been using such a means to efficiently trade commodities. In this section the oldest, the biggest and one relatively new market have been presented.

### 2.7.1 CBOT/CBT

The Chicago Board of Trade (also CBOT, CBT) was founded on April 3, 1848 by 82 Chicago merchants and business leaders in a flour store attic, and continues today as the world’s oldest commodities exchange.[8]

The CME Group Mobile app, available for iPhone or Android, offers users the ability to create, sort and save a custom product lists including front months of all Globex and Open Outcry futures, 10 minute delayed market data, and price charts.[9]

The following services are provided with the app:

- Block Trade data and filtering
- Portfolio Management
- Education and Product Research
- Social Integration
2.7.2 **BM&FBOVESPA**

The BM&FBOVESPA S.A. – Securities, commodities and Futures Exchange was created in 2008 through the integration of the Brazilian Mercantile and Futures Exchange (BM&F) and the Sao Paulo Stock Exchange (Bovespa). [10]

Using BM&FBOVESPA mobile application (for iPhone, iPad and Android) customers can follow quotations for indexes, stocks and commodities, as well as real time news with interactive graphics, and be able to search for brokerage houses.
2.7.3 AFET

The agricultural Futures Exchange of Thailand (AFET) is an independent private organization established by the Ministry of Commerce under the agricultural Future Trading Act B.E. 2542 (A.D. 1999). AFET is the only futures exchange in Thailand for the trading of agricultural commodity futures. [10]

2.8 Technologies

This bachelor thesis requires basic knowledge of Java, Android, HTML, JavaScript, Web Services and related Technologies. In this section a brief explanations of these technologies have been presented.

2.8.1 Android

Android is Google, Inc. owned open software stack mainly for small devices. The Android stack consists of application layer, a virtual machine layer (Dalvik Virtual Machine), a middleware and Linux based operating system. The most popular mobile platform began its journey at the hands of Google in 2005 when the company bought the platform from Android, Inc. [5]
2.8.2 Web Services

Web services are client and server applications that communicate over the world wide web’s HyperText Transfer Protocol (HTTP)[6]. The main features of web service are interoperability, extensibility as well as machine-processable description.

There are different ways to implement a web service. Nevertheless, SOAP and RESTful API’s are by far the most commonly used types of implementations.

SOAP-based design:

In such web services the messages follow a standard known as Simple Object Access Protocol. In SOAP protocol, the message formats and architectures are XML based. SOAP-based web services contain WSDL a description for the services offered by the web services.
A SOAP-based design must include the following elements [6].

- A formal contract must be established to describe the interface that the web service offers. WSDL can be used to describe the details of the contract, which may include messages, operations, bindings, and the location of the web service.

- The architecture must address complex nonfunctional requirements. Many web service specifications address such requirements and establish a common vocabulary for them.

- The architecture needs to handle asynchronous processing and invocation. In such cases, the infrastructure provided by standards, such as web services Reliable Messaging (WSRM), and APIs, such as JAX-WS, with their client-side asynchronous invocation support, can be leveraged out of the box.

RESTful design:

RESTful web services do not have its own protocol but it uses the existing HTTP standards. As compared to SOAP-based web services RESTful web services are lightweight and use minimal tools to develop and in general the cost of developing RESTful APIs is low.

2.8.3 Web Application Technologies

HTML:

HTML specifies the content of web applications and Cascaded stylesheets (CSS) presents the web applications.

JavaScript:

JavaScript is the programming language of the web and it defines the behavior of web applications [7]
3 Methodology

In the previous chapter it is mentioned that stakeholders’ most preferred means of market data collection has been IVR however due to poor telecommunication infrastructure and quality currently SMS services took the lead as most important means to retrieve market information.

Nevertheless, the mobile applications proposed in this section could be considered as a hybrid of the two main techniques (See Figure 5) smallholder farmers and the business community prefers.

Firstly, the design of apps considers content localization, so in the first phase three local languages (Amharic, Afan Oromo and Tigrigna) has been used and depending on the demand it is possible to add more local languages in the future.

Secondly, it is possible to retrieve market data information at anytime from anywhere. In this case the commodity grade codes and other relevant information have been included on the app so smallholder
farmer with very little or no English knowledge could understand the codes.

Thirdly, the apps do not need a huge bandwidth and thus the cost of Internet for such purposes is quite small and affordable. In addition, vital information related to commodity trade for example hourly weather forecast and daily foreign currency exchange are disseminated to the end users.

Finally, the apps could be considered as installing the electronic tickers right into the house of smallholder farmers and concerned people. See Figure 5.

This chapter explains the methodology I have followed to achieve the concrete and verifiable goals listed out in the introduction chapter. In addition, it presents the tools and technologies I have used to implement the system needed to get expected results. This bachelor’s thesis includes the development of RESTful API on a MySQL database, consumption of the web services and development of Android application. So implementation of the project began with the Backend i.e. MySQL database and web services then web service consumption and application. Finally, testing, report writing and documentation has been done. The detailed project time schedule for this Bachelors thesis has been submitted separately. The overall diagram of the project has been illustrated in Figure 6.
3.1 Front-end

To carry out tests and gather information in the results section, I have setup a system as shown in Figure 6 above. MySQL database has been installed and secure API has been built upon the relational database. In the database I have created tables for commodity symbols, commodity grades, daily transactions, monthly transactions, monthly summary report, monthly trends, major world currencies, weather information for major cities in the country. This information is accessed through web services in a secure manner. The ECX had informed that they want to keep the standard of their services and wanted to follow their own procedure of hiring a company to setup the APIs required. Therefore, since the API from ecx can’t get ready for this project, I have setup my own test environment as explained in this section.

The following are the basic functional requirements of the app to be designed and developed in this bachelor’s thesis.

- Reach customers with all kind of reports intended for stakeholders. In this case the reports and all the information are available in local languages (Amharic, Afan Oromo and Tigrigna)
- Provide real-time transactions (transactions running on the octagonal trading floor)
- Provide weather information for major cities in the country.

- Provide exchange rates for the major currencies.


### 3.2 Back-end

In this project the app designed and implemented meets standards of Android application look and feel requirements. In a similar manner, in case of iOS application, quality has been set a priority. Furthermore, in the final stage of the deployment, the apps will be available on Google Play and iTunes store where clients could download the apps for free.

In this section I have developed a web application that will be used to manage tables in the database. The administrator in charge could add record, update record, and delete record.

### 3.3 Survey

In here an interview has been given to a certain participants at the commodity exchange market place. The participants partaking in the survey has been chosen to represent all the range of possible educational, age, gender, ethnicity, lifestyle and residence backgrounds. For this study 35 subjects are chosen in total and are presented with the list of questions [See Appendix A].

In the Survey the following are the points to investigate:

- Evaluate the impact of the introduction of apps on the existing system and the consumers.

- Find out any changes required to improve user experience
3.4 **Tools and Technologies**

For the implementation of the project, I have used commonly used open and free tools. In the coding stage, java has been used as a main language.

3.4.1 **Tools**

The following IDE’s and Software have been used for the implementation.

**Eclipse Indigo:**

Eclipse Indigo service release 2 has been used to develop Android application. Currently Google has another development environment that is currently official for Android developers, however due to previous experience on Eclipse I had used for the project.

**NetBeans:**

NetBeans 8.0.1 has been used to develop the API that could securely access the bottom layer. NetBeans provides the simplest way to develop web service from relational database tables. Further, I have used Glassfish server 3.1.2 with NetBeans.

**MySQL:**

Tables created for the test purposes have been stored on MySQL, Oracle’s free community software.

3.4.2 **Technologies**

**Android/Java:**

Eclipse has been used to develop Android application.

**Web Service:**
RESTful web services have been implemented to access the test database securely.

HTML 5 and JavaScript:

The administration page for the system has been developed with HTML 5 and JavaScript.
4 Design and Implementation

In this chapter a brief explanation of the app design and details of the procedures followed have been presented. Diagrams, Figures and illustrations have been used to clearly show the concepts. In addition, screen captures taken from the actual apps have been included. Figure 7 illustrates the architecture. The implementation of apps and Web Services consumption are the tasks to be carried out in this project.

![Diagram of ECX Mobile application]

---

Figure 7. ECX Mobile application
4.1 Apps Design

The mobile app provides all kinds of reports (currently four reports) on the commodity exchange and it uses graphs to show trade history. Moreover, each of the symbols for commodity grades could be retrieved and description of each of these symbols could be retrieved in local languages.

In addition, using the app end users could retrieve and read news pushed from the ECX. Weather forecasts for capital cities of regional states and foreign exchange rates for eight major currencies of the world could be retrieved.

4.1.1 BPMN Diagram

Using the apps once the installation is done, the app itself retrieves the updated information. Therefore, in this case the clients could get information from ECX.

However, it is also possible to retrieve different reports. Customers only need to change in the settings sections if they do not want the default preference (see Figure 8).
4.1.2 Use Case Diagram

The use case diagram for the app developed is shown in Figure 9. The diagram shows the core function of the app however other additional functionalities such as commodity price quote from the farmers is not displayed.
4.1.3 Class Diagram

Class diagram which displays the list of classes used in the coding have been shown in Figure 10.
In the first phase of the project, we have agreed with the company that the following list of Activities (See Figure 11 below) are enough. However, in the future there will be possible additions of extra features and more local languages.

4.2 Interfaces

In the first phase of the project, we have agreed with the company that the following list of Activities (See Figure 11 below) are enough. However, in the future there will be possible additions of extra features and more local languages.
The design of interface reflects the colour preferences and look of the company’s logo as well as the web page [1]. As shown in Figure 11, the elliptical launcher icon and the widget are part of an app for Android mobile platform. However, the rectangular launcher icon and notification center (not shown in the Figure) are designed for iOS devices. The rest of UI takes similar styles for both cases.

4.3 Database and Web Services

The back-end of the application is entirely built on the database of the company which already owns fully developed web page [1] and other applications for information dissemination. The API for these particular mobile applications has been prepared by the company. So on the side of
the mobile application, the task is just to carry out the consumption of these web services securely.

However, for testing purpose, we have developed our own database. Here the database and the web services are used only to test the interfaces and check out the feel and look on different devices.

4.4 Web Application

API's are implemented using RESTful-based design. To that end NetBeansTM has been used. Due to prior experience with the IDE itself and convenience for the tasks in this section NetBeans has been found the worthy to use as compared to Eclipse, which I have used for Android development. Further, the API running on NetBeans are consumed on Eclipse.

The RESTful API provides layer of abstraction and helps to setup secure mechanism to manage the database. In the RESTful API, we have four methods: GET, PUT, POST and DELETE.

4.4.1 Security

Web services act as a trust boundary within service oriented architecture (or SOA) [2]. In other words, web services are like gateways between trusted business components and less trusted client components. Therefore, the trusted party, which is ECX, should consider best practices of web service security. In this case ECX is expected to consider: authentication, authorization, protection of sensitive data and handling malicious input. The tasks carried out in this subsection are part of the implementation of the API's by the owner of the database. So the actual task that concerns us in this case would be to communicate with the database securely and to that end the project is expected to add extra codes. However, during the writing of this report the web services are being implemented. For that reason, the project hasn’t yet known exactly what sort of secured access is demanded from ECX.
5 Results

In this section the results of the project has been presented. So in this chapter firstly Android applications and widget are presented (Figure 12), second the web services and third the management system has been explained. Finally, small empirical data has been collected from a few fellow citizens in the industry on the overall usability of the app.

---

Figure 12. Result Screenshots.
5.1 Android Application

Using the Android Application, customers of the Ethiopian Commodity Exchange could follow ongoing or active transactions, they could fetch the monthly trend of an active transaction, change languages, follow exchange rates of world major currencies, check weather information for major cities in Ethiopia, see details of commodities traded in the octagonal trading floor.

5.1.1 Active Transactions

Active transaction activity shows list of currently traded commodity. This window shows exactly the kind of information customers could get from Electronic display.

![Figure 13. Active Transactions](image-url)
5.1.2 Monthly Trend

The monthly trend of a commodity is the graphical illustration of the particular commodity in a month period of time. This illustration is accompanied by detailed additional information of the particular commodity see Figure 14.

![Figure 14. Monthly Trend](image)

5.1.3 Language

In the languages activity customers may choose from three local languages (Amharic, Afan Oromo and Tigrigna) and English language. See Figure 15
5.1.4 Major Currencies

In the Currencies Activity current exchange rates are listed for Major Currencies (See Figure 16). Customers are able to display from among list of currencies on their notification bar.
5.1.5 Regional Capital Cities

In the Cities Activity, list of regional capital cities have been shown. Customers could choose the capital city of their interest area. In Ethiopia Nine regions exist, so nine cities have been added in this window (See Figure 17).
5.1.6 Commodities

The Commodity Activity provides all the lists of commodities exchanged at ECX (See Figure 18). Users of the Application choose which commodity they want to follow and only those commodities chosen are displayed.
5.1.7 News

In here news and updates (See Figure 19) which the company puts on its official webpage will be shown from the same table in the database.
The news Activity provides the latest news update from the ECX.

5.1.8 Commodity grade Description

In this activity (see Figure 20) all the symbols are listed and the customers could choose a symbol. Further, this activity provides detailed information about a particular commodity Symbol. Finally, the Widget for the application provides shortcut to the details of information.
5.1.9 Widget
5.1.10 Administration

In the test environment a web application has been developed in order to manage the database. In this web application different pages has been made that is used to manage tables used in the Android App. In the real environment, the company could use the existing mechanisms on their system. The administration page is shown in Figure 22.

![Administration](image.png)

Figure 22. Administration
5.1.11 Observations and Feedback from Target Customers

Target Customers residing in the Capital Addis Ababa has been briefed about the goals of the application and what the application could do (N.B. ‘Customers’ are those business owners, farmers who are participating in the outcry). Then they are shown how they could fetch information from ECX. This has been done for 35 customers. The feedback shown in Table 2 has been collected.

Table 2. Feedbacks from Target Groups

<table>
<thead>
<tr>
<th>% Interested</th>
<th>% Not Interested</th>
<th>% Prefer App over other channels</th>
<th>% Does not Prefer App but use it if available</th>
<th>% Expect Free App</th>
<th>% Expect Small Payments</th>
</tr>
</thead>
<tbody>
<tr>
<td>88.5</td>
<td>11.5</td>
<td>82.9</td>
<td>5.6</td>
<td>71.4</td>
<td>17.1</td>
</tr>
</tbody>
</table>
6 Conclusions

With regard to the goals presented in chapter one, this thesis project has achieved the concrete and verifiable goals. In other words, the implementations are carried out smoothly and the intended results are quite promising. However, the perspective from the point of real users is hard to precisely come to the conclusion despite the empirical data I have gathered with individuals engaged in the IT industry. Upon the release of such application in the intended community, some challenges are inevitable. Some of the challenges that could arise from the fact that the target community resides deep inside technologically less privileged part of the world. Even most of the consumers by themselves are illiterate and needs period of time to get familiar with such technologies. Nevertheless, taking into consideration the fast pace technology penetration and the young age of this community, I believe the challenge shall not sustain and reach a level to deter the usage of such an application within the target group, Ethiopian farmers, small scale traders, importers and exporters.

6.1 Contribution and Impact

The application developed in this project contributes to Ethiopia Commodity Exchange, which is committed to modernize commodity market in the country by providing better information dissemination means. Using this application, farmers, small –scale traders, commodity importers and exporters could fetch valuable real time information from anywhere they are even from abroad. So which means the new channel increases information availability. Further, the local language support could provide more friendly and convenient mechanism to fetch commodity information. Last but not least consumers could get updated information on the move from anywhere.

6.2 Ethical Deliberations

The tasks carried out in this bachelor’s thesis had the obligation to keep the expected standards of scientific report writing. Further, the rules and
regulations of the institution itself have carefully been followed. Some issues related to copyright violations and plagiarisms have been avoided by following best practices in scientific report writing.

Further, the output of this thesis has an ultimate aim to improve the livelihood of a group of community in manner which doesn’t not break rules implemented by juridical systems in the countries of interest (i.e. Ethiopia and Sweden) as well as across the globe.

Therefore, in general the impact of the output of this bachelors thesis would only be expected to affect the specific society positively through helping to achieve the goals of entities involved in achieving the aims of the target group itself.

### 6.3 Future Work

In the future work I have a plan to add iOS application. iOS apps development demands a little more time to learn Objective C, which is a language entirely new for me and also the development process is costly in terms of money. However, since the iPhone and iPad are used by quite a number of people in the country of concern, this future plan address those customers. Further, the future plan on this project has been to add more and more local languages so that farmers in the remotest areas of the country could use this app in their own language.
References


Retrieved October 10, 2015


[8] Online Library, http://library.uic.edu/ Chicago Board of Trade, retrieved 05/02/16


[11] The Agricultural Futures Exchange of Thailand,
http://www.afet.or.th/ retrieved 05/02/2016
Appendix A: Questionnaire

This section is about a basic questions for targeted customers to get feedback and observation about the ECX apps. (N.B. ‘Customers’ are those business owners, farmers who are participating in the outcry).

Questions:

1. How long have you been using the Internet, Social Sites and Smart phones?

2. How long have you been a member of ECX? What kind of information source do you often use to update yourself? Do you think the existing information sources are enough? Do you suggest any additional means to fetch commodity information updates? If Yes, Please explain.

3. How many different information channels are you able to use? Did you face any difficulty to access each of the channels? Did you came across something confusing and intolerable incident during fetching? did you face any delay to fetch your information?

[--Apps Explained and shown how it works--]

4. Would you use applications if that’s available as additional means to provide the commodity market information? If Yes,

5. Do you prefer to use apps?

6. Do you expect any payments for the apps?

47