Mobile Based System for Palestine Exchange Management

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Abstract

This paper aims to provide better stock market watching through user friendly, efficient, and convenient mobile based system. It allows investors to monitor financial market using short message service (SMS). On one hand, our system sends the trading prices of stocks to customers as these prices change. On the other hand customers can inquire about trading summary. Also our system contains several modules for facilitating investing process including an offline multimedia learning module. The usability of system is tested by a set of participants and the results showed fulfillment of participants.

Key words: *Mobile module, Palestine Exchange, SMS based system.*

I. Introduction

The importance of mobile phones in our daily life is becoming more evident, especially with enormous development of mobile services. Jenny C. Aker and Isaac M.Mbiti in [1], pointed to the ability of mobile phones to improve several important aspects of human life, including economic development, agricultural and social life. They focused on the substantial economic benefits, including the progress of the agricultural market, the labor market and the financial market. They suggested several mechanisms that can provide economic benefits through mobile phones including supplying customers with easy ways to get the required information on a specific service or field; consequently this will contribute to simplifying the coordination of agents among each other and to reducing the costs of transportation and mobility.

Palestine Exchange (PEX) is one of the most important companies in the economic sector in Palestine where poor self management may lead to financial losses. Investing in PEX is done by either being a partner in a company posted in PEX Or buying bonds and getting a periodically return on investment (ROI).

Trading in PEX happens from Sunday till Thursday every week, and trading session begins at 09:45 and finishes at 13:30 [2]. At present, investors watch the market through their computers or tablets by browsing PEX formal web site which requires continues internet connection. This way of communication limits the use of mobile phones for tracking PEX. The reason behind that is the absence of 3G network in Palestine as Israel refuses to grant the Palestinian Authority needed bandwidth for 3G mobile data service.

Based on discussion with PEX clerks and many investors there is no mobile based system for facilitating trading and tracking process of financial market in Palestine. Our goal is to build a mobile based system that provides its users with the ability to track trading process without an internet connection using GSM network.

Mobile devices are ubiquitous nowadays, and this makes smart phones attractive tools to achieve several tasks including: receive trading prices, view line graph of PEX index (Al-Quds index), view frequently asked questions (FAQs) using multimedia learning module, request trading summary.

The rest of this paper is organized as follows. Section 2 reviews related work. In section 3, we present requirement gathering to build the system. Section 4 presents system architecture and mobile application design. In section 5 we describe system development techniques. Then we continue with system usability testing, results and discussion in sections 6, 7 and 8 correspondingly. Finally, we conclude this paper and discuss future directions in section 9.

II. Related work

We will clarify our contributions in the following paragraphs by offsetting them with prior related work. Financial mobile applications are defined as a set of systems that facilitate follow-up and implementation of financial transactions without the need to access the main center for these services [1]. We follow this definition in our paper.

Several studies mentioned controlling and managing stock market using PDAs. Hillol Kargupta et al in [3] proposed MobiMine system which is a mobile data mining system for

tracking the financial stock market using PDAs, cell phones or any hand held device. The system consists of client side running on PDA, monitoring a stream of financial data coming from MobiMine server. The system has the bottleneck of low bandwidth communication, viewing complex data on small screen size and the system interface needs multimedia based improvements.

Another SMS based mobile system that offers automated stock price delivery and interactive voice response (IVR) for delivering prices on the basis of speech prompt is developed in [4]. This system can only deliver stock prices to financial market investors neglecting other important services the customer needs.

Maria Bibi et al reported in [5] SEI system for accessing stock exchange news .It is an SMS based system that enables its users to save time, cost and resources by tracking stock market on their mobile phones. However, the system has limited functionality characterized by tracking stock prices only. In our proposed system, we aim to provide investors in PEX with a mobile based system that allows them to receive stock prices in addition to several other services such as viewing Al-Quds index chart, viewing FAQs, changing application language and request trading summary.

III. Requirement gathering

Consultative phase and requirement gathering is the most important issue before starting development of the system. Meetings were held with investors and clerks in PEX to discuss the concept of our system. Sessions with 10 investors and 3 clerks lead to the following:

- The idea is appreciated by both investors and clerks.
- Cost is of primary concern for both investors and clerks, so system usage cost should be low to be attractive for its users.
- The system should be easy to use, convenient, works without internet to alleviate 3G absence. Also Arabic interface is preferable.
- The system should offer extra information about trading such as gainers, losers, top 5 by volume, etc.

Based on these observations, PEX clerks need an efficient and easy to use system that will connect them with the investors and let them manage PEX watching service through registering new customers, manage and edit their data and supply customers with monthly invoices. Also the clerks recommended integrating a learning module inside the mobile application to clarify investing procedures and principles.

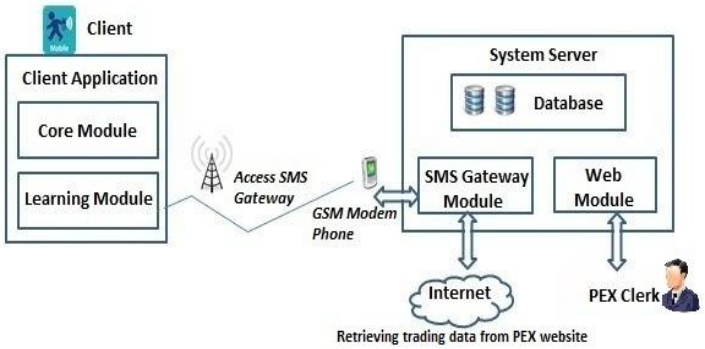
IV. System architecture and mobile application design

Our system consists of 3 main parts: mobile application for investors, web module for PEX clerks and SMS gateway module. These parts are illustrated in figure 1.

A. Mobile application

The mobile application consists of 2 main modules: The first one is core module, which enables customer to get main services such as messages of trading prices, sending trading summary request, view Al-Quds index, and view FAQs.

The second module is learning module. It consists of an offline learning module which presents FAQs by investors in PEX. Also it synchronizes text with an audio narration reading the text for the customer. The audio is implemented



as a set of .mp3 files and text is stored as two files, one for Arabic and one for English.

Fig .1: System Architecture

The mobile application allows the user to:

- Receive trading prices when any change occurs.
- Send a request for trading summary which includes gainers, losers, Top 5 by volume, Top 5 by value, trading summary.
- Send any text message to PEX inquiring about anything the user wants.
- View Al-Quds index line chart and update graph data by sending updating request message to the server.
- Receive monthly invoice containing amount of money to be paid.
- View PEX address and contact information such as: location, P.O.B, telephone, fax and e-mail.
- Browse FAQ
- Manage settings of mobile application like changing password.
- Change the application interface language as shown in figure 2.
- Navigate help screens that provide explanations or some notations about each mentioned above option.

Regarding interface design, it is built in a manner that makes it convenient and easy to use. We used design rules and principles mentioned in [6], [7] and [8]. The text size is balanced with screen content and size. In regard to application colors, we chose colors that are comfortable for eyes and suitable to achieve readability and clarity such as white for background, black for text and blue for welcome screen. Menus and submenus are used to arrange items and components of mobile application. Each item leads to open a screen with limited information and to provide explanation in separate help pages. Main menu icons are designed to reflect their functionality with the name of the icon under its image.

B. The SMS gateway module

The SMS gateway application is a small interface between client and server; it analyzes all messages received by GSM modem and verifies its source phone number. If it is sent from one of registered clients, it is processed according to its tag and stored in system database. Otherwise message is discarded.

C. Web module

The Web application is the last component in the system. It is accessed by service provider for viewing investors' data and communicating with investors through several form-based interfaces for sending reply messages, and to manage invoices of investors. This module aims to help system administration staff to register new subscribers with his/her name, e-mail, mobile phone number, address, subscription date, interested companies .Also they can edit or delete subscribers, view all subscribers, view and modify bills for customers according to the number of messages sent to them, view all sent /received messages to/from specific customer and reply to the customer messages.

Fig.2: Arabic and English Interfaces

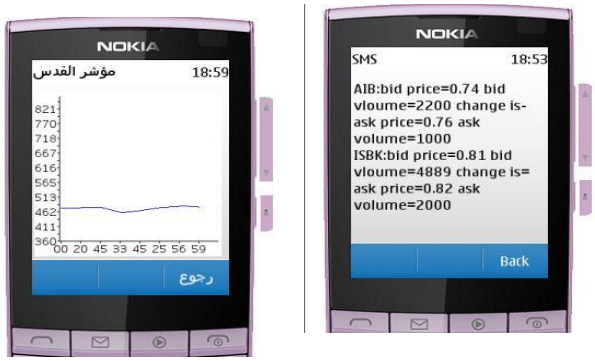


Fig.3: Screen shots for mobile application

V. System development

For developing the system, we used several technologies as shown next:

A. Mobile application

The mobile module is developed using J2ME, because most mobile phones being sold on the market come standard with built in JavaTM virtual machine which gives applications on such mobiles portability. JavaTM technology has many class libraries that provide different functionalities for mobile applications and has java application launcher to run any java program [9] . To enable the application to send and receive SMS message on the mobile phone, the J2ME Wireless Message API (WMA) library is used. The application size is 6.69 MB.

B. *Web module*

The web- based portal is developed with the widely-used asp .net language which enabled us to develop dynamic websites with help and support of a familiar drag-and-drop, event-driven model. Also it provides developers with the following features: server controls, master page, membership, security, state management and performance [10].

C. *The SMS gateway module*

The GSM gateway module is developed with Java and installed on systems server which is connected to a GSM modem that works with a wireless network. The library used to operate the GSM modem is the open source SMSLib version 3.4.3 for JavaTM that supports reading, writing and deleting SMS messages from GSM modem [11].

VI. Usability testing

After finishing development of the whole system, we conducted usability testing for client mobile module. The techniques mentioned in [12, 13] are used. Usability testing is accomplished by some people to get first feedback and their indication about the system. In our usability test we asked 10 participants to contribute to the testing process. The targeted group is classified to two subgroups according to age. First group is (group A) with users above 40 years old. The second group is (group B) with customers less than 40 years old. Group A has 2 women and 3 men, while group B has 3 women and 2 men. Although 10 users is a small number, it is enough to give us primary indication about application. Before we started the testing process, we had conducted a training session for participants and we explained main functionalities of our system. Each participant is asked to determine his watch list which is the group of companies of interest. Then we registered these customers to the service through the web module of our system.

The first phase of evaluation is to write a checklist of usability testing tasks that should be performed by users. Each task has execution time, a score indicating the ease of performing the task and the number of times help is requested to do the task. Ease of performing the task can have the following scores: [1] very difficult, [2] difficult, [3] medium, [4] easy, [5] very easy. The tasks are:

1. Login to the application.
2. View messages of trading prices.
3. Send request for trading summary.
4. View Al-Quds index.
5. Change application language.
6. View FAQs and stop audio narration.
7. Change password.

The evaluation is performed on Nokia X2 device with the application installed on it by all participants.

VII. Results

The results of usability test are reflected in Table 1 and Table 2 below:

Table 1: Average measures of usability testing for group A

Task number	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Execution time (Sec)	22.28	5.91	15.41	11.17	10.16	15.7	24.1
Ease of task	5	5	3	4	5	4	3
No .of times of requested help	0	1	1	1	1	2	2

Table 2: Average measures of usability testing for group B

Task number	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Execution time (Sec)	20.75	5.11	8.71	8.68	6.19	5.44	11.3
Ease of task	5	5	4	4	5	4	5
No. of times of requested help	0	1	1	1	0	0	1

As we can see from results tables, most of tasks had easy and very easy scores, and a small number of times help is requested. The following figure compares between execution time for group A and B. In general, execution time for group B is less than group A. This is because users below 40 years old are more familiar with mobile phones and mobile applications.

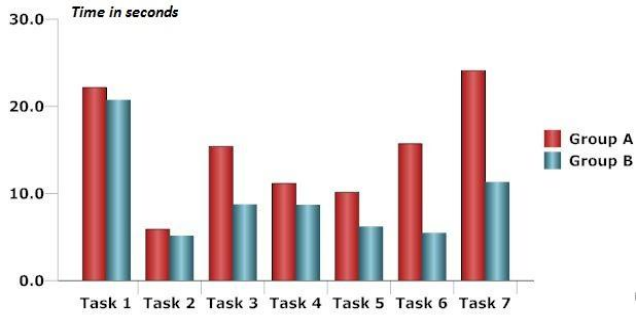


Fig. 4: Average execution time for both user groups

VIII. Discussion

The majority of users said that first task was clear and the login screen is simple with suitable text size and comfortable colors. Only two of users who are in group A, suggested to make the text a little bit larger. Also the majority of participants were impressed with main menu design, which consists of icons arranged in a manner that makes most frequently used item to be marked and displayed first; to access it quickly. Each menu item leads to a hierarchal sub menu as proposed in [14] in which users can select a menu item and then open another sub menu and so on until reaching required functionality.

Messages of trading prices can be viewed easily by selecting inbox icon. The message consists of bid price, bid volume, change sign (positive or negative), ask price, and ask volume as shown in figure 3 on the right. Most of participants revealed that it is simple and easy to view trading information, since it is similar to open any message in mobile phones. The Participants experience of using mobile phones made this task familiar and manageable.

The third task was not as simple as the previous two tasks. The customer should select his choice first, and then send the message for service supplier. After 40 seconds on average, trading summary reply will be received. The users were comfortable with multiple choices screen, which allow them to select one request at a time. Some of participants suggested increasing number of choices, so they can enquire about more things. But in general the available choices are the most frequently used ones.

One of the most important features of our application, its ability to draw a line chart for Al-Quds index as shown in figure 3 on the left. It gives an indication of general direction of trading prices. As declared by participants, it is a good functionality but it is time consuming. The task needs 37 seconds on average to draw Al-Quds index chart. At first, the request to update chart data is sent to the server through GSM network, and then the reply is viewed as a line chart. Although it is not fast process, it is accurate and gives important indication about market for customer.

Our application supports both English and Arabic interfaces. This task was simple for both groups A and B. The time for executing this task was the same for the two groups.

Regarding E-learning module, the users were fascinated by enabling them to view and listen to audio narration for FAQs. This part supplies the users with general knowledge about PEX and gives them information about trading process. It includes many questions and their answers, such as what is stock price floating?, what is PEX index?, is there a ceiling for trading transactions in one day?, is there a ceiling for trading transactions in one day?, etc . Some participants from group B suggested adding more questions and advices about investing process.

The final task was simple and similar to standard options on mobile. Users of group A suggested showing written password instead of viewing asterisks. But we told them that this would increase security of the application and they understood that and appreciated it.

Finally, we conclude that the system is attractive for participants. They agreed on its usefulness and one of them said “It is an amazing application that solves the problem of 3G network”. Another one said “I can now receive all changes on trading prices from anywhere without sticking on my computer”. Most of participants said the application is practical, easy to use and have a familiar interface. Some of them suggested adding a prediction module that predicts financial market status after a period of time and others proposed to integrate online mobile trading through GSM.

IX. Conclusion and future work

We presented in this paper a mobile based system for tracking financial market in Palestine. The system is practical and attractive. It solves the problem of 3G network absence and achieved the goal of watching PEX any time and everywhere. Also the testing of system proved its usability, accessibility and availability. The next step would be to add more learning material on system, supply system with intelligent techniques that will predict financial market status, provide users with online mobile trading service through GSM network and to conduct long term testing on large number of users.

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