

# A Model for Increasing Usability of Mobile Banking Apps on Smart Phones

Amin Babazadeh Sangar<sup>1\*</sup> and Salar Rastari

Department of Computer Engineering, Urmia Branch, Islamic Azad University, Urmia, Iran;  
bsamin2@live.utm.my, Salar.Rastari@gmail.com

## Abstract

Today, Smart phones with different operating systems play an important role in people's lives. In the age of communication, the use of these devices and using their useful applications is inevitable that becomes part of the main requirements in order to enhance the quality and comfort of life in society. Smart phone soft wares are applications, each of them can enable the user to various activities and personalized depending on his needs do. One of the most important applications is banking applications that have managed make a big change in modern electronic banking. These applications or new capabilities makes saving resources, time and cost of users. Unfortunately, due to lack of proper usability, the use of these applications is very low. Usability is one of the factors affecting in construction and development of software that leads to improved efficiency and quality of them. This paper reports on the implementation and development of a banking application, based on the proposed new usability obtained from the study and analysis of usability previous models has focused.

**Keywords:** Banking Application, Electronic Banking, Smart Phones, Usability

## 1. Introduction

Having a useful application on a smart phone that can be obviated easily all your needs, to a program, today, the challenge is to develop mobile applications. In addition to this construction of such programs is considered efficient users to set an important factor in the development of software, has complete dependence. A topic that arises in this case in the modern scientific community computer known as Software Usability since the most of mobile applications from are category of widely used and specific used, therefore, the necessity to topic of usability these applications are very important and witness of numerous researches by various scientists in this area that the results of this research show that there are different factors affecting the usability of softwares. Usability is one of the important factors for the production of products such as website and software with quality and high usability.

Usability of good a system is the main purpose of interface design. The various models of Usability has presented that by study on them can be used to create applications that interface with quality, obtained a great help.

## 2. Mobile Banking

Mobile Banking is systems that through the mobile phone can be doing their banking operations. In this system by installing an application on a cell phone without a visit to the bank and at any time of the day can be do operations such as account balance received, transfer funds and pay bills. Also design of the programs, based on the size of the screen and use the maximum screen of smart phones is very important<sup>1</sup>.

Applications that are installed on the smart phone which includes unique features, such as:

\* Author for correspondence

- Pay bills.
- Transfer funds between accounts.
- Operations and Transactions related to loans.
- Receipt of the invoice (turnover, inventory, etc.).
- Determining the amount of Czech.

According to studies conducted in the previous truths system and mobile banking, mobile banking, despite the variety services gives available to users. Unfortunately, faced with low growth or declining. This research is intended to provide appropriate solutions for it. Important reasons for low use of banking application that analyses the results obtained of population are as follows:

- Font size and their colour are not suitable.
- Clear information icons are not available for customer.
- Go from the one page to another is not easy.
- Menus function was not satisfied.
- All the needs of customer payments not have.
- Fill of fields was not clear enough.
- Design programmed environment and user interface is not very attractive.
- Provide this software is limited to one or two platforms.

According to preliminary studies and research that was done by collecting information from the questionnaires that were raised, the researchers, in an early study concluded that the problems of using these programs on topics in these programs is called Usability that to solve this problem and increase the amount of use, the banks need to build and design a Usable program, so this study's main focus is on Usability.

### 3. Usability

Usability ease of use and learning is a man-made object. The theme uses, can be a software program, website, book, tools, machine, process or any other thing that people interact with it. With the advent and rapid adoption of smart phone technology, a number of recent studies have been focused on the usability of mobile phones<sup>2</sup>. Problems caused by the physical limitations<sup>3</sup> mobile devices and wireless networks this implies that design and usability studies for mobile applications, need to carefully order to select appropriate research method and to minimize the effect of potential contextual factors to be considered, when they are not at the centre of studies<sup>4</sup>. Capabilities using of measurement techniques such as needs analysis<sup>5</sup> and the study of principles lies in an

object's perceived efficiency or beauty. Human-computer interaction and computer science, usability to study of elegance and clarity with which the interaction with a computer program or a website (web usability) has been designed deals. Evaluating for product development and usability are critical understanding of it, as the path for product development, process design, and the final results establish<sup>6</sup>. Usability of user satisfaction and the user experience is distinct because it also considers beneficial usability. By perform the analysis of Usability, can be aspects of usability of the software architecture before the implementation stage, we better visualize. In turn, this can then help to determine the three main components of the user interface: Required components, the components ideal for the user, and components specified to run<sup>7</sup>. Mobile usability includes some of the challenges related to mobility, such as: Mobile framework, connections, small screen size, different resolutions, power and limited processing capability and input methods<sup>8</sup>. Usability features make it usable product or system. In other words, if a system is usable, the user must feature both subjective and objective experience<sup>9</sup>. In this study was done based on a study that, factors affecting usability Smart phone apps was extracted from the predecessor model. And after comparing existing models factors affecting Usability, was divided into three grades. Then design was a questionnaire containing several questions was obtained other influential factors.

Also based on researches and the results of preliminary studies and surveys, with the exception of the factors in earlier research, other factors in this study were extracted. Derived factors include:

- Visibility
- Design
- Navigation
- Compatibility

## 4. The Proposed Model of Usability

After studies conducted on existing models and collect data from users, the model of Usability is provided by a 12 factor.

### 4.1 Learnability

In this age individuals over 65 years and older has the largest population among the countries that use the smart

phone can be very useful for those people<sup>10</sup> For example, a program of health, diabetes and blood sugar testing etc<sup>11</sup>. Addition of additional details on the program may reduce of learning program and causing problems in the use of smart phones<sup>12</sup>.

At this point the user should with application and its capabilities, access level, how to use and performance was introduced.

#### 4.2 Satisfaction

Satisfaction can include many factors that are two parts important one product and another service<sup>13</sup>. For having with quality program should be more considered aspects of users.

#### 4.3 Efficiency

In this era role of the customer to online shopping, online auctions, online banking etc, has been become that by using smart phone technology can be more productive in these areas<sup>14</sup>.

#### 4.4 Effectiveness

Efficacy can be as tools such as smart phones to be used in the field of help to have a healthy lifestyle<sup>15</sup>. For more effective apps is better, the demands of users with each other, combined<sup>16</sup>.

#### 4.5 Memorability

Software should be designed in such a way that the user according to early learning and using the software to work with the structure and function and its application, so familiar that the next time he easily and without the learning of soft again uses the software. Most popular of smart phones applications until 2015 to enter text passwords, they use that this, of remembering program reduced<sup>17</sup> so use of graphical passwords can increase remembering program<sup>18</sup>. Also use of graphical passwords, because of to be multi-touch screen can log in to the application have more quickly than text passwords<sup>19</sup>.

#### 4.6 Errors

At this stage should be noted, that all aspects be taken into account and the application in the worst possible states, we put so that we can correct shortcomings, so the user when performing the most complex actions,

not have trouble. Until 2014 plans were made for testing applications that can be used to measure the amount of errors<sup>20</sup>. Also phones today have sensors and capabilities to detect errors that could be used.

#### 4.7 Safety

Recently construction of smart phones has been increasing and this makes creating applications for hacking are very important<sup>21</sup>. The program can be expanded so that prevent unauthorized downloading, and the apps automatically reject it<sup>22</sup>.

#### 4.8 Performance

According to the possibilities of having 3G and 4G on smart phones of today, to develop an application that can use of these facilities to enhance usability and programs<sup>23</sup>. Ability of with the help of Wi-Fi can also plans to faster transfer of information with high security developed<sup>24</sup>.

#### 4.9 Design

Smart phones means of a touch screen, an operating system and a keyboard for write operations is to build a smart phone can be divided into two categories, one Solid User Interface (SUI) and other Graphical User Interface (GUI). Can be said the design of program, an important part of the development of smart phone softwares that can fascinate the audience at first sight. The appearance of program is very important.

#### 4.10 Navigation

Guidance is the process that knows the user's current position in the application and to the user helps to go from one location to another. In fact, going from one page to another is not confusing so that the user can easily between features included in the pages of the program guide.

#### 4.11 Compatibility

Due to the rapid development of technology and the arrival of new operating systems and also to update these operating systems, from companies provider, makes the smart phone day by day increase and lead to more smart of these phones, so users are directed to your hand. Therefore, making application that can be ability to run on all phones with have different platforms are necessary.

## 4.12 Visibility

Today, with the help of smart phones with different operating systems, they can be using related applications, most of the hotels, residences, places of amusement, banks, universities, etc, found. In general, the user should first look at be aware of all the details of the program. This means that on every page the user can easily view the features included in the program and be aware of its performance.

## 5. Banking Program based on the Proposed Model

In this section, Usability model offered to build a banking program under Android operating system has been studied the following sections different this program has been introduced.

### 5.1 Introduction Page

First page that the user is faced with getting into the program is introduction page of the application.

### 5.2 Login Page

After loading the program, to the login page, by entering the username and password that guidance can be accessed on the main page. According to the program include financial information and bank accounts of user, hence carry out any transaction or payment by any person with this program as easy as possible, so that the page provides security of program that prevents the Login or unauthorized access to the personal financial information. In the Figure 3-4 prevent the entry of unauthorized users to the application, allowing security is one of the important factors of Usability, observed in this page. Also Graphical User Interface has a unique design, which design and its visibility, is another important factor in Usability, is imposed on this page. For example, by using in the username and password of the icons that exist, at first sight the user can easily be informed from the demands of the program.

### 5.3 Main Menu

The main menu is shown in Figure 1 and 2, including the main page for quick access to them. The menu is sliding from left to right by the user program is available on all pages. As well as located on top of the Search button,

the user can easily find the features included in the program. Factor is applied in the Navigation menu, which accelerates user access to all parts of the program. For example, a user in any part of the of program he can with touch the left side and pull your hand to the right, the program drop-down menu will appear. In addition to the ease of using the facilities of program in terms of aesthetic design program, has been increased. According to factors visibility, at first glance in this menu that the user can have had a quick overview of the all the features and contents in program, this affair raises the factors learnability program. By considering the factors of visibility and learnability, on the menu have applied, remember ability also the factors that makes memorable how to use the program guide, spontaneous has been adhered. Drop-down menu app contains accounts, payment, transfer, cards, Czech, messages, locations, charity, contacts, settings and exit the user can click on any of them to desired page to be transferred.

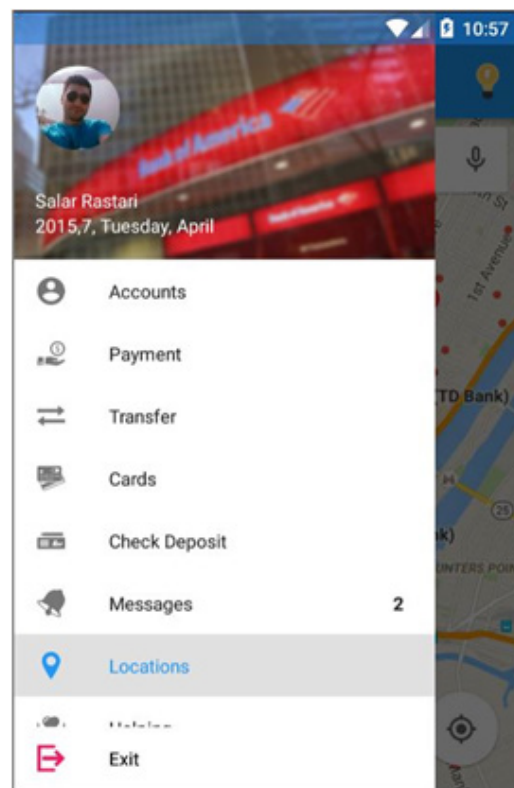


Figure 1. Drop-Down Menu of.

### 5.4 Accounts Page

After successful login of user to program the first page that is seen, is the account page. In this page accounts

attached to the application along with inventory and account number were displayed that by choosing any one of these accounts can be used to get information about the account, including turnover, expenses and summary account is accessed. In this page also due to the use of all information and resources related to each account individually, invoices visibility and Navigation from one page to another by simply touching the screen from left to right and vice versa, the navigation factor has been adhered.

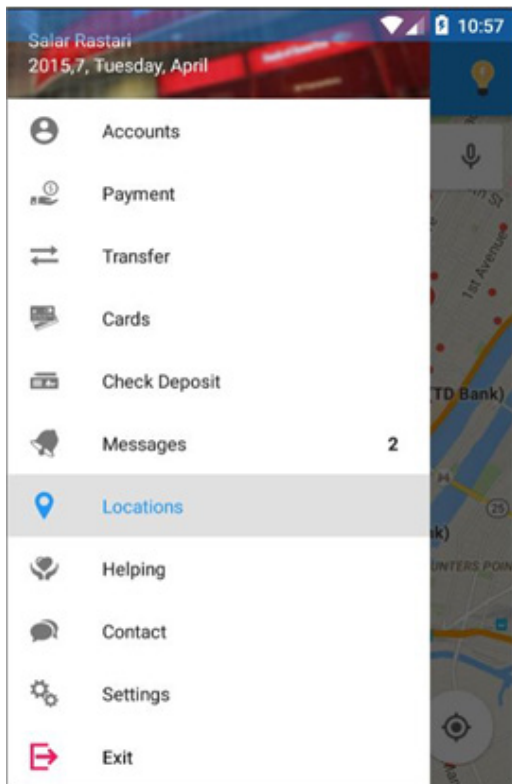


Figure 2. Page-Down Menu of.

### 5.5 Turnover Page

In this page, the list of transactions conducted in the account will be displayed. Each transaction includes the date, time, type of transaction and the amount of it. In this page also displays the transaction because of the design, the user can easily move between the lists of transactions done that it causes increase navigation factor of the program.

Date of each transaction to a calendar icon, details of each transaction, and the amount of it by using fonts that are easily readable, are designed in such a way that the user can easily be informed of the exact transaction

has taken place, this increases the visibility and accelerate the user learnability by using part of program help and understand and analyse the time of each transaction, therefore, memorability is very easy.

#### 5.5.1 Expenses Page

On top of the total amount of expenditure and the number of turns made in a week. Then spending figure conducted in total expenses for each day of the week and show the payment is drawn in the same week. Also comparability of spending this week with the week before and the current day has been included on this page. The invoice of visibility and design with graphical charts and having fonts appropriate to consider the possibility of better understanding and faster from expenditure carried out by the user provides. Graphical user interface to do good in this page is applied. By using the button of program help, to learnability program as soon as possible will help.

#### 5.5.2 Account Summary Page

Figure 3 summarizes the account by using a simple graphical design can be used with choose the desired date can deposit sum money, money output and account balances, seen.



Figure 3. Page of Account Summary.

Factors such as design and visibility on this page have been applied.

Page payment by using the NFC technology can be all payments performed by the user with confidence and with high speed. Just phone to store NFC device near and with a mention in the shortest possible time payment is done. Due to the use of NFC technology that causes accelerates application performance leads to an increase in pay and increase the satisfaction. On the other hand, because of the rapid and safe method for the addition to easy learning and memorability, with high speed and accuracy, and ability to finish the process, the invoice of productivity and the effectiveness is also in this method, unlike POS devices is very low error rate.

### 5.5.3 Pay Bill Page

In bill payment page, by selecting the account and enter the bill number, the user can pay the bills add it to the list. Bill added to the list contains information such as the type of bill, bill amount, account and payment deadline is selected. The user can also bill added to the list by using the delete button be removed from the list of payments.

Given that at first glance the user can see all objects on the page in bill payment showing adhered the invoice of visibility and design. Ability to pay those bills on this page to specified target accuracy and integrity in a short period of time and process effectiveness the invoice of effectiveness and performance is included. Payment method is so easy that the user immediately learns how to use it, also by using part of program help, learnability is more easily possible.

### 5.5.4 Cards Page

Bank card connected to the mobile user accounts with the type of card and it will show up on this page. The user can by using a key, card that you want to enable or disable. How to shown cards and access to them the invoice of visibility and design in the covers. Also to the when card is lost or stolen, because the user can easily reach your desired card out, safety misuse of card users is increased.

### 5.5.5 Check Deposit Page

This page has been designed for determining the amount of Czech in order to prevent the abuse. The user can by select the desired account, determining the amount, taking photos of the Czech and the back of Czech, Czech

desired amount in the bank confirmed. The user saves time and money due to high speed and visibility program performance is high. Also safety that this method offers assurance of users of the program provided and the satisfaction invoice in the covers. Page of program help is caused of learnability. In this page, messages, alerts and notifications relating to financial accounts, payments and incoming messages from the bank to user will be displayed. By using part of program help, the user can be notified of incoming messages.

Each message is grouped in terms of with the colour that the user can easily recognize With the shelter look at the type of message, that invoice design, visibility, learnability, memorability and satisfaction in the covers.

## 5.6 Locations Page

In this page, the user can easily with search for the desired location from location of bank branches and ATM machines to be informed. With the part of help of the app, the user can easily learn how to use this capability to be easily learning (Learnability).

### 5.6.1 Contact Page

The user can by this section communicate with the bank backup and their questions with them, which is shared.

According to the user through their own questions and can resolve their problems, as a result of satisfaction from the program increases. With section the help of app, user can easily learn how to use this capability (Learnability).

### 5.6.2 Charity Page

By using charity page, the user can contribute to charities.

## 5.7 Settings Page

By using the configuration screen, the user can change the settings for the program. By using on or off button to enable or disable the program, in the profile can be email, password and your photo be change. In the accounts can manage their accounts. Part of sound, warning sound to change the program, in the language can choose your preferred language, the font size to change the font sizes and using part of update, you can update the software. About the software can be installed version of the program information as well as information on the development team, will be seen.

After the proposed model of Usability, it to a number

of experts and software developers for test and experiment of Usability was provided.

Also after the construction and development of banking applications based on the Android operating system, on multiple Android phone was tested with different page sizes, made plans to test available for fluent in English, was placed, then a questionnaire, in order to gain data the satisfaction of program proposed bank presented to the user.

Phones that on them, the banking program is offered Installation and Testing have been done, Include: LG Nexus 4, LG Nexus 5, Motorola Nexus 6, HTC One M9, Samsung Galaxy S6 edge and LG G4. By a questionnaire to experts after testing the software, by analysing the data collected is shown in Figure 4. It was found that the bank made the proposed model is based on Usability with the high rate of satisfaction in Figure 5, 6 and 7 can be respond to the needs of public payments, is located.

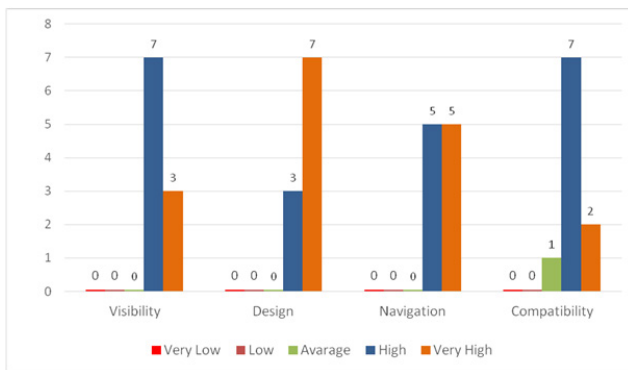


Figure 4. The Results Obtained from the Model Usability Evaluation Factors Suggested by Experts.

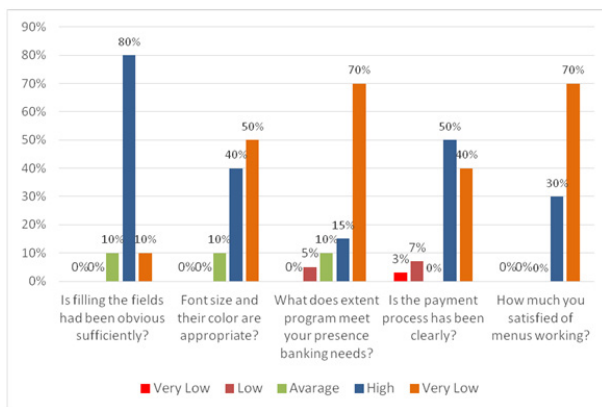


Figure 5. User Satisfaction Data of the Proposed Banking Program.

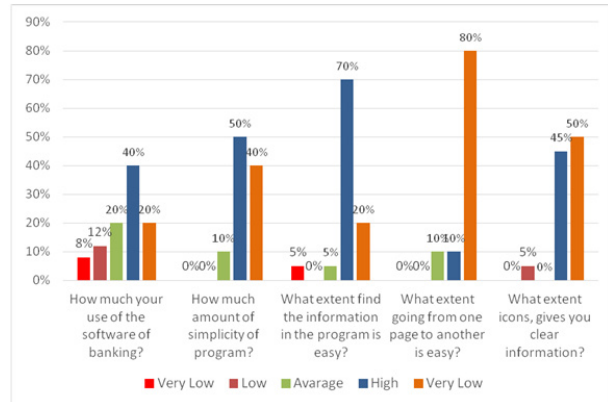


Figure 6. User Satisfaction Data of the Proposed Banking Program.

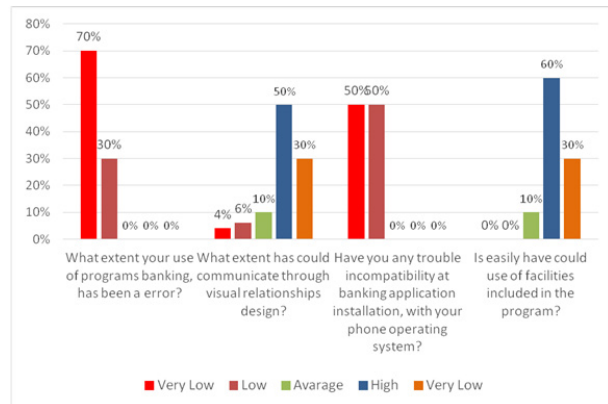


Figure 7. User Satisfaction Data of the Proposed Banking Program.

## 6. Conclusion

In this study, provide a model to increase usability software for mobile phones, smart banking, was discussed. In this regard, in addition to the factors in previous models, in this study, four factors of new “Visibility”, “Design”, “Navigation” and “Compatibility” was obtained. S and A Usability Model contain twelve factors.

Banking program implemented in this paper, is based on the Android operating system that uses the programming environment Android Studio, has been developed (According to the software supplied by Google, most likely, in the future replaced eclipse, ADT and take and there is no need to use them. The application includes the SDK is also available).

According to the agents in the previous studies and factors obtained in this study, the proposed model was

presented. After the proposed model of usability and build a banking application based on this model, by raising the level of satisfaction of users of this application, and properly is obtained accuracy of the proposed model by the Usability experts with a high rate of satisfaction, the final version usability is obtained as Figure 8.



**Figure 8.** S and A Usability Model.

**Table 1.** Grading Factors Affecting Usability

First grade Factors	(Learnability)	
	(Satisfaction)	
	(Efficiency)	
Second grade Factors	(Effectiveness)	
	(Memorability)	(Reliability in use)
	(Errors)	(Throughput)
	(Safety)	(Speed of performance)
Third grade Factors	(Attitude)	
	(Flexibility)	(Internationality)

It is recommended for future research based on previous studies, new factors we extract and on the new version of operating system that will add new features to them, this model was developed Usability. The researchers of this study due to lack of access to banking data were not able to test all features included in the software, also due to the lack of time to learn Android and sanctions available from Google, Persian build applications under Android OS. For developers Iran is faced with a problem.

## 7. References

- Gunduz F, Pathan A-S K. On the Key Factors of Usability in Small-Sized Mobile Touch-Screen Application. *International Journal of Multimedia and Ubiquitous Engineering*. May 2013; 8(3):24.
- Ryu YS. Development of Usability Questionnaires for Electronic Mobile Products and Decision Making Methods. Dissertation submitted to the Faculty of Virginia Polytechnic Institute and State University in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in Industrial and Systems Engineering; 2005.
- Gafni R. Usability Issues in Mobile-wireless Information Systems. *Issues in Informing Science and Information Technology*. 2009; 6:755–69.
- Zhang D, Adipat B. Challenges, Methodologies, and Issues in the Usability Testing of Mobile Applications. *International Journal of Human-Computer Interaction*. 2005; 18(3):293–308.
- Karwowski W, Soares MM, Stanton NA. Human Factors and Ergonomics in Consumer Product Design: Methods and Techniques. (Handbook of Human Factors in Consumer Product Design): Needs Analysis: Or, How Do You Capture, a Represent, and Validate User Requirements in a Formal Manner/Notation before Design (Chapter 26 by K Tara Smith), CRC Press; 2011.
- Alshehri Fayez, Freeman Mark. Methods of Usability Evaluations of Mobile Devices. Geelong; Dec 2012.
- R J-R, A Mejia, M G-R. Implementing User-oriented Interfaces: From User Analysis to Framework's Components. *International Conference on Uncertainty Reasoning and Knowledge Engineering IEEE*; 2011.
- Nayebi Fatih, Desharnais J-M, Abran Alain. The State of the Art of Mobile Application Usability Evaluation; 2013.
- Koohang Alex. Expanding the Concept of Usability. *University of Wisconsin – Milwaukee; Milwaukee; WI. Informing Science Journal*. 2004; 7.
- Leung Rock Anthony. Improving the Learnability of Mobile Devices for Older Adults. The University of British Columbia; July 2011.
- Smith A. Mobile Access 2010. *Pew Internet*; 2010.
- Moffatt KA. Addressing Age-related Pen-based Target Acquisition Difficulties (Doctoral dissertation). University of British Columbia; Vancouver: Canada. 2010.
- Cengiz Emrah Ph.D. Measuring Customer Satisfaction: Must or Not? *Journal of Naval Science and Engineering*. 2010; 6(2):76–88.
- Xue Mei, Harker Patrick T. Customer Efficiency Concept and Its Impact on E-Business Management. University of Pennsylvania. *Journal of Service Research*. 2002 May; 4(4):253–67.
- Boulos MN, Wheeler S, Tavares C, Jones R. How Smart phones are changing the Face of Mobile and Participatory Healthcare: An overview, with example from eCAALYX. *Biomed Eng Online*. 2011; 10:24.
- José I R-R, Carlos M-C, Natividad G-V, Amparo G-A, Arietealanizbeascoa Maria S, Yolanda S-G, Jose A M-F, Diana



- P-A, Emiliano R-S, Manuel A G-M, Luis G-O and on behalf the EVIDENT Group. Effectiveness of a Smart phone Application for Improving Healthy Lifestyles, a randomized Clinical Trial (EVIDENT II): Study protocol. Recio-Rodríguez et al. *BMC Public Health*. 2014; 14:254
17. Schaub F, Deyhle R, Weber M. Password Entry Usability and Shoulder Surfing Susceptibility on Different Smart Phone Platforms. *Proceeding Mobile and Ubiquitous Multimedia MUM '12*. ACM; 2012.
  18. Ritter Daniel, Schaub Florian, Walch Marcel, Weber Michael. MIBA: Multi-touch Image-Based Authentication on Smart phones. *CHI 2013 Extended Abstracts*. April 27. May 2 2013. Paris, France. ACM 978-1-4503-1952-2 / 13/04.
  19. Chiasson S, PC Van Oorschot, Biddle R. Graphical Password Authentication Using Cued Click Points. In *Proceedings ESORICS '07*; Springer; 2007.
  20. Villasante A, Fernandez C. Measurement Errors in the Use of Smart Phones as Low-cost Forestry Hypsometers. *Silva Fennica*, article in 1114. 2014; 48(5):11
  21. Gartner. November Report. Available from: <http://www.gartner.com/it/page.jsp?id=1466313>
  22. Beresford R Alastair, Rice Andrew, Skehin Nicholas, Sohan Ripduman. *MockDroid: Trading Privacy for Application Functionality on Smart phones*. 12th Workshop on Mobile Computing Systems and Applications; 2011.
  23. Huang Junxian, Xu Qiang, Tiwana Birjodh. *Anatomizing Application Performance Differences on Smartphones*. San Francisco; California: USA. June 2010.p.15-8.
  24. Willkomm D, Machiraju S, Bolot J, Wolisz A. *Primary Users in Cellular Networks: A Large-scale Measurement Study*. DySpAN; 2008.