

Mobile Applications Usability Parameters: Taking an Insight View

Sakshi Goel, Renuka Nagpal and Deepti Mehrotra

Abstract Nowadays, mobiles are like the general purpose computers with inbuilt sensors, constant access to Internet and a huge variety of applications. Different applications are categorized in such a way that they can perform their task in the best possible manner. Usability of mobile applications is the ability of an individual to use the application for its intended purpose without getting frustrated. In this paper, the attention draws on the major usability factors of different applications. After finding out the factors, we are trying to give the brief introduction of various methodologies used to rank the factors and the structural relationships among these parameters are modeled. Major techniques among them are interpretive structural modeling (ISM) approach, analytical hierarchal approach (AHP) and DEMETAL (decision-making trial and evaluation technique). These methodologies are used to identify parameters affecting mobile applications, and the structural relationships between these parameters are modeled.

Keywords Usability · Mobile applications · Parameters · ISM
DEMATAL · AHP · TOPSIS

1 Introduction

The versatility that is emerging nowadays in mobile phones opens the doors for many new opportunities in the mobile world [1]. Mobile devices are becoming like a blessing to the users, and today millions of users are using it without any hindrance. The advancement that is seen in today's scenario with respect to mobile technology enabled a huge range of applications used by the population while they move [2]. Developers sometimes pay less attention toward the fact that the users are more interested in using these devices while they are moving. The key concern of

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using mobile phones is its limited screen size, huge power consumption and limited connectivity that lacks it behind when compared with desktops [3]. Major among all is the context in which we are using them. After all mobile devices are new PC nowadays, consumers are rapidly shifting toward smartphones and tablets instead of those bulky computers to access the wide range of services and products [4]. In 2010, it was the first time that smartphones are sold much higher than the PC's.

Mobile applications are software applications that are specifically designed to be used on the small, computing devices, wireless computing devices rather than laptops or desktops [5]. Mobile applications are categorized in three categories [6].

- **Native apps**—these applications are created particularly for a designed platform.
- **Web based**—these applications are dependent on the Web. They need Internet access every time in order to use them.
- **Hybrid apps**—these applications will combine the features of both the Web-based and native applications.

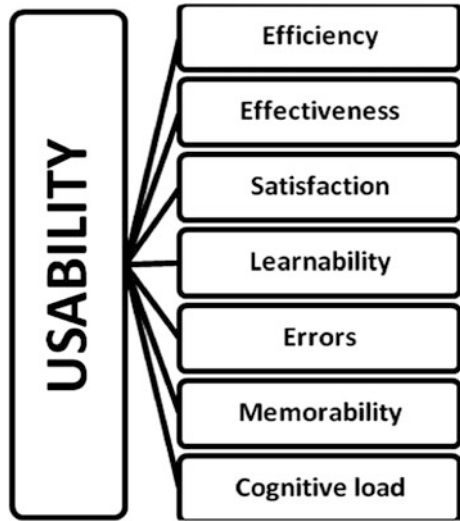
There are different applications in the smartphones that influence the life of an individual in either way. Different applications have different significance, and when we talk about usability, there are many factors that need to be considered at the time of defining its usability.

In this paper, we identified the factors for the usability of different applications. Apart from this, in this work the main emphasis draws on the studies carried out in decision making of the various usability factors. We try to make the user experience wonderful while using the mobile applications. In this regard, we identify the major usability factors of various applications and rank them in a decreasing order. Section 2 describes the related work that has been carried out in the field of usability. Section 3 of the paper describes the various applications and the usability factors associated with it and gives the brief idea of the techniques we can use to rank them and categorize them efficiently. Section 4 concludes the paper.

2 Related Work

Han et al. (2001), Kwahk and Han (2002) make use of usability evaluation framework consisted of two layers: usability formation and evaluation of usability [7]. Nigel Bevan et al. define the study for measuring the usability as a part of user-centered design process [8]. Rachel Harisson et al. define the PACMAD (people at the center of mobile application development) model of usability. This methodology brings different attributes of different usability factors together to develop an extraordinary comprehensive model [9]. The usability of the mobile applications can be measured by three criteria. They are efficiency, effectiveness and satisfaction. Some other attributes like cognitive load are overlooked, even though they are very prominent for the success or failure of a particular application. Cognitive load is the amount of cognitive processing needed by a particular user to

Fig. 1 PACMAD usability evaluation framework



see the applications [10]. In order to overcome with this difficulty, PACMAD (people at the center of mobile development application) was introduced. The PACMAD gives a model that adds four attributes other than the three attributes, i.e., learnability, errors, cognitive load and memorability. In order to overcome the present model, PACMAD depends upon three factors. They are task, user and context of use [11] (Fig. 1).

Scott Gerber [12] gives the usability considerations that are highly responsible for the proper functionality of the mobile applications [13]. Fateh nayebi et al. present the state of art for the evaluation and measurement of the mobile usability applications [14]. Constantinos K. Coursaris et al. design a framework for the evaluation of the usability. A meta-analytical review is conducted of so many usability studies to draw the final conclusion [15].

3 Proposed Work

We have identified the mobile applications namely e-commerce applications, gaming applications, social applications, banking applications, books and references and news applications. We draw a table for the factors that are valuable for the usability of these applications. However, there are some common usability parameters that can be suited with any of the above applications. Basically the study shows the categorization of different usability applications along with their usability factors that are very basic while using the mobile applications. They are shown in Fig. 2 (Table 1).

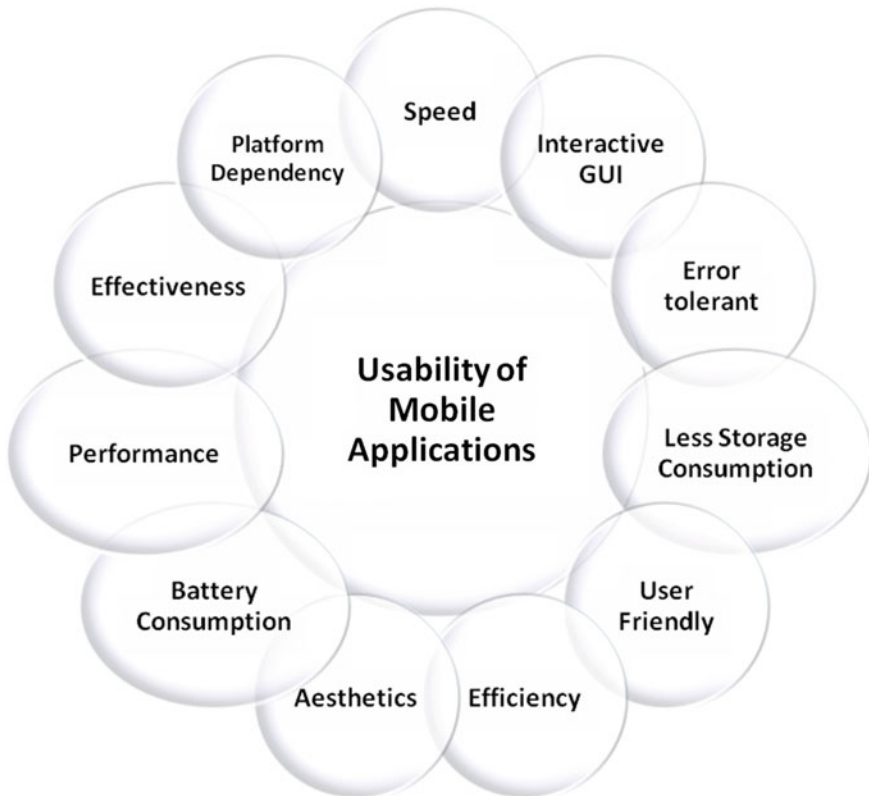


Fig. 2 Usability factors of mobile applications

Proposed technology

In order to make the decision between the choices available for the attributes of e-commerce applications and other proposed applications, various techniques can be used. They are shown as follows

3.1 MCDM (Multiple Criteria Decision Making)

Multiple criteria decision making (MCDM) is a decision-making technique when their present multiple but conflicting choices. This technique is used in day to day life [16]. MCDM deals with choosing and identifying values on the basis of preferences of the person who is taking decisions. Making the decisions shows that some alternative choices are also present and the decision maker is considering them and in such situation our responsibility is to not only identifying the number of choices present but to choose the best one among all which can fits with the

Table 1 Usability parameters of different mobile applications

S. no	Gaming applications	Social applications	Banking applications	News application	Books and references	E-commerce applications
1	Varying screen sizes	High data rate	Security	High readability on every operating system	Adjustable font size	Hardware configuration
2	Swiping, tilting and replacement options	Content	E-transfer of money	Audio and video options along with text display	Less scrolling	Platform dependency
3	Battery consumption	Battery consumption.	Login credentials at every login	Quick updates	Interactive GUI	Secure payment gateway
4	Size of RAM	Security	Smooth backend	The pop ups that appear while browsing the news must be avoided	Efficiency	Network connectivity
5	User setting option (volume, language control, sound)	Platform dependency for new features	Ease of use	Low space consumption	Esthetics	Ease of use
6	Saved functionalities	Notifications at the lock screen	Voice recognition system	News must be available in all languages	Easily convertible in any format	Content
7	Level of game must be specified	Offline features	ATM locators application	GUI must be interactive	Efficient	Response time
8	Avoid hang problem	Interactive GUI	Accessing balance info without login	Content	High resolution of images and tables	Informational retrieval performance
9	Platform supportive	Efficiency	Network connectivity	Smooth navigation	Quick searching while entering keywords	Navigation
10	High resolution	Strong esthetics	Ease of use	Zooming without disturbing actual functionality	Consume less size in memory when downloaded	Optimization

model [17]. This is the methodology that comes under operational research which is categorized into two methods, namely multi-attribute decision making (MADM) and multi-object decision making (MODM) [18].

- **Multiple attribute decision making (MADM)**—it selects the “best” alternative from the predescribed alternatives with respect to multiple attributes.
- **Multiple objective decision making (MODM)**—it deals with the designing of the alternatives which actually optimize the multiple objectives of the person who is making the decisions.

3.2 AHP (*Analytical Hierarchy Process*)

It stands for analytical hierarchy process. It is a decision-making method that gives ratio scales of different parameters. In order to take input, it can be measurable (height, weight) or subjective (feeling, preference, satisfaction) opinion. The ratio scales are derived from Eigen values, and parameters are derived from Eigen vectors. AHP works on the human mentality who by nature clusters the things in their mind by their complexities and characteristics. It took both quantitative and qualitative factors into considerations [19]. The foremost importance of this method is its ease to solve multiple attribute problems. Moreover, AHP is quite easy to understand and deals with qualitative and quantitative data at a time. One reason of ease is the less involvement of mathematics. It only performs the pairwise comparison, generation of vectors and synthesis [20]. It breaks the problem into smaller and smaller parts and guides the decision maker with the help of pairwise comparison to give the relative intensity or the relative strength of the elements in the hierarchy.

It is that simple that there is no need of providing the formal training and they can understand and take participation actively. Satty [21] found one common behavior among various examples of the trend of dealing with complexity by humans—that is the hierarchical complexity structuring into the homogeneous clusters.

3.3 MAUT (*Multi-Attribute Utility Theory*)

MAUT is again a decision-making technique. It is a structured methodology that is build to handle the variations among various objectives. This technology was first introduced at Mexico airport in early 1970s to find the alternative locations for new airport at Mexico City [22]. MAUT is a compensatory strategy. This theory states that the preference of an individual between the alternative solutions for a particular problem can be expressed in terms of “utility function” which allots numbers to show the degree of desirability [23]. Multiple attributes are compared on the basis

of their weights to find the best optimal solution [24]. The desirability is expressed such that the high number correlates with the higher desirability and the lower number with the low desirability [25].

3.4 Interpretive Structural Modeling (ISM)

It is a process of converting the poorly articulated model into a well-defined model that is helpful for many purposes [26]. The foremost focus of using ISM is to identify the directly and indirectly related elements. It identifies relationship among various sets of items that defines a particular problem. While using a system that is complex in nature, the user gets frustrated and does not want to spend much time on that system [27]. ISM provides the better understanding of the system by identifying the directly or indirectly related elements and to identify the structure within the system. It also changes the poorly defined attributes into the set of well-defined attributes. The very first step of ISM is to identify the variables. After choosing the contextually related elements, structural self-interaction matrix (SSIM) is developed. After finding the transitivity the levels are identified and finally with the help of MICMAC analysis, dependent and driving powers are identified [28].

3.5 TOPSIS (Technique for Order Preference by Similarity to Ideal Solution)

It is a technique that works with multi-attributes or with MCDM (multi-criteria decision making) problems. It provides the ease to the decision maker to manage the problem in the way that it will be solved and carry out the analysis and ranking of the different attributes after comparing them. Traditionally TOPSIS was introduced by yoon and hwang for solving MCDM. The concept behind this is that the alternatives so chosen must have shortest Euclidian distance from PIS (positive ideal solution) and farthest from NIS (negative ideal solution). Positive ideal solution is the solution that has minimum cost criteria and maximum benefit criteria. On the contrary, negative ideal solution has maximum cost criteria and minimum benefit criteria [29].

3.6 DEMATEL

Decision-making trial and evaluation laboratory (DEMATEL) is used in analytical network process (ANP), fuzzy set method and multi-criteria decision making (MCDM), etc. for enhancing these old methodologies into some new kind of applications for many hybrid methods. DEMATEL can sum up with many other

techniques such as initial direct relation matrix. DEMATEL was come into light with the prior belief that the correct use of scientific research method will enhance the understanding of certain problems that are critical in nature. DEMATEL is applied to handle problems with regard to some crucial features for the problems and help in finding the best possible decisions. Some scientists use this method to change the application of the attributes and evaluation for the problems. DEMATEL determines the constraining and interdependent relations depend on some features.

4 Conclusion

In this work, we basically make an attempt to introduce the different mobile applications usability factors that are commonly used and after that we suggest some of the techniques that are helpful in drawing the decision and creating relationship among various factors. Among the different applications, we choose e-commerce as one of the applications where we will be applying interpretive structural modeling (ISM) along with the DEMATEL in our future work. With the parameters suggested above, we will try to create the relationships among the parameters and create a matrix on that basis.

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