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Investigating Usability Guidelines in Developing Mobile Application

Mengkaji Garis Panduan Kebolehgunaan dalam Pembangunan Aplikasi Mudah Alih

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Abstract

The extensive use of smart phones has become an increasingly trend in promoting and disseminating the sharing of information. Use of smart phone is also widely in use among university students to help them in term of education, time management, and access of information. However, numbers of mobile application for public universities in Malaysia is still low. Usability has been recognized as a significant quality dimension to determine the success of information sharing among the mobile phone users. Usability has become the key factor for successful use of mobile applications especially for those who have limited experiences with new technology. User expectations are the most basic thing in designing mobile applications. Therefore, the selection of the best guidelines should be taken into considerations in determining the usability aspects in the early design phase of the application. Nevertheless, there is still lack of structured guidelines that are available from the literature of mobile applications development. Thus, this article reviews some existing studies to investigate the best usability guidelines available in developing mobile application for public universities in Malaysia. This review will help researchers and practitioners to create more usable applications that meet the user expectations especially in the university environment.

Keywords: Mobile application, usability guidelines.

Abstrak

Penggunaan telefon pintar secara meluas telah meningkatkan trend dalam memprompso dan menyebarkan perkongsian maklumat. Penggunaan telefon pintar secara meluas juga dalam kalangan pelajar universiti telah membantu mereka dari segi pendidikan, pengurusan masa dan capaian maklumat. Namun, bilangan aplikasi mudah alih untuk universiti awam di Malaysia masih rendah. Kebolehgunaan telah diangkat sebagai dimensi kualiti penting untuk menentukan kejayaan perkongsian maklumat dalam kalangan pengguna telefon mudah alih. Kebolehgunaan telah menjadi faktor utama untuk kejayaan penggunaan aplikasi mudah alih terutama kepada mereka yang mempunyai pengalaman terhad dengan teknologi baharu. Jangkaan pengguna adalah perkara asas dalam merekabentuk aplikasi mudah alih. Oleh itu, pemilihan garis panduan yang terbaik perlu diambil pertimbangan dalam menentukan aspek kebolehgunaan dalam fasa reka bentuk aplikasi. Walau bagaimanapun, masih terdapat kekurangan garis panduan berstruktur yang boleh diperolehi dari literatur dalam pembangunan aplikasi mudah alih. Oleh itu, artikel ini meneliti kajian terdahulu untuk menyiasat garis panduan kebolehgunaan sedia ada dalam pembangunan aplikasi mudah alih untuk universiti awam di Malaysia. Ulasan ini akan membantu penyelidik dan pengamal dalam menghasilkan aplikasi yang lebih bersifat bolehguna yang memenuhi jangkaan pengguna terutama untuk persekitaran universiti.

Kata kunci: Aplikasi mudah alih, garis panduan kebolehgunaan.

INTRODUCTION

The use of mobile phones has become an increasingly widespread trend in promoting information sharing among university students (Malaysian Communications and Multimedia Commission 2013). Therefore, it is important for the university to develop mobile apps that can give sufficient information and guidance to students on the university environment to improve access to communication and information sharing. Moreover, it would be useful if the university is also targeting international students for the university admissions. Among the major challenges in developing mobile application is to ensure the usability of the application to optimize access and sharing of information (Mahmood, Amen and Lu, 2014; Shitkova et al, 2015).

The selection of best guidelines is important in determining the usability aspects during the early design phase of the application. Nevertheless, structured guidelines available from the literature are still lacking and need to be investigated further (Shitkova et al, 2015). Thus, it is the aim of this paper to investigate the existing usability guidelines available to be adopted for developing a mobile application in the university environment. Identification of the best guidelines can serve as an effective guide to application developers in improving the usability of the mobile application especially in the university environment. In line with the rapid development of technology, the university should be willing to provide the best service to the students through efficient information sharing. This paper is trying to answer the question of which usability guidelines should be considered to develop a usable mobile application in a university environment.

USABILITY

Table 1: Usability guidelines by ISO, Nielsen, and Shneiderman (Hussain & Fernelley, 2008)

ISO 9241	Jakob Nielsen	Shniederman
- Effectiveness	- Consistency and standards - Error prevention	- Strive for consistency
- Efficiency	- Flexibility and efficiency of use - Aesthetic and minimalist design - Help users recognize, diagnose, and recover from errors -	- Design dialog to yield closure - Offer simple error handling - Reduce short-term memory load
- Satisfaction	- User control and freedom - Visibility of system status - Match between system and the real world - Recognition rather than recall - Help and documentation	- Offer informative feedback - Enable frequent users to use shortcuts - Permit easy reversal of actions - Support internal locus of control

According to Nielsen (2012), usability means making products and systems easier to use, and matching them more closely to user needs and requirements during the design process. Usability is meant to achieve user specified goals such as effectiveness, efficiency and satisfaction in a specified context of use (Nielsen, 1993). Usability is considered the most important factor in each process of application development and cannot be wait until the end of product delivery to the customer (Hujainah, Dahlan & Al-haimi, 2013)**.** There are few attributes of usability guidelines that have been developed by previous researchers. Table 1 shows the usability guidelines of ISO, Jakob Nielsen and Shneiderman that have been categorized into three guidelines based on ISO attributes (Hussain &Ferneley, 2008).

Challenges in Mobile Application Usability

According to Jun &Tarasewich (2004), there are few challenges found during usability testing of mobile applications. These were identified as mobile context, connectivity, small screen size, different display resolutions and limited processing capability and power (Jun &Tarasewich, 2004).

a) Mobile Context

Mobile contextcan be state as any of the information that can be related to the interaction between the users, the application, and the environment that was surrounding the user.

b) Connectivity

As we know, internet was connected by the user while using the mobile devices through the wireless internet connection. If the connection of the internet was faster, it will guarantee that downloading process was smoothly good. It also will enhance the quality of the streaming media. Time and locations in wireless network will be different due to strength of signal and data transfer speed. Meanwhile, for the factor of the low connections, it must be taken during the usability testing of the mobile application.

c) Small Screen Size

Small screen size of mobile devices will make the user not very satisfied while using it. It is the one of the factors for usability application that compromises to the user while browsing or surfing the internet application.

d) Different Display Resolutions

The display of the resolutions was different depends on the types of capability. Such as, mobile devices have a low display resolution compare with the desktop that has higher resolution. So, different levels of display resolution on different mobile devices may cause differentof usability test results.

e) Limited Processing Capability and Power

Memory capacity and computational power of mobile devices was limited and less than the desktop

or laptops memory. So, it needs considerations such as application's capacity to install in mobile device to develop the application. Because of the limited processing capability and power of mobile devices, the developers must to remove some of the functions examples high image resolution and dynamic frame movement to ensure the usability of the application.

Existing Usability Guidelines in Mobile Application

Table 2 shows summarizations of existing usability guidelines that can be used to developed mobile applications. These guidelines are studies from various domains. This study attempts to review and make synthesis of these guidelines. Findings from this review will support this research on preliminary ideas of the attribute needed to develop a mobile application in a university environment.

Table 2: Summarization of the existing usability guidelines for mobile application

Researcher		Description
Tapanee Treeratanapon (2012)	-	Reserchер had measured a mobile application that are developed by free developers in various mobile software distribution platforms based on the guidelines.
Fatih Nayebi, Jean-Marc Desharnais, Alain Abran (2012)	-	In this paper, it presents the state of the art of the evaluation and measurement of mobile application usability.
Fadhl Hujainah, Halina Dahlan, Basheer Al-haimi (2013)	-	In this paper, researcher had study about the usability attributes of mobile learning application and the existing usability guidelines of mobile application and then concentrated more in studying the usability guidelines for mobile learning application.
Rosnita Baharuddin, Dalbir Singh, Rozilawati Razali (2013)	-	This study has presented a set of of usability dimensions, which is illustrated as a unified model for mobile applications. This dimensions were proposed based on the reviews of previous related studies.
Rachel Harrison, Derek Flood, David Duce (2013)	-	This review is about the PACMAD (People at the Centre of Mobile Application Development) usability model that was designed to address the limitations of existing usability models in order to create a more comprehensive model.
Maria Shitkova, Justus Holler, Tobias Heide, Nico Clever, Jorg Becker (2015)	-	This paper introduces a catalogue of usability guidelines for mobile applications and websites, and subsequently demonstrate their usage by applying them in two case studies.

FINDINGS AND RESULTS

Review of the Existing Usability Guidelines for Mobile Application

This review is presented based on the summarization of the existing usability guidelines in Table 2. We compare these guidelines based on the attributes of usability and factors of usability by the researchers. Each paper has different attributes that are being used for the research. Some of the researchers does not mention about the factors of usability, however some inferences were made during the review.

In 2012, Treeratanapon (2012) proposed a methodology and framework to measure mobile application that are developed by free developers in various mobile software distribution platforms. Researcher

used guidelines from ISO 9241 standard and Technology Acceptance Model (TAM) to establish the framework. As we know, usability guidelines of ISO are effectiveness, effeciency and satisfaction. Meanwhile for the TAM were perceived usefulness (PU), perceived ease of use (PEOU), and intention to use (IU). The factors for this research are user, task, equipment and environment. Researcher think that these factors highly and mainly impact to the usability of mobile application. Meanwhile, Nayebi, Desharnais & Abran (2012) presented about the state of the art of the evaluation and measurement of mobile application usability. They said that every usability evaluation method has its advantages and disadvantages. Some of them are difficult to apply but others were dependent on the measurer's opinions or instruments. The usability in this paper fully based on ISO guidelines. While Treeratanapon (2012) did not emphasized on the technology factor, Nayebi, Desharnais and Abran (2012) believed that up to date mobile technologies has significant impact on mobile application usability.

As for Hujainah, Dahlan & Al-halmi (2013), they proposeda usability guideline for mobile learning application into for attributes, which are adjustability, funability, reliability and satisfaction. However, the attributes are still not comprehensive as some usability attributes from other usability guidelines are not covered. In addition, it does not cover on the technology aspect that are being used when learning using mobile. On the other hand, Baharuddin, Singh & Razali (2013) suggested a set of usability dimensions that should be considered to design and evaluate for mobile applications. The usability dimensions that are effectiveness, efficiency, satisfaction, usefulness, aesthetic, learnability, simplicity, intuitiveness, understandable and attractiveness was based on four contextual factors. The four contextual factors are user, environment, task or activity and technology. All the usability dimensions were strongly influenced by the factors. So, each factor need to be identified to illustrate the future potential application and be analyzed.

Harrison, Flood & Duce (2013) developed a new usability model that are both from the ISO and Nielsen usability model and from the theory of cognitive load. This model named PACMAD, incorporates the cognitive load theory, which is being overlooked in existing usability models. According to them, cognitive load refers to user's mobility while using the mobile application and the amount of congnitive processing may impact the level of mobile usage. In their research, 23% of the studies measured the cognitive load of the mobile application under evaluation. The results showed that the area of mobile applications is beginning to recognise the importance of cognitive load as it has direct impact on the mobile application usability. There are seven attributes being proposed, which are effectiveness, efficiency, satisfaction, learnability, memorability, errors and cogntive load. This model is suitable to be used in developing a mobile application, however this model can be further defined by identifying the underlying measures for each attribute.

According to Shitkova, Holler, Heide, Clever & Becker (2015), they introduce a catalogue of usability guidelines for mobile applications and websites, and subsequently demonstrate their usage by applying them in two case studies that are development of a mobile application for a process modeling tool and a mobile website for research portals. The usability guidelines were categorized as layout, navigation, design, content and perfomance. All usability guidelines were demonstrated by the two cases that are mobile app for process modelling and mobile website for research portals. The catalogue usability

guidelines are well sructured and has a distinctive category. However, the presented guidelines only being applied in two demonstration cases. Thus, further usefulness of the guidelines can be demonstrated further in other cases such as in developing a mobile application in a university environment as for our research.

Table 3 below provides further review and summarization of all usability guidelines for mobile application from the existing usability guidelines being reviewed above. Table below highlights theattributes of usabilityand the factors of usability.

Table 3: Summarization of the existing usability guidelines for mobile application

Researcher	Attribute of Usability	Factors of Usabilty
Tapanee Treeratanapon (2012)	- Effectiveness - Efficiency - Satisfaction	- User - Task - Equipment - Environment
Fatih Nayebi, Jean-Marc Desharnais, Alain Abran (2012)	- Effectiveness - Effeciency - Satisfaction	- Up to date mobile technologies - Physical restrictions
Fadhl Hujainah, Halina Dahlan, Basheer Al-haimi (2013)	- ISO guidelines - Jakob Nielsen guidelines	- User - Task - Equipment - Environment
Rosnita Baharuddin, Dalbir Singh, Rozilawati Razali (2013)	- Effectiveness - Effeciency - Satisfaction - Usefulness aesthetic - Learnability - Simplicity - Intuitiveness - Understandable - Attractiveness	- User - Environment - Technology - Task/activity
Rachel Harrison, Derek Flood, David Duce (2013)	- Effectiveness - Effeciency - Learnability - Memorability - Errors - Cognitive load	- Context - Development methodology - Interaction - Task - User
Maria Shitkova, Justus Holler, Tobias Heide, Nico Clever, Jorg Becker (2015)	- Layout - Navigation - Design - Content - Perfomance	

CONCLUSION

This article presents a review of usability guidelines for mobile application in answering question on which usability guidelines should be considered to develop a usable mobile application in a university environment. Based on the analysis above, we found that a structured usability guidelines for developing a mobile application is still scarce. Most of the usability guidelines does not provide the details information on the underlying measures that need to take into considerations while given the usability attributes. Furthermore, all these usability attributes have yet to be applied in developing a mobile application for Malaysia public universities. Therefore, findings from this review gives the preliminary ideas of the usability attributes needed in developing a mobile application for Malaysia public university. For conclusion, most usability guidelines for the mobile application can be used but the existing of usability guidelines should also provide a details information on the underlying measure for each given usability attributes. For future research, we would like to propose a comprehensive usability guidelines consist of the usability attributes together with the measures in a more distinctive category.

RUJUKAN

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