VISUALIZATION PATTERN FOR SHOPPING MOBILE WEB APPLICATION USER INTERFACE DESIGN BASED ON EYE-TRACKING ANALYSIS

LAU KING LIENG

UMS
UNIVERSITI MALAYSIA SABAH

FACULTY OF COMPUTING AND INFORMATICS
UNIVERSITI MALAYSIA SABAH
2018

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LAU KING LIENG

UMS
UNIVERSITI MALAYSIA SABAH

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_____
LAU KING LIENG
MI1611005T

_____
(Tandatangan Pustakawan)

Tarikh: 30 August 2018

_____
(Dr. Aslina Binti Baharum)
Penyelia

DECLARATION

I hereby declare that the work described herein is entirely my own, except for quotations and summaries resources of which have been duly acknowledged.

24 May 2018

_____

LAU KING LIENG

MI1611005T

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CERTIFICATION

NAME : **LAU KING LIENG**

MATRIC NUMBER : **MI1611005T**

TITLE : **VISUALIZATION PATTERN FOR SHOPPING MOBILE WEB APPLICATION USER INTERFACE DESIGN BASED ON EYE-TRACKING ANALYSIS**

Degree : **MASTER (COMPUTER SCIENCE**)

DATE OF VIVA : **18/05/2018**

CERTIFIED BY

SUPERVISOR Signature

Dr. Aslina Binti Baharum _____

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ABSTRACT

Over the last decades, the use of mobile phone has brought a great conveniences and contributions to society in daily life. Online shopping takes a large portion in their online activities, due to this, the availability and the adequacy assessment in this situation are becoming increasingly requires. Eye-tracking technology has been claimed that, the used of the technology can be easy to study on how users interact with the visual elements within the mobile applications (apps). Currently, mobile app developers are facing the issues of limited guidelines for a proper mobile apps users' interface design. Moreover, the bad interaction between a user and interface design could lead to failure of the mobile app development. Besides, different users' expectation in online shopping could be affected by gender, generation or shopping behaviour. Thus, further study is needed. The aim of this research is to explore the eye-tracking technology and the analysis method used for user interface design of shopping mobile web app. This research will present the eye-tracking result of existing designed guideline, meanwhile, the result obtained from the eye-tracking analysis will be used to develop a visualization pattern of user interface guideline. The visualization pattern of user interface guideline that develops at the end of this research may improve the usability of mobile apps particularly for shopping mobile web apps.

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ABSTRAK

Corak visualisasi untuk aplikasi sesawang membeli-belah mudah alih reka bentuk antara muka berdasarkan analisis pengesanan mata

Sejak beberapa dekad yang lalu, penggunaan telefon bimbit telah memberi impak dan sumbangan yang besar kepada masyarakat dalam kehidupan seharian. Membeli-belah atas talian merupakan sebahagian besar aktiviti pengguna atas talian, maka, ketersediaan dan kecukupan penilaian dalam situasi ini semakin diperlukan. Penjejak-mata telah diakui bahawa penggunaan teknologi tersebut memudahkan kajian ke atas interaksi dengan elemen visual dalam aplikasi mudah alih. Pada masa kini, pembangun aplikasi mudah alih menghadapi isu terhadap garis panduan yang terhad bagi reka bentuk antara muka pengguna. Selain itu, interaksi yang tidak baik di antara pengguna dan reka bentuk antara muka boleh membawa kepada kegagalan pembangunan tersebut. Selain itu, jangkaan pengguna yang berbeza di kalangan pembeli atas talian boleh dipengaruhi oleh jantina, generasi dan tingkah laku seseorang. Oleh itu, kajian lanjut berkaitan perbezaan ini diperlukan. Matlamat kajian ini ialah untuk meneroka teknologi penjejak-mata dan analisis yang digunakan untuk reka bentuk antara muka pengguna bagi aplikasi web mudah alih membeli-belah. Kajian ini akan membentangkan hasil dapatan penjejak-mata bagi garis panduan reka bentuk yang sedia ada, sementara itu, dapatan yang diperolehi daripada analisis penjejak-mata akan digunakan untuk membangunkan corak visualisasi garis panduan antara muka pengguna. Corak visualisasi garis panduan antara muka pengguna yang dibangunkan diharapkan dapat memperbaiki kebolehgunaan aplikasi mudah alih terutamanya aplikasi web mudah alih membeli-belah.

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LIST OF ABBREVIATIONS

APPS	Applications
HCI	Human Computer Interaction
GUI	Graphical User Interface
UI	User Interface
MDS	Mobile Device Stand
RTA	Retrospective Think Aloud
SUS	System Usability Scale
HD	High Quality
AOI	Area of Interest
MS	Milliseconds

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Over the last two decades, the use of computers and mobile phone has brought great conveniences and contributions to society in daily activities. Both computer systems and mobile applications (apps) have been built to make people, even more, convenience in many aspects. With continuing penetration of the Internet into daily life, it has changed the definition of computers and mobile phones, and become an essential part of the peoples' communication and daily life. While the web and mobile technologies have become everyday life, in order to face the new market environment which is in constant change, the company must place the customer in the centre of its attention (Tarca et al., 2009). Developing a website and mobile application makes it possible an excellent communication with the clients, and this leads to a constant adaptation of the company's offer to the continuously changing customers' requests. Due to this, the availability, and adequacy assessment in this situation are becoming increasingly requires. In order to study how users interact with the visual elements within the website and mobile apps, the Eye-tracking technology is increasingly applied to the usability study.

Today, many possibilities already exist where the usability of websites and mobile apps, among others, can be assessed with the help of Eye-tracking (Abu Experience, 2017). Eye-tracking measures where a person is looking, often used to measure how users interact with the visual elements, with the aims of improving its design and availability (iMotions, 2016). It shows where the user's attention is focused and which paths are followed, provides an unobtrusive means to examine cognitively and attention to deal with. Thus, this research applied Eye-tracking technology, survey both different genders of users' experience cognitive processes

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when shopping online, and determine whether this procedure for usability testing has added insight or value.

In general, different gender has different perspectives in most activities including online shopping and user interface design (Li and Zhang, 2002). Recently, online shopping has grown in their popularity in line with growing of the Internet and shopping mobile apps on smartphones (Smith, 2017). Mobile apps are designed and developed by developers and are available in app stores. Mobile user interface design is an essential in the mobile apps development process. A poor user interaction with mobile apps could lead to failure of apps (Vala et al., 2014). User Interface design is a crucial part in mobile apps and website development and had claimed that mental model theory help developers in designing a user-friendly and strong visual hierarchy user interface for a mobile app and website (Akpem, 2016).

In recent years, HTML5 has emerged as a very popular way for building mobile apps, called mobile web apps. Mobile web apps looked very much like native apps but built at a much faster and cheaper rate in HTML/CSS. The mobile web apps can be reached the widest range of the devices by only one design. In this study, two different shopping mobile web app interface will be developed based on the existing gender-based users' mental model pattern guidelines. The eye-tracking technology will be used to evaluate the developed interfaces. A pilot and main study will be conducted and evaluated by analysing participants' eye movement pattern through the Scanpath (Scanpath Trend Analysis and Cued Retrospective Think Aloud) and Heatmap. By analysing participants' eye movement pattern, valuable insight into usability and other issues can be acquired (Habuchi and Takeuchi, 2012). Besides, the valuable information likes conclusions about the positioning of elements also can be drawn (Habuchi and Takeuchi, 2012). From the result obtained from Eye-tracking analysis, a visualization pattern of user interface guideline will be created.

1.2 Problem Background

Nowadays, website and mobile apps developer still facing the problem of limited guidelines for proper user interface design. Vala et al. (2014) and Punitha and Aslina

(2016) mentioned that most of the mobile apps developers have been facing proper graphical user interface (GUI) design recently. Some of the existing guidelines for GUI design are only describing fundamental patterns or use cases (Vala et al., 2014). Vala et al. (2014) mentioned that there is a noticeable lack of studies in the area of mobile app design compared to web app user interface (UI) design. Moreover, Vala et al. (2014) and Punitha and Aslina (2016) also stated that the bad interaction between a user's of mobile apps and a GUI could lead to some misunderstandings, errors, and frustration from an inability to achieve a goal and could lead to failure of the mobile. Thus, the UI design is a crucial part of the development process, and it cannot be despised.

Besides, Gagandeep and Gopal (2003) suggested that online shopping websites should focus more on female section instead of male section, as their research results shows that female have a higher ratio to shop online. In contrast, Lina et al. (2007) identified male customers do more online shopping and outlay more money than women, and they do or are more likely to shop online in the future. Besides, Dennis et al. (2010) stated, even though most of the shopping is done by women, online purchasing often to be dominance by male consumers. As a result, different users' expectation among users in online shopping is significantly affected by gender. Thus, the interface design for the shopping apps and website should not focus on a single gender, but need to consider both gender.

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1.3 Problem Statement

Based on the section 1.2, the problems have been identified and extracted in brief. Undermentioned are the problem statements that will be solved throughout the research processes:

- Bad interaction between users and interface design (Vala et al., 2014; Punitha and Aslina, 2016).

- Limited guideline for proper user interface design for mobile application (Vala et al., 2014; Punitha and Aslina, 2016).

- Different users' expectation among users in online shopping is significantly affected by gender (Gagandeep and Gopal, 2003; Dennis et al., 2010).

1.4 Research Questions

Undermentioned are the research questions that will be answered throughout the research process:

- Is the existing guideline (users' mental model pattern) satisfying the mobile app users?

- Does the Eye-tracking technology help in identify the users' mental model pattern?

- Does the interface design layout that was developed at the end of the research satisfy the mobile app users (both genders)?

- How good is the interaction of users with the redesigned interface layout?

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1.5 Objectives

Four objectives have been identified to answer the research questions identified in the foregoing sub-sections, which are:

- To adapt user's existing mental model pattern guideline into a design mobile application.

- To analyse the Eye-tracking data on developed shopping mobile web app using Scanpath + Cued Retrospective Think Aloud (RTA) and Heatmap analysis method.

- To develop a visualization pattern of user interface guideline based on Eye-tracking analysis.

- To evaluate the usability of developed shopping mobile web app based on adapted guideline using System Usability Scale.

1.6 Research Scopes

The scope of this research consists of examining the presenting design guideline by adapted the present design guideline to develop a shopping mobile web app. The content used to design the shopping mobile web app will be based on the event of Universiti Malaysia Sabah (UMS), Tamu Gadang, this will help to design the shopping mobile web app in more realistic. Currently, there is no web app for the UMS, Tamu Gadang event, thus, this research will come out with an app that can be used in UMS. Meanwhile, the data collection to be conducted in UMS on the web app design will help to obtain a better or accurate data since the UMS students are the user of the web app.

Moreover, the use of Eye-tracking technology and Eye-tracking analysis method are also one of the scopes of this research, which will be the major focus of this research. Data collection conducted at Universiti Teknologi Mara (UiTM - Melaka) and Universiti Tenaga Nasional (UNITEN - Selangor) and collected through the use of Eye-tracking technology. The reason of choosing these two universities is because one of the university is a public university and the other one is the private university, this will help to obtain a variety of sample data. The collected data will be analysed by using Eye-tracking analysis method including Scanpath + Cued RTA and Heatmap. Since the case study is using UMS Tamu Gadang event online portal as a content, thus, the data collection will take place at university. The focused samples in this research are male and female students, thus the samples will be aged around or near to 24 years old.

1.7 Thesis Organization

Chapter one is the introduction of the research. This chapter briefly introduces the research background, problem statements, and objectives.

Chapter 2 is the literature review of the research. This chapter briefly explains the existing research that related to this research, and the problem faced and the recommended solution. Existing research including gender differences in shopping behaviour, online shopping, the mental model in user interface design, Eye-Tracking technology, Eye-Tracking data analysis approaches and System Usability Scale (SUS) will be reviewed.

Chapter 3 is the methodology which summarizes all the method that applied in this project to obtain the result. The procedure of carrying out this research is listed out with the aid of flowcharts. In this research, mixed method (qualitative and quantitative) will be used to evaluate through eye-tracking technology. The qualitative method including Scanpath, Scanpath map as a cue in an RTA Interview and Heatmap will be used to analyse collected eye-tracking data. For quantitative studies, data collection method will be using SUS and distribute the questionnaire through the Online.

Chapter 4 explains the experimental setting, which covers in details involved to run experiments in stages for this research. Data pre-processing and the experimental setup are discussed here.

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Chapter 5 shows all the results obtained from the experiments carried out in this research. It followed by the detailed explanation and analysis of the results.

A conclusion of all the works in this research is given in the last chapter of this thesis. It also details possible future enhancements of this research. All the references that aided in this research are stated in the appendix in the last section of this report.

1.8 Conclusion

This chapter describes the early stage of the research. This research aim to find out the gender diversity in shopping mobile web app design, for which, the information needed will be collected by using Eye-tracking technology and analyse the collected