



USABILITY COMPONENT FOR MEDICAL CONSULTATION WEB-BASED SYSTEM



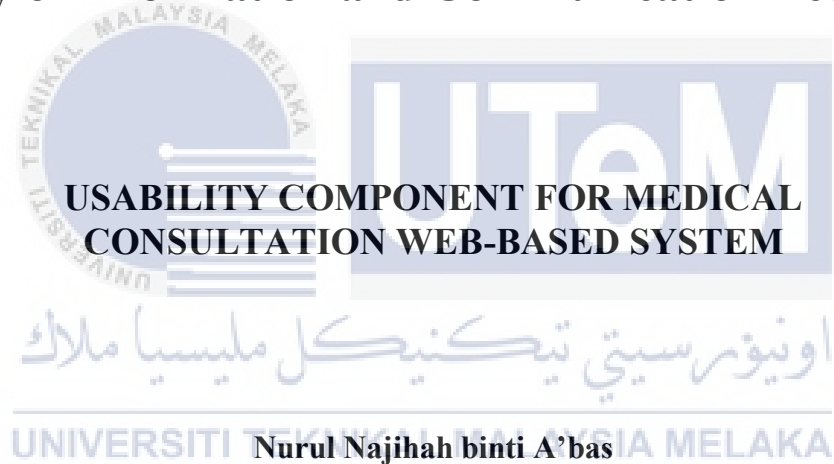
NURUL NAJIHAH BINTI A'BAS

**MASTER OF SCIENCE IN INFORMATION AND
COMMUNICATION TECHNOLOGY**

2023



Faculty of Information and Communication Technology

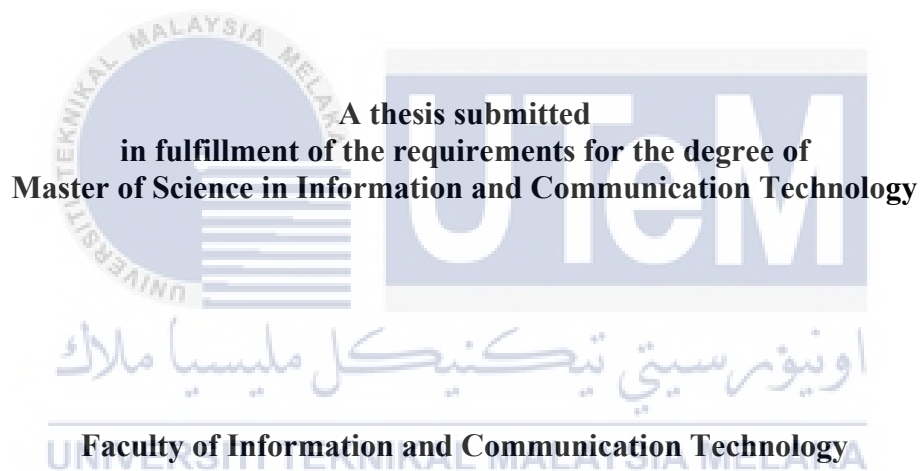


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**USABILITY COMPONENT FOR MEDICAL CONSULTATION WEB-BASED
SYSTEM**

NURUL NAJIHAH BINTI A'BAS



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2023

DECLARATION

I declare that this thesis entitled “Usability Component for Medical Consultation Web-based System” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.



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APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Master of Science in Information and Communication Technology.



Signature :

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Date : 3 January 2023

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DEDICATION

I would want to express my gratitude to my beloved husband and parents for their support, care, and tolerance during this time of research. To my family, who has always supported and encouraged me throughout my research journey. A special thanks goes out to my supervisor, Ts. Dr. Sarni Suhaila binti Rahim, as well as to all my friends who have supported, encouraged, and helped me finish my research.



ABSTRACT

Medical technology relies heavily on computerised technologies to offer solutions for the best possible medical management. One of the crucial medical systems is the consultation system, a digitalised tool for connecting with a specialist and asking for guidance on an electronic platform. The system usability is influenced by the effectiveness, efficiency, and satisfaction with which specific users can execute a particular set of tasks in each context. Health information technology's poor usability is still a serious challenge. Currently, the evaluation of a computerised system's usability is based on general usability principles, regardless of the delivery platform and field. The current medical usability concepts are used in the evaluation of medical computerised systems. Because of this, the current usability evaluation does not accurately reflect the system's output, leading to the creation of unpromising systems. The system created are not fully met of medical expectations and best practises in many ways. As a consequence, this study intends to thoroughly examine the necessary evaluation factors of the usability of web-based systems, focusing on the medical consultation system from the views of medical experts. The research project being presented has two stages. First, the thesis seeks to present the establishment of a new consultation system for screening for diabetic retinopathy. The evaluation of the developed system based on its general and usability components will be presented in the thesis' second section. The study develops a new set of components that serve as a fundamental for the usability of web-based systems by consolidating a critical viewpoint that is medical for producing and evaluating the usability of medical consultation systems. To meet the expected usability quality of computerised systems in the medical field, the usability evaluation components are crucial as a benchmark and guidance. This research is expected to speed up the development of computerised systems, in particular the medical consultation system, and enable the support systems to work more effectively in raising the standard of the healthcare system while also fulfilling expectations from a medical standpoint.

KOMPONEN KEBOLEHGUNAAN UNTUK SISTEM PERUNDINGAN PERUBATAN BERASASKAN WEB

ABSTRAK

Teknologi perubatan sangat bergantung pada teknologi berkomputer untuk menawarkan penyelesaian bagi pengurusan perubatan yang terbaik. Salah satu sistem perubatan yang penting ialah sistem perundingan, alat digital untuk berhubung dengan pakar dan meminta panduan mengenai platform elektronik. Kebolehgunaan sistem dipengaruhi oleh keberkesanan, kecekapan dan kepuasan yang pengguna tertentu boleh melaksanakan set tugas tertentu dalam setiap konteks. Kebolehgunaan teknologi maklumat kesihatan yang lemah masih menjadi cabaran yang serius. Pada masa ini, penilaian kebolehgunaan sistem berkomputer adalah berdasarkan prinsip kebolehgunaan umum, tanpa mengira platform dan medan penghantaran. Konsep kebolehgunaan perubatan semasa digunakan dalam penilaian sistem berkomputer perubatan. Oleh sebab itu, penilaian kebolehgunaan semasa tidak menggambarkan dengan tepat sistem yang telah dihasilkan, yang membawa kepada penciptaan sistem yang tidak menepati. Sistem yang dicipta tidak memenuhi sepenuhnya jangkaan perubatan dan amalan terbaik dalam banyak cara. Akibatnya, kajian ini berhasrat untuk meneliti secara menyeluruh faktor penilaian yang diperlukan bagi kebolehgunaan sistem berasaskan web, memberi tumpuan kepada sistem perundingan perubatan daripada pandangan pakar perubatan. Projek penyelidikan yang dibentangkan mempunyai dua peringkat. Pertama, tesis ini bertujuan untuk membentangkan penubuhan sistem perundingan baru untuk pemeriksaan untuk retinopati diabetik. Penilaian sistem yang dibangunkan berdasarkan komponen am dan kebolehgunaannya akan dibentangkan dalam bahagian kedua tesis. Kajian ini membangunkan satu set komponen baharu yang berfungsi sebagai asas untuk kebolehgunaan sistem berasaskan web dengan menyatukan sudut pandangan kritikal yang bersifat perubatan untuk menghasilkan dan menilai kebolehgunaan sistem perundingan perubatan. Untuk memenuhi jangkaan kualiti kebolehgunaan sistem berkomputer dalam bidang perubatan, komponen penilaian kebolehgunaan adalah penting sebagai penanda aras dan panduan. Penyelidikan ini dijangka mempercepatkan pembangunan sistem berkomputer, khususnya sistem perundingan perubatan, dan membolehkan sistem sokongan berfungsi dengan lebih berkesan dalam meningkatkan standard sistem penjagaan kesihatan di samping memenuhi jangkaan dari sudut perubatan.

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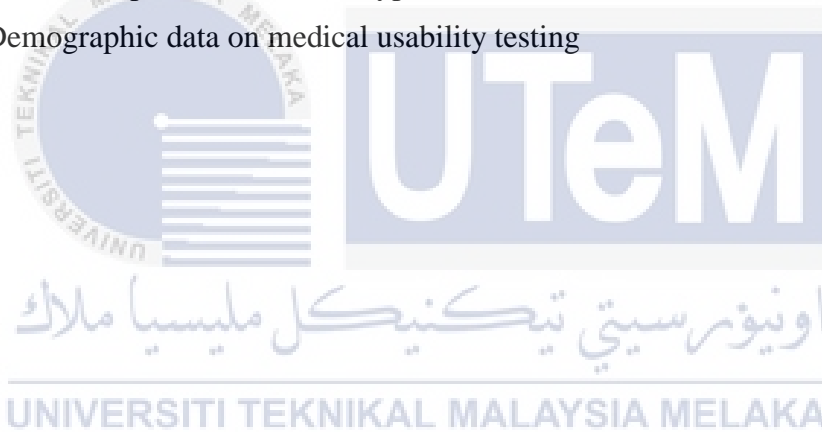
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LIST OF ABBREVIATIONS

BLs	-	Bright lesions
CMS	-	Content Management System
COPe-support	-	Carers for People with Psychosis e-support
CRUD	-	Create, Read, Update, and Delete
DM	-	Diabetes Mellitus
DR	-	Diabetic Retinopathy
DRCS	-	Diabetic Retinopathy Consultation System
ECG	-	Electrocardiogram
ERD	-	Entity Relationship Diagram
F1-score	-	Harmonic mean between precision and recall
FAQs	-	Frequently Asked Questions
GP	-	General Practitioner
GSM	-	Global System for Mobile communication
HEMs	-	Haemorrhages
HTML	-	Hypertext Markup Language
ID	-	Identity document
IeM	-	Inference engine Module
iEMS1669	-	Innovative Emergency Medical System 1669
IoT	-	Internet of Things
JKNM	-	Jabatan Kesihatan Negeri Melaka
MAs	-	Microaneurysms
MWA	-	Mobile web applications
NIEM	-	National Institute for Emergency Medicine
PHP	-	Hypertext Preprocessor
RHEC	-	Rama Health Electronic Consulting
RIP	-	Respiratory Inductance Plethysmography
SDLC	-	Software Development Life Cycle
SOP	-	Standard Operating Procedure
SQL	-	Structured Query Language

- UG - Usability Guidelines
URL - Uniform Resource Locator



LIST OF PUBLICATIONS

1. A'bas, N.N., Rahim, S.S., Saifudin, W.S.N., Abdullasim, N., Parumo S. and Raja Omar, R.N., 2020 Development of Diabetic Retinopathy Consultation System (DRCS). in Raja Abdullah, R. I., Abdul Aziz, M. S., Ariff, H., Salleh, M. S., Yahaya, S. H. (ed.) *Proceeding of Innovative Research and Industrial Dialogue 2020*, IRID 2020. held 17 December 2020 at Melaka, Malaysia. Malaysia: Penerbit UTeM Press, pp. 9-10.
2. A'bas, N.N., Rahim, S.S., Dolhalit, M.L., Saifudin, W.S.N., Abdullasim, N., Parumo, S., Raja Omar, R.N., Md Khair, S.Z., Kalaichelvam, K. and Noor Izhar, S.I., 2021. Development and Usability Testing of a Consultation System for Diabetic Retinopathy Screening. *International Journal of Advanced Computer Science and Applications*, 12(5), pp. 178-188. <http://dx.doi.org/10.14569/IJACSA.2021.0120522>.
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اوتیور سیتی تکنیکل ملیسیا ملاک

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CHAPTER 1

INTRODUCTION

1.1 Background

Computerised systems are vital in today's medical area in providing solutions for optimised medical management. One of the important medical systems is the consultation system, a digitalised application for meeting purposes with an expert to seek advice through an electronic platform. It would be easier and much more practical if the consultation with the expert can be done through online platform which is web-based consultation system.

Since the spreading of Covid-19 to the world, medical field started to build as many medical systems as possible to assist the health management and one of it is web-based consultation system, where it is accessible through multiple devices and easy to access it online. With this opportunity, online consultation also helpful for primary health cares in the health clinic to get expert's opinion or consultation.

The effectiveness, efficiency and satisfaction when certain users can complete a set of tasks in each environment contribute to the system usability. Poor usability of health information technology continues to be a major concern. Currently, the usability evaluation of computerised systems, regardless of the delivery platform and field, is based on the generic principles of usability. In the medical field at present, the evaluation of computerised medical systems uses existing usability principles. As a result, the

existing usability evaluation does not fully represent the system outcome and causes an unpromising system to be built.

The medical expectation and medical practice are not fully met in the system currently developed. Therefore, this study aims to investigate, in-depth, the required evaluation components of the usability of a web-based system, focusing on the medical consultation system from the medical experts' perspectives. The research will propose a new set of components as fundamental for web-based system usability by consolidating important medical perspectives for producing and evaluating the usability of the medical consultation system. The usability evaluation components are important as a guideline and benchmark to achieve the expected usability standard of computerised systems in the medical area. It is envisaged that this research will facilitate computerised system development, particularly the medical consultation system, and allow the support system to function more competently in improving the quality of the medical system, while also catering to the expectations from medical points of view.

The first chapter of this thesis opens with the background of the study and further describes the field of medical systems and usability. Section 1.2 presents the problem statement of the research, while Section 1.3 explains the research purpose. The objectives and questions of the research are clearly presented in Section 1.4 and Section 1.5. In addition, Section 1.6 explains the scope of the research, while Section 1.7 reveals the significance of the research. Finally, Section 1.8 presents the overview of the chapters of this thesis, and a summary of the first chapter is provided in Section 1.9.

1.2 Problem Statement

The development of computerised systems is a prominent topic for research, and many academics work in this field and advance it. Nowadays, in the medical field, computer-based systems are widely used in hospitals and greatly contribute to improving the quality of care. In order to evaluate the usability of the developed medical systems, system testing is performed. Some of the reported developments focus on and propose the implementation of various medical systems. For example, usability evaluations of the medical system are proposed in Guanna (2020); Su (2020); Sin et al. (2019); Safdari et al. (2018); Jayapavitra et al. (2017); Ramachandran and Bashyam (2017). Nonetheless, one of the important medical systems, i.e., the consultation system, is proposed in Caballero et al. (2021); Mao and Zhang (2021); Taçyıldız and Çelik Ertuğrul (2020); Walker et al. (2020); Torres et al. (2019); Banks et al. (2018); Pronsawatchai et al. (2018). These researchers have done the research on medical consultation system and the descriptions have been highlighted in Table 2.2. Thus, medical consultation system is proposed in the research since it is essential to help and improve the primary health cares in the health clinic to get online consultation with the specialists from the hospital. However, these investigations are evaluating the usability of the developed systems based on the generic principles provided and currently there are many existing medical consultation systems exist. The common usability principles or components used are learnability, efficiency, memorability, user satisfaction and others.

Many computerised system is delivered through a web-based platform in order to achieve the benefits of online delivery as proposed in Caballero et al. (2021); Mao and Zhang (2021); Taçyıldız and Çelik Ertuğrul (2020); Walker et al. (2020); Torres et

al. (2019); Banks et al. (2018); Pronsawatchai et al. (2018). Since the system is delivered in a web-based platform, several technical elements such as the compatibility of devices, decent internet capability, suitability of user interfaces and other factors should be considered as well during the development and evaluation stages. Currently, there is no specific model or benchmark framework created as a guideline in the medical field to assist the development of optimum medical management that outfits medical technology best practices which can refer to Table 2.6 that highlights the issues on general usability components tested on medical systems. As a result, the computerised medical systems developed have not achieved the expected standard of medical practitioners due to insufficient technical requirements and needs. The system evaluation also uses the generic principles of usability testing, which are unsuitable for the medical system types and needs. Several amendments and refinement processes are therefore required to overcome the limitations generated, and this is inefficient, ineffective and time-consuming. This research study, therefore, will investigate the requirements and needs for a web-based system for producing an optimum medical consultation system. Medical experts' perspectives will be analysed and later combined to produce solid usability components in implementing an optimised system in the healthcare setting. The research proposes a new usability component for medical system evaluation. The study also indirectly proposes design considerations for developers in healthcare web-based systems.