USABILITY COMPONENT FOR MEDICAL CONSULTATION WEB-BASED SYSTEM

NURUL NAJIHAH BINTI A'BAS

UTeM
اونيۏرسيتي تيکنيکل مليسيا ملاك
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

MASTER OF SCIENCE IN INFORMATION AND COMMUNICATION TECHNOLOGY

2023

Faculty of Information and Communication Technology

USABILITY COMPONENT FOR MEDICAL CONSULTATION WEB-BASED SYSTEM

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Nurul Najihah binti A'bas

Master of Science in Information and Communication Technology

2023

USABILITY COMPONENT FOR MEDICAL CONSULTATION WEB-BASED SYSTEM

NURUL NAJIHAH BINTI A'BAS

A thesis submitted
in fulfillment of the requirements for the degree of
Master of Science in Information and Communication Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
اونيۏرسيتي تيکنيکل مليسيا ملاک

Faculty of Information and Communication Technology

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.

Signature : .....

Name : Nurul Najihah Binti A’bas

Date : 3 January 2023

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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 : .....

Supervisor Name : Ts. Dr. Sarni Suhaila Rahim

Date : 3 January 2023

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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.

UTeM
اونيۏرسيتي تيکنيکل مليسيا ملاک
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ACKNOWLEDGEMENTS

In the Name of Allah, the Most Gracious, the Most Merciful

First and foremost, I would like to express my profound gratitude to Allah the Almighty, The Most Merciful and The Most Beneficent for the strength and blessings He has showered upon me throughout the years and now I have finally finished my thesis.

I am deeply indebted to my supervisor, Ts. Dr. Sarni Suhaila Rahim for her constructive comments and valuable guidance in assisting me to complete this thesis. I have no words to describe how thankful I am for the knowledge and experience gained since my first day at the Universiti Teknikal Malaysia Melaka. To my co-supervisor, Dr. Mohamad Lutfi Dolhalit, thank you for the great ideas and helpful suggestions.

Particularly, my sincere gratitude goes to my family especially my husband, Muhammad 'Ammar Muhammad Sani, my father, A'bas Amin and my mother, Puziayah Yaacob for being my major motivation to strive for successes. You are my backbone, and I would never be able to repay your sacrifices, but I hope I have made you proud of all the achievements that I have made. To my siblings, thank you for the continuous support and kind words. You are absolutely my ultimate blessings from Allah the Almighty.

The research was sponsored by the Universiti Teknikal Malaysia Melaka High Impact Short Term Research Grant, Project No: PJP/2020/FTMK/HI17/S01715. In addition, the research also received support, particularly in the contribution of expertise, from the Department of Ophthalmology at the Hospital Melaka, under the Ministry of Health for Malaysia.

Special thanks to my peers, thank you so much for the endless support and encouragement especially during my hard times as a postgraduate. I truly appreciate your support and kindness. Finally, I want to express my gratitude to everyone who attended the critical parts of this project's realisation.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

TABLE OF CONTENTS

		PAGE
DECLARATION		
DEDICATION		
ABSTRACT		**i**
ABSTRAK		**ii**
ACKNOWLEDGEMENTS		**iii**
TABLE OF CONTENTS		**iv**
LIST OF TABLES		**vi**
LIST OF FIGURES		**viii**
LIST OF APPENDICES		**xi**
LIST OF ABBREVIATIONS		**xii**
LIST OF PUBLICATIONS		**xiv**
CHAPTER		
1.	**INTRODUCTION**	**1**
	1.1 Background	1
	1.2 Problem Statement	3
	1.3 Research Purpose	5
	1.4 Research Questions	8
	1.5 Research Objectives	8
	1.6 Scope of Research	9
	1.7 Research Significance	9
	1.8 Thesis Outline	11
	1.9 Summary	12
2.	**LITERATURE REVIEW**	**15**
	2.1 Introduction	15
	2.2 Medical System	16
	2.3 Medical Consultation System	17
	2.4 Diabetic Retinopathy	25
	2.5 Diabetic Retinopathy Screening Process	27
	2.6 Usability	30
	2.7 Web Usability	31
	2.8 Medical System Usability	33
	2.9 Issues on General Usability Components	34
	2.10 Summary	37
3.	**RESEARCH METHODOLOGY**	**38**
	3.1 Introduction	38
	3.2 Research Design	38
	3.3 Study Population	48
	3.4 Location of Research Study	49
	3.5 Research Methodology	50
	3.6 Data Collection	57

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

3.6.1 Phase 1: Development of Medical Web System 58
3.6.2 Phase 2: Usability Evaluation of Medical Web System 66
3.7 Data Analysis 71
3.8 Ethics Approval 80
3.9 Summary 81

4. DESIGN AND DEVELOPMENT OF DRCS AND USABILITY COMPONENTS 82
4.1 Introduction 82
4.2 Diabetic Retinopathy Consultation System (DRCS) 82
4.2.1 Create, Read, Update, Delete 92
4.2.2 Image Processing 96
4.2.3 Image Editing 97
4.2.4 Forum 98
4.3 Usability Component for Medical System 100
4.3.1 High performance in solving 101
4.3.2 Fulfill standard medical practice and embedded into routine work 102
4.3.3 Updatability and flexibility 102
4.3.4 Acceptance 103
4.3.5 Transparency authority 103
4.3.6 Data confidentiality 104
4.3.7 Effectiveness as a learning platform 104
4.3.8 Easy and user friendly 105
4.3.9 Health system compatibility 106
4.4 Summary 107

5. RESULT AND DISCUSSION 109
5.1 Introduction 109
5.2 Generic Usability Testing 110
5.2.1 Alpha Usability Testing 110
5.2.2 Beta Usability Testing 125
5.3 Medical System Usability Testing 133
5.4 Summary 145

6. CONCLUSION AND RECOMMENDATIONS FOR FUTURE RESEARCH 147
6.1 Introduction 147
6.2 Review of the Work and Contributions 148
6.3 Implications and recommendations for future work 151
6.4 Practical Barrier 154
6.5 Summary 155

REFERENCES 157
APPENDICES 162

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF TABLES

TABLE	TITLE	PAGE
1.1	The significant effects of the problem statement	10
1.2	Summary of research content	13
2.1	Summary of existing medical system	17
2.2	Summary of existing medical consultation system	24
2.3	Usability components (Nielsen, 1993)	31
2.4	Summary of web usability element	31
2.5	Summary of previous research on medical system usability	33
2.6	Summary of issues on general usability components	36
3.1	List of procedures and guidelines for a Web Application Lifestyle and Process	54
3.2	Summary of the interview conducted	59
3.3	Summary of the focus group conducted	61
3.4	Summary of the online survey conducted for pre-testing	62
3.5	Summary of the online survey conducted for alpha testing	63
3.6	Summary of the online survey conducted for beta testing	65
3.7	Summary of the focus group conducted with the specialists at the Eye Clinic, Department of Ophthalmology, Hospital Melaka	68
3.8	Summary of the medical usability components testing survey conducted	70
3.9	Demographic	73
3.10	Computer literacy/skills	74
3.11	Expected outcome	78
4.1	Summary of user accessibility	85
4.2	List of annotation tools	98
4.3	Summary of web usability components in medical	106
5.1	Demographic of the respondents	111
5.2	Summary of the alpha testing conducted	112
5.3	Testing on the functionality (Admin)	112
5.4	Admin testing on usability	114

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

5.5	Functionality testing on specialist site	115
5.6	Specialist testing on usability	117
5.7	Functionality testing on medical doctor site	119
5.8	Medical doctor testing on usability	123
5.9	Summary of the beta testing conducted	125
5.10	Demographic data on usability testing	126
5.11	Functionality testing	127
5.12	Way of communication with the ophthalmologists on discussing DR cases	128
5.13	Ease of use testing	129
5.14	Ease of learning testing	131
5.15	Satisfactory result	132
5.16	Summary of the medical system usability test conducted	133
5.17	Value of 4-point Likert Scale type	134
5.18	Demographic data on medical usability testing	135

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF FIGURES

FIGURE	TITLE	PAGE
1.1	Research Framework	7
2.1	Patient's Booking and On Demand Screen	19
2.2	Doctor's Status and Scheduling Screen	19
2.3	Event Logs Screen	20
2.4	Clinical examination information collection screen	21
2.5	Java Bot calculates the values of the Asserted Key Metrics and Inferred Key Metrics	21
2.6	Suggestions proposed by the system for the pediatric patient are seen to evaluation	22
2.7	Diabetic retinopathy features (Ministry of Health Diabetic Retinopathy Screening Team, 2017)	26
2.8	Process flow for screening of diabetic retinopathy to prevent blindness (Ministry of Health Malaysia et al., 2011)	29
2.9	Current model of fundus camera non-mydriatic (Ministry of Health Diabetic Retinopathy Screening Team, 2017)	30
3.1	Research design diagram	39
3.2	Detailed phase one research design diagram	41
3.3	Detailed phase two research design diagram	43
3.4	System functional design	45
3.5	Usability testing design	47
3.6	Research study location	49
3.7	Web Application Development Process	53
3.8	Research methodology for usability components of medical web system	55
3.9	Detailed research method process	55
3.10	Identifying existing usability components phase	56
3.11	Interview session with Expert 1 at the Eye Clinic, Department of Ophthalmology, Hospital Melaka	59
3.12	Focus group discussion with the specialists at the Eye Clinic, Department of Ophthalmology, Hospital Melaka	60

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

3.13	Questionnaire session with the doctors from Eye Clinic, Department of Ophthalmology, Hospital Melaka at The Pines Melaka	64
3.14	Questionnaire session with the primary health care from Health Clinics in Melaka at Pusat Sumber dan Teknologi Pengajaran, UTeM	66
3.15	Focus group discussion for phase two with the specialists at the Eye Clinic, Department of Ophthalmology, Hospital Melaka	69
3.16	Survey conducted for phase two with the primary health cares at the Eye Clinic, Department of Ophthalmology, Hospital Melaka	71
3.17	Current problems or challenges in DR screening	75
3.18	Way of communication with the ophthalmologists on discussing DR cases	76
3.19	Limitation in current communication methods	77
3.20	Features and functions require	79
4.1	Flow of the system design	83
4.2	Homepage of DRCS	85
4.3	Interface for admin	86
4.4	Interface for specialist	87
4.5	Interface for primary health care	88
4.6	Interface for public user	89
4.7	Flow of the system development phase	90
4.8	Patient demographics	93
4.9	Patient clinical findings	94
4.10	Patient's eye details	95
4.11	Grayscale filtering and magnifier features	96
4.12	Annotation feature	97
4.13	Case forum section	99
4.14	Overall case forum results	100
4.15	Medical-based usability for web application	101
5.1	Distribution of result for high performance in solving component for medical system	136
5.2	Distribution of result for fulfill standard medical practice and embedded into routine work component for medical system	137
5.3	Distribution of result for updatability and flexibility component for medical system	138
5.4	Distribution of result for acceptance component for medical system	139
5.5	Distribution of result transparency authority component for medical system	140

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

5.6	Distribution of result for data confidentiality component for medical system	141
5.7	Distribution of result for effectiveness as a learning platform component for medical system	142
5.8	Distribution of result for easy and user friendly component for medical system	143
5.9	Distribution of result for health system compatibility component for medical system	144
5.10	Average result of usability components for medical system	145

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	Milestones	162
B	Gantt Chart	163
C	Letter of Distribution DRCS Questionnaire to Health Clinics via JKNM	164
D	Pre-Testing Questionnaire Diabetic Retinopathy Consultation	165
E	Alpha Testing (Admin) Questionnaire Diabetic Retinopathy Consultation	174
F	Alpha Testing (Specialist) Questionnaire Diabetic Retinopathy Consultation	181
G	Alpha Testing (Medical Doctor) Questionnaire Diabetic Retinopathy Consultation	190
H	Beta Testing Questionnaire Diabetic Retinopathy Consultation	201
I	Usability of Medical Web Consultation System Testing Survey	211
J	Letter of Ethical Considerations from Department of Ophthalmology, Hospital Melaka	218
K	Screenshots of Diabetic Retinopathy Consultation System (DRCS)	220
L	Usability Components of Medical Web Consultation System Verification	231
M	Questionnaire Usability Components of Medical Web Consultation System Verification	233
N	Alteration of Questionnaire Usability Components of Medical Web Consultation System Verification	239

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

UG	-	Usability Guidelines
URL	-	Uniform Resource Locator

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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.

3. 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., Noor Izhar, S.I., 2021. Web Usability Testing on Diabetic Retinopathy Consultation System. *Ingénierie des Systèmes d'Information*, 26(3), pp. 255-264. https://doi.org/10.18280/isi.260302.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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 works 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 Guannna (2020); Su (2020); Sin et al. (2019); Safdari et al. (2018); Jayapravitra 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.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA