

The copyright © of this thesis belongs to its rightful author and/or other copyright owner. Copies can be accessed and downloaded for non-commercial or learning purposes without any charge and permission. The thesis cannot be reproduced or quoted as a whole without the permission from its rightful owner. No alteration or changes in format is allowed without permission from its rightful owner.

**CONCEPTUAL MODEL FOR USABLE MULTI-MODAL
MOBILE ASSISTANCE DURING UMRAH**



**DOCTOR OF PHILOSOPHY
UNIVERSITI UTARA MALAYSIA
2017**



Awang Had Salleh
Graduate School
of Arts And Sciences

Universiti Utara Malaysia

PERAKUAN KERJA TESIS / DISERTASI
(Certification of thesis / dissertation)

Kami, yang bertandatangan, memperakukan bahawa
(We, the undersigned, certify that)

AHMED SHEIKH ABDULLAH AL-AIDAROOS

calon untuk Ijazah

PhD

(candidate for the degree of)

telah mengemukakan tesis / disertasi yang bertajuk:

(has presented his/her thesis / dissertation of the following title):

"CONCEPTUAL MODEL FOR USABLE MULTI-MODAL MOBILE ASSISTANCE DURING UMRAH"

seperti yang tercatat di muka surat tajuk dan kulit tesis / disertasi.
(as it appears on the title page and front cover of the thesis / dissertation).

Bahawa tesis/disertasi tersebut boleh diterima dari segi bentuk serta kandungan dan meliputi bidang ilmu dengan memuaskan, sebagaimana yang ditunjukkan oleh calon dalam ujian lisan yang diadakan pada : **14 Mei 2017.**

That the said thesis/dissertation is acceptable in form and content and displays a satisfactory knowledge of the field of study as demonstrated by the candidate through an oral examination held on: May 14, 2017.

Pengerusi Viva:
(Chairman for VIVA)

Assoc. Prof. Dr. Yuhanis Yusof

Tandatangan
(Signature)

Pemeriksa Luar:
(External Examiner)

Prof. Dr. Sazilah Salam

Tandatangan
(Signature)

Pemeriksa Dalam:
(Internal Examiner)

Dr. Ruzinoor Che Mat

Tandatangan
(Signature)

Nama Penyelia/Penyelia-penyelia:
(Name of Supervisor/Supervisors)

Assoc. Prof. Dr. Ariffin Abdul Mutalib

Tandatangan
(Signature)

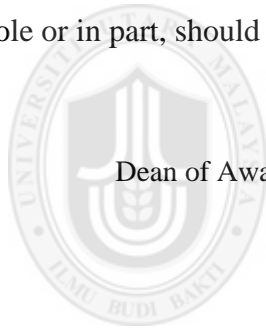
Tarikh:

(Date) May 14, 2017

Permission to Use

In presenting this thesis in fulfilment of the requirements for a postgraduate degree from Universiti Utara Malaysia, I agree that the Universiti Library may make it freely available for inspection. I further agree that permission for the copying of this thesis in any manner, in whole or in part, for scholarly purpose may be granted by my supervisor(s) or, in their absence, by the Dean of Awang Had Salleh Graduate School of Arts and Sciences. It is understood that any copying or publication or use of this thesis or parts thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to Universiti Utara Malaysia for any scholarly use which may be made of any material from my thesis.

Requests for permission to copy or to make other use of materials in this thesis, in whole or in part, should be addressed to:



Dean of Awang Had Salleh Graduate School of Arts and Sciences

UUM College of Arts and Sciences

Universiti Utara Malaysia

06010 UUM Sintok

Declaration

I declare that this thesis is my own work and has not previously been submitted in any form for another degree or diploma at any other university or other institute of tertiary education. Information derived from the published and unpublished work of others has been acknowledged in the text and a list of references is given.

Ahmed Sheikh Al-Aidaros

2017



Abstrak

Melaksanakan ibadah Umrah adalah sukar dan dijalankan dalam persekitaran yang teramat padat dengan manusia. Oleh itu, pelbagai usaha telah dijalankan bagi mengatasi kesukaran yang dihadapi oleh para Jemaah. Namun, usaha-usaha tersebut menumpu kepada memperoleh perspektif awal dan pengetahuan asas sebelum berlepas ke Mekah. Dapatan kajian awal menunjukkan usaha-usaha tersebut tidak menyokong kepelbagaian modaliti bagi interaksi pengguna. Kini keupayaan pengkomputeran dalam telefon pintar membolehkan ia menyokong keperluan harian manusia dalam pelbagai aspek kehidupan. Sehubungan itu, jumlah pengguna telefon pintar telah meningkat dengan mendadak dalam dekad yang lalu. Justeru, kajian ini menetapkan matlamat untuk mencadangkan sebuah model konsep yang lengkap bagi alat bantu mudah alih pelbagai-modaliti yang berguna ketika menjalankan Umrah dan dinamakan Pembantu Mudah Alih Pelbagai-modaliti ketika Umrah (MMA-U). Demikianlah, empat objektif dibentuk, dan Design Science Research Methodology telah diadaptasi. Bagi kebolegunaan MMA-U, Systematic Literature Review (SLR) telah menemukan 10 ciri: kebergunaan, kadar kesilapan, kesederhanaan, kebolehpercayaan, mudah digunakan, keselamatan, fleksibiliti, kebolehcapaian, sikap, dan kebolehterimaan. Manakala, analisis kandungan dan perbandingan menghasilkan lima komponen yang membentuk model konsep MMA-U: struktur, komposisi kandungan, prinsip reka bentuk, pendekatan pembangunan, teknologi, dan teori reka bentuk dan kebolegunaan. Seterusnya, MMA-U telah dinilai dan diterima dengan baik oleh 15 orang pakar. Kemudiannya, MMA-U telah digabungkan ke dalam sebuah prototaip yang dinamakan Mutawif Peribadi Digital (PDM). PDM dibangunkan dan digunakan sebagai alatan asas dalam ujian pengguna di lapangan. Dapatan ujian menunjukkan bahawa PDM membantu pelaksanaan ibadah Umrah dan berjaya memenuhi keperluan dan harapan Jemaah. Selain itu, Jemaah didapati berpuas hati dan yakin bahawa mereka memerlukan PDM. Malah mereka akan mencadangkan PDM kepada rakan mereka. Ini merupakan kesan daripada perasaan selamat dan selesa apabila menggunakan PDM semasa melaksanakan Umrah. Kesimpulannya, sumbangan teoritikal; model konsep MMA-U; boleh dijadikan panduan bagi membangunkan alat bantu mudah alih ketika melaksanakan ibadah Umrah.

Kata kunci: Ciri-ciri kebolegunaan, Pelbagai-modaliti, Personal Digital Mutawwif (PDM), Alat bantu mudah alih Umrah, Mod arahan.

Abstract

Performing Umrah is very demanding and to be performed in very crowded environments. In response to that, many efforts have been initiated to overcome the difficulties faced by pilgrims. However, those efforts focus on acquiring initial perspective and background knowledge before going to Mecca. Findings of preliminary study show that those efforts do not support multi-modality for user interaction. Nowadays the computational capabilities in mobile phones enable it to serve people in various aspects of daily life. Consequently, the mobile phone penetration has increased dramatically in the last decade. Hence, this study aims to propose a comprehensive conceptual model for usable multimodal mobile assistance during Umrah called Multi-model Mobile Assistance during Umrah (MMA-U). Thus, four (4) supporting objectives are formulated, and the Design Science Research Methodology has been adopted. For the usability of MMA-U, Systematic Literature Review (SLR) indicates ten (10) attributes: usefulness, errors rate, simplicity, reliability, ease of use, safety, flexibility, accessibility, attitude, and acceptability. Meanwhile, the content and comparative analysis result in five (5) components that construct the conceptual model of MMA-U: structural, content composition, design principles, development approach, technology, and the design and usability theories. Then, the MMA-U has been reviewed and well-accepted by 15 experts. Later, the MMA-U was incorporated into a prototype called Personal Digital Mutawwif (PDM). The PDM was developed for the purpose of user test in the field. The findings indicate that PDM facilitates the execution of Umrah and successfully meet pilgrims' needs and expectations. Also, the pilgrims were satisfied and felt that they need to have PDM. In fact, they would recommend PDM to their friends, which mean that use of PDM is safe and suitable while performing Umrah. As a conclusion, the theoretical contribution; the conceptual model of MMA-U; provides guidelines for developing multimodal content mobile applications during Umrah.

Keywords: Usability attributes, Multimodality, Personal Digital Mutawwif (PDM), Umrah mobile assistance, Instruction mode.

Acknowledgement

All praise goes to Allah the Almighty

First and foremost, I would like to express my sincere appreciation to my supervisor Assoc. Prof. Dr. Ariffin Abdul Mutalib. I am too grateful for his compassionate guidance, advices, and useful comments throughout this study. Without his encouragement, scholarly support and commitment of time, this study could not have been accomplished by now.

Secondly, I am sincerely indebted to my parents who have moulded part of my vision and have taught me the excellent morals that do really matter in life. Undoubtedly, without their warm-hearted love, support, and encouragement, this study would have never been accomplished too. My thanks should go also to my beloved wife for her emotional support, camaraderie, and the caring she granted. Indeed, she sacrificed so much for my Ph.D. study to come true; therefore, I can hardly find appropriate words to express my deep gratitude. Thanks should go to my lovely daughter Huda and my charming son Mohammed who sacrificed much of their childhood great time for the sake of their fathers' study comes true.

Thirdly, I would like to extend my gratitude to my family members who have given me the opportunity to pursue my academic career. Especially, I would like to thank my dear only sister for her unconditional and understanding support and to my dear brother for his compassionate encouragement.

Fourthly, being a member of Al-Ahqaf University assistant lecturing staff, I would like to express my deep gratitude to Al-Ahqaf University. Without its financial and incorporeal support I would not be able to complete my Ph.D. degree.

Last but not least, I must thank the Universiti Utara Malaysia for the unlimited facilities it offers, especially the honorable lecturers, staff members and colleagues of School of Multimedia Technology and Communication (SMMTC).

Finally, I would like to dedicate this work to the memory of my grandfathers as well as grandmothers.

Ahmed Sheikh Al-Aidaros

Dedication

This thesis is dedicated to **the almighty Allah**, the most beneficent, the most merciful for **His** benevolence and mercies towards me and my family,

And to

My father, Sheikh Abdullah Al-Aidaros

My mother, Zainab Aidaros Al-Kaff

My wife, Zainab Abo Baker Bosri

My daughter, Huda

My son, Mohammed

My brother, sister, and friends, for their sacrifices, love and prayers

With love

Ahmed Sheikh Al-Aidaros (2017)



UUM
Universiti Utara Malaysia

Table of Contents

Permission to Use.....	i
Declaration	ii
Abstrak	iii
Abstract	iv
Acknowledgement.....	v
Dedication	vi
Table of Contents	vii
List of Tables.....	xvi
List of Figures	xviii
List of Appendices	xxi
List of Abbreviations.....	xxii
List of Publications and Awards	xxiv
CHAPTER ONE INTRODUCTION	1
1.1 Introduction.....	1
1.1.1 Electronic Book (e-book).....	2
1.1.1.1 Audio Book	3
1.1.1.2 Mobile Book (m-book).....	3
1.1.2 Umrah and Hajj.....	4
1.1.3 Usability.....	6
1.2 Motivation of Study	9
1.3 Initial Study.....	11
1.3.1 Findings	11
1.3.1.1 Findings of Interview	12
1.3.1.2 Findings of Prototype Evaluation.....	13
1.3.1.2.1 Experts Evaluation	13
1.3.1.2.2 Users Evaluation	14
1.3.2 The Initial Study Resolution.....	15
1.4 Problem Statement	16
1.5 Research Questions	20
1.6 Research Objectives	21
1.7 Research Scope	21
1.8 Research Significance	23

1.9 Research Theoretical Framework	24
1.10 Terminologies and Operational Definition	26
1.11 Thesis Structure.....	27
CHAPTER TWO LITERATURE REVIEW	30
2.1 Introduction.....	30
2.2 Conceptual Model	30
2.2.1 The Definitions of Conceptual Model.....	31
2.2.2 The Benefits of Conceptual Model.....	32
2.2.2.1 Highlighting the Buried and Hidden Aspects	32
2.2.2.2 Shifting the Conversation.....	32
2.2.2.3 Distant Connections or Relation Drawing	32
2.2.2.4 Usage of Active Verbs	33
2.2.2.5 Non-Essential Concepts Elimination	33
2.2.2.6 Collections of Ideas in Context.....	33
2.2.3 Components of Conceptual Model.....	34
2.3 Interaction Design and User Experience.....	35
2.4 Multimodality and Multi-Modal	36
2.4.1 Multimodal Related Studies	37
2.4.1.1 Critiques on Existing Models of Umrah or Hajj	42
2.4.2 Multimodal interaction.....	43
2.4.3 Multi-modal Input.....	46
2.4.4 Multi-modal Input\Output	47
2.4.5 The Ambiguity in Multimodal Interpretation.....	49
2.5 Usability	50
2.6 The Importance of Usability	52
2.7 Usability Factors	53
2.7.1 User (The Human Factor).....	53
2.7.1.1 Experience	54
2.7.1.2 Domain Knowledge.....	55
2.7.1.3 Cultural Background	55
2.7.1.4 Disability	56
2.7.1.5 Age and Gender.....	56
2.7.2 Task.....	57

2.7.3 Environment.....	58
2.7.4 Technology.....	58
2.8 Usability Characteristics (Attributes).....	59
2.8.1 Efficient:	60
2.8.2 Effective.....	61
2.8.3 Engaging.....	62
2.8.4 Error Tolerant.....	63
2.8.5 Easy to Learn (Learnability).....	64
2.9 Usable Design's Principles	65
2.9.1 Usefulness (Value and Relevance)	65
2.9.2 Consistency and Compatibility	66
2.9.3 Simplicity and Explicitness	67
2.9.4 Communication and Feedback.....	67
2.9.5 Error Prevention and Handling	68
2.9.6 Efficiency.....	69
2.9.7 Workload Reduction	70
2.9.8 Usability Judgment.....	70
2.9.9 Technology Transferring	71
2.10 Usability Testing or Evaluation	71
2.10.1 Mobile Usability Evaluation Frameworks.....	72
2.10.1.1 Coursaris and Kim (2011).....	73
2.10.1.2 Treeratanapon (2012)	74
2.10.1.3 Rosnita et al. (2013).	75
2.10.2 When to Conduct a Usability Test?.....	76
2.10.3 Where to Conduct a Usability Test?.....	77
2.10.3.1 Laboratory Usability Testing	77
2.10.3.2 Field Usability Testing	78
2.10.3.3 Remote Usability Testing.....	79
2.10.3.4 Comparison between Laboratory, Field, and Remote Usability Testing.....	79
2.10.4 How to Perform a Usability Testing (Testing Methods)?	80
2.11 Information Architecture.....	81
2.11.1 Definitions of IA.....	82
2.11.2 Components of IA	84

2.11.2.1 Organization Systems.....	84
2.11.2.2 Labelling Systems	87
2.11.2.3 Navigation Systems.....	88
2.11.2.4 Search Systems.....	90
2.11.2.5 Metadata and Controlled Vocabularies	91
2.11.3 Styles of IA.....	92
2.11.4 Principles of IA.....	92
2.11.5 An Effective IA.....	95
2.11.5.1 Context or Business.....	95
2.11.5.2 Content	96
2.11.5.3 Users.....	96
2.11.6 Steps of Creating Effective IA	97
2.11.6.1 Defining the Objectives of Key Stakeholders	97
2.11.6.2 Identifying the Audiences Objectives and Expectations.....	98
2.11.6.3 Defining the Content Areas.....	98
2.11.6.4 Organizing the Content Areas	99
2.11.6.5 Creating the Product Map	99
2.11.6.6 Outlining the Navigation Structure	100
2.11.6.7 Labeling the Content Areas.....	100
2.11.6.8 Creating Wireframes	100
2.12 User Interface Architecture	101
2.12.1 Affinity: Fetching Some Objects to the Life via a Well Visual Design	101
2.12.2 Assistance: Offer Proactive Aid.....	102
2.12.3 Availability: All Objects must be Available at Anytime.....	103
2.12.4 Encouragement: Making Actions are Reversible and Predictable	103
2.12.5 Familiarity: Build on the Prior Knowledge of Users	104
2.12.6 Obviousness: Keep Controls and Objects Intuitive and Visible.....	104
2.12.7 Personalization: Allow the User to Personalize their Interface	104
2.12.8 Safety: Keep the User a Way form Troubles.....	105
2.12.9 Satisfaction: Create the Sense of Progress and Achievement Pleasure	105
2.12.10 Simplicity: Do Not Relinquish Usability for Functionality	105
2.12.11 Support: Enable the User to Control the System	106
2.12.12 Versatility: Support Alternate Interaction Approaches	106
2.13 Summary	106

CHAPTER THREE RESEARCH METHODOLOGY	109
3.1 Introduction	109
3.2 Research Design.....	109
3.2.1 Justification of Using DSRM in this Study.....	111
3.3 The Research Methodology Phases	112
3.4 The First Phase: Problems Awareness	113
3.4.1 The Research Gap Identification.....	115
3.4.2 Interview and Observation.....	116
3.4.3 Literature Review	116
3.4.4 Experts' Consultation.....	117
3.4.5 Preliminary Study	119
3.5 The Second Phase: Suggestion	120
3.5.1 Modes and Modals Selection	121
3.5.2 Systematic Literature Review	122
3.5.2.1 Planning.....	123
3.5.2.2 Conducting the Review	124
3.5.2.3 Reporting the Review.....	125
3.6 The Third Phase: Development.....	125
3.6.1 Artifacts' Designing	126
3.6.2 Constructing the Model.....	126
3.6.3 Hypothesizing	129
3.6.4 Prototyping	130
3.7 The Fourth Phase: Evaluation	130
3.7.1 Experts' Review.....	131
3.7.2 Usability Evaluation	132
3.7.3 Instrument Design.....	133
3.7.3.1 Goal Question Metric Approach (GQM)	135
3.7.4 The Instrument Goodness Testing: Pilot Study.....	136
3.7.5 Sampling.....	137
3.7.6 Data Collection	140
3.8 The Fifth Phase: Conclusion	141
3.8.1 Data Analysis	142
3.9 Summary	143
CHAPTER FOUR CONCEPTUAL DESIGN MODEL OF MMA-U	144

4.1 Overview	144
4.2 Usability Attributes	147
4.2.1 Reporting the Review.....	149
4.3 Mode and Models Selection.....	152
4.3.1 Interaction Modes.....	152
4.3.1.1 GPS Mode	153
4.3.1.2 Voice Commands Mode.....	154
4.3.2 Models Selection	154
4.4 Model Construction.....	158
4.4.1 Structural Components (SCs).....	158
4.4.2 Content Composition Components (CCCs)	164
4.4.2.1 Interaction Design	165
I. Modalities	165
II.Presentation styles	167
III.Instruction modes.....	167
IV.Flow patterns	168
4.4.2.2 Human Entities	169
4.4.3 Principles of Usable Design	174
4.4.4 Development Approach.....	179
4.4.5 Technology.....	181
4.5 Model Validation	183
4.5.1 Review Instrument and Procedures	185
4.5.2 Findings of Expert Review	186
4.6 Revision of the Conceptual Design Model of MMA-U.....	191
4.6.1 Correction of the Grammar and Spelling Errors	191
4.6.2 Theories and principles	192
4.6.3 Highlight the Uniqueness of the Application.....	192
4.6.4 Clarification of Terminologies	193
4.6.5 Focus on Male Pilgrims Only.....	194
4.6.6 Add Smartwatch as a Recommended Devices in Technologies	194
4.7 Summary	196
CHAPTER FIVE PROTOTYPE DESIGN AND DEVELOPMENT	198
5.1 Overview	198
5.2 The Development of PDM.....	198

5.2.1 Pre-Production phase.....	199
5.2.1.1 Contents Gathering in Arabic Language.....	199
5.2.1.2 Contents Validation.....	200
5.2.1.3 Contents Translation to Malay Language	200
5.2.1.4 Translation Validation.....	201
5.2.1.5 Contents Organization.....	201
5.2.1.6 Labeling.....	202
5.2.1.7 Navigation Specification	203
5.2.1.8 Layout Sketching.....	205
5.2.1.9 Editing	206
5.2.1.10 Quality Measure	206
5.2.2 Production phase.....	206
5.2.2.1 Audio files preparation.....	207
5.2.2.2 Images preparation	207
5.2.2.3 Icons preparation	208
5.2.2.4 Interface design	208
5.2.2.5 Actual contents inserting.....	208
5.2.2.6 Multimedia elements inserting.....	208
5.2.2.7 Navigation organization	208
5.2.2.8 Insert transitions	208
5.2.2.9 Editing	209
5.2.2.10 Quality measure.....	209
5.2.3 Post-Production phase.....	209
5.2.3.1 Editing	210
5.2.3.2 Functionality Assurance	210
5.2.3.3 Packaging	210
5.2.3.4 Publishing.....	211
5.3 The Personal Digital Mutawwif	211
5.3.1 Opening Segment	211
5.3.2 The Contents Segment	213
A. Interaction Design.....	213
i.Modalities	213
ii.The Presentation Styles.....	216

iii. The Interaction Modes	217
iv. Flow Patterns	220
B. Human Entities	220
5.3.3 The Closing Segment	221
5.4 Summary	221
CHAPTER SIX USER EXPERIENCE.....	223
6.1 Overview	223
6.2 Instrument Design	223
6.3 Pilot Study: Instrument Goodness Testing of Q-U3MA.....	227
6.3.1 Face and Content Validity	227
6.3.1.1 Subject.....	228
6.3.1.2 Findings of Content Validity Test.....	228
6.3.2 Instrument Reliability.....	229
6.3.2.1 Subject.....	229
6.3.2.2 Findings of the Reliability Test.....	230
6.3.3 Construct Validity (Factor Analysis).....	231
6.3.3.1 Subject.....	232
6.3.3.2 Findings of Factor Analysis	232
6.4 Experimental Study: Measuring Usability	235
6.4.1 Demographic Background.....	236
6.4.2 Data Distribution.....	238
6.4.2.1 Normality Test.....	239
6.4.3 General Findings.....	240
6.4.3.1 The Usefulness of PDM	241
6.4.3.2 Error Rate in PDM	242
6.4.3.3 The Simplicity of PDM.....	244
6.4.3.4 The Reliability of PDM.....	245
6.4.3.5 PDM Ease of Use	246
6.4.3.6 Safety in PDM.....	247
6.4.3.7 The Flexibility of PDM.....	248
6.4.3.8 The Contents Accessibility in PDM.....	250
6.4.3.9 The User's Attitude	251
6.4.3.10 The Acceptability of PDM	252

6.5 Hypotheses Testing	253
6.5.1 Testing H ₁	254
6.5.2 Testing H ₂	255
6.5.3 Testing H ₃	255
6.5.4 Testing H ₄	256
6.5.5 Testing H ₅ , H ₆ and H ₇	257
6.6 Summary	259
CHAPTER SEVEN DISCUSSION AND CONCLUSION.....	261
7.1 Overview	261
7.2 Research Question 1	261
7.3 Research Question 2	263
7.4 Research Question 3	264
7.5 Aim and Objectives: Revisit	265
7.6 Research Contribution.....	266
7.6.1 Addressing the Difficulties Faced by Malaysian Pilgrims	266
7.6.2 Conceptual Model for Multimodal Mobile Assistance during Umrah	268
7.6.3 Providing a Usable Multimodal Mobile Assistance during Umrah	269
7.6.4 Providing a New Usability Evaluation Framework	270
7.7 Limitation and Recommendation	270
7.7.1 The Incorporation of the Sensor Based Interaction Mode	271
7.7.2 Providing PDM in Various other Languages	271
7.7.3 Perception	271
7.7.4 Gather Data from Users from Other Countries	272
7.8 Future Research.....	273
7.9 Conclusion	274
REFERENCES.....	275

List of Tables

Table 1.1 The Objectives of the Initial Study and the Used Methods	11
Table 1.2 The Most Difficult Rituals in Hajj and the Reasons	12
Table 1.3 Descriptive Statistics for All Items in User Interface Satisfaction Questionnaire..	13
Table 1.4 General Outcomes of Data	14
Table 1.5 New users VS Used users	15
Table 2.1 Meta-analysis of the Related Studies in Multimodality and Interactive Multimedia	41
Table 2.2 The Usability Test Benefits for Users and Developers	53
Table 2.3 A Simple Comparison between the Usability Testing Environments.....	80
Table 2.4 The Information Structure Patterns	86
Table 2.5 The Information Structure Patterns That Will be Used in This Study.....	87
Table 2.6 The Information Architecture Principles	93
Table 3.1 The Findings of Peers and Experts Discussion in Conferences.....	121
Table 3.2 The List of Selected Journals in HCI and Usability	124
Table 3.3 Five-Point Likert Scale Format.....	135
Table 4.1 The Criteria of Human Participants in UCD.....	147
Table 4.2 The Previous SLRs	148
Table 4.3 The List of Selected Journals Titles in HCI and Usability	149
Table 4.4 The Original List of Usability Measures in the Previous SLRs.....	149
Table 4.5 The Collapsed List of Usability Measures	150
Table 4.6 Justification of Selecting Desktop Models for Hajj and Umrah (DT)	155
Table 4.7 List of the Selected MA from Google Paly with Justification.....	156
Table 4.8 Details of the Structural Components	159
Table 4.9 Components Categories Index	160
Table 4.10 Structural Components for DTs	160
Table 4.11 Structural Components for MAs	161
Table 4.12 Summary of Structural Component of Existing Models.....	162
Table 4.13 The Proposed Structural Component of MMA-U after Analysis	162
Table 4.14 The Proposed Structural Component of MMA-U after Experts Revision.....	163
Table 4.15 Content Composition Components for DTs	170
Table 4.16 Content Composition Component for MAs	171
Table 4.17 MMA-U Content Composition Components Based Comparative Analysis .	172
Table 4.18 The Proposed Content Composition Components of MMA-U.....	173

Table 4.19 The Proposed Design Principles of MMA-U.....	175
Table 4.20 The Demographic Profiles of Experts.....	184
Table 4.21 Frequency of Responses from Expert Review.....	186
Table 4.22 Further remarks from the expert reviews.....	189
Table 6.1 List of Standard Questionnaires that the Instrument Items were adapted from.....	225
Table 6.2 The First Draft of Adapted Instrument Items.....	225
Table 6.3 Reliability Test before Factor Analysis.....	231
Table 6.4 The Results of KMO Test and Bartlett's Test of Sphericity.....	233
Table 6.5 The Results of Factor Loading for each Item in the Q-U3MA.....	233
Table 6.6 Reliability Test.....	235
Table 6.7 The Demographic Profile of Respondents.....	237
Table 6.8 The Research Hypothesis.....	238
Table 6.9 The Skewness, Kurtosis, and Z-score Values for All Attributes.....	240
Table 6.10 The Usefulness of PDM.....	242
Table 6.11 The Errors Rate in PDM.....	243
Table 6.12 The Simplicity of PDM.....	244
Table 6.13 The Reliability of PDM.....	246
Table 6.14 The Ease of Use of PDM.....	246
Table 6.15 The Safety of PDM.....	248
Table 6.16 The Flexibility of PDM.....	249
Table 6.17 The Accessibility in PDM.....	250
Table 6.18 The User's Attitude.....	252
Table 6.19 The Acceptability of PDM.....	252
Table 6.20 The t-Test Results for Users' Attitude in Different Groups.....	255
Table 6.21 The t-Test Results for Users' Acceptance in Different Groups.....	255
Table 6.22 Correlations of Effectiveness and Users' Satisfaction in PDM.....	256
Table 6.23 Correlations of Efficiency and Users' Satisfaction in PDM.....	256
Table 6.24 Responses Classification.....	257
Table 6.25 Descriptive Statistics of Effectiveness, Efficiency, and Satisfaction of PDM.....	258
Table 7.1 The List of Selected Journals Titles in HCI and Usability.....	262

List of Figures

Figure 1.1: Research and Theoretical Framework	25
Figure 2.1: Snapshots of Web-Based Hajj Simulation Software	38
Figure 2.2: Snapshots of V-Hajj	38
Figure 2.3: An Example of Multimodal Integration System	44
Figure 2.4: The Input Fusion and Output Fission Processes in Multimodal Application.....	46
Figure 2.5: Example of the Input and Output in Multi-modal System	46
Figure 2.6: The Important of Usability and Utility	51
Figure 2.7: The Percentage Increase in Cost Based on Development Phase	52
Figure 2.8: The Multifaceted Characteristics of Usability or the 5 Es	59
Figure 2.9: The Mobile Usability Framework	73
Figure 2.10: Model of Usability Dimension Base-on Four Context Factors	76
Figure 2.11: The Disciplines Included in IA.....	84
Figure 2.12: Popular Navigation Schemes layout.....	89
Figure 2.13: The Information Ecology or the Three Circles of IA	95
Figure 3.1: The Basis of Methodology	110
Figure 3.2: The Design Science Research Methodology	111
Figure 3.3: The Research Methodology phases	113
Figure 3.4: The First Phase in Methodology (Problems Awareness)	114
Figure 3.5: The Procedure of Formulating a Worthy Problem Statement	115
Figure 3.6: The Second Phase of Methodology (Suggestion).....	120
Figure 3.7: The Steps of SLR	123
Figure 3.8: The Third Phase of Methodology (Development).....	126
Figure 3.9: The Iteration Loop in the Model Construction Process.....	128
Figure 3.10: The Fourth Phase of Methodology (Evaluation)	131
Figure 3.11: The Goal Question Metric Approach	136
Figure 3.12: A Visual Representation of Selecting the Simple in This Study.....	140
Figure 3.13: The Steps of Data Collection.....	141
Figure 3.14: The Fourth Phase of Methodology (Evaluation)	142
Figure 4.1: Summary of activities in constructing the conceptual model of MMA-U.....	144
Figure 4.2: Summary of Participants in Construction Process of the Proposed Model.....	146
Figure 4.3: Summary of How the 27 Usability Measures collapsed to ten only	152
Figure 4.4: Classification Condition	162

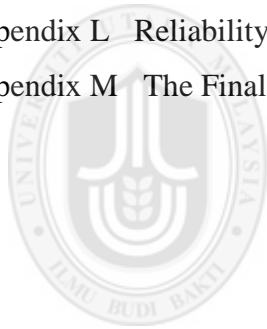
Figure 4.5: The Proposed Model for SC of MMA-U	164
Figure 4.6: The Proposed Model for Content Composition Component of MMA-U... 174	
Figure 4.7: The Proposed Design Principles of MMA-U	179
Figure 4.8: The First Draft of the Conceptual Design Model of MMA-U	182
Figure 4.9: Relevancy of the Proposed Elements in the Components of MMA-U.. 187	
Figure 4.10: Understanding of the Proposed Design Principles in MMA-U.....	188
Figure 4.11: Clarity of Terminologies	188
Figure 4.12: Connections and Flows, and Readability of the Conceptual Design Model of MMA-U.....	188
Figure 4.13: Revised Conceptual Design Model of MMA-U.....	195
Figure 5.1: Pre-Production Phase.....	199
Figure 5.2: The Flowchart of Hajj Simulation Program	201
Figure 5.3: The Flowchart of PDM.....	202
Figure 5.4: Examples of the Contents' Labels in PDM	203
Figure 5.5: Liner Navigational Style for Next-and-Next Task Sequences in PDM	204
Figure 5.6: Hybrid Navigational Style in PDM	204
Figure 5.7: Layout Sketching of PDM.....	205
Figure 5.8: Production Phase	207
Figure 5.9: Post-Production Phase	209
Figure 5.10: The Welcoming Screen of PDM (Opening Segment)	212
Figure 5.11: The Main Menu of PDM (Mode Selection)	212
Figure 5.12: Audios in PDM.....	214
Figure 5.13: The Visual Elements in PDM.....	215
Figure 5.14: The Instruction-Based Style in PDM	216
Figure 5.15: The Demonstration Style in PDM	217
Figure 5.16: The Contents organization and Labelling in PDM.....	218
Figure 5.17: Applying the Navigation Principles in PDM.....	218
Figure 5.18: The Oral Instruction Mode in PDM	219
Figure 5.19: The GPS Instruction Mode in PDM	220
Figure 5.20: The Flow Patterns in PDM	220
Figure 5.21: Closing Segment in PDM.....	221
Figure 6.1: Summary of the Instrument Development Approach.....	224
Figure 6.2: The Proposed Constructs for Measuring Usability of PDM	224
Figure 6.3: The Demographic Profile of Respondents.....	237

Figure 6.4: The Usefulness of PDM	242
Figure 6.5: The Errors Rate in PDM.....	243
Figure 6.6: The Simplicity of PDM	245
Figure 6.7: The Reliability of PDM	245
Figure 6.8: The Ease of Use of PDM.....	247
Figure 6.9: The Safety of PDM.....	248
Figure 6.10: The Flexibility of PDM	249
Figure 6.11: The Accessibility in PDM	251
Figure 6.12: The User's Attitude	251
Figure 6.13: The Acceptability of PDM	253



List of Appendices

Appendix A	Questionnaire for User Interface Satisfaction of Mobile Dua and Zikr for Hajj (MDZ4H).....	301
Appendix B	Questionnaire for Application Usability.....	302
Appendix C	A Brief Overview of the Usability Testing Methods	304
Appendix D	User Interface of the Selected Mobile Applications	307
Appendix E	Sample of Consent Form for Expert.....	311
Appendix F	Sample of Experts' Invitation Email and Response.....	312
Appendix G	Sample of Appointment Letter for Expert.....	313
Appendix H	The Instrument of Expert Review	314
Appendix I	Books Cover Pictures (The Sources of Contents).....	316
Appendix J	The First Draft of Q-U3MA	317
Appendix K	The Instrument for Face and Content Validity of Q-U3MA.....	321
Appendix L	Reliability Test Results.....	325
Appendix M	The Final Version of Q-U3MA	329



UUM
Universiti Utara Malaysia

List of Abbreviations

CAS	College of Arts and Sciences
CCCs	Content Composition Components
CS	Computer Science
DSR	Design Science Research
DSRM	Design Science Research Methodology
DT	Desktop Models
GPS	Global Positioning System
GQM	Goal Question Metric
HCI	Human Computer Interaction
IA	Information Architecture
IEHF	Institute of Ergonomics and Human Factors
IOS	International Organization for Standardization
IS	Information Systems
IT	Information Technology
ITM	Iterative Triangulation Methodology
J2ME	Java 2 Platform Micro Edition
KSA	Kingdom of Saudi Arabia
MA	Mobile Applications
MCMC	Malaysian Communications and Multimedia Commission
MDZ4H	Mobile Dua and Zikir for Hajj
MMA-U	Multimodal Mobile Assistant during Umrah
MMI	Multi Modal Interface
MMS	Multimedia Messaging Service
MSC	Multimedia Super Corridor
PDM	Personal Digital Mutawwif
QUIS	Questionnaire for User Interaction Satisfaction
SCs	Structural Components
SDK	Software Development Kit
SE	Software Engineering
SLR	Systematic Literature Review
SMMTC	School of Multimedia Technology and Communication

SMS	Short Message Service
SOC	School of Computing
SPSS	Statistical Package for the Social Sciences
SRS	Simple Random Sample
SUMI	Software Usability Measurement Inventory
TNOU	Tamil Nadu Open University
UCD	User Centered Design
UIA	User Interface Architecture
UUM	Universiti Utara Malaysia
W3C	World Wide Web Consortium
XML	Extensible Mark-up Language



List of Publications and Awards

Journals:

- **Al-Aidarooos, A. S.**, Abdul Nasir, Z., & Che Mat, R. (2013). Development of Mobile Dua and Zikr for Hajj (MDZ4H). *TELKOMNIKA Indonesian Journal of Electrical Engineering*, 11(5), 2723-2730.
- **Al-Aidarooos, A. S.**, & Ariffin, A. M. (2015). Design of the Usability Measurement Tool for Multimodal Mobile Applications. *Jurnal Teknologi*, 77(29), 41–47.
- **Al-Aidarooos, A. S.**, & Ariffin, A. M. (2015). Personal Digital Mutawwif: A Multi-Modal Mobile Hajj Assistance Using the Location Based Services. *Jurnal Teknologi*, 77(29), 15–20.

Conference Proceedings:

- **Al-Aidarooos, A. S.**, Ariffin, A. M., Abdul Nasir, Z., & AbuHassira, M. M. (2013). *Users' Perceptions and Usability of Mobile Dua and zikrFor Hajj (MDZ4H)*. Paper presented at the First International Conference on Applied Sciences, ICAS2013, Gaza, Palestine.
- **Al-Aidarooos, A. S.**, Ariffin, A. M., & Abdul Nasir, Z. (2013). *A Study of Users' Perceptions Toward Mobile Dua and Zikr For Hajj (MDZ4H) Usability*. Paper presented at the International Conference on Advances in IT for the Holy Quran and its Sciences (NOORIC2013), Al-Madinah Al-Munawwarah, Saudi Arabia.
- **Al-Aidarooos, A. S.**, Ariffin, A. M., & Abdul Nasir, Z. (2014). *Speech Recognition Incorporation in a Multiple Input Modality Mobile Application for Pilgrims (MDZ4H)*. Paper presented at the 2nd International Conference on Islamic Applications in Computer Science And Technology (IMAN2014), Amman, Jordan.
- **Al-Aidarooos, A. S.**, & Ariffin, A. M. (2014). *Multiple Input Modality Mobile Application for Pilgrims*. Paper presented at the The Knowledge Management International Conference (KMICe2014).

Presentation:

- 1) **Event** International Conference on Interactive Digital Media
Year\Venue 2012, Bayview Hotel, Langkawi, Malaysia
Title Development of Mobile Dua and Zikir For Hajj (MDZ4H)
Resercher **Al-Aidarooos, A. S.**, Abdul Nasir, Z., and Che Mat, R.
- 2) **Event** Creative Industry International Conference
Year\Venue 2015, EDC Hotel, UUM, Sintok, Kedah, Malaysia
Title Design of the Usability Measurement Tool for Multimodal Mobile Applications
Resercher **Al-Aidarooos, A. S.**, and Ariffin, A. M.

- 3) **Event** Creative Industry International Conference
Year/Venue 2015, EDC Hotel, UUM, Sintok, Kedah, Malaysia
Title Personal Digital Mutawwif: A Multi-Modal Mobile Hajj Assistance Using the Location Based Services.
Resercher **Al-Aidarooos, A. S.**, and Ariffin, A. M.

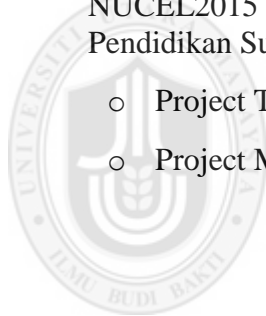
Awards:

• **Best Paper Award**

- International Conference on Interactive Digital Media (CIIC2015) 4 - 5 October 2015.
- EDC Hotel, UUM, Sintok, Kedah, Malaysia
- Title: Design of the Usability Measurement Tool for Multimodal Mobile Applications
- Authors: **Al-Aidarooos, A. S.**, and Ariffin, A. M.

• **Silver Medal** at Invention, Innovation, and Design on E-Learning at NUCEL2015 (National University Carnival on E-Learning), Universiti Pendidikan Sultan Idris (UPSI), Tanjung Malim, Perak, Malaysia.

- Project Title: Doa Dan Zikir Untuk Haji.
- Project Members: **Al-Aidarooos, A. S.**, and Ariffin, A. M.



Universiti Utara Malaysia

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Since the invention of the Mobile phone by John F. Mitchell and Dr. Martin Cooper in 1973, the aspiration began to enhance and improve the mobile phone to be more than a tool weighing around 1kg that was able to make phone calls only. Great enhancement and advancement were made over the mobile phone such as reducing the weight (McLaren, Wright, Parkinson, & Jackson, 1999), improving the capabilities (Jin & Von Zedtwitz, 2008), and upgrading the service quality level. Since 2000, a lot of services have been provided by the mobile phone service providers such as the Short Message Service (SMS) and the Multimedia Messaging Service (MMS). Today, many more utilities have been added by mobile phone manufactures such as address book, calendar, planner, games, and calculator. Later, the blending of the characteristics of Personal Digital Assistant (PDA) and features of hand phones bring new powerful capabilities into mobile phones, in which it is called Smartphone (Aram, Troiano, & Pasero, 2012).

According to Nusca (2009), smartphone's computing abilities are very high. Those computational capabilities allows smartphones to carry out professional services and applications such as Global Positioning System (GPS) functionalities, E-Banking, email clients, and web browser besides to the typical functions like contacts, calendar, diary, notepad, and voice recorder (Charlesworth, 2009). Nowadays, smartphones can deal with more than personal communication and data services (Chen, 2011).

Statistics have shown the existence of more than 3.3 billion mobile connections around the world, and from day to day this number constantly increases (Rosnita,

The contents of
the thesis is for
internal user
only

REFERENCES

- Abdul-Hamed, K. R. (2009). *Arabic Language Programs in Malaysia Need More Scientific Attention*. Paper presented at the 5th Asia Association of Computer Assisted Language Learning International Conference (ASIACALL), University Putra Malaysia, Malaysia.
- Abran, A., Khelifi, A., Suryan, W., & Seffah, A. (2003). Usability Meanings and Interpretations in ISO Standards. *Software Quality Journal*, 11(4), 325-338.
- Abudena, M. A., & Hameed, S. A. (2015). Toward a Novel Module for Computerizing Quran's Full-Script Writing. *International Journal of Computer Systems*, 2(11), 469-474.
- Adèr, H. J., & Mellenbergh, G. J. (2008). *Advising on Research Methods: A Consultant's Companion* (1st ed.). Huizen, Netherlands: Johannes van Kessel Publishing.
- Ahmad, A. T. (2010). Museum Preservation and Conservation of Cultural Heritage in the Northern Region of Peninsula Malaysia. *SARI: Jurnal Alam dan Tamadun Melayu*, 28(2), 3-34.
- Ahmed, A., Al-Khraissha, L., Hart, S., Asfour, Z., Elsharif, F., & Nasreddin, A. (2017). *The Muslim 500: The World's 500 Most Influential Muslims*. Amman, Jordan: The Royal Islamic Strategic Studies Centre.
- Al-Aidaros, A. S. A. (2012). *Mobile Dua and Zikr for Hajj (MDZ4H)*. Master of Science (Information Technology), Universiti Utara Malaysia, Sintok, Kedah, Malaysia.
- Al-Aidaros, A. S. A., Abdul Nasir, Z., & Che Mat, R. (2013). Development of Mobile Dua and Zikr for Hajj (MDZ4H). *TELKOMNIKA Indonesian Journal of Electrical Engineering*, 11(5), 2723-2730.
- Al-Rabie, A. (2016). 3.7 Million Umrah Pilgrims Arrive. *Okaz: Saudi Gazette* Retrieved 02/07/2016, from <http://saudigazette.com.sa/saudi-arabia/3-7-million-umrah-pilgrims-arrive/>
- Al-Siddiqui, A. W. (2009). Major Haj Plan Caters for 2.5 Million Pilgrims Retrieved 16/05/2013, from <http://www.saudigazette.com.sa/index.cfm?method=home.regcon&contentid=2009110853908>
- Alaşehir, O., Sezgin, E., & Özkan, S. (2013). The Role of Gender in Pharmacists Attitudes Towards E-pharmacy Application. *Procedia-Social and Behavioral Sciences*, 83, 1111-1115.
- Albert, W., & Tullis, T. (2013). *Measuring the User Experience: Collecting, Analyzing, and Presenting Usability Metrics* (2nd ed.). San Francisco, USA: Morgan Kaufmann.
- Alcantud, F., Coret, J., Jimenez, E., Marquez, S., & Moreno, F. (2014). Analysis of Research on Web Usability and Cognitive Disability. *International Journal of Advanced Computer Science*, 4(5), 223-229.
- Alghamdi, A. S., Al-Badi, A. H., Alroobaea, R. S., & Mayhew, P. J. (2013). A Comparative Study of Synchronous and Asynchronous Remote Usability Testing Methods. *International Review of Basic and Applied Sciences*, 1(3), 61-97.
- Ali, I. (2012). *Hajj for People With Psychiatric Problems*: Xlibris Corporation.
- Alibaba. (2012). 2012 Newest Duaa Hajj /Umrah Player Retrieved 05-05-2013, from http://www.alibaba.com/product-gs/550706390/2012_newest_duaa_hajj_umrah_player.html
- Allen, J. F., & Ferguson, G. (1997). Actions and Events in Interval Temporal Logic.

- In O. Stock (Ed.), *Spatial and Temporal Reasoning* (pp. 205-245): Kluwer Academic Publishers.
- Ally, M. (2009). *Mobile learning: Transforming the delivery of education and training*: Au Press.
- Alsrhid, A. M. M. (2013). Difficulties Face by Foreign Students in Learning Arabic Language Programs for Non-Native Speakers (Evaluation Study). *Journal of Education and Practice*, 4(2), 160-170.
- Alzaza, N. S. (2012). *Mobile Learning Services Acceptance Model Among Malaysian Higher Education Students*. Doctoral dissertation, Universiti Utara Malaysia, Sintok, Kedah.
- American Heritage Dictionary, A. (2011). *The American Heritage® Dictionary of the English Language* (5th ed.): Houghton Mifflin Company.
- Anad, M. M. (2009). *A Mobile Application to Guide Hajj Pilgrims*. Master of Science (Information Technology), Universiti Utara Malaysia, Sintok, Kedah, Malaysia.
- Anand, R. (2015). *Principles Of Software Project Management* (1st ed.). New Delhi, India: S K Kataria & Sons.
- Andre, M., Popescu, V., Shaikh, A., Medl, A., Marsic, I., Kulikowski, C., & Flanagan, J. (1998). *Integration of Speech and Gesture for Multimodal Human-Computer Interaction*. Paper presented at the 2nd International Conference on Cooperative Multimodal Communication, Tilburg, Netherlands.
- Arabian Business. (2015). Number of Umrah Visas to Treble in 2016. *Arabian Business*. Retrieved 25/10/2015, from <http://www.arabianbusiness.com/number-of-umrah-visas-treble-in-2016-608718.html>
- Aram, S., Troiano, A., & Pasero, E. (2012). *Environment Sensing Using Smartphone*. Paper presented at the Sensors Applications Symposium (SAS), Galveston, Texas, USA.
- Ardakan, M. A., & Mohajeri, K. (2009). Applying Design Research Method to IT Performance Management: Forming a New Solution. *Journal of Applied Sciences*, 9(7), 1227-1237.
- Ariffin, A. (2009). *Conceptual Design of Reality Learning Media (RLM) Model Based on Entertaining and Fun Constructs*. Doctoral dissertation, Universiti Utara Malaysia, Sintok, Kedah, Malaysia.
- Ariffin, A., & Norshuhada, S. (2009). *Conceptual design model of Reality Learning Media (RLM)*. Paper presented at the International Conference e-Society (IADIS).
- Arnhold, M., Quade, M., & Kirch, W. (2014). Mobile Applications for Diabetics: A Systematic Review and Expert-Based Usability Evaluation Considering the Special Requirements of Diabetes Patients Age 50 Years or Older. *Journal of medical Internet research*, 16(4), e104.
- Aronowitz, H., Li, M., Toledo-Ronen, O., Harary, S., Geva, A., Ben-David, S., . . . Pankanti, S. (2014). *Multi-Modal Biometrics for Mobile Authentication*. Paper presented at the International Joint Conference on Biometrics (IJCB).
- ASTM. (2014). *Form and Style for ASTM Standards*. Conshohocken, USA: International American Society for Testing & Materials.
- Azham, H., & Ferneley, E. (2008). *Usability Metric for Mobile Application: A Goal Question Metric (GQM) Approach*. Paper presented at the 10th International Conference on Information Integration and Web-based Applications & Services.

- Azham, H., & Kutar, M. (2009). Usability Metric Framework for Mobile Phone Application. *PGNet*.
- Bailey, J. E., & Pearson, S. W. (1983). Development of a Tool for Measuring and Analyzing Computer User Satisfaction. *Management science*, 29(5), 530-545.
- Bakker, M., & Wicherts, J. M. (2014). Outlier Removal, Sum Scores, and the Inflation of the Type I Error Rate in Independent Samples t-Tests: The Power of Alternatives and Recommendations. *Psychological methods*, 19(3), 409-427.
- Balentine, B., & Morgan, D. P. (1999). *How to build a speech recognition application: a style guide for telephony dialogues*: Enterprise Integration Group.
- Banga, C., & Weinhold, J. (2014). *Essential Mobile Interaction Design: Perfecting Interface Design in Mobile Apps* (1st ed.). New Jersey, USA: Pearson Education.
- Barker, I. (2005). What is Information Architecture? Retrieved from Step Two Designs website: http://www.steptwo.com.au/files/kmc_whatisinfoarch.pdf
- Barnum, C. M. (2002). *Usability Testing and Research*. New York, USA: Longman, Pearson Education, Inc.
- Barnum, C. M. (2011). *Usability Testing Essentials: Ready, Set... Test!* (1st ed.). Burlington, USA: Morgan Kaufmann Elsevier.
- Basaeed, E., Berri, J., Zemerly, M., & Benlamri, R. (2007). Web-Based Context-Aware M-Learning Architecture. *International Journal Interactive Mobile Technologies*, 1(1), 5-10.
- Bastien, J. (2010). Usability Testing: A Review of Some Methodological and Technical Aspects of the Method. *International Journal of Medical Informatics*, 79(4), e18-e23.
- Bateman, J. (2008). *Multimodality and Genre: A Foundation for the Systematic Analysis of Multimodal Documents*. London, UK: Palgrave Macmillan.
- Batra, R. K., Brunel, F., & Chandran, S. (2009). When Good Looks Kill: An Examination of Consumer Response to Visually Attractive Product Design. *Advances in Consumer Research*, 8(1), 252-253.
- Bauchhage, C. (2002). *Evaluating Integrated Speech-and Image Understanding*. Paper presented at the 4th IEEE international conference on Multimodal interfaces.
- Becker, S. A., & Mottay, F. E. (2001). A Global Perspective on Web Site Usability. *Software, IEEE*, 18(1), 54-61.
- Belanche, D., Casaló, L. V., & Guinalú, M. (2012). Website Usability, Consumer Satisfaction and the Intention to Use a Website: The Moderating Effect of Perceived Risk. *Journal of retailing and consumer services*, 19(1), 124-132.
- Bellik, Y. (2001). *Technical Requirements for a Successful Multimodal Interaction*. Paper presented at the International Workshop on Information Presentation and Natural Multimodal Dialogue, Verona, Italy.
- Bergman, E. (2000). *Information Appliances and Beyond: Interaction Design for Consumer Products* (1st ed.). San Francisco, USA: Morgan Kaufmann Pub.
- Bernama. (2016). Malaysia's Haj Quota Remains At 22,320 - TH. *Malaysian Digest* Retrieved 15-01-2017, from <http://malaysiandigest.com/news/602812-malaysia-s-haj-quota-remains-at-22-320-th.html>
- Bertoa, M. F., Troya, J. M., & Vallecillo, A. (2006). Measuring the Usability of Software Components. *Journal of Systems and Software*, 79(3), 427-439.
- Bevan, N. (2009). *What Is the Difference between the Purpose of Usability and User Experience Evaluation Methods*. Paper presented at the EXAM 09 Workshop, INTERACT.

- Bias, R. G., & Mayhew, D. J. (2005). *Cost-Justifying Usability: An Update for the Internet Age* (2nd ed.). San Francisco, USA: Morgan Kaufmann.
- Biel, B., Grill, T., & Gruhn, V. (2010). Exploring the Benefits of the Combination of a Software Architecture Analysis and a Usability Evaluation of a Mobile Application. *Journal of Systems and Software*, 83(11), 2031-2044.
- Biswas, P. (2012). An Inclusive Approach to Develop Web TV Applications. *Journal of Assistive Technologies*, 6(3), 221-225.
- Biswas, P., Duarte, C., Langdon, P., Almeida, L., & Jung, C. (2013). *A Multimodal End-2-End Approach to Accessible Computing*. New York, USA: Springer.
- Blair-Early, A., & Zender, M. (2008). User Interface Design Principles for Interaction Design. *Design Issues*, 24(3), 85-107.
- Blumendorf, M., Roscher, D., & Albayrak, S. (2010). *Dynamic User Interface Distribution for Flexible Multimodal Interaction*. Paper presented at the International Conference on Multimodal Interfaces and the Workshop on Machine Learning for Multimodal Interaction.
- Böhm, V., & Wolff, C. (2014). *A Review of Empirical Intercultural Usability Studies*. Paper presented at the 3rd International Conference on Design User Experience, and Usability. Theories, Methods, and Tools for Designing the User Experience, DUXU 2014, Crete, Greece.
- Bordens, K. S., & Abbott, B. B. (2013). *Research And Design Methods: A Process Approach* (9th ed.). New York, USA: McGraw-Hill Humanities.
- Bouma, G. D., & Atkinson, G. B. J. (1996). *A Handbook of Social Science Research* (2ed ed.). New York, USA: Oxford University Press.
- Bourguet, M.-L. (2003). *Designing and Prototyping Multimodal Commands*. Paper presented at the Ninth IFIP TC13 International Conference on Human-Computer Interaction, INTERACT, Zurich, Switzerland.
- Brancheau, J. C., Schuster, L., & March, S. T. (1989). Building and Implementing an Information Architecture. *ACM SIGMIS Database*, 20(2), 9-17.
- Brooke, J. (1996). SUS-A Quick and Dirty Usability Scale. *Usability evaluation in industry*, 189(194), 4-7.
- Brown, B., & Chalmers, M. (2003). *Tourism and mobile technology*. Paper presented at the Eighth European Conference on Computer-Supported Cooperative Work, ECSCW 2003, Helsinki, Finland.
- Brown, D. (2009). In Which a Concept Model Makes Me Giddy Retrieved 17/05/2014, from http://www.uie.com/articles/concept_models
- Brown, D. (2010). Eight Principles of Information Architecture. *Bulletin of the American Society for Information Science and Technology*, 36(6), 30-34.
- Brown, P. (2003). *Information Architecture with XML: A Management Strategy* (1st ed.). West Sussex, England: John Wiley & Sons.
- Burgess, T. F. (2001). *A General Introduction to the Design of Questionnaires for Survey Research* (1st ed.). Leeds, UK: University of Leeds.
- Burns, C. M., Ho, G., & Arrabito, G. R. (2011). *Mapping Ecologically to Modalities*. Paper presented at the 55th Annual Meeting of the Human Factors and Ergonomics Society, Las Vegas, Nevada, USA.
- Byrom, G. (1998). If You Can't Read It Then Audio Read It. *The United Kingdom Literacy Association (Reading)*, 32(2), 3-7.
- Calcinelli, D., & Mainguenaud, M. (1994). Cigales, a Visual Query Language for a Geographical Information System: The User Interface. *Journal of Visual Languages & Computing*, 5(2), 113-132.
- Caldiera, V., & Rombach, H. D. (1994). The Goal Question Metric Approach.

- Encyclopedia of software engineering*, 2(1994), 528-532.
- Card, S. K., Moran, T. P., & Newell, A. (1980). The Keystroke-Level Model for User Performance Time with Interactive Systems. *Communications of the ACM*, 23(7), 396-410.
- Caschera, M. C. (2009). Interpretation Methods and Ambiguity Management in Multimodal Systems. In P. Grifoni (Ed.), *Handbook of Research on Multimodal Human Computer Interaction and Pervasive Services: Evolutionary Techniques for Improving Accessibility* (1st ed., pp. 87-102). Hershey, Pennsylvania, USA: IGI Global.
- Caschera, M. C., Ferri, F., & Grifoni, P. (2007a). *An Approach for Managing Ambiguities in Multimodal Interaction*. Paper presented at the Workshops on the Move to Meaningful Internet Systems (OTM), Vilamoura, Portugal.
- Caschera, M. C., Ferri, F., & Grifoni, P. (2007b). Multimodal Interaction Systems: Information and Time Features. *International Journal of Web and Grid Services*, 3(1), 82-99.
- Caschera, M. C., Ferri, F., & Grifoni, P. (2008). The Management Of Ambiguities. In F. Ferri (Ed.), *Visual Languages for Interactive Computing: Definitions and Formalizations* (1st ed., pp. 129-140). Hershey, Pennsylvania, USA: IGI Global.
- Caschera, M. C., Ferri, F., & Grifoni, P. (2013). InteSe: An Integrated Model for Resolving Ambiguities in Multimodal Sentences. *Systems, Man, and Cybernetics: Systems, IEEE Transactions on*, 43(4), 911-931.
- Chai, J. Y., Hong, P., & Zhou, M. X. (2004). *A Probabilistic Approach to Reference Resolution in Multimodal User Interfaces*. Paper presented at the 9th International Conference on Intelligent User Interfaces, Funchal, Portugal.
- Chalil Madathil, K., & Greenstein, J. S. (2011). *Synchronous Remote Usability Testing: A New Approach Facilitated By Virtual Worlds*. Paper presented at the Conference on Human Factors in Computing Systems (SIGCHI), Vancouver, British Columbia, Canada.
- Chan, F. T., & Chan, H. K. (2008). A Survey on Reverse Logistics System of Mobile Phone Industry in Hong Kong. *Management Decision*, 46(5), 702-708.
- Charlesworth, A. (2009). The Ascent of Smartphone. *Engineering & technology*, 4(3), 32-33.
- Chen, C.-M., & Lin, S.-T. (2014). Assessing Effects of Information Architecture of Digital Libraries on Supporting E-learning: A Case Study on the Digital Library of Nature & Culture. *Computers & Education*, 75(2014), 92-102.
- Chen, X. (2011). *Smartphone Virtualization: Status and Challenges*. Paper presented at the International Conference on Electronics, Communications and Control (ICECC), Ningbo, China.
- Chen, Y. (2010). Dictionary Use and EFL Learning. A Contrastive Study of Pocket Electronic Dictionaries and Paper Dictionaries. *International Journal of Lexicography*, 23(3), 275-306.
- Chin, J. P., Diehl, V. A., & Norman, K. L. (1988). *Development of an Instrument Measuring User Satisfaction of the Human-Computer Interface*. Paper presented at the International Conference on Human Factors in Computing Systems Washington, DC, USA.
- Chin, W. W., Marcolin, B. L., & Newsted, P. R. (2003). A Partial Least Squares Latent Variable Modeling Approach for Measuring Interaction Effects: Results from a Monte Carlo Simulation Study and an Electronic-Mail Emotion/Adoption Study. *Information systems research*, 14(2), 189-217.

- Chittaro, L. (2011). *Designing Visual User Interfaces for Mobile Applications*. Paper presented at the 3rd ACM symposium on Engineering interactive computing systems (SIGCHI), Pisa, Italy.
- Choe, P., & Schumacher, D. (2015). Influence of Different Types of Vibrations on Technical Acceptance of a Mobile Game Aiming for Hedonic Satisfaction. *International Journal of Human-Computer Interaction*, 31(1), 33-43.
- Chou, E. (2002). *Redesigning a Large and Complex Website: How to Begin, and a Aethod for Success*. Paper presented at the 30th annual ACM conference on User services (SIGUCCS), Providence, Rhode Island, USA.
- Christine Roy, M., Dewit, O., & Aubert, B. A. (2001). The Impact of Interface Usability on Trust in Web Retailers. *Internet research*, 11(5), 388-398.
- Coakes, S. J., & Ong, C. (2011). *SPSS Version 18.0 for Windows. Analysis without Anguish*. Milton, Australia: John Wiley and Sons Australia Ltd.
- Coakes, S. J., & Steed, L. (2009). *SPSS: Analysis Without Anguish Using Spss Version 14.0 for Windows*. New York, NY, USA: John Wiley & Sons, Inc.
- Cockton, G. (2013). Usability Evaluation. In D. R. F. Soegaard M. (Ed.), *The Encyclopedia of Human-Computer Interaction* (2nd ed.). Aarhus, Denmark The Interaction Design Foundation. Retrieved from https://www.interaction-design.org/encyclopedia/usability_evaluation.html.
- Constantine, L. L., & Lockwood, L. (2002). Process Agility and Software Usability: Toward Lightweight Usage-Centered Design. *Information Age*, 8(8), 1-10.
- Cooper, A., & Reimann, R. (2003). About Face 2.0: The Essentials of Interaction Design. *Information Visualization*, 3(2004), 223-225.
- Cooper, D., Emory, C., & Schindler, P. (2003). *Business Research Methods* (8th ed.). Boston, USA: McGraw Hill Higher Education.
- Costa, D., & Duarte, C. (2011). *Adapting Multimodal Fission to User's Abilities*. Paper presented at the 6th International Conference on Universal Access in Human-Computer Interaction (Design for All and eInclusion), Orlando, Florida, USA.
- Coursaris, C. K., & Kim, D. (2006). *A Qualitative Review of Empirical Mobile Usability Studies*. Paper presented at the 12th Americas Conference On Information Systems (AMCIS2006), Acapulco, Mexico.
- Coursaris, C. K., & Kim, D. J. (2011). A Meta-Analytical Review of Empirical Mobile Usability Studies. *Journal of usability studies*, 6(3), 117-171.
- Craig Tomlin, W. (2009, Mar 17, 2014). Usability and Concept Models Retrieved 02/05/2014, from <http://www.usefulnessability.com/usability-and-concept-models/>
- Crinnion, J. (1992). *Evolutionary Systems Development: A Practical Guide to the Use of Prototyping within a Structured Systems Methodology*. Cambridge, MA: Perseus Publishing.
- D'Ulizia, A., Ferri, F., & Grifoni, P. (2010). Generating Multimodal Grammars for Multimodal Dialogue Processing. *IEEE Transactions on Systems, Man, and Cybernetics - Part A: Systems and Humans*, 40(6), 1130-1145.
- D'Ulizia, A. (2009). Exploring Multimodal Input Fusion Strategies. *The Handbook of Research on Multimodal Human Computer Interaction and Pervasive Services: Evolutionary Techniques for Improving Accessibility*, 34-57.
- Dansereau, D. F., & Simpson, D. D. (2009). A Picture is Worth a Thousand Words: The Case for Graphic Representations. *Professional Psychology: Research and Practice*, 40(1), 104-110.
- Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, And User Acceptance of Information Technology. *MIS quarterly*, 319-340.

- De Waal, G. A., & Knott, P. (2013). Innovation Tool Adoption and Adaptation in Small Technology-Based Firms. *International Journal of Innovation Management*, 17(03), 1-19.
- De Witte, N., Gobbens, R., De Donder, L., Dury, S., Buffel, T., Schols, J., & Verté, D. (2013). The Comprehensive Frailty Assessment Instrument: Development, Validity and Reliability. *Geriatric Nursing*, 34(4), 274-281.
- Denyer, D., & Tranfield, D. (2015). *Doing a Literature Review in Business and Management*: Sage.
- Department of Health and Human Services, U. (2014). Usability Evaluation Basics Retrieved 30/11/2014, from <http://www.usability.gov/what-and-why/usability-evaluation.html>
- DePue, T. L., & Hein, D. A. (2006). Flexible Touch-Sense Switch. USA: Google Patents.
- Deris, Z. Z., Hasan, H., Ab Wahab, M., Sulaiman, S. A., Naing, N., & Othman, N. H. (2010). The Association between Pre-Morbid Conditions and Respiratory Tract Manifestations amongst Malaysian Hajj Pilgrims. *Tropical Biomedicine*, 27(2), 294-300.
- Desrosiers, R. E. (1996). *Electronic Books as Teaching Supplements*. Paper presented at the 26th Annual Conference Proceedings of Frontiers in Education, Salt Lake, Utah, USA.
- DeVon, H. A., Block, M. E., Moyle-Wright, P., Ernst, D. M., Hayden, S. J., Lazzara, D. J., . . . Kostas-Polston, E. (2007). A Psychometric Toolbox for Testing Validity and Reliability. *Journal of Nursing scholarship*, 39(2), 155-164.
- Dey, A. K., & Mankoff, J. (2005). Designing mediation for context-aware applications. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 12(1), 53-80.
- Dhillon, G., Stahl, B. C., & Baskerville, R. (2009). *Information Systems--Creativity and Innovation in Small and Medium-Sized Enterprises*. Paper presented at the International Conference on Advances in Information and Communication Technology (IFIP), Guimaraes, Portugal.
- Dillon, A. (2002). Information Architecture in JASIST: Just Where Did We Come From? *JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE AND TECHNOLOGY*, 53(10), 821-823.
- Dissanayake, D. (2013). Research, Research Gap and the Research Problem *MPRA* (pp. 5). Munich, Germany: University Library of Munich
- Dix, A., Finlay, J., Abowd, G. D., & Beale, R. (2003). *Human-Computer Interaction* (3rd ed.). Harlow Culver, England: Pearson Education Limited.
- Djamasbi, S., Siegel, M., & Tullis, T. (2011). *Visual Hierarchy and Viewing Behavior: An Eye Tracking Study*. Paper presented at the 14th International Conference on Human-Computer Interaction: Design and Development Approaches, Orlando, Florida, USA.
- Duh, H. B.-L., Tan, G. C., & Chen, V. H.-h. (2006). *Usability Evaluation for Mobile Device: A Comparison of Laboratory and Field Tests*. Paper presented at the 8th Conference on Human-Computer Interaction with Mobile Devices and Services, Espoo, Finland.
- Dwivedi, S., & Dubey, S. K. (2014). Measurement of Web Usability: An Approach. *International Journal of Computer and Communication System Engineering (IJCCSE)*, 1(2), 59-65.
- Eco, U. (1979). *A Theory of Semiotics* (1st ed. Vol. 217). Bloomington, Indiana, USA: Indiana University Press.

- Efendioğlu, A. (2012). Courseware Development Model (CDM): The Effects of CDM on Primary School Pre-Service Teachers' Achievements and Attitudes. *Computers & Education*, 59(2), 687-700.
- Effken, J. A. (2003). An Organizing Framework for Nursing Informatics Research. *Computers Informatics Nursing*, 21(6), 316-325.
- Elias, N. F., Ghani, R. A., & Mohd, M. (2014). A Comprehensive Instrument for Measuring Knowledge Management System Satisfaction. *Journal on Computing (JoC)*, 2(4), 93-102.
- Ellis, T. J., & Levy, Y. (2008). Framework of Problem-Based Research: A Guide for Novice Researchers on the Development of a Research-Worthy Problem. *Informing Science: The International Journal of an Emerging Transdiscipline*, 11(1), 17-33.
- Embley, D. W., & Thalheim, B. (2012). *Handbook of Conceptual Modeling: Theory, Practice, and Research Challenges* (1st ed.). New York, USA: Springer.
- Eskridge, T. C., Still, D., & Hoffman, R. R. (2014). Principles for Human-Centered Interaction Design, Part 1: Performative Systems. *Intelligent Systems, IEEE*, 29(4), 88-94.
- Ezra, S. (2015). Saudi to Increase Indonesia's Hajj Quota by 10,000, Jakarta Says. *Jakarta Globe* Retrieved 09/10/2015, from <http://jakartaglobe.id/news/saudi-increase-indonesias-hajj-quota-10000-jakarta-says/>
- Falge, E., Baldocchi, D., Olson, R., Anthoni, P., Aubinet, M., Bernhofer, C., . . . Dolman, H. (2001). Gap Filling Strategies for Defensible Annual Sums of Net Ecosystem Exchange. *Agricultural and forest meteorology*, 107(1), 43-69.
- Fang, X., & Holsapple, C. W. (2007). An Empirical Study of Web Site Navigation Structures' Impacts on Web Site Usability. *Decision support systems*, 43(2), 476-491.
- Farooq, U., & Zirkler, D. (2010). *API Peer Reviews: A Method for Evaluating Usability of Application Programming Interfaces*. Paper presented at the CSCW '10, ACM conference on Computer supported cooperative work, Savannah, Georgia, USA
- Fathnan, A. A., Wibowo, C. P., Hidayat, N. F., Marenda, D. A., & Ferdiana, R. (2010). *Web-Based Hajj Simulation Software Learning Hajj through Interactive Software*. Paper presented at the International Conference on Information and Communication Technology for the Muslim World (ICT4M 2010), Jakarta, Indonesia.
- Ferri, F., & Paolozzi, S. (2009). Analyzing Multimodal Interaction. In P. Grifoni (Ed.), *Multimodal Human Computer Interaction and Pervasive Services* (1st ed., pp. 19-33). Hershey, Pennsylvania, USA: IGI Global.
- Ferri, F., & Rafanelli, M. (2005). Geopql: A Geographical Pictorial Query Language That Resolves Ambiguities in Query Interpretation. In S. Spaccapietra & E. Zimányi (Eds.), *Journal on Data Semantics III* (Vol. 3534 pp. 50-80). New York, USA: Springer.
- Feser, J. (2010). mLearning Is Not eLearning on A Mobile Device. Retrieved from <http://floatlearning.com/2010/04/mlearning-is-not-elearning-on-a-mobile-device/>
- Floridi, L. (2005). Is Semantic Information Meaningful Data? *Philosophy and Phenomenological Research*, 70(2), 351-370.
- Floridi, L. (2010). *Information: A Very Short Introduction* (1st ed.). New York, USA: Oxford University Press.
- Folch-Lyon, E., & Trost, J. F. (1981). Conducting Focus Group Sessions. *Studies in*

- family planning*, 12(12), 443-449.
- Følstad, A., & Hornbæk, K. (2010). Work-Domain Knowledge in Usability Evaluation: Experiences with Cooperative Usability Testing. *Journal of Systems and Software*, 83(11), 2019-2030.
- Ford, A. (2000). *Modeling the Environment: An Introduction To System Dynamics Modeling Of Environmental Systems* (1st ed.). Washington, D.C, USA: Island Press.
- Forest Interactive. (2013). Latest IEMR's Mobile Operator Forecast – Malaysia Mobile Statistics Retrieved 05/05/2013, from <http://www.forest-interactive.com/malaysia-2/>
- Forsyth, M. (2014). *Collins English Dictionary* (12th ed.). New York, USA: Harper Collins Publishers.
- Gaber, M. M., Zaslavsky, A., & Krishnaswamy, S. (2005). Mining Data Streams: A Review. *ACM Sigmod Record*, 34(2), 18-26.
- Ganga, A. M. (2009). *Conceptual-to-Object Schema Mapping*. Doctoral dissertation, Hamburg University of Science and Technology, Hamburg, Germany.
- Garson, G. D. (2012). *Testing Statistical Assumptions*. Asheboro, NC, USA: Statistical Associates Publishing.
- Geldard, F. A. (1957). Adventures in Tactile Literacy. *American Psychologist*, 12(3), 115.
- General Authority for Statistics KSA, G. (2016). Hajj Statistics 1437 AH Retrieved 15/01/2017, from http://hajmap.stats.gov.sa/hajen_1437.pdf
- George, C. (2008). *User-Centred Library Websites: Usability Evaluation Methods* (1st ed.). Wetney, UK: Chandos Publishing (Oxford) Limited.
- Gerhardt-Powals, J. (1996). Cognitive Engineering Principles for Enhancing Human-Computer Performance. *International Journal of Human-Computer Interaction*, 8(2), 189-211.
- Gericke, A. (2009). *Analysis of Design Science Research Patterns from an Engineering Perspective*. Paper presented at the IADIS International Conference Information Systems, Barcelona, Spain.
- Giberson, G. A., & Moriarty, T. A. (2010). *What We Are Becoming: Developments in Undergraduate Writing Majors* (1st ed.). Logan, Utah, USA: Utah State University Press.
- Giurgiu, I., Riva, O., Juric, D., Krivulev, I., & Alonso, G. (2009). Calling the Cloud: Enabling Mobile Phones as Interfaces to Cloud Applications *Middleware 2009* (pp. 83-102): Springer.
- Graham, R., & Carter, C. (2000). Comparison of speech input and manual control of in-car devices while on the move. *Personal Technologies*, 4(2-3), 155-164.
- Gregory, R. L. (Ed.). (2004). *The Oxford companion to the mind* (2ed ed.). New York, NY, US: Oxford University Press.
- Grudin, J. (2011). Human-computer interaction. *Annual review of information science and technology*, 45(1), 367-430.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis* (7th ed.). Upper Saddle River, New Jersey, USA: Pearson Prentice Hall.
- Haj Ministry Portal. (2015). General Statistics in Home Page Retrieved 30/12/2015, from <http://www.haj.gov.sa/en-us/SitePages/Default.aspx>
- Hameed, S. A. (2010). *ICT to serve Hajj: Analytical study*. Paper presented at the International Conference on Computer and Communication Engineering (ICCCE2010), International Islamic University Malaysia, Kuala Lumpur, Malaysia.

- Haneef, S. S. S., & Hashim, A. M. (2009). *Ibadat (Worship) in Islam: A Comparative Jurisprudential Analysis* (1st ed.). Selangor, Malaysia: IIUM Press.
- Harmain, H. M., El Khatib, H., Saeed, N., & Aljohar, B. (2004). *Web Services-Based Hajj Information System*. Paper presented at the International Conference on Information & Computer Science (ICICS2004), Dhahran, Saudi Arabia.
- Haron, S. C., Ahmad, I. S., Mamat, A., & Mohamed, I. H. A. (2010). Understanding Arabic-speaking skill learning strategies among selected Malay learners: A case-study at the International Islamic University Malaysia (IIUM). *Contemporary Issues in Education Research (CIER)*, 3(8), 9-20.
- Harper, B. D., & Norman, K. L. (1993). *Improving User Satisfaction: The Questionnaire for User Interaction satisfaction Version 5.5*. Paper presented at the 1st Annual Mid-Atlantic Human Factors Conference, Virginia Beach, Virginia, USA.
- Hasegawa, S., Sato, K., Matsunuma, S., Miyao, M., & Okamoto, K. (2005). Multilingual disaster information system: information delivery using graphic text for mobile phones. *AI & SOCIETY*, 19(3), 265-278.
- Hasimah, H. M., Muhammad Rafie, H. M. A., & Muhammad Dzulhilmi, A. (2016). *M-HAJJ DSS: A Mobile Decision Support System for Hajj Pilgrims*. Paper presented at the 3rd International Conference on Computer and Information Sciences (ICCOINS), Kuala Lumpur, Malaysia.
- Hasimah, H. M., Muhammad Rafie, H. M. A., Nuraini, A. R., Zurinahni, Z., Wahidah, H., Omar, A. M., . . . Abdul Rhaffor, H. M. (2013). *M-Umrah: An Android-Based Application to Help Pilgrims in Performing Umrah*. Paper presented at the International Conference on Advanced Computer Science Applications and Technologies (ACSAT), Sarawak, Malaysia.
- Hayden, J., Keegan, M., Kardong-Edgren, S., & Smiley, R. A. (2014). Reliability and validity testing of the Creighton Competency Evaluation Instrument for use in the NCSBN National Simulation Study. *Nursing education perspectives*, 35(4), 244-252.
- Haynes, S. N., Richard, D., & Kubany, E. S. (1995). Content Validity in Psychological Assessment: A Functional Approach to Concepts and Methods. *Psychological assessment*, 7(3), 238-247.
- Heller, E. J. (2012). *Why You Hear What You Hear: An Experiential Approach to Sound, Music, and Psychoacoustics* (1st ed.). New Jersey: Princeton University Press.
- Hendriks, D., Schiffelers, R. R., Hüfner, M., & Sonntag, C. (2011). *A Transformation Framework for the Compositional Interchange Format for Hybrid Systems*. Paper presented at the 18th International Federation of Automatic Control (IFAC2011) World Congress, Milano, Italy.
- Henry, S., & Kafura, D. (1981). Software Structure Metrics Based on Information Flow. *IEEE Transactions on Software Engineering*, SE-7(5), 510-518.
- Hertzum, M., Clemmensen, T., Hornbæk, K., Kumar, J., Shi, Q., & Yammiyavar, P. (2011). Personal Usability Constructs: How People Construe Usability across Nationalities and Stakeholder Groups. *International Journal of Human-Computer Interaction*, 27(8), 729-761.
- Hestenes, D. (1997). *Modeling Methodology for Physics Teachers*. Paper presented at the Proceedings of ICUPE (AIP Conference Proceedings), Maryland, USA.
- Hevner, A., & Chatterjee, S. (2010). *Design Research in Information Systems: Theory and Practice* (1st ed. Vol. 22). New York, USA: Springer

- Hevner, A., March, S. T., Park, J., & Ram, S. (2004). Design Science in Information Systems Research. *MIS quarterly*, 28(1), 75-105.
- Himdi, T. F., & Sandhu, R. S. (1997). *Lattice-Based Models for Controlled Sharing Of Confidential Information in the Saudi Hajj System*. Paper presented at the Proceedings of the 13th Annual Computer Security Applications Conference, Washington, DC, USA.
- Hobbs, R. J., & Norton, D. A. (1996). Towards A Conceptual Framework for Restoration Ecology. *Restoration ecology*, 4(2), 93-110.
- Hoffer, J. A., George, J. F., & Valacich, J. S. (2013). *Modern Systems Analysis and Design* (7th ed.). New Jersey, USA: Prentice Hall.
- Holzinger, A. (2014). Lecture 12 Methodology for Information Systems: System Design, Usability, and Evaluation. In A. Holzinger (Ed.), *Biomedical Informatics: Discovering Knowledge in Big Data* (pp. 501-545): Springer.
- Holzinger, A., & Errath, M. (2007). Mobile Computer Web-Application Design in Medicine: Some Research Based Guidelines. *Universal Access in the Information Society*, 6(1), 31-41.
- Honold, F., Schüssel, F., & Weber, M. (2012). *Adaptive Probabilistic Fission for Multimodal Systems*. Paper presented at the Proceedings of the 24th Australian Computer-Human Interaction Conference, Melbourne, VIC, Australia.
- Hum, N. J., Chamberlin, P. E., Hambright, B. L., Portwood, A. C., Schat, A. C., & Bevan, J. L. (2011). A Picture is Worth a Thousand Words: A Content Analysis of Facebook Profile Photographs. *Computers in Human Behavior*, 27(5), 1828-1833.
- Hunyadi, L., Bertók, K., Nemeth, T. E., Szekrényes, I., Abuczki, Á., Nagy, G., . . . Bódog, A. (2011). *The Outlines of a Theory and Technology of Human-Computer Interaction As Represented In the Model of the Hucomtech Project*. Paper presented at the 2nd International Conference on Cognitive Infocommunications (CogInfoCom2011), Budapest, Hungary.
- IBM. (2001). *IBM Ease of Use: User Interface Architecture* (2nd ed.). Dallas, Texas, USA: International Business Machines Corporation.
- Iding, M., Klemm, E., Auernheimer, B., & Crosby, M. (2002). *Guidelines for Designing Evaluations of Web-Based Instructional Materials*. Paper presented at the 46th Hawaii International Conference on System Sciences, Maui, Hawaii, USA.
- Ismail, N., & O'Brien, E. (2008). *Enabling Multimodal Interaction in Web-Based Personal Digital Photo Browsing*. Paper presented at the International Conference on Computer and Communication Engineering (ICCCE2008), Kuala Lumpur, Malaysia.
- ISO 9241. (1998). *ISO 9241-11: Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs): Part 11: Guidance on Usability*: International Organization for Standardization.
- Istepanian, R., Laxminarayan, S., & Pattichis, C. S. (2006). *M-Health: Emerging Mobile Health Systems* (1st ed.). Berlin, Germany: Springer.
- Jackson, S. (2015). *Research Methods and Statistics: A Critical Thinking Approach* (5th ed.). New York, USA: Cengage Learning.
- Jamil, G. L. (2013). *Rethinking the Conceptual Base for New Practical Applications in Information Value and Quality* (1st ed.). Hershey, Pennsylvania, USA: IGI Global.
- Jaworski, B. J., Stathakopoulos, V., & Krishnan, H. S. (1993). Control Combinations

- in Marketing: Conceptual Framework and Empirical Evidence. *Journal of Marketing*, 57(1), 57-69.
- Jepsen, A. L., & Eskerod, P. (2009). Stakeholder Analysis in Projects: Challenges in Using Current Guidelines in the Real World. *International Journal of Project Management*, 27(4), 335-343.
- Jick, T. D. (1979). Mixing Qualitative and Quantitative Methods: Triangulation in Action. *Administrative Science Quarterly*, 24(4), 602-611.
- Jin, J., & Von Zedtwitz, M. (2008). Technological Capability Development in China's Mobile Phone Industry. *Technovation*, 28(6), 327-334.
- Johnson, J., & Henderson, A. (2002). Conceptual Models: Begin by Designing What to Design. *interactions*, 9(1), 25-32.
- Johnson, K. (2011). *Audience Use of New Media Applications on NPR. Org: An Exploratory Study*. Doctoral dissertation, Florida State University, Tallahassee, Florida, USA.
- Jones, D. (2005). Voice recognition: a new assessment tool? *Technology, Pedagogy and Education*, Vol. 14, No. 3, 2005, 14(3), 413-427.
- Jordan, P. W. (1998). *An Introduction to Usability* (1st ed.). Gunpowder Square, London, UK: Taylor & Francis Ltd.
- Jordan, P. W., Thomas, B., McClelland, I. L., & Weerdmeester, B. (1996). *Usability Evaluation in Industry* (1st ed.). London, UK: Taylor & Francis Ltd.
- Joy, J. (2013). *A Study To Evaluate The Effectiveness Of Chilled Cabbage Leaves Application For Relief Of Breast Engorgement In Volunteered Postnatal Mothers Who Are Admitted In Maternity Ward Of Selected Hospital In Belgaum*. Doctoral dissertation, KLE University, Belgaum, India.
- Juristo, N., Windl, H., & Constantine, L. (2001). Guest Editors' Introduction: Introducing Usability. *IEEE Software*, 18(1), 20-21.
- Kabbany, N., Ming, S. S., & Radwan, A. (2011). *Developing E-Market Model Using Social Networks*. Paper presented at the IEEE Symposium on Industrial Electronics and Applications (ISIEA 2011), Singapore.
- Kaikkonen, A., Kekäläinen, A., Cankar, M., Kallio, T., & Kaikkonen, A. (2005). Usability Testing of Mobile Applications: A Comparison between Laboratory and Field Testing. *Journal of usability studies*, 1(4-16), 23-28.
- Kaleen, T., & Allwood, C. M. (1991). A survey of the training of computer users in Swedish companies. *Behaviour & Information Technology*, 10(1), 81-90.
- Kammer, D., Franke, I. S., Groh, R., Steinhilf, J., Kirchner, M., & Schönefeld, F. (2011). *The Eleventh Finger: Levels of Manipulation in Multi-Touch Interaction*. Paper presented at the 29th Annual European Conference on Cognitive Ergonomics, Rostock, Germany.
- Kamper, R. J. (1999). *Highlighting Tool for Search Specification in a User Interface of a Computer System*. USA: Google Patents.
- Katsanos, C., Tselios, N., & Avouris, N. (2008). *AutoCardSorter: Designing the Information Architecture of a Web Site Using Latent Semantic Analysis*. Paper presented at the Conference on Human Factors in Computing Systems (SIGCHI2008), Florence, Italy.
- Kawulich, B. B. (2005). *Participant Observation as a Data Collection Method*. Berlin, Germany: FQS.
- Kerlinger, F. N., & Lee, H. B. (2000). *Foundations of Behavioral Research* (4th ed.). New York, USA: Holt Rinehart and Winston.
- Kettebekov, S., & Sharma, R. (2001). Toward Natural Gesture/Speech Control of a Large Display. In M. R. Little & L. Nigay (Eds.), *Engineering for Human-*

- Computer Interaction* (Vol. 2254 pp. 221-234). Toronto, Canada: Springer.
- Khan, Q. S. (2007). *Hajj- Journey Problems and Their Easy Solutions* (1st ed.). Mumbai, India: Tanveer Publication.
- Kim, C., & Christiaans, H. (2011). Who Are the People That Experience Soft Usability Problems? In C. Stephanidis (Ed.), *HCI International 2011–Posters’ Extended Abstracts* (Vol. 173 pp. 171-175). Orlando, FL, USA: Springer.
- Kim, Y. (2011). The Pilot Study in Qualitative Inquiry Identifying Issues and Learning Lessons for Culturally Competent Research. *Qualitative Social Work*, 10(2), 190-206.
- Kirakowski, J. (1996). The Software Usability Measurement Inventory: Background and Usage. In P. W. Jordan, B. Thomas, I. L. McClelland & B. Weerdmeester (Eds.), *Usability evaluation in industry* (1st ed., pp. 169-178). London, UK: Taylor & Francis Ltd.
- Kirakowski, J. (2000). Questionnaires in Usability Engineering: A List of Frequently Asked Questions (3rd Ed.). Retrieved from Human Factors Research Group website: <http://www.ucc.ie/hfrg/resources/qfaq1.html>
- Kirakowski, J., & Cierlik, B. (1998). *Measuring the Usability of Web Sites*. Paper presented at the 42nd Annual Meeting on Human Factors and Ergonomics Society Santa Monica, California, USA.
- Kirakowski, J., & Corbett, M. (1993). SUMI: The Software Usability Measurement Inventory. *British journal of educational technology*, 24(3), 210-212.
- Kissinger, J. S. (2011). *A Collective Case Study of Mobile E-Book Learning Experiences*. Doctoral Dissertation, University of North Florida, Florida, USA.
- Kitchenham, B. (2004). *Procedures for Performing Systematic Reviews* (Vol. 33). Keele, England: Software Engineering Group, Department of Computer Science, Keele University.
- Kitzinger, J. (1995). Qualitative Research. Introducing Focus Groups. *BMJ: British medical journal*, 311(7000), 299–302.
- Klein, R. (2006). Why Usability is Important / Usability ROI Retrieved 10/11/2014, from http://www.kleinresearch.com/pdf/klein_why_usability_roi.pdf
- Kline, R. B. (2016). *Principles and Practice of Structural Equation Modeling* (4th ed.). New York: Guilford Press.
- Klischewski, R. (2012). *Identifying Informational Needs for Open Government: The Case of Egypt*. Paper presented at the 45th Hawaii International Conference on System Science (HICSS 2012) Maui, Hawaii, USA.
- Konno, K., Kato, M., & Kosaka, T. (2013). *Speech Recognition with Large-Scale Speaker-Class-Based Acoustic Modeling*. Paper presented at the Asia-Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA2013), Kaohsiung, Taiwan.
- Kress, G. (2010). *Multimodality: A Social Semiotic Approach to Contemporary Communication* (1st ed.). New York, USA: Routledge.
- Kress, G., & Bezemer, J. (2009). Writing In a Multimodal World of Representation. In R. Beard, D. Myhill, J. Riley & M. Nystrand (Eds.), *The SAGE handbook of writing development* (1st ed., pp. 167-181). Thousand Oaks, California, USA: SAGE
- Krug, S. (2013). *Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability* (3rd ed.). San Francisco, USA: New Riders.
- Kuo, M. A. (2011). The Global Impact of Islamic Finance in Asia: Identity, Innovation, Institutions. *Journal of the International Relations and Affairs Group (JIRAG)*, 1(1), 46-74.

- Lal, R. (2013). *Digital Design Essentials: 100 Ways to Design Better Desktop, Web, and Mobile Interfaces* (1st ed.). Beverly, USA: Rockport Publishers.
- Lan, Y.-J., Sung, Y.-T., & Chang, K.-E. (2013). From Particular to Popular: Facilitating EFL Mobile-Supported Cooperative Reading. *Language Learning & Technology*, 17(3), 23-38.
- Lane, N. D., Miluzzo, E., Lu, H., Peebles, D., Choudhury, T., & Campbell, A. T. (2010). A Survey of Mobile Phone Sensing. *IEEE Communications Magazine*, 48(9), 140-150.
- Laouris, Y., & Eteokleous, N. (2005). *We Need an Educationally Relevant Definition of Mobile Learning*. Paper presented at the Proceedings of the 4th World Conference on Mobile Learning, Rio de Janeiro, Brazil.
- Laudon, K., & Laudon, J. (2015). *Management Information Systems: Managing the Digital Firm, Global Edition* (13th ed.). Harlow, England: Pearson Education Ltd.
- Lazar, J. (2006). *Web Usability: A User-Centered Design Approach* (1st ed.). New York, USA: Pearson Addison Wesley.
- Lee, K., & Kim, J. H. (2005). *Cultural Difference and Mobile Phone Interface Design: Icon Recognition According To Level of Abstraction*. Paper presented at the Proceedings of the 7th Conference on Human-Computer Interaction with Mobile Devices and Services, Salzburg, Austria.
- Lee, N., Shin, H., & Sundar, S. S. (2011). *Utilitarian vs. Hedonic Robots: Role of Parasocial Tendency and Anthropomorphism in Shaping User Attitudes*. Paper presented at the Proceedings of the 6th International Conference on Human-Robot Interaction, Lausanne, Switzerland.
- Lee, W.-M. (2012). *Beginning android 4 application Development* (1st ed.). Indiana, Canada: John Wiley & Sons.
- Lee, Y., & Chin, F. (1995). An Iconic Query Language for Topological Relationships in GIS. *International Journal of Geographical Information Systems*, 9(1), 25-46.
- Leon, J. C., Aponte, A., Vega, S., & Romero, E. (2013). *Usability Evaluation of a Mobile Tool to Support Prenatal Examination*. Paper presented at the IX International Seminar on Medical Information Processing and Analysis, Mexico City, Mexico.
- Lew, P., Olsina, L., & Zhang, L. (2010). *Quality, Quality in Use, Actual Usability and User Experience As Key Drivers for Web Application Evaluation*. Paper presented at the 10th International Conference on Web Engineering (ICWE2010), Vienna, Austria.
- Lewis, J. R. (1995). IBM Computer Usability Satisfaction Questionnaires: Psychometric Evaluation and Instructions for Use. *International Journal of Human-Computer Interaction*, 7(1), 57-78.
- Lewis, M. (1998). Iterative Triangulation: A Theory Development Process Using Existing Case Studies. *Journal of Operations Management*, 16(4), 455-469.
- Li, M., Arning, K., Sack, O., Park, J., Kim, M.-H., Ziefle, M., & Kobbelt, L. (2013). Evaluation of a Mobile Projector-Based Indoor Navigation Interface. *Interacting with Computers*, iwt053.
- Liang, H., Song, H., Fu, Y., Cai, X., & Zhang, Z. (2011). *A Remote Usability Testing Platform for Mobile Phones*. Paper presented at the IEEE International Conference on Computer Science and Automation Engineering (CSAE2011), Shanghai, China.
- Lichtenstein, A. H. (2015). Systematic Reviews in the Field of Nutrition. In C. W. Bales, J. L. Locher & E. Saltzman (Eds.), *Handbook of Clinical Nutrition and*

- Aging* (3rd ed., pp. 21-34). New York, USA: Springer.
- Lidwell, W., Holden, K., & Butler, J. (2010). *Universal Principles of Design, Revised and Updated: 125 Ways to Enhance Usability, Influence Perception, Increase Appeal, Make Better Design Decisions, and Teach Through Design* (2nd ed.). Beverly, Massachusetts, USA: Rockport Publishers.
- Lim, S., Kim, J., Kim, J.-H., & Lee, H.-S. (2012). Designing Usability Assessment to Improve User's Acceptability on Quality of Life Technology (QoLT) for Individuals with Disability. *Journal of the HCI Society of Korea*, 7(2), 43-48.
- Livingstone, S. (2010). Giving People a Voice: On the Critical Role of the Interview in the History of Audience Research. *Communication, Culture & Critique*, 3(4), 566-571.
- Locke, L., Spirduso, W., & Silverman, S. (2013). *Proposals That Work: A Guide for Planning Dissertations and Grant Proposals* (6th ed.). Thousand Oaks, California, USA: SAGE Publications.
- Lu, C.-C., Kang, S.-C., Hsieh, S.-H., & Shiu, R.-S. (2009). Improvement of a Computer-Based Surveyor-Training Tool Using a User-Centered Approach. *Advanced Engineering Informatics*, 23(1), 81-92.
- Lucente, M., Zwart, G.-J., & George, A. D. (1998). *Visualization space: A testbed for deviceless multimodal user interface*. Paper presented at the AAAI Spring Symposium Intelligent Environments Symposium, Palo Alto, California, USA.
- Lunney, G. S. (2001). e-Obviousness. *Michigan Telecommunications and Technology Law Review*, 7(1), 363-421.
- Lupash, L. O., & Wlad, J. M. (2001). Method for Navigation of Moving Platform by Using Satellite Data Supplemented by Satellite-Calibrated Baro Data. USA: Google Patents.
- Lutkewitte, C. (2013). *Multimodal Composition: A Critical Sourcebook* (1st ed.). Boston, USA: Bedford/St. Martin's.
- Ma, X., Yan, B., Chen, G., Zhang, C., Huang, K., Drury, J., & Wang, L. (2013). Design and Implementation of a Toolkit for Usability Testing of Mobile Apps. *Mobile Networks and Applications*, 18(1), 81-97.
- MacDonald, M. (2008). User Interface Architecture. In D. Shakeshaft (Ed.), *Pro. NET 2.0 Windows Forms and Custom Controls in C#* (3rd ed., pp. 3-39). San Benito, USA: Apress Express.
- Mahmoud, Q. H. (2004). J2ME and Location-Based Services Retrieved 29/06/2015, from <http://www.oracle.com/technetwork/systems/location-156846.html>
- Majid, Z. B., Ali, R. S., & Amir, R. S. (2012). Designing Mobile Electronic Books as a New Model of Providing Learning Contents for Medical Sciences. *Strides in Development of Medical Education*, 9(1), 18-24.
- Mandourah, Y., Al-Radi, A., Ocheltree, A., Ocheltree, S., & Fowler, R. (2012). Clinical and Temporal Patterns of Severe Pneumonia Causing Critical Illness during Hajj. *BMC Infectious Diseases*, 12(1), 1-8.
- Mangal, N. (2013, 27/05/2014). What Is Usability Retrieved from <http://nimitmangal.wordpress.com/2013/09/19/what-is-usability/>
- Mankoff, J., Hudson, S. E., & Abowd, G. D. (2000). *Providing Integrated Toolkit-Level Support for Ambiguity in Recognition-Based Interfaces*. Paper presented at the Conference on Human Factors in Computing Systems (SIGCHI 2000), The Hague, Netherlands.
- March, S. T., & Smith, G. F. (1995). Design and Natural Science Research on Information Technology. *Decision support systems*, 15(4), 251-266.
- Marshall, M. N. (1996). Sampling for Qualitative Research. *Family practice*, 13(6),

522-526.

- Martin, J.-C. (1997). *Towards Intelligent Cooperation between Modalities: The Example of a System Enabling Multimodal Interaction with a Map*. Paper presented at the Workshop on "Intelligent Multimodal Systems, Nagoya, Japan.
- Maxwell, J. A. (2013). *Qualitative Research Design: An Interactive Approach* (3rd ed. Vol. 41). Thousand Oaks, California, USA: SAGE Publications.
- McCool, M. (2006). Information Architecture: Intercultural Human Factors. *Technical Communication*, 53(2), 167-183.
- McCrae, R. R., Kurtz, J. E., Yamagata, S., & Terracciano, A. (2010). Internal Consistency, Retest Reliability, and Their Implications for Personality Scale Validity. *Personality and social psychology review*, 15(1), 28-50.
- McLaren, J., Wright, L., Parkinson, S., & Jackson, T. (1999). A Dynamic Life-Cycle Energy Model of Mobile Phone Take-back and Recycling. *Journal of Industrial Ecology*, 3(1), 77-91.
- MCMC, M. C. a. M. C. (2013). MCMC Confident of Hitting Smartphone Target Retrieved 05/05/2013, from <http://www.skmm.gov.my/Media/Press-Clippings/MCMC-confident-of-hitting-smartphone-target.aspx>
- Mehla, R., & Aggarwal, R. (2014). Automatic Speech Recognition: A Survey. *International Journal of Advanced Research in Computer Science and Electronics Engineering (IJARCSEE)*, 3(1), 45-53.
- Morrow, L., Drane, A., Kroeker, J., Boulanov, O., Quibria, N., & Robinson, M. R. (2013). Speech recognition method of and system for determining the status of an answered telephone during the course of an outbound telephone call: Google Patents.
- Mian, P., Conte, T., Natali, A., Biolchini, J., & Travassos, G. (2005). *A Systematic Review Process for Software Engineering*. Paper presented at the Proceedings of the 2nd Experimental Software Engineering Latin American Workshop (ESELAW 2005), Rio de Janeiro, Brazil.
- Michaelis, P. R., & Wiggins, R. H. (1982). A human factors engineer's introduction to speech synthesizers. *Directions in Human-Computer Interaction, Ablex, Norwood, NJ*, 149-178.
- Miller, G. A. (1956). The Magical Number Seven, Plus or Minus Two: Some Limits on our Capacity for Processing Information. *Psychological review*, 63(2), 81.
- Mitra, T., Natalia, S., & Aditya, B. (2016). Govt Aims to Increase Hajj Quota by 42,000, *Tempo.Co : Indonesian News Portal*. Retrieved from <https://en.tempo.co/read/news/2016/09/13/055803704/Govt-Aims-to-Increase-Hajj-Quota-by-42000>
- Mohammadi, H. (2015). A Study of Mobile Banking Loyalty in Iran. *Computers in Human Behavior*, 44, 35-47.
- Mohd Fitri, Y., Abdul Nasir, Z., & Nor Fadziana, F. M. (2011). *Virtual Hajj (V-Hajj)—Adaptation of Persuasive Design in Virtual Environment (VE) and Multimedia Integrated Approach Learning Courseware Methodology*. Paper presented at the IEEE Conference on Open Systems (ICOS 2011), Langkawi, Malaysia
- Mohd Shafry, M., Ahmad, Z. A. F., Ahmad, H. B., Arief Salleh, R., Nizar, T. J., & Farah Wahida, M. Y. (2011). *Development of 3D Tawaf Simulation for Hajj Training Application Using Virtual Environment*. Paper presented at the Second International Visual Informatics Conference on Visual Informatics Sustaining Research and Innovations, Selangor, Malaysia.
- Mohrman, S. A. (2007). Having Relevance and Impact The Benefits of Integrating the Perspectives of Design Science and Organizational Development. *The*

- Journal of Applied Behavioral Science*, 43(1), 12-22.
- Molchanov, D. (2014). The 22 Principles Of Good Website Navigation and Usability Retrieved 28\12\2015, from <http://swimbi.com/blog/22-principles-of-good-web-navigation-and-maximum-usability>
- Molina, A. I., Redondo, M. A., Lacave, C., & Ortega, M. (2014). Assessing the Effectiveness of New Devices for Accessing Learning Materials: An Empirical Analysis Based on Eye Tracking and Learner Subjective Perception. *Computers in Human Behavior*, 31, 475-490.
- Monares, Á., Ochoa, S. F., Pino, J. A., Herskovic, V., Rodriguez-Covili, J., & Neyem, A. (2011). Mobile Computing In Urban Emergency Situations: Improving the Support to Firefighters in the Field. *Expert systems with applications*, 38(2), 1255-1267.
- Moorstein, M. (2004). *Frameworks: Conflict in Balance* (1st ed.). Bloomington, Indiana: iUniverse.
- Morgan, D. L. (1996). *Focus Groups as Qualitative Research* (2nd ed.). Thousand Oaks, California, USA: SAGE Publications.
- Morgan, G. A., & Griego, O. V. (1998). *Easy Use and Interpretation of SPSS for Windows: Answering Research Questions with Statistics* (1st ed.). Mahwah, New Jersey, USA: Psychology Press.
- Morrough, E. (2003). *Information Architecture: An Emerging 21st Century Profession* (1st ed.). New Jersey, USA: Pearson Education.
- Morville, P., & Rosenfeld, L. (2007). *Information Architecture for the World Wide Web: Designing Large-Scale Web Sites* (3rd ed.). Sebastopol, California, USA: O'Reilly Media, Inc.
- Motamedi, S., & Choe, P. (2015). Smartphone Information Displays When Reading News in Persian and English Languages. *International Journal of Human-Computer Interaction*, 31(6), 427-439.
- Moulin, C., Sugawara, K., & Fujita, S. (2013). *Synchronous Remote Collaboration Using Multi-touch Devices*. Paper presented at the Eighth International Conference on P2P, Parallel, Grid, Cloud and Internet Computing (3PGCIC), Compiègne, France.
- National Information Technology Council, N.-M. (2013). Smartphone Rebate Intended for Lower Income Group : MCMC Retrieved 05/05/2013, from http://nitc.mosti.gov.my/nitc_beta/index.php/misc/news-articles-reports-a-speeches/10-news/198-smartphone-rebate-intended-for-lower-income-group-mcmc
- Navarre, D., Palanque, P., Ladry, J.-F., & Barboni, E. (2009). ICOs: A Model-Based User Interface Description Technique Dedicated To Interactive Systems Addressing Usability, Reliability and Scalability. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 16(4), 18.
- Navas-Acien, A. (2015). *Systematic Reviews and Meta-Analyses: The Road from Medicine to Environmental Health*. Paper presented at the AAAS Annual Meeting, Boston, Massachusetts, USA.
- Nayebi, F., Desharnais, J.-M., & Abran, A. (2012). *The State Of The Art of Mobile Application Usability Evaluation*. Paper presented at the 25th IEEE Canadian Conference on Electrical & Computer Engineering (CCECE2012), Montreal, Canada.
- Negahban, A., & Chung, C.-H. (2014). Discovering Determinants of Users Perception of Mobile Device Functionality Fit. *Computers in Human Behavior*, 35, 75-84.
- Nguyen-Duc, A., Cruzes, D. S., & Conradi, R. (2015). The Impact of Global Dispersion on Coordination, Team Performance and Software Quality—A Systematic

- Literature Review. *Information and Software Technology*, 57(1), 277-294.
- Nielsen, J. (1993). *Usability Engineering* (1st ed.). San Francisco, USA: Morgan Kaufmann.
- Nielsen, J. (1994). *Usability Inspection Methods*. Paper presented at the Conference Companion on Human Factors in Computing Systems, Boston, Massachusetts, USA.
- Nielsen, J. (1997). The Use and Misuse of Focus Groups. *IEEE Software*, 14(1), 94-95.
- Nielsen, J. (2012a). How Many Test Users in a Usability Study? Retrieved 04/06/2012, from <http://www.nngroup.com/articles/how-many-test-users/>
- Nielsen, J. (2012b). Usability 101: Introduction to Usability Retrieved 04/01/2012, from <http://www.nngroup.com/articles/usability-101-introduction-to-usability/>
- Niu, D. F., Yang, S., & Deng, M. (2013). Principles of Interaction Design Research Based on Cognitive Characteristics. *Applied Mechanics and Materials*, 347(1), 3446-3449.
- Normala, R., Nazirah, A. H., Wan Malini, W. I., & Siti Dhalila, M. (2013). A Survey on Components of Virtual Umrah Application. *International Journal of Multimedia & Its Applications*, 5(5), 17-27.
- Norshuhada, S., & Shahizan, H. (2013). *Design Research in Software Development: Constructing and Linking Research Questions, Objectives, Methods and Outcomes* (2ed ed.). Sintok, Kedah: Penerbit Universiti Utara Malaysia.
- Nur Afiqah, A. B., Abdul Nasir, Z., & Nur Fadziana, F. M. (2011). *The Use of Multimedia, Augmented Reality (AR) and Virtual Environment (VE) in Enhancing Children's Understanding of Road Safety*. Paper presented at the IEEE Conference on Open Systems (ICOS2011), Langkawi, Kedah, Malaysia.
- Nurulnadwan, A. (2015). *Conceptual Design and Development Model of Assistive Courseware for Young Low Vision Learners (Ac4lv)*. Doctoral dissertation, Universiti Utara Malaysia, Sintok, Kedah, Malaysia.
- Nusca. (2009). Smartphone Vs. Feature Phone Arms Race Heats Up; Which Did You Buy? Retrieved 08/04/2013, from <http://www.zdnet.com/blog/gadgetreviews/smartphone-vs-feature-phone-arms-race-heats-up-which-did-you-buy/6836>
- Obaid, M. A. (2008). *Hajj Concept & Practice* (1st ed.). Kuala Lumpur, Malaysia: A. S. Noordeen.
- Ochoa, S. F., Bravo, G., Pino, J. A., & Rodríguez-Covili, J. (2011). Coordinating Loosely-Coupled Work in Construction Inspection Activities. *Group Decision and Negotiation*, 20(1), 39-56.
- Offermann, P., Levina, O., Schönherr, M., & Bub, U. (2009). *Outline of a Design Science Research Process*. Paper presented at the Proceedings of the 4th International Conference on Design Science Research in Information Systems and Technology, Philadelphia, PA, USA.
- Ojanen, M. (2015). Mastering Kurenniemi's Rules (2012): The Role of the Audio Engineer in the Mastering Process. *Journal on the Art of Record Production*, 1(10), 1-15.
- Ong, C.-S., & Lai, J.-Y. (2004). *Developing an Instrument for Measuring User Satisfaction with Knowledge Management Systems*. Paper presented at the 37th Hawaii International Conference on System Sciences (HICSS'04), Big Island, Hawaii, USA.
- Oppenheim, A. N. (2000). *Questionnaire Design, Interviewing and Attitude Measurement* (2nd ed.). London, United Kingdom: Bloomsbury Academic.
- Oppenheim, C. (1998). The Correlation between Citation Counts and the 1992

- Research Assessment Exercise Rating for British Research in Genetics, Anatomy and Archaeology. *Journal of documentation*, 53(5), 477-487.
- Oviatt, S. (2012). Multimodal Interfaces. In A. Sears & J. A. Jacko (Eds.), *The human-computer interaction handbook: Fundamentals, evolving technologies and emerging applications* (3rd ed., pp. 405-403). Boca Raton, Florida, USA: CRC Press.
- Ozsoyoglu, G., Balkir, N. H., Cormode, G., & Ozsoyoglu, Z. M. (2000). *Electronic Books in Digital Libraries*. Paper presented at the IEEE Proceedings on Advances in Digital Libraries, Washington, DC, USA.
- Oztoprak, A., & Erbug, C. (2008). Field versus Laboratory Usability Testing: A First Comparison. Ankara, Turkey: Department of Industrial Design-METU/BILTIR/UTEST Product Usability Unit, Faculty of Architecture, Middle East Technical University.
- Pachler, N., Bachmair, B., & Cook, J. (2010). *Mobile Learning: Structures, Agency, Practices*. New York, USA: Springer.
- Pal, P. (2015). Why Designers Should Follow User Experience Process for a Product Startup Retrieved 15/09/2015, from <https://think360studio.com/why-designers-should-follow-user-experience-process-for-a-product-startup/>
- Pallant, J. (2013). *SPSS Survival Manual: A Step-By-Step Guide to Data Analysis Using SPSS Version 15* (5th ed.). New York: McGraw-Hill Education.
- Patrick, D. L., Burke, L. B., Gwaltney, C. J., Leidy, N. K., Martin, M. L., Molsen, E., & Ring, L. (2011). Content Validity—Establishing and Reporting the Evidence in Newly Developed Patient-Reported Outcomes (PRO) Instruments for Medical Product Evaluation: ISPOR PRO Good Research Practices Task Force Report: Part 1—Eliciting Concepts for a New PRO Instrument. *Value in Health*, 14(8), 978-988.
- Paul, P. K., Kumar, K., Chatterjee, D., & Rajesh, R. (2014). Usability Engineering and User Interface Design for Electronic Information Systems and Its Subsystems: Overview. *Information Studies*, 20(1), 23-32.
- Penhaker, M., & Kijonka, J. (2012). *Healthcare Multimedia Application for Multimodal Mobile Device Interaction*. Paper presented at the The Fourth International Conferences on Advances in Multimedia, Chamonix, France.
- Petter, S. C., & Gallivan, M. J. (2004). *Toward A Framework for Classifying and Guiding Mixed Method Research in Information Systems*. Paper presented at the Proceedings of the 37th Annual Hawaii International Conference on System Sciences, Big Island, Hawaii, USA.
- Pongnumkul, S., Wang, J., & Cohen, M. (2008). *Creating Map-Based Storyboards for Browsing Tour Videos*. Paper presented at the Proceedings of the 21st Annual ACM Symposium on User Interface Software and Technology, Monterey, CA, USA.
- Porteous, M., Kirakowski, J., & Corbett, M. (1993). SUMI User Handbook. *Human Factors Research Group, University College Cork, Ireland*.
- Punch, K. (2006). *Developing Effective Research Proposals* (2nd ed.). New York, USA: SAGE Publications Ltd.
- Qin, H., Ma, X., Herawan, T., & Zain, J. M. (2011). Data Filling Approach of Soft Sets under Incomplete Information. In N. T. Nguyen, C.-G. Kim & A. Janiak (Eds.), *Intelligent Information and Database Systems* (Vol. 6592 pp. 302-311). Berlin, Germany: Springer.
- Quesenbery, W. (2001). *What Does Usability Mean: Looking Beyond Ease of Use'*. Paper presented at the 48th Annual Conference-Society for Technical

- Communication, Chicago, Illinois, USA.
- Quesenbery, W. (2003). The Five Dimensions of Usability. In M. J. Albers & M. B. Mazur (Eds.), *Content and complexity: Information design in technical communication* (1st ed., pp. 81-102). New York, USA: Routledge, Taylor and Francis Group.
- Quesenbery, W. (2004). Balancing the 5Es of Usability. *Cutter IT Journal*, 17(2), 4-11.
- Quesenbery, W. (2006). Using the 5Es to Understand Users, from <http://www.wqusability.com/articles/getting-started.html>
- Rad, Y. T., & Jabbari, R. (2012). *Use of Global Consistency Checking for Exploring and Refining Relationships between Distributed Models: A Case Study*. Master's thesis, Blekinge Institute of Technology Karlskrona, Sweden.
- Radice, R. A. (2002). *High Quality Low Cost Software Inspections* (1st ed.). Andover, Massachusetts: Paradoxicon Publishing.
- Ravitch, S. M., & Riggan, M. (2016). *Reason & Rigor: How Conceptual Frameworks Guide Research* (2nd ed.). Thousand Oaks, California, USA: SAGE Publications.
- Ray, J. J. (1982). Survey Research and Attitude Measurement Retrieved 01/02/2015, from <http://jonjayray.tripod.com/stats.html>
- Razali, N. M., & Wah, Y. B. (2011). Power Comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling Tests. *Journal of statistical modeling and analytics*, 2(1), 21-33.
- Reichenauer, A. (2005). *LUCIA: Development of a Comprehensive Information Architecture Process Model for Websites*. Doctoral Dissertation, University of Regensburg, Regensburg, Germany.
- RHKW, R. H. K. W. s. (2001). *Random House Kernerman Webster's College Dictionary* (2nd ed.). New York, United States: Random House Reference.
- Riiser, K., Løndal, K., Ommundsen, Y., Sundar, T., & Helseth, S. (2013). Development and Usability Testing Of an Internet Intervention to Increase Physical Activity in Overweight Adolescents. *JMIR Research Protocols*, 2(1), e7.
- Robertson, J. (2003). Selecting Staff for Stakeholder Interviews Retrieved 12/09/2013, from http://www.steptwo.com.au/files/cmb_interviewselect.pdf
- Roda, C., Borel, A. M., Gentchev, E., & Thomas, J. (2005). Digital Image Library Development in Academic Environment: Designing and Testing Usability. *OCLC Systems & Services*, 21(4), 264-284.
- Rodman, H. (1980). Are Conceptual Frameworks Necessary for Theory Building? The Case of Family Sociology*. *The Sociological Quarterly*, 21(3), 429-441.
- Rodriguez, B., Wiechno, P., Dahl, D., Ashimura, K., & Tumuluri, R. (2012). Registration & Discovery of Multimodal Modality Components in Multimodal Systems: Use Cases and Requirements Retrieved 13/04/2014, from <https://www.w3.org/TR/2012/NOTE-mmi-discovery-20120705/>
- Romano Bergstrom, J. C., Olmsted-Hawala, E. L., & Jans, M. E. (2013). Age-Related Differences in Eye Tracking and Usability Performance: Website Usability for Older Adults. *International Journal of Human-Computer Interaction*, 29(8), 541-548.
- Rosnita, B., Dalbir, S., & Rozilawati, R. (2013). Usability Dimensions For Mobile Applications—A Review. *Res. J. Appl. Sci. Eng. Technol*, 5(6), 2225-2231.
- Rowley, D. E. (1994). *Usability Testing in the Field: Bringing the Laboratory to the User*. Paper presented at the Proceedings of the SIGCHI conference on Human factors in computing systems, Boston, MA, USA.

- Rubin, J., & Chisnell, D. (2008). *Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests* (2nd ed.). Indiana, USA: John Wiley & Sons.
- Rusu, C., Roncagliolo, S., Rusu, V., & Collazos, C. (2011). *A Methodology to Establish Usability Heuristics*. Paper presented at the The Fourth International Conference on Advances in Computer-Human Interactions, osier, Guadeloupe, France.
- Ryu, Y. S., & Smith-Jackson, T. L. (2006). Reliability and Validity of the Mobile Phone Usability Questionnaire (MPUQ). *Journal of usability studies*, 2(1), 39-53.
- Saffer, D. (2010). *Designing for Interaction: Creating Innovative Applications and Devices* (2nd ed.). Indianapolis, Indiana, USA: New Riders Press.
- Sahrir, M. S., Yahaya, M. F., & Nasir, M. S. (2012). EZ-Arabic for Children: A Virtual Learning Resource Tool for Malaysian Primary Schools.
- Sajedi, A., Afzali, H., & Mahdavi, M. (2008). *Improving Learnability and Usability of Software Applications*. Paper presented at the Proceedings of International Conference on Interfaces and Human Computer Interaction, Amsterdam, Netherlands.
- Sajjad, M. (2009). *Acceptance and Use of Information Technology by Senior Executives*. Doctoral dissertation, Foundation University, Islamabad, Pakistan.
- Salazar, L. H. A., Lacerda, T., Nunes, J. V., & von Wangenheim, C. G. (2013). A Systematic Literature Review on Usability Heuristics for Mobile Phones. *International Journal of Mobile Human Computer Interaction (IJMHCI)*, 5(2), 50-61.
- Saleem, J. J., Patterson, E. S., Militello, L., Anders, S., Falciglia, M., Wissman, J. A., . . . Asch, S. M. (2007). Impact of Clinical Reminder Redesign on Learnability, Efficiency, Usability, and Workload for Ambulatory Clinic Nurses. *Journal of the American Medical Informatics Association*, 14(5), 632-640.
- Sandilyan, M. B., & Darley, J. (2013). Voice recognition software: psychiatrist as transcriber. *The Psychiatrist*, 37(4), 130-134.
- Saparova, D., Basic, J., Lu, Y., Kibaru, F., Ma, Y., & Yadamsuren, B. (2013). Usability Problems in Patient-and Clinician-Oriented Health Information Systems: What Are They And How Do They Differ? In V. G. Duffy (Ed.), *Digital Human Modeling and Applications in Health, Safety, Ergonomics, and Risk Management. Healthcare and Safety of the Environment and Transport* (Vol. 8025 pp. 276-285). Vegas, Nevada, USA: Springer.
- Sarter, N. B. (2006). Multimodal Information Presentation: Design Guidance and Research Challenges. *International journal of industrial ergonomics*, 36(5), 439-445.
- Saudi Gazette. (2013). Mataf Capacity: 105,000 People per Hour after First Expansion. *Saudi Gazette* Retrieved 08/11/2014, from <http://www.sauress.com/en/saudigazette/158186>
- Sauro, J., & Kindlund, E. (2005). *A Method to Standardize Usability Metrics into a Single Score*. Paper presented at the Proceedings of the SIGCHI conference on Human factors in computing systems, Portland, Oregon, USA.
- Schreiber, J., & Asner-Self, K. (2011). *Educational Research: The Interrelationship of Questions, Sampling, Design, and Analysis* (1st ed.). Hoboken, New Jersey, USA: John Wiley & Sons Inc

- Sean, R. (2008). Worldwide Enterprise Converged Mobile Device 2008-2012 Forecast and Analysis Retrieved 09/04/2013, from <http://www.marketresearch.com/>
- Sekaran, U. (1992). *Research Methods for Business: A Skill-Building Approach* (2nd ed.). USA: John Wiley & Sons.
- Sekaran, U., & Bougie, R. (2013). *Research Methods of Business: A Skill-Building Approach* (6th ed.). New York, USA: John Wiley & Sons, Inc.
- Sewdass, N., & Du Toit, A. (2014). Current State of Competitive Intelligence in South Africa. *International Journal of Information Management*, 34(2), 185-190.
- Sharlin, M., Tu, E., & Bartus, T. (2009). Guide to Creating Website Information Architecture and Content. *Office of Communications, Princeton University*, 2(2), 4-43.
- Sharp, H., Rogers, Y., & Preece, J. (2007). *Interaction Design: Beyond Human-Computer Interaction* (2nd ed.). England: John Wiley & Sons.
- Sharp, H., Rogers, Y., & Preece, J. (2011). *Interaction Design: Beyond Human-Computer Interaction* (3rd ed.). England: John Wiley & Sons.
- Shneiderman, B. (1997). *Direct Manipulation for Comprehensible, Predictable and Controllable User Interfaces*. Paper presented at the Proceedings of the 2nd International Conference on Intelligent User Interfaces, Orlando, Florida, USA.
- Shneiderman, B., & Plaisant, C. (2005). *Designing the User Interface: Strategies for Effective Human-Computer Interaction* (4th ed.). Boston, USA: Pearson Addison Wesley.
- Shneiderman, B., Plaisant, C., Cohen, M., & Jacobs, S. (2010). *Designing the User Interface: Strategies for Effective Human-Computer Interaction* (5th ed.). Boston, USA: Pearson Addison Wesley.
- Shojania, K. G., Sampson, M., Ansari, M. T., Ji, J., Doucette, S., & Moher, D. (2007). How Quickly Do Systematic Reviews Go Out of Date? A Survival Analysis. *Annals of internal medicine*, 147(4), 224-233.
- Shuib, L., Shamshirband, S., & Ismail, M. H. (2015). A Review of Mobile Pervasive Learning: Applications and Issues. *Computers in Human Behavior*, 46, 239-244.
- Shyu, S. J. (2006). Efficient Visual Secret Sharing Scheme for Color Images. *Pattern Recognition*, 39(5), 866-880.
- Silvennoinen, J., Vogel, M., & Kujala, S. (2014). Experiencing Visual Usability and Aesthetics in Two Mobile Application Contexts. *Journal of usability studies*, 10(1).
- Singhal, M., & Shukla, A. (2012). Implementation of Location based Services in Android using GPS and Web Services. *IJCSI International Journal of Computer Science Issues*, 9(1), 237-242.
- Sinha, G., Shahi, R., & Shankar, M. (2010). *Human Computer Interaction*. Paper presented at the 3rd International Conference on Emerging Trends in Engineering and Technology (ICETET), New York, USA.
- Sinha, S., Agrawal, S., & Jain, A. (2013). Continuous Density Hidden Markov Model for Hindi Speech Recognition. *GSTF International Journal on Computing (JoC)*, 3(2), 103.
- Siti Mahfuzah, S. (2011). *Conceptual Design Model of Computerized Personal-Decision AID (ComPDA)*. Doctoral Dissertation, Universiti Utara Malaysia, Sintok, Kedah, Malaysia.
- Smashing, M. (2012). *A Field Guide to Usability Testing* (1st ed.). Freiburg, Germany: Smashing Media GmbH.
- Solingen, R. V., Basili, V., Caldiera, G., & Rombach, H. D. (2002). Goal Question Metric (GQM) Approach. In J. J. Marciniak (Ed.), *Encyclopedia of software*

- engineering*. New York, USA: John Wiley & Sons, Inc. .
- Solingen, R. V., & Berghout, E. (1999). *The Goal/Question/Metric Method: A Practical Guide for Quality Improvement of Software Development* (1st ed.). Henrico, VA, USA: McGraw-Hill Inc.
- Sonderegger, A., & Sauer, J. (2010). The Influence of Design Aesthetics in Usability Testing: Effects on User Performance and Perceived Usability. *Applied ergonomics*, 41(3), 403-410.
- Sonderegger, A., & Sauer, J. (2013). The Influence of Socio-Cultural Background and Product Value in Usability Testing. *Applied ergonomics*, 44(3), 341-349.
- Sowa, T., Kopp, S., & Latoschik, M. E. (2001). *A Communicative Mediator in a Virtual Environment: Processing of Multimodal Input and Output*. Paper presented at the Proceedings of the International Workshop on Information Presentation and Natural Multimodal Dialogue (IPNMD-2001), Verona, Italy.
- Spilker, J., Klarner, M., & Görz, G. (2000). Processing Self-Corrections in a Speech-To-Speech System. In W. Wahlster (Ed.), *Verbmobil: Foundations of Speech-to-Speech Translation* (pp. 131-140). New York, USA: Springer.
- Stacy, K. C., Jaffe, J., Boggs, R., & Stephen, D. D. (2011). Worldwide Mobile Worker Population 2011–2015 Forecast Retrieved 09/04/2013, from <http://www.idc.com>
- Stadler, A., & Lorenz, H. (2008). Graphical User Interfaces *Wiley Encyclopedia of Computer Science and Engineering* (pp. 1464-1476). Potsdam, Germany: John Wiley & Sons, Inc.
- Stallmeister, J. (2012). User Interface Architectures – Four Things Architecture and Interface Design Have in Common Retrieved 02/03/2015, from <http://www.centigrade.de/blog/en/article/user-interface-architectures-four-things-architecture-and-interface-design-have-in-common/>
- Stephanidis, C., & Antona, M. (2013). *Universal Access in Human-computer Interaction: Design Methods, Tools, and Interaction Techniques for EInclusion*. Paper presented at the Proceedings of the 7th International Conference on Universal Access in Human-Computer Interaction, Las Vegas, NV, USA.
- Stevenson, A., & Waite, M. (2011). *Concise Oxford English Dictionary: Book & CD-ROM Set* (12th ed.). New York, USA: Oxford University Press.
- Stivers, T., & Sidnell, J. (2005). Introduction: multimodal interaction. *Semiotica*, 2005(156), 1-20.
- Stone, B. (2008). Publishers Phase Out Piracy Protection on Audio Books Retrieved 13/03/2013, from <http://www.nytimes.com/2008/03/03/business/media/03audiobook.html>
- Su'aidi, S. (1997). *Computer Assisted Arabic Writing Computer Based Learning Unit*. Doctoral Dissertation, University of Leeds, Woodhouse Ln, Leeds, United Kingdom.
- Suhm, B., Myers, B., & Waibel, A. (1999). *Model-Based and Empirical Evaluation of Multimodal Interactive Error Correction*. Paper presented at the Proceedings of the SIGCHI conference on Human Factors in Computing Systems, Pittsburgh, PA, USA.
- Sun, Y., Shi, Y., Chen, F., & Chung, V. (2007). *An Efficient Multimodal Language Processor for Parallel Input Strings in Multimodal Input Fusion*. Paper presented at the 1st IEEE International Conference on Semantic Computing (ICSC), Irvine, California, USA.
- Sy, D., & Miller, L. (2008). *Optimizing Agile User-Centred Design*. Paper presented at the Extended Abstracts on Human Factors in Computing Systems,

- Florence, Italy.
- Syamsul Bahrin, Z. (2011). *Mobile Game-Based Learning (mGBL) Engineering Model*. Doctoral dissertation, Universiti Utara Malaysia, Sintok, Kedah, Malaysia.
- Tabachnick, B. G., & Fidell, L. S. (2013). *Using Multivariate Statistics* (6th ed.). Upper Saddle River, New Jersey: Pearson Education, Inc.
- Taileb, M., Al-Ghamdi, E., Al-Ghanmi, N., Al-Mutari, A., Al-Jadani, K., Al-Ghamdi, M., & Al-Mutari, A. (2014). Manasek AR: A Location-Based Augmented Reality Application for Hajj and Umrah *Virtual, Augmented and Mixed Reality. Applications of Virtual and Augmented Reality* (pp. 134-143): Springer.
- Takahashi, T., Kannisto, J., Harju, J., Kanaoka, A., Takano, Y., & Matsuo, S. i. (2014). *Expressing Security Requirements: Usability of Taxonomy-Based Requirement Identification Scheme*. Paper presented at the IEEE World Congress on Services, Anchorage, Alaska, USA.
- Takayoshi, P., & Huot, B. (2002). *Teaching Writing with Computers: An Introduction* (3rd ed.). Boston, USA: Cengage Learning.
- Taylor, J. M. (2004). Serving Blind Readers in a Digital Age-LC's National Library Service for the Blind and Physically Handicapped moves toward a digital future. *American Libraries*, 35(11), 49-51.
- Tessier, J., & Clausen, K. (n. d.). How to Create a Conceptual Model for Learning: A Step by Step Approach. 11. Retrieved from Ready 2Go Training Solutions Membership Community website: <http://www.ready2gocommunity.com/wp-content/uploads/Conceptual-Modeling-Toolbox.pdf>
- Thackara, J. (2001). The Design Challenge of Pervasive Computing. *interactions*, 8(3), 46-52.
- The Information Architecture Institute, I. (2013). What is Information Architecture Retrieved 12/02/2015, from http://iainstitute.org/documents/learn/What_is_IA.pdf
- Thimbleby, H. (2010). *Press On: Principles of Interaction Programming* (1st ed.). London, UK: The MIT Press.
- Tognazzini, B. (2014). *First Principles of Interaction Design (Revised & Expanded)*. Retrieved from <http://asktog.com/atc/principles-of-interaction-design/>
- Tosho, A. (2016). *Usability Strategies of Instructional Interface Design Courseware for Inclusive Education System*. Doctoral dissertation, Universiti Utara Malaysia, Sintok, Kedah, Malaysia.
- Treeratanapon, T. (2012). *Design of the Usability Measurement Framework for Mobile Applications*. Paper presented at the Proceedings of the international Conference on Computer and Information Technology (ICCIT'2012), Chittagong, Bangladesh.
- Turner, D. W. (2010). Qualitative interview design: A practical guide for novice investigators. *The qualitative report*, 15(3), 754.
- Uyangoda, J. (2011). *Writing Research Proposals in the Social Sciences and Humanities: A theoretical and Practical Guide* *Social Scientists' Association* Retrieved from <https://nusrlmethods2012.files.wordpress.com/2012/01/researchproposal0305.pdf>
- Vacca, R. T., & Vacca, J. A. L. (2005). *Content Area Reading: Literacy and Learning Across the Curriculum* (8th ed.). Boston, USA: Allyn & Bacon.
- Vaishnavi, V. K., & Kuechler, W. J. (2008). *Design Science Research Methods and Patterns: Innovating Information and Communication Technology* (2nd ed.). New York, USA: CRC Press: Taylor & Francis Group.
- van Leeuwen, R. (2015). Islamic Reformism and Pilgrimage: The Hajj of Rashid Rida In 1916. In L. Mols & M. Buitelaar (Eds.), *Hajj: Global Interactions through*

- Pilgrimage* (1st ed., pp. 83-93). Leiden, Netherlands: Sidestone Press.
- Van Teijlingen, E., & Hundley, V. (2002). The Importance of Pilot Studies. *Nursing Standard*, 16(40), 33-36.
- Vassiliou, M. S., Sundareswaran, V., Chen, S., Behringer, R., Tam, C. K., Chan, M., . . . McGee, J. H. (2000). *Integrated Multimodal Human-Computer Interface and Augmented Reality for Interactive Display Applications*. Paper presented at the Proceedings of SPIE Cockpit Displays VII: Displays for Defence Applications, Orlando, Florida, USA.
- Venable, J. (2006). *A Framework for Design Science Research Activities*. Paper presented at the Information Resources Management Association International Conference, USA.
- Ververidis, C., & Polyzos, G. C. (2006). Location-Based Services in the Mobile Communications Industry. In K. Mehdi (Ed.), *Encyclopedia of E-Commerce, E-Government and Mobile Commerce* (pp. 716-721). Hershey, USA: Idea Group Reference.
- Vitense, H. S., Jacko, J. A., & Emery, V. K. (2002). *Multimodal Feedback: Establishing a Performance Baseline for Improved Access by Individuals with Visual Impairments*. Paper presented at the Proceedings of the Fifth International ACM Conference on Assistive Technologies, New York, NY, USA.
- Vo, M. T., & Wood, C. (1996). *Building an Application Framework for Speech and Pen Input Integration in Multimodal Learning Interfaces*. Paper presented at the IEEE International Conference on Acoustics, Speech, and Signal Processing Atlanta, Georgia, USA.
- Vuong, A. M., Huber Jr, J. C., Bolin, J. N., Ory, M. G., Moudouni, D. M., Helduser, J., . . . Forjuoh, S. N. (2012). Factors Affecting Acceptability and Usability of Technological Approaches to Diabetes Self-Management: A Case Study. *Diabetes technology & therapeutics*, 14(12), 1178-1182.
- Wang, C. L., & Ahmed, P. K. (2004). The Development and Validation of the Organisational Innovativeness Construct Using Confirmatory Factor Analysis. *European journal of innovation management*, 7(4), 303-313.
- Wang, M., Yang, Y., Song, X., Yang, H., & Wang, J. (2011). *Mobile GIS System for Pipeline Inspection at CoalBed Methane Field*. Paper presented at the 19th International Conference on Geoinformatics, Shanghai, China
- Wang, Y.-S., Tang, T.-I., & Tang, J.-t. E. (2001). An Instrument for Measuring Customer Satisfaction Toward Web Sites That Market Digital Products and Services. *J. Electron. Commerce Res.*, 2(3), 89-102.
- Wechsung, I. (2014). What Are Multimodal Systems? Why Do They Need Evaluation?—Theoretical Background. In I. Wechsung (Ed.), *An Evaluation Framework for Multimodal Interaction: Determining Quality Aspects and Modality Choice* (pp. 7-22). New York, USA: Springer.
- Weiss, D. M., & Basili, V. R. (1985). Evaluating Software Development by Analysis of Changes: Some Data from the Software Engineering Laboratory. *IEEE Transactions on Software Engineering*, 11(2), 157-168.
- Welch, K. E. (1999). *Electric Rhetoric: Classical Rhetoric, Oralism, and a New Literacy* (1st ed.). Boston, USA: The MIT Press
- Werder, K., Haake, P., & Maedche, A. (2014). Usability Readiness of German Software SMEs—Three Segments and their Characteristics. In M. Koch, A. Butz & J. Schlichter (Eds.), *Mensch und Computer 2014 – Tagungsband* (pp. 185-194). Berlin, Germany: De Gruyter Oldenbourg.
- West, R., & Lehman, K. (2006). *Automated Summative Usability Studies: an Empirical*

- Evaluation*. Paper presented at the Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Montreal, Québec, Canada.
- Whittaker, S., & Walker, M. (1991). *Toward A Theory of Multi-Modal Interaction*. Paper presented at the Proceedings of the National Conference on Artificial Intelligence Workshop on Multi-modal Interaction, Maratea, Italy
- Wickens, C. D., Lee, J. D., Gordon, S. E., & Liu, Y. (2011). *An Introduction to Human Factors Engineering* (2nd ed.). New Delhi, India: Prentice Hall India Ltd.
- Wieggers, K. (2001). *Peer Reviews in Software: A Practical Guide* (1st ed.). Boston, USA: Addison-Wesley Professional.
- Wieggers, K. (2002). Seven Truths About Peer Reviews. *Cutter IT Journal*, 15(7), 31-37.
- Wieringa, R. (2013). Empirical Research Methods for Technology Validation: Scaling Up To Practice. *Journal of Systems and Software*, 95(1), 19-31.
- Willett, K. D. (2008). *Information Assurance Architecture* (1st ed.). Florida, USA: CRC Press, Auerbach Publications.
- Williams, S. M. (2004). *College of Education: A Guide to Researching the Animal Kingdom on the Internet*. Master Thesis, California State University, San Bernardino, California, USA.
- Wright, A., & Jorm, A. F. (2009). Labels Used by Young People to Describe Mental Disorders: Factors Associated with Their Development. *Australian and New Zealand Journal of Psychiatry*, 43(10), 946-955.
- Wu, J. (2006). *The Development and Implementation of an Intelligent, Semantic Machine Control System with Specific Reference to Information System Architecture Design*. Doctoral Dissertation, Cape Peninsula University of Technology CPUT, Cape Town, South Africa.
- Wurgler, C. (1987). *Voice Recognition-The Next Generation Man-Machine, Input Device?* Paper presented at the Southern Tier Technical Conference, 1987. Proceedings of the 1987 IEEE.
- Xie, I., & Joo, S. (2012). Factors Affecting the Selection of Search Tactics: Tasks, Knowledge, Process, and Systems. *Information Processing & Management*, 48(2), 254-270.
- Youngblood, N. E., & Youngblood, S. A. (2013). User Experience and Accessibility: An Analysis of County Web Portals. *Journal of usability studies*, 9(1), 25-41.
- Zhang, D., & Adipat, B. (2005). Challenges, Methodologies, and Issues in the Usability Testing of Mobile Applications. *International Journal of Human-Computer Interaction*, 18(3), 293-308.
- Zhang, J., Johnson, T. R., Patel, V. L., Paige, D. L., & Kubose, T. (2003). Using Usability Heuristics to Evaluate Patient Safety of Medical Devices. *Journal of biomedical informatics*, 36(1), 23-30.
- Zhu, Z., Nakata, C., Sivakumar, K., & Grewal, D. (2013). Fix It Or Leave It? Customer Recovery from Self-Service Technology Failures. *Journal of Retailing*, 89(1), 15-29.
- Zikmund, W., Babin, B., Carr, J., & Griffin, M. (2012). *Business Research Methods* (9th ed.). Farmington, USA: Cengage Learning.
- Zimmermann, T. (2005). Information Architecture Retrieved 16/02/2015, from <http://www.mayr.informatik.tu-muenchen.de/konferenzen/Jass05/courses/6/Papers/03.pdf>
- Zulkarnain, Z. (2001). *Statistik Pengurusan* (2nd ed.). Sintok, Kedah, Malaysia: Penerbit Universiti Utara Malaysia.

Appendix A

Questionnaire for User Interface Satisfaction of Mobile Dua and Zikr for Hajj (MDZ4H)

Please rate your satisfaction with the system.

- Try to respond to all the items.
- For items that are not applicable, use: **NA**
- Add a comment about an item in 1-6.

OVERALL REACTION TO THE SOFTWARE		1	2	3	4	5		NA
1.	terrible	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	wonderful	<input type="checkbox"/>
2.	difficult	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	easy	<input type="checkbox"/>
3.	frustrating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	satisfying	<input type="checkbox"/>
4.	inadequat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	adequate	<input type="checkbox"/>
5.	dull	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	stimulating	<input type="checkbox"/>
6.	rigid	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	flexible	<input type="checkbox"/>
SCREEN		1	2	3	4	5		NA
7.	Reading characters on the screen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	very clear	<input type="checkbox"/>
8.	Organization of information	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	very clear	<input type="checkbox"/>
9.	Sequence of screens	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	very clear	<input type="checkbox"/>
TERMINOLOGY AND SYSTEM INFORMATION		1	2	3	4	5		NA
10.	Use of terms throughout system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	consistent	<input type="checkbox"/>
11.	Position of messages on screen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	consistent	<input type="checkbox"/>
LEARNING		1	2	3	4	5		NA
12.	Learning to operate the system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Easy	<input type="checkbox"/>
13.	Exploring new features by trial and error	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Easy	<input type="checkbox"/>
14.	Remembering names and use of commands	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Easy	<input type="checkbox"/>
15.	Performing tasks is straightforward	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	always	<input type="checkbox"/>
SYSTEM CAPABILITIES		1	2	3	4	5		NA
16.	System speed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	fast enough	<input type="checkbox"/>
17.	System reliability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	reliable	<input type="checkbox"/>
18.	System tends to be	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	quiet	<input type="checkbox"/>
19.	Designed for all levels of users	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	always	<input type="checkbox"/>

List the most negative aspect(s):	List the most positive aspect(s):
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.

Thank you very much for your cooperation

Appendix B

Questionnaire for Application Usability

System to be rated:

Mobile Dua and Zikr for Hajj (MDZ4H).

Objective:

Obtain your view on the evaluation of the MDZ4H.

Introduction:

This questionnaire consists of two sections:

- General Information
- Mobile Dua and Zikr for Hajj (MDZ4H) Evaluation.

Please answer **ALL** questions from each segment.

1) General Information

This segment is about your background information. *Please fill up the blanks and mark [√] where appropriate.*

1. Gender: Male Female

2. Age: 10-25 Years. 26-40 Years.

41-55 Years. Over 55 Years.

3. Education background

Diploma Degree Master Ph.D.

4. Your mobile applications experience _____ months.

5. Have you been to Makkah to perform Hajj or Umrah? Yes No.

If yes how many times _____ .

6. Can you read Arabic? Yes No.

If yes please rate you Arabic reading level Excellent Good Bad.

2) Mobile Dua and Zikr for Hajj MDZ4H Prototype Evaluation

This segment is intended to obtain your view on the Mobile Dua and Zikr for Hajj prototype. Please check or shade the answer to the following questions.

1 = Strongly Disagree

2 = Disagree

3 = Neutral

4 = Agree

5 = Strongly Agree

Perceived Usefulness	1	2	3	4	5
7. Using MDZ4H would enable me to accomplish the reciting of dua and zikr for Hajj more quickly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Using MDZ4H would improve my performance in reciting the dua and zikr for Hajj.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Using MDZ4H would increase my productivity in reciting the dua and zikr for Hajj.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Using MDZ4H would enhance my effectiveness in reciting the dua and zikr for Hajj.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Using MDZ4H would make it easier to recite the dua and zikr for Hajj	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. I would find MDZ4H useful in every Hajj or Umrah task.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Perceived Ease Of Use	1	2	3	4	5
13. Learning to operate MDZ4H would be easy for me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. I would find it easy to get MDZ4H to do what I want it to do.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. My interaction with MDZ4H would be clear and understandable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. I would find MDZ4H to be flexible to interact with.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. It would be easy for me to become skilful at using the MDZ4H.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. I would find MDZ4H easy to use.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Outcome / Future Use	1	2	3	4	5
19. I was able to complete the recitation of the dua and zikr for Hajj quickly using MDZ4H.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. I could effectively complete the recitation of the dua and zikr for Hajj using MDZ4H.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. I was able to efficiently complete the recitation of the dua and zikr for Hajj using MDZ4H.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. I believe I could become productive quickly in reciting the dua and zikr for Hajj using MDZ4H.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. From my current experience with using MDZ4H, I think I would use it regularly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Thank you very much for your cooperation

Appendix C

A Brief Overview of the Usability Testing Methods

Type Of Evaluation	Evaluation Method	Purpose Of Evaluation	Data Generation And Collection Techniques	Description Of The Method	Design And Development Stage	Evaluation Performed By	Advantages	Disadvantages
USABILITY INSPECTION								
Analytic	Formal usability inspection	Examine usability of user interface; find design flaws early in design process	Specifications; questionnaire; observation; verbal protocols; video or audio recording	Inspections walk through tasks with the user's goal and purpose in mind	Early in design and development process	Experts in the field, specially assigned inspectors	Can be held on early prototypes of design specifications of paper mock-ups	Does not provide insights into real user patterns of use and problems
Analytic	Heuristic evaluation	Find usability defects early in design process	Heuristics; checklist; verbal protocol; video or audio recording	Experts assess design guided by heuristics	Particularly well suited for earlier stages of the design process	Experts (usually 2-5)	Diagnostic; high potential return on investment; cost-effective	Subject to bias; locating experts may present a problem; no real user involved
Analytic	Cognitive walkthrough	Find interaction design flaws and user difficulties	Usability specifications; checklist; verbal protocol; video or audio recording	Experts role play users performing the real task on early prototype	Early in design process	Expert evaluators	Cost-effective; can be held specifications; can provide a typical usage scenario	Restrictions in role playing locating experts may be problematic : no real users involved
USABILITY INSPECTION								
Analytic	Pluralistic walkthrough	Evaluate user interface on interaction	Verbal protocols; observation; critical incident taking; questionnaire	User developers' and usability professionals collaborate to analyze the system	Early in development process	Users together with developers and usability professionals	Interaction between users and developers helps resolve usability problems faster	Requires special organizations; involves high costs and time investments

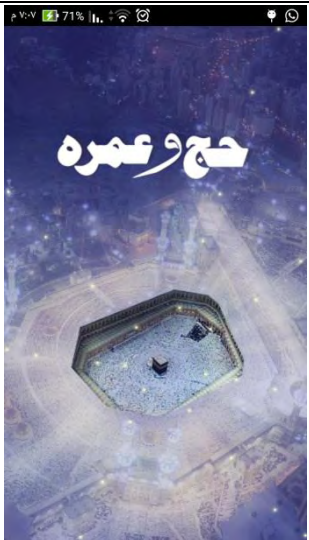


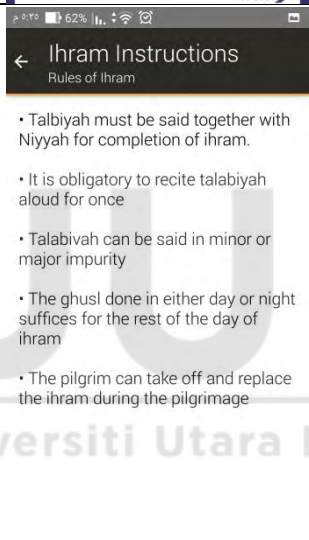


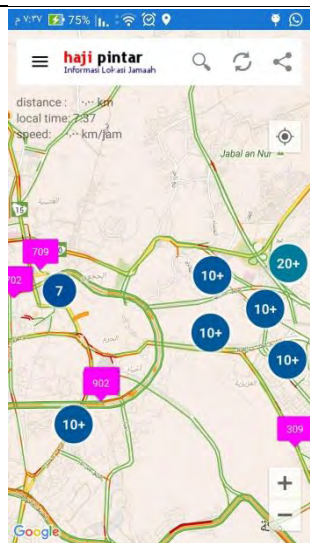
Type Of Evaluation	Evaluation Method	Purpose Of Evaluation	Data Generation And Collection Techniques	Description Of The Method	Design And Development Stage	Evaluation Performed By	Advantages	Disadvantages
USABILITY INQUIRY								
Empirical	Survey	Obtain information about users' preferences or understanding of the system	Questionnaire; user interview	Data collected from questionnaires or interviews	Implementation users and evaluation stage (late in design process)	Users	Can be diagnostics; can be used for large groups; replicable	Information is subjective; low response rates; time-consuming
Empirical	Interview; focus group; panel	Obtain information on users' needs; get user feedback on the system	User interview; retrospective verbal protocols	Data collected from user interviews, panels or focus groups	Analysis (formulation of users' needs); implementation and evaluation stage	Users	Flexible; allow in-depth attitude and experience probing	Information is subjective; time-consuming; requires special organization; data analysis may be complex
USABILITY INQUIRY								
Empirical	Contextual Inquiry	Gather information about problems experienced by users on product use	Contextual interviews; observation; verbal protocols; video or audio recording	Developers observe users performing real tasks and discuss the process with them	Early in development process	Users	Natural context of use; can help identify the causes of users' actions and decisions	High costs; difficult to analyze and interpret data
USABILITY TESTING								
Empirical	Experiments	Examine user performance on the structured tasks; gain insights into what users actually do	Logging of activities; performance measures; verbal protocols; observation; video recording; questionnaires	Users perform clearly defined 'typical' user tasks in a controlled environment	Development implementation and evaluation stage (late in design process)	Users (5-20) or experts as user to distinguish patterns of use	Powerful; reliable; finds highly used (or in used) features	High costs; data analysis; time consuming; low ecological validity; can affect user's performance level

Type Of Evaluation	Evaluation Method	Purpose Of Evaluation	Data Generation And Collection Techniques	Description Of The Method	Design And Development Stage	Evaluation Performed By	Advantages	Disadvantages
Empirical	Co-discovery	Gather information about problems experienced by users on product use	Participant observation; verbal protocols; video or audio recording	Developers observe 2 users who work together and verbalize the process	Any stage of design and development process	2 users	Can bring out more insights than a single participant vocalizing his or her thoughts	High cost; difficult to analyze and interpret
USABILITY TESTING								
Empirical	Prototype evaluation/testing	Get feedback from users on the system 'under construction'	Verbal or written protocols or notes; informal feedback	Designers let users try out the product and get their feedback	Any stage of design and development process	1-2 users and/or experts	Provides data on user preferences and experiences; low cost; can be held in natural	Information can be subjective; provides incomplete picture
Empirical	Trial-run	Reveal problem and improve usability of the system before release	Performance measures; logging of activities; questionnaires; interviews	User perform the whole range of tasks and activities they would in the real life	Implementation users and evaluation stages (late in the design process)	Users	Powerful; reliable; valid data; high ecological validity	High costs; time-consuming; requires special organization; user behavior can be effected by evaluation

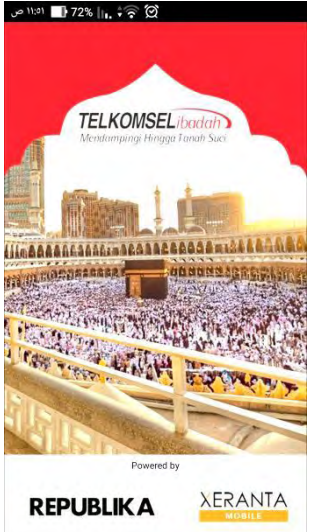
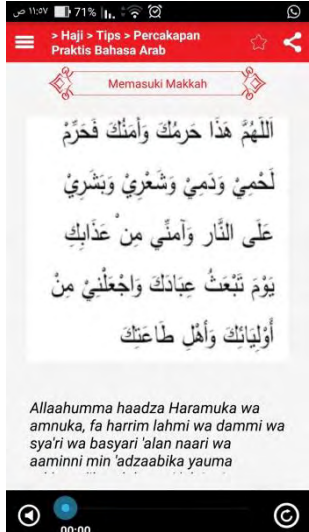
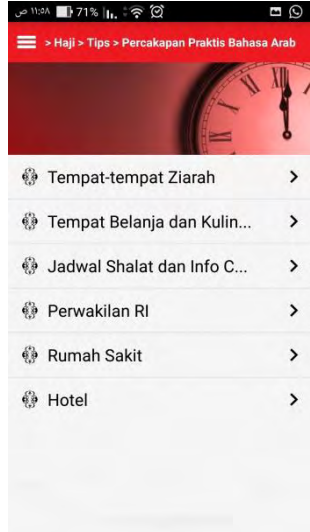
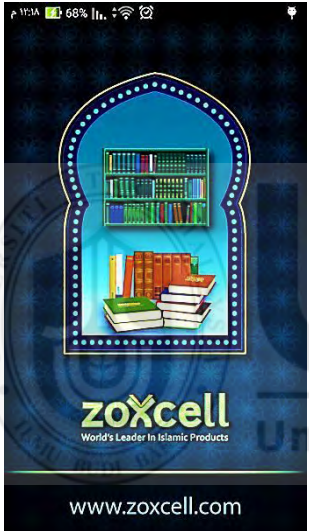

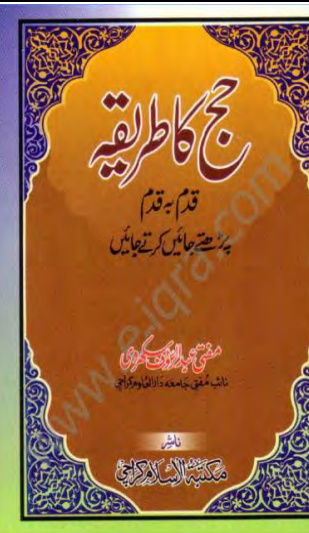

Appendix D

User Interface of the Selected Mobile Applications

Apps Name	Opening Section	Contents Section	Closing Section
Salam: Hajj & Umrah Guide			
Al-Mutawif for Hajj, Umrah and Ziarah (المطوف للحج والعمرة والزيارة)			
Hajj and Umrah Guide			

Apps Name	Opening Section	Contents Section	Closing Section
Hajj and Umrah			
Umrah & Hajj Guide		 <ul style="list-style-type: none"> • Talbiyah must be said together with Niyyah for completion of ihram. • It is obligatory to recite talbiyah aloud for once • Talabivah can be said in minor or major impurity • The ghusl done in either day or night suffices for the rest of the day of ihram • The pilgrim can take off and replace the ihram during the pilgrimage 	 <ul style="list-style-type: none"> • Avoid drinking tap water • Avoid consuming raw salads, vegetables and fruits • Add salt into water for drinking to avoid dehydration • Have a wrist blood pressure kit for blood pressure patient • Glucometer
Haji Pintar			

Apps Name	Opening Section	Contents Section	Closing Section
Manasik Haji dan Umrah			
Hajj & Umrah Guide			
Lovers' Hajj (حج العاشقين)			

Apps Name	Opening Section	Contents Section	Closing Section
Telkomsel Ibadah			
Hajj and Umrah Guide English			No Closing Section
Hajj aur Umrah in Urdu			No Closing Section

Appendix E

Sample of Consent Form for Expert



**Consent Form of Expert Reviewer for Conceptual Design
Model of Personal Digital Mutawwif (PDM)**
School of Multimedia Technology and Communication
College of Arts and Science
Universiti Utara Malaysia (UUM)


1. I have accepted the official appointment letter from UUM. With the expertise and the existing knowledge that I have, I volunteer to be an expert reviewer for "*Personal Digital Mutawwif (PDM)*" proposed by Ahmad Sheikh Abdullah Al-Aidarooos under supervision of Dr. Ariffin Abdul Mutalib.
2. I understand that the expert review process is designed to gather information and comments in improving the proposed model.
3. I understand that no part of the proposed model may be reproduced, stored in retrieved system, or transmitted in any form or by any means, electronic, mechanical photocopying, recording, or otherwise, without prior permission from the researcher and her supervisor.
4. I understand that the researcher will not identify me by name in any report using information obtained from the questionnaire, and that my confidentiality as a participant in this study will remain secure. Subsequent uses of records and data will be subject to standard data use policies which protect the anonymity of individuals and institutions.
5. I understand that this study has been reviewed and approved by the School of Multimedia Technology and Communication, College of Arts and Science, UUM.
6. I have read and understood the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this study.
7. I am given a copy of this consent form.

My Signature

ASSOC. PROF. DR. AKRAM MZM KHEDHER
Deputy Director
Centre for Islamisation (CENTRIS)
International Islamic University Malaysia

Akram MZM Khedher
My Printed Name and Official Stamp

Date


Signature of the Researcher

For further information, please contact:

s94410@alumni.uum.edu.my / Mr.alaidaroos@Gmail.com /am.ariffin@uum.edu.my

Appendix F


Sample of Experts' Invitation Email and Response

Expert review request on conceptual design model of PDM - Google Chrome


Microsoft Corporation [US] | <https://outlook.office.com/owa/projection.aspx>

Reply all | Delete Junk | ...

Expert review request on conceptual design model of PDM

 **Ahmed Sheikh Abdullah Al-Aidaros**
Thu 14/1/2016, 10:13 PM
sazilah@utem.edu.my

Sent Items

 **Consent form.docx**
93 KB

Show all 1 attachments (93 KB) Download Save to OneDrive - UNIVERSITY UTARA MALAYSIA

Dear **Prof. Madya. Dr. Sazilah binti Salam**
Assalamualaikum & Good Day

I am Ahmed Sheikh Abdullah Al-Aidaros and currently pursuing PhD program in Multimedia at Universiti Utara Malaysia (UUM), Malaysia. I am interested in your expertise which is in Multimedia Information Systems.

With the expertise you possess, I will be glad that review my proposed model which is named: Personal Digital Mutawwif (PDM). It is a conceptual design model of Multimodal Mobile Application that is specifically designed to be usable in assisting pilgrims during Hajj.

If you agree, please fill-up the attached consent form and return back to me after which I will send to you the appointment letter officially from UUM together with the proposed model and the instrument (questionnaire).

The proposed model is in the form of figure which is illustrated on a single page of paper. With the expertise that you have, it is expected to take 20 to 30 minutes for you to review.

Hope to hear positively from you soon.

Thanking you in advance for your time, assistance, and cooperation.


Thank you.
Kind regards
Ahmed Al-Aidaros
PhD Student
Universiti Utara Malaysia (UUM)

Re: Expert review request on conceptual design model of PDM - Google Chrome

Microsoft Corporation [US] | <https://outlook.office.com/owa/projection.aspx>

Reply all | Delete Junk | ...

Re: Expert review request on conceptual design model of PDM

 **PROFESOR DR. SAZILAH BINTI SALAM** <sazilah@utem.edu.my>
Tue 19/1/2016, 12:39 PM
Ahmed Sheikh Abdullah Al-Aidaros

Inbox

You replied on 6/2/2016 4:30 PM.

Assalamualaikum Ahmed.

Thank you for your email invitation.

Yes, insyaAllah I would be happy to be your reviewer.

Thank you.

Sazilah (012 7013863)

Appendix G

Sample of Appointment Letter for Expert



PUSAT PENGAJIAN TEKNOLOGI MULTIMEDIA DAN KOMUNIKASI
SCHOOL OF MULTIMEDIA TECHNOLOGY AND COMMUNICATION
Universiti Utara Malaysia
06010 UUM SINTOK
KEDAH DARUL AMAN
MALAYSIA



Tel: 604-928 5801
Faks (Fax): 604-928 5804
Laman Web (Web): <http://www.smmtc.uum.edu.my>

KEDAH AMAN MAKMUR • BERSAMA MEMACU TRANSFORMASI

UUM/CAS(SMMTC)/P-30
18 January 2016

Dr. Murni Binti Mahmud,
Associate Professor,
Department of Information Systems,
Kulliyah of Information and Communication Technology,
International Islamic University Malaysia
P.O. Box 10, 50728 Kuala Lumpur, Malaysia.
Tel: 603 6196 5647, 603 6196 5620

Madam,

APPOINTMENT AS EXPERT REVIEWER FOR CONCEPTUAL DESIGN MODEL OF MULTIMODAL MOBILE ASSISTANCE DURING HAJJ: PERSONAL DIGITAL MUTAWWIF (PDM)

Thank you for agreeing to involve as an expert in a PHD study, particularly for reviewing and evaluating a conceptual model with the following details:

Student Name : Ahmed Sheikh Abdullah Al-Aidarooos
No Matrik : 94410
School : School of Multimedia Technology and Communication, UUM
Research Title : Conceptual Model of Multi-Modal Usable Mobile Assistance during Hajj
Supervisor : Dr. Ariffin Abdul Mutalib

For your information, the student will use the model for his research. Therefore, he needs your expertise to review the proposed model in a few dimensions as stated in the reviewing form.

Your cooperation, time, and assistance are greatly appreciated.

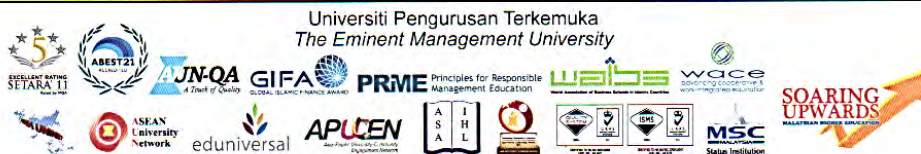
Thank you.

"ILMU BUDI BAKTI"

Sincerely yours,

DR. NORSIAH ABDUL HAMID

Dean
School of Multimedia Technology and Communication,
UUM College of Arts and Sciences
Universiti Utara Malaysia



Appendix H

The Instrument of Expert Review

INSTRUMENT FOR EXPERT REVIEW:

CONCEPTUAL DESIGN MODEL OF MULTIMODAL MOBILE ASSISTANCE DURING HAJJ: PERSONAL DIGITAL MUTAWWIF (PDM)

Dear Prof. / Dr. / Sir / Ma,

EXPERT REVIEW OF CONCEPTUAL DESIGN MODEL OF PDM

I am **Ahmed Sheikh Abdullah Al-Aidaros** and currently pursuing PhD program in Multimedia at Universiti Utara Malaysia (UUM), Malaysia. I am delighted to inform you that you have been selected to participate in this research on the reason as follows:

1. Your qualifications either in Human Computer Interaction (HCI) or Mobile Applications or Multimedia or Software Engineering (SE) or Information Systems (IS) or Computer Science (CS) or any related areas, and/or
2. You have been researching/teaching in Multimedia or Usability or HCI or instructional design or IT or CS areas for at least five years.

My PhD research proposes **A CONCEPTUAL MODEL OF MULTI-MODAL USABLE MOBILE ASSISTANCE DURING HAJJ**. As part of this research, a conceptual design model which is named **Personal Digital Mutawwif (PDM)** has been designed. It is aimed to provide a conceptual design model of developing a multimodal mobile application that is specifically designed to be usable in assisting pilgrims during Hajj.

Therefore, as part of the prerequisite for this research, it is required that you evaluate the appropriateness of the proposed design strategies in the instrument listed in the review form below.

It would be greatly appreciated if you could complete this evaluation form.

The information supplied will be treated as confidential and will be used for the research purposes, which will be reported anonymously in academic publications.

Please feel free to contact me by e-mail: **Mr.Alaidaros@gmail.com** in regard to any queries or my supervisor **am.ariffin@uum.edu.my**.

INSTRUCTIONS:

Please read and go through the **PDM** figure carefully. Once this is done, with the expertise you possess, please provide feedback for all questions in the provided spaces.

EXPERT/REVIEWER DETAILS

Name* : _____

Highest educational level* : _____ Gender : Male Female

Years of Experience* : _____ Age : _____

ITEMS TO REVIEW

Based on the proposed conceptual model (as depicted in the given handout), please tick (✓) your choice.

1.	The proposed elements in the following components are relevant	All proposed components and elements are relevant	Some are definitely not relevant	Some may not be relevant
	Structural			
	Content Composition			
	Design Principles			
	Technology			
	Development Approach			
2.	The proposed design principles are understood	Needs very detailed explanation	Needs some explanation	It's easy to understand
	Texts Formatting			
	Images			
	Graphics			
	Animations			
	Audios			
	Fusion and Fission			
	Instruction-Base			
	Organization			
	Labelling			
	Navigation Systems			
	Transitions			
	User Interface and Layout			
3.	The following terminology	Needs very detailed explanation	Needs some explanation	It's easy to understand
	Modalities			
	Fusion			
	Fission			
	Manual Mode			
	Oral Mode			
	Automatic Mode			
	Instruction-Base			

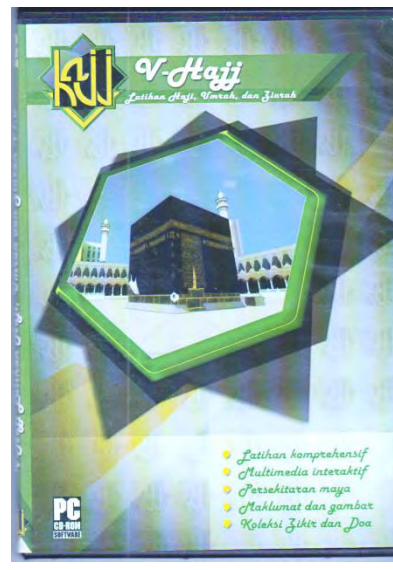
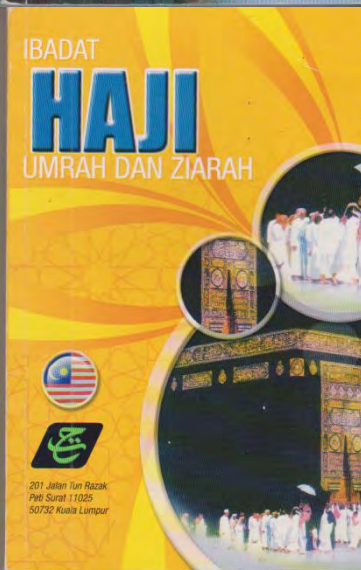
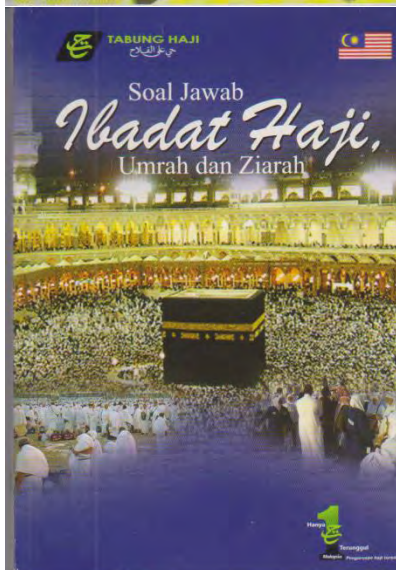
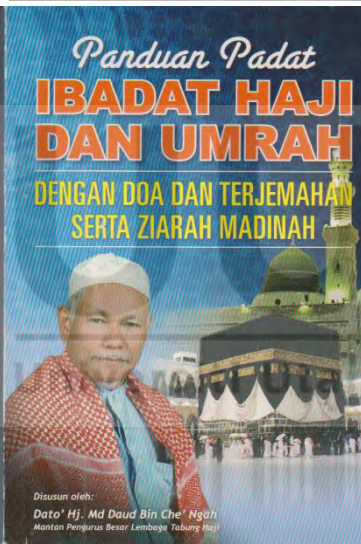
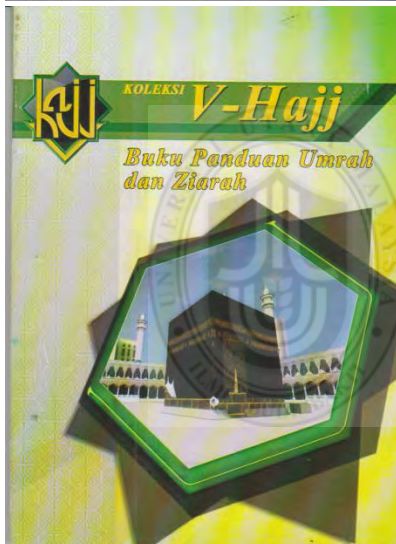
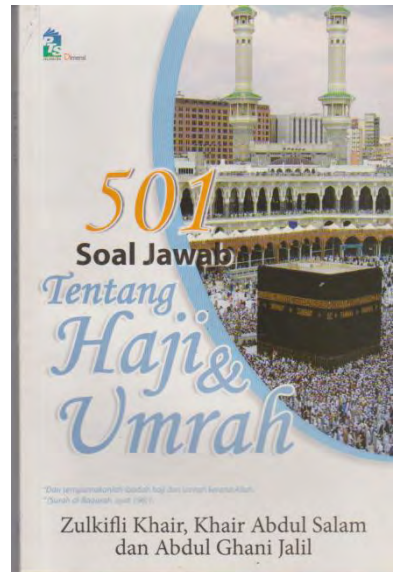
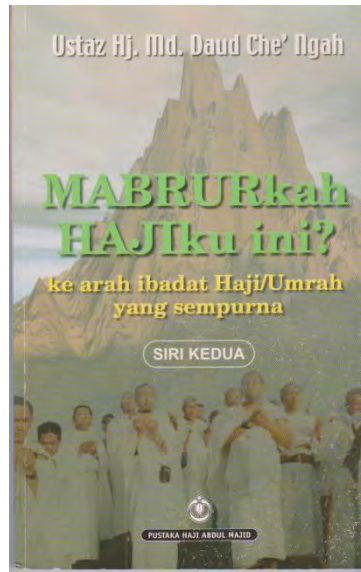
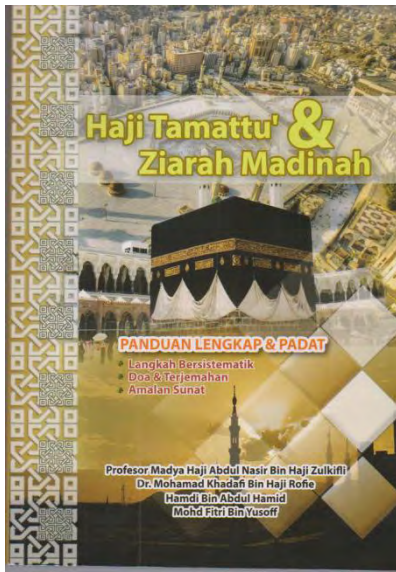
4. The connections and flows of all the components are logical? Yes [] No []

5. Overall, the production model is readable? Yes [] No []

6. Please write your further comments below:-----

Appendix I

Books Cover Pictures (The Sources of Contents)



Section B: PDM Usability Evaluation

INSTRUCTION: Please circle (O) on the scale of your choice.

Strongly Disagree ← 1 2 3 4 5 → Strongly Agree

Effectiveness

Usefulness

- | | | | | | | |
|-----|--|---|---|---|---|---|
| 1. | The information provided by PDM is enough and helpful. | 1 | 2 | 3 | 4 | 5 |
| 2. | The information provided by PDM is effective in helping me complete the rituals of Hajj. | 1 | 2 | 3 | 4 | 5 |
| 3. | Using PDM would enable me to accomplish the rituals of Hajj more quickly. | 1 | 2 | 3 | 4 | 5 |
| 4. | Using PDM would enhance my effectiveness in performing the rituals of Hajj. | 1 | 2 | 3 | 4 | 5 |
| 5. | Using PDM would make it easier to perform the rituals of Hajj. | 1 | 2 | 3 | 4 | 5 |
| 6. | Using PDM would increase my productivity in performing the rituals of Hajj. | 1 | 2 | 3 | 4 | 5 |
| 7. | PDM meets my needs and does everything I would expect. | 1 | 2 | 3 | 4 | 5 |
| 8. | The voice instructions in PDM are clear and easy to understand. | 1 | 2 | 3 | 4 | 5 |
| 9. | Sounds in PDM are sufficiently pure and not noisy. | 1 | 2 | 3 | 4 | 5 |
| 10. | In PDM, the recitation speed of voice instructions is sufficiently moderate. | 1 | 2 | 3 | 4 | 5 |
| 11. | I would find PDM useful in Hajj. | 1 | 2 | 3 | 4 | 5 |

Errors

- | | | | | | | |
|----|---|---|---|---|---|---|
| 1. | I think PDM prevents me from making errors. | 1 | 2 | 3 | 4 | 5 |
| 2. | I can recover from mistakes quickly and easily while operating PDM. | 1 | 2 | 3 | 4 | 5 |
| 3. | PDM has at some time stopped unexpectedly. | 1 | 2 | 3 | 4 | 5 |

Simplicity

- | | | | | | | |
|----|---|---|---|---|---|---|
| 1. | The operations of PDM are simple and uncomplicated. | 1 | 2 | 3 | 4 | 5 |
| 2. | The organization of information on PDM is clear and easy to understand. | 1 | 2 | 3 | 4 | 5 |
| 3. | I learned to use PDM quickly. | 1 | 2 | 3 | 4 | 5 |
| 4. | I easily remember how to use PDM. | 1 | 2 | 3 | 4 | 5 |
| 5. | The information provided by PDM is easy to understand. | 1 | 2 | 3 | 4 | 5 |
| 6. | PDM is designed for all levels of users. | 1 | 2 | 3 | 4 | 5 |
| 7. | I found PDM simple to use. | 1 | 2 | 3 | 4 | 5 |

Reliability

- | | | | | | | |
|----|---|---|---|---|---|---|
| 1. | PDM is reliable, dependable, and trustworthy. | 1 | 2 | 3 | 4 | 5 |
| 2. | PDM is accurate in identifying my exact location. | 1 | 2 | 3 | 4 | 5 |

3. PDM is accurate in interpreting my voice commands.	1	2	3	4	5
4. PDM has all the functions and capabilities I expect it to have.	1	2	3	4	5

Efficiency

Ease of Use

1. I can use PDM without written instructions.	1	2	3	4	5
2. PDM requires the fewest steps possible to accomplish what I want to do.	1	2	3	4	5
3. The speed of PDM is fast enough.	1	2	3	4	5
4. It is easy to make PDM does exactly what I want.	1	2	3	4	5
5. It would be easy for me to become skillful at using PDM.	1	2	3	4	5
6. It is easy to learn PDM.	1	2	3	4	5
7. I can use PDM successfully every time.	1	2	3	4	5
8. Using PDM is effortless.	1	2	3	4	5
9. Using PDM is sufficiently easy.	1	2	3	4	5

Safety

1. The highlighting on the PDM screens is helpful.	1	2	3	4	5
2. It is sufficiently easy to operate PDM with one hand.	1	2	3	4	5
3. PDM is safe to use without causing harm or difficulty.	1	2	3	4	5
4. It is safe to use PDM while performing rituals of Hajj.	1	2	3	4	5
5. PDM is suitable to use in a crowded environment like Hajj.	1	2	3	4	5

Flexibility

1. It is easy to move from one part of a task to another.	1	2	3	4	5
2. I do not notice any inconsistency as I use PDM.	1	2	3	4	5
3. All operations in PDM can be carried out in a systematically similar way.	1	2	3	4	5
4. In PDM, the control matches user skills.	1	2	3	4	5
5. The visual representation in PDM is consistent with familiar conventions.	1	2	3	4	5
6. The wording in PDM is familiar.	1	2	3	4	5
7. PDM provides zooming for display expansion.	1	2	3	4	5
8. The interface of PDM is consistent with other products I have used.	1	2	3	4	5

Accessibility

1. It is easy to find the information I need in PDM.	1	2	3	4	5
2. It is easy to navigate the PDM.	1	2	3	4	5
3. The organization of the PDM menus is sufficiently logical.	1	2	3	4	5
4. The buttons are sufficiently easy to locate.	1	2	3	4	5

- | | | | | | |
|---|---|---|---|---|---|
| 5. The amount of information displayed on the PDM screens is adequate. | 1 | 2 | 3 | 4 | 5 |
| 6. The characters on PDM screens are easy to read. | 1 | 2 | 3 | 4 | 5 |
| 7. The terminologies used in PDM are consistent and always related to the task. | 1 | 2 | 3 | 4 | 5 |
| 8. The sequence of PDM screens is clear and logical. | 1 | 2 | 3 | 4 | 5 |

Satisfaction

Attitude

- | | | | | | |
|--|---|---|---|---|---|
| 1. I feel I need to have PDM. | 1 | 2 | 3 | 4 | 5 |
| 2. I feel comfortable and confident using PDM. | 1 | 2 | 3 | 4 | 5 |
| 3. I feel excited when using PDM. | 1 | 2 | 3 | 4 | 5 |
| 4. I would recommend PDM to my friends. | 1 | 2 | 3 | 4 | 5 |

Acceptability

- | | | | | | |
|---|---|---|---|---|---|
| 1. The interface of PDM is attractive and pleasant. | 1 | 2 | 3 | 4 | 5 |
| 2. PDM is wonderful. | 1 | 2 | 3 | 4 | 5 |
| 3. Overall, I am satisfied with PDM. | 1 | 2 | 3 | 4 | 5 |



END OF QUESTIONS

THANK YOU FOR PARTICIPATING!

Universiti Utara Malaysia

Appendix K

The Instrument for Face and Content Validity of Q-U3MA

INSTRUMENT FOR CONTENT VALIDITY: MEASURING THE USABILITY OF MULTI-MODAL MOBILE APPLICATIONS (Q-U3MA)

Guide for expert/ reviewer

You are selected to review this questionnaire on reasons as follows:

- You are PhD or master holder in either in Human Computer Interaction (HCI) or Usability or Mobile Applications or Multimedia or Software Engineering (SE) or Information Systems (IS) or Computer Science (CS) or any related areas, and/or
- You have a teaching background for five years or above in the above mentioned areas or any relevant area.

On top of that, you have at least five years studying/ researching/ teaching in the above mentioned areas or any relevant area.

Apparatus:

1. This sheet
2. The questionnaire of measuring the usability of multi-modal mobile applications (Q-U3MA)
3. Pen

Instructions:

- You are provided with the above listed apparatus.
- Read and understand the Q-U3MA carefully.
- Finally, with the expertise you have, it is expected that you could provide feedback for all questions in the provided spaces.

QUESTIONS FOR REVIEW

Section A: Effectiveness

Q1) Sub-measures relevancy?

Sub-Measures	Relevant	Not relevant
Usefulness		
Errors		
Simplicity		
Reliability		

Q2) Items representativeness and clarity?

Representativeness	Scale	Clarity
Item is not representative	1	Item is not clear
Item needs major revisions to be representative	2	Item needs major revisions to be clear
Item needs minor revisions to be representative	3	Item needs minor revisions to be clear
Item is representative	4	Item is clear

A) Usefulness Items		Representativeness				Clarity			
		1	2	3	4	1	2	3	4
1.	The information provided by PDM is enough and helpful.								
2.	The information provided by PDM is effective in helping me complete the rituals of Hajj.								
3.	Using PDM would enable me to accomplish the rituals of Hajj more quickly.								
4.	Using PDM would enhance my effectiveness in performing the rituals of Hajj.								
5.	Using PDM would make it easier to perform the rituals of Hajj.								
6.	Using PDM would increase my productivity in performing the rituals of Hajj.								
7.	PDM meets my needs and does everything I would expect.								
8.	The voice instructions in PDM are clear and easy to understand.								
9.	Sounds in PDM are sufficiently pure and not noisy.								
10.	In PDM, the recitation speed of voice instructions is sufficiently moderate.								
11.	I would find PDM useful in Hajj.								

B) Errors Items		Representativeness				Clarity			
		1	2	3	4	1	2	3	4
1.	I think PDM prevents me from making errors.								
2.	I can recover from mistakes quickly and easily while operating PDM.								
3.	PDM has at some time stopped unexpectedly.								

C) Simplicity Items		Representativeness				Clarity			
		1	2	3	4	1	2	3	4
1.	The operations of PDM are simple and uncomplicated.								
2.	The organization of information on PDM is clear and easy to understand.								
3.	I learned to use PDM quickly.								
4.	I easily remember how to use PDM.								
5.	The information provided by PDM is easy to understand.								
6.	PDM is designed for all levels of users.								
7.	I found PDM simple to use.								

D) Reliability Items		Representativeness				Clarity			
		1	2	3	4	1	2	3	4
1.	PDM is reliable, dependable, and trustworthy.								
2.	PDM is accurate in identifying my exact location.								
3.	PDM is accurate in interpreting my voice commands.								
4.	PDM has all the functions and capabilities I expect it to have.								

Section B: Efficiency

Q1) Sub-measures relevancy?

Sub-Measures	Relevant	Not relevant
Ease of use		
Safety		
Flexibility		
Accessibility		

Q2) Items representativeness and clarity?

Representativeness	Scale	Clarity
Item is not representative	1	Item is not clear
Item needs major revisions to be representative	2	Item needs major revisions to be clear
Item needs minor revisions to be representative	3	Item needs minor revisions to be clear
Item is representative	4	Item is clear

A) Ease of Use Items		Representativeness				Clarity			
		1	2	3	4	1	2	3	4
1.	I can use PDM without written instructions.								
2.	PDM requires the fewest steps possible to accomplish what I want to do.								
3.	The speed of PDM is fast enough.								
4.	It is easy to make PDM does exactly what I want.								
5.	It would be easy for me to become skillful at using PDM.								
6.	It is easy to learn PDM.								
7.	I can use PDM successfully every time.								
8.	Using PDM is effortless.								
9.	Using PDM is sufficiently easy.								

B) Safety Items		Representativeness				Clarity			
		1	2	3	4	1	2	3	4
1.	The highlighting on the PDM screens is helpful.								
2.	It is sufficiently easy to operate PDM with one hand.								
3.	PDM is safe to use without causing harm or difficulty.								
4.	It is safe to use PDM while performing rituals of Hajj.								
5.	PDM is suitable to use in a crowded environment like Hajj.								

C) Flexibility Items		Representativeness				Clarity			
		1	2	3	4	1	2	3	4
1.	It is easy to move from one part of a task to another.								
2.	I do not notice any inconsistency as I use PDM.								
3.	All operations in PDM can be carried out in a systematically similar way.								
4.	In PDM, the control matches user skills.								
5.	The visual representation in PDM is consistent with familiar conventions.								
6.	The wording in PDM is familiar.								
7.	PDM provides zooming for display expansion.								
8.	The interface of PDM is consistent with other products I have used.								

D) Accessibility Items		Representativeness				Clarity			
		1	2	3	4	1	2	3	4
1.	It is easy to find the information I need in PDM.								
2.	It is easy to navigate the PDM.								
3.	The organization of the PDM menus is sufficiently logical.								
4.	The buttons are sufficiently easy to locate.								

5.	The amount of information displayed on the PDM screens is adequate.								
6.	The characters on PDM screens are easy to read.								
7.	The terminologies used in PDM are consistent and always related to the task.								
8.	The sequence of PDM screens is clear and logical.								

Section C: Satisfaction

Q1) Sub-measures relevancy?

Sub-Measures	Relevant	Not relevant
Attitude		
Acceptability		

Q2) Items representativeness and clarity?

Representativeness	Scale	Clarity
Item is not representative	1	Item is not clear
Item needs major revisions to be representative	2	Item needs major revisions to be clear
Item needs minor revisions to be representative	3	Item needs minor revisions to be clear
Item is representative	4	Item is clear

A) Attitude Items		Representativeness				Clarity			
		1	2	3	4	1	2	3	4
1.	I feel I need to have PDM.								
2.	I feel comfortable and confident using PDM.								
3.	I feel excited when using PDM.								
4.	I would recommend PDM to my friends.								

B) Acceptability Items		Representativeness				Clarity			
		1	2	3	4	1	2	3	4
1.	The interface of PDM is attractive and pleasant.								
2.	PDM is wonderful.								
3.	Overall, I am satisfied with PDM.								

Section D: General Comments (Please specify the item):

END OF QUESTIONS
Thank you for participating

Appendix L Reliability Test Results

1- Usefulness (2 Items Deleted)

Reliability Statistics Before FA		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.875	.893	11

Reliability Statistics After FA	
Cronbach's Alpha	N of Items
.934	9

Scale Statistics			
Mean	Variance	Std. Deviation	N of Items
43.6286	57.476	7.58127	11

Item Statistics			
	Mean	Std. Deviation	N
USF1	4.1429	.80961	35
USF2	4.2571	.85209	35
USF3	4.1143	.90005	35
USF4	3.0286	1.50461	35
USF5	4.3714	.97274	35
USF6	3.2286	1.05957	35
USF7	4.1429	1.03307	35
USF8	4.0857	.98134	35
USF9	4.1714	.92309	35
USF10	3.9429	1.05560	35
USF11	4.1429	1.11521	35

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
USF1	39.4857	47.669	.819	.826	.852
USF2	39.3714	48.240	.719	.611	.857
USF3	39.5143	49.257	.586	.768	.864
USF4	40.6000	50.071	.241	.445	.900
USF5	39.2571	46.432	.762	.753	.852
USF6	40.4000	57.541	-.074	.447	.906
USF7	39.4857	46.139	.732	.807	.853
USF8	39.5429	46.491	.749	.794	.853
USF9	39.4571	47.079	.753	.801	.854
USF10	39.6857	45.634	.752	.761	.852
USF11	39.4857	44.492	.789	.862	.848

2- Errors Rate (No Item Deleted)

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.848	.851	4

Scale Statistics			
Mean	Variance	Std. Deviation	N of Items
15.8000	9.988	3.16042	4

Item Statistics			
	Mean	Std. Deviation	N
ERR1	4.1429	.91210	35
ERR2	3.9143	.88688	35
ERR3	4.0857	.95090	35
ERR4	3.6571	1.05560	35

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
ERR1	11.6571	5.997	.707	.559	.798
ERR2	11.8857	5.810	.793	.694	.764
ERR3	11.7143	6.328	.576	.355	.852
ERR4	12.1429	5.479	.687	.580	.809

3- Simplicity (1 Item Deleted)

Reliability Statistics Before FA		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.891	.912	7

Reliability Statistics After FA	
Cronbach's Alpha	N of Items
.943	6

Scale Statistics			
Mean	Variance	Std. Deviation	N of Items
27.5143	36.022	6.00182	7

Item Statistics			
	Mean	Std. Deviation	N
SIM1	4.0571	1.05560	35
SIM2	4.0571	1.02736	35
SIM3	4.2000	1.02326	35
SIM4	4.2000	1.02326	35
SIM5	4.0571	1.02736	35
SIM6	2.8286	1.50461	35
SIM7	4.1143	.96319	35

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
SIM1	23.4571	27.197	.700	.601	.874
SIM2	23.4571	26.197	.834	.837	.858
SIM3	23.3143	26.869	.764	.709	.867
SIM4	23.3143	26.222	.835	.826	.858
SIM5	23.4571	25.844	.873	.871	.854
SIM6	24.6857	29.222	.279	.177	.943
SIM7	23.4000	27.071	.801	.787	.864

4- Reliability (No Item Deleted)

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.901	.904	4

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
15.9429	12.820	3.58053	4

Item Statistics

	Mean	Std. Deviation	N
REL1	4.0857	.98134	35
REL2	3.9714	1.01419	35
REL3	3.8857	.93215	35
REL4	4.0000	1.13759	35

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
REL1	11.8571	7.420	.830	.692	.855
REL2	11.9714	7.440	.786	.626	.870
REL3	12.0571	7.879	.778	.624	.874
REL4	11.9429	7.055	.740	.555	.892

5- Ease Of Use (1 Item Deleted)

Reliability Statistics Before FA

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.896	.909	7

Reliability Statistics After FA

Cronbach's Alpha	N of Items
.929	6

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
27.0000	35.529	5.96066	7

Item Statistics

	Mean	Std. Deviation	N
EOU1	4.0857	1.01087	35
EOU2	2.9429	1.37076	35
EOU3	4.0286	.92309	35
EOU4	3.7714	1.05957	35
EOU5	3.9429	1.16171	35
EOU6	4.1143	1.02244	35
EOU7	4.1143	.99325	35

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
EOU1	22.9143	25.669	.863	.793	.862
EOU2	24.0571	28.291	.368	.295	.929
EOU3	22.9714	26.852	.818	.754	.869
EOU4	23.2286	26.534	.721	.697	.877
EOU5	23.0571	25.879	.702	.569	.880
EOU6	22.8857	26.398	.770	.801	.872
EOU7	22.8857	26.281	.811	.784	.868

6- Safety (No Item Deleted)

Reliability Statistics Before FA		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.916	.915	4

Scale Statistics			
Mean	Variance	Std. Deviation	N of Items
16.0000	12.471	3.53137	4

Item Statistics			
	Mean	Std. Deviation	N
SAF1	4.0571	.96841	35
SAF2	3.9429	.96841	35
SAF3	4.1143	1.02244	35
SAF4	3.8857	.99325	35

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
SAF1	11.9429	7.585	.740	.550	.913
SAF2	12.0571	7.232	.826	.724	.884
SAF3	11.8857	6.751	.880	.797	.864
SAF4	12.1143	7.281	.784	.648	.898

7- Flexibility (No Item Deleted)

Reliability Statistics Before FA		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.951	.951	7

Scale Statistics			
Mean	Variance	Std. Deviation	N of Items
27.8857	38.457	6.20138	7

Item Statistics			
	Mean	Std. Deviation	N
FLE1	4.0286	.98476	35
FLE2	3.8857	1.05081	35
FLE3	4.0286	1.07062	35
FLE4	3.8000	.99410	35
FLE5	4.0571	.96841	35
FLE6	4.0571	.99832	35
FLE7	4.0286	.98476	35

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
FLE1	23.8571	28.891	.812	.694	.945
FLE2	24.0000	28.176	.823	.791	.944
FLE3	23.8571	27.538	.870	.829	.940
FLE4	24.0857	28.787	.814	.699	.945
FLE5	23.8286	28.793	.840	.736	.943
FLE6	23.8286	28.264	.866	.777	.940
FLE7	23.8571	28.950	.806	.702	.945

8- Accessibility (1 Items Deleted)

Reliability Statistics Before FA		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.910	.931	8

Reliability Statistics After FA	
Cronbach's Alpha	N of Items
.961	7

Scale Statistics			
Mean	Variance	Std. Deviation	N of Items
30.2286	46.182	6.79570	8

Item Statistics			
	Mean	Std. Deviation	N
ACS1	4.0857	.98134	35
ACS2	3.9714	.95442	35
ACS3	3.8571	1.06116	35
ACS4	4.0286	1.01419	35
ACS5	3.8286	.98476	35
ACS6	3.9143	1.01087	35
ACS7	2.5143	1.54104	35

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
ACS1	26.1429	35.185	.862	.877	.886
ACS2	26.2571	36.197	.790	.716	.892
ACS3	26.3714	34.770	.822	.866	.888
ACS4	26.2000	35.400	.808	.795	.890
ACS5	26.4000	35.482	.829	.761	.889
ACS6	26.3143	35.045	.845	.812	.887
ACS7	27.7143	39.916	.200	.168	.961

9- Attitude (No Items Deleted)

Reliability Statistics Before FA		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.923	.923	5

Scale Statistics			
Mean	Variance	Std. Deviation	N of Items
20.4571	19.903	4.46122	5

Item Statistics			
	Mean	Std. Deviation	N
ATT1	4.1429	1.00419	35
ATT2	4.0000	1.00000	35
ATT3	3.8857	1.02244	35
ATT4	4.1143	1.02244	35
ATT5	4.3143	1.05081	35

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
ATT1	16.3143	13.104	.796	.724	.907
ATT2	16.4571	13.020	.815	.704	.903
ATT3	16.5714	13.429	.724	.619	.920
ATT4	16.3429	12.820	.825	.733	.901
ATT5	16.1429	12.538	.841	.744	.897

10- Acceptability (No Items Deleted)

Reliability Statistics Before FA		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.900	.900	4

Scale Statistics			
Mean	Variance	Std. Deviation	N of Items
16.1714	13.205	3.63387	4

Item Statistics			
	Mean	Std. Deviation	N
ACP1	4.0571	.96841	35
ACP2	3.7714	1.05957	35
ACP3	4.2000	1.05161	35
ACP4	4.1429	1.06116	35

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
ACP1	12.1143	8.104	.755	.619	.879
ACP2	12.4000	7.482	.794	.693	.865
ACP3	11.9714	7.676	.759	.619	.877
ACP4	12.0286	7.440	.801	.702	.862

Appendix M
The Final Version of Q-U3MA

School of Multimedia Technology and Communication
College of Arts and Sciences
UNIVERSITI UTARA MALAYSIA



QUESTIONNAIRE

BORANG SOAL SELIDIK

Measuring the Usability of Multi-Modal Mobile Applications (Q-U3MA)

Mengukur Kebolegunaan Aplikasi Multi-Modal Mobile (Q-U3MA)

Assalammu'alaikum and Good Day,

Assalammu"alaikum dan Salam Sejahtera,

Dear respondents, we are delighted to inform you that you have been selected randomly to participate in our research (CONCEPTUAL MODEL OF MULTI-MODAL USABLE MOBILE ASSISTANCE DURING HAJJ). The aim of the questionnaire is to measure the usability of Personal Digital Mutawwif (PDM).

Responden yang dihormati, kami gembira untuk memberitahu anda bahawa anda telah dipilih secara rawak untuk mengambil bahagian dalam penyelidikan kami (MODEL KONSEPTUAL BANTUAN MULTI-MODAL MENGGUNAKAN MOBILE SEMASA HAJJ). Tujuan soal selidik ini adalah untuk mengukur kebolegunaan Personal Digital Mutawwif (PDM).

The information supplied will be treated as confidential and will be used for research purposes which may be reported anonymously in academic publication.

Maklumat yang dibekalkan akan dianggap sebagai sulit dan akan digunakan untuk tujuan penyelidikan yang boleh dilaporkan tanpa nama dalam penerbitan akademik.

It would be greatly appreciated if you could complete the questionnaire with honest and sincere. I would like to say thank you for your time and cooperation.

Adalah amat di hargai sekiranya anda dapat melengkapkan soal selidik dengan jujur dan ikhlas. Saya ingin mengucapkan terima kasih untuk masa dan kerjasama anda.

Yours Truly (*Ikhlas*),

Ahmed Sheikh Al-Aidaros

Section A: Respondent's Demographic

Bahagian A: Responden Demografi

INSTRUCTION: Please tick (✓) in the box [] and fill in the blank.

ARAHAN: Sila tandakan (✓) pada kotak yang disediakan [] dan isi tempat kosong.

1. Gender/ *Jantina*: [] Male/ *Lelaki* [] Female / *Wanita*

2. Age/ *Umur*: [] 25 years and below / *25 tahun dan ke bawah*

[] 26-40 years/ *26-40 tahun*

[] 41-55 years/ *41-55 tahun*

[] Over 55 Years/ *Lebih 55 tahun*

3. Education level /*Tahap Pendid*: [] Pre-Bachelor Degree/ *Pra-Ijazah Sarjana Muda*

[] Bachelor Degree/ *Ijazah Sarjana Muda*

[] Post Bachelor Degree/ *Post Ijazah Sarjana Muda*

[] None of the Above/ *Tiada di atas*

4. Your experience on mobile applications/ *Pengalaman anda pada aplikasi mudah alih*:

[] One year or Less/ *Satu tahun atau kurang*

[] More than one year/ *Lebih daripada satu tahun*

5. Have you been to Makkah to perform Hajj or Umrah

Pernah ke Makkah untuk mengerjakan Haji atau Umrah:

[] No / *Tidak*

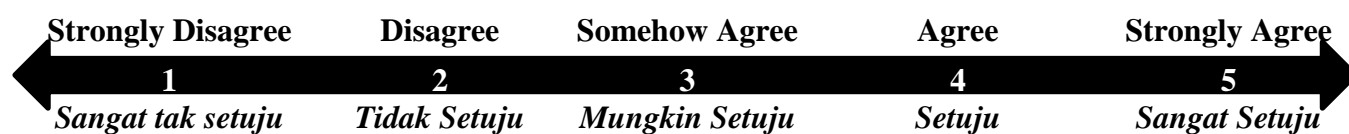
[] Yes/ *Ya*

Section B: PDM Usability Evaluation

Section B: PDM Penilaian Kebolegunaan

INSTRUCTION: Please circle (O) on the scale of your choice.

ARAHAN: bulatan Sila (O) pada skala pilihan anda.



EFFECTIVENESS/ KEBERKESANAN

Usefulness/ Kegunaan

1.	The information provided by PDM is helpful enough. <i>Maklumat yang diberikan oleh PDM cukup membantu.</i>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
2.	The information provided by PDM is effective in helping me to complete the rituals of Hajj/Umrah. <i>Maklumat yang diberikan oleh PDM berkesan dalam membantu saya untuk melengkapkan ritual Haji / Umrah.</i>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3.	Using PDM would enable me to accomplish the rituals of Hajj/Umrah contentedly. <i>Menggunakan PDM akan membolehkan saya untuk mencapai ibadat Haji / Umrah dengan puas hati.</i>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
4.	Using PDM would make it easier to perform the rituals of Hajj/Umrah. <i>Menggunakan PDM akan membuat ia lebih mudah untuk melaksanakan manasik haji / umrah.</i>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
5.	PDM meets my needs and expectation. <i>PDM memenuhi keperluan dan jangkaan saya.</i>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
6.	The voice instructions in PDM are easy to understand. <i>Arahan suara dalam PDM mudah difahami.</i>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
7.	Sounds in PDM are free of noise. <i>Bunyi di PDM adalah bebas daripada bunyi bising.</i>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
8.	In PDM, the recitation speed of voice instructions is sufficiently moderate. <i>Dalam PDM, kelajuan bacaan arahan suara cukup sederhana.</i>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
9.	I would find PDM useful in performing Hajj/Umrah. <i>Saya akan mencari PDM berguna dalam menunaikan Haji / Umrah.</i>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Errors Rate/ Kadar Kesilapan

1.	PDM prevents me from making errors. <i>PDM menghalang saya daripada membuat kesilapan.</i>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
2.	In PDM, I can recover from mistakes quickly. <i>Dalam PDM, saya boleh pulih daripada kesilapan dengan cepat.</i>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3.	In PDM, the error messages effective in assisting me to fix problems. <i>Dalam PDM, mesej ralat yang berkesan dalam membantu saya untuk menyelesaikan masalah.</i>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
4.	PDM rarely stopped unexpectedly. <i>PDM jarang berhenti tiba-tiba.</i>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Simplicity/ Kemudahan

1.	The operations of PDM are simple/ <i>Operasi PDM adalah mudah.</i>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
2.	The organization of information on PDM is clear. <i>Penganturan maklumat mengenai PDM jelas.</i>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3.	It is easy to learn PDM/ <i>Ia adalah mudah untuk belajar PDM.</i>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

4.	I easily remember how to use PDM. <i>Saya mudah ingat bagaimana untuk menggunakan PDM.</i>	1	2	3	4	5
5.	The information provided by PDM is easy to understand. <i>Maklumat yang diberikan oleh PDM adalah mudah difahami.</i>	1	2	3	4	5
6.	I found PDM simple to use. <i>Saya mendapati PDM mudah untuk digunakan.</i>	1	2	3	4	5
Reliability/ Kebolehpercayaan						
1.	PDM is trustworthy /PDM boleh dipercayai.	1	2	3	4	5
2.	PDM is accurate in identifying my exact location. <i>PDM adalah tepat dalam mengenal pasti lokasi sebenar saya.</i>	1	2	3	4	5
3.	PDM is accurate in interpreting my voice commands. <i>PDM adalah tepat dalam menafsirkan arahan suara saya.</i>	1	2	3	4	5
4.	PDM has all the functions I expect it to have. <i>PDM mempunyai segala fungsi yang saya mengharapkan ia mempunyai</i>	1	2	3	4	5
EFFICIENCY/ KECEKAPAN						
Ease of Use/ Kemudahan Penggunaan						
1.	I can use PDM without written instructions. <i>Saya boleh menggunakan PDM tanpa arahan bertulis.</i>	1	2	3	4	5
2.	It is easy to make PDM does exactly what I want. <i>Mudah untuk membuat PDM tidak betul-betul apa yang saya mahu.</i>	1	2	3	4	5
3.	It would be easy for me to become skillful at using PDM. <i>Ia akan menjadi mudah bagi saya untuk menjadi mahir dengan menggunakan PDM.</i>	1	2	3	4	5
4.	I can use PDM successfully every time. <i>Saya boleh menggunakan PDM berjaya setiap kali.</i>	1	2	3	4	5
5.	Using PDM is effortless. <i>Menggunakan PDM adalah tanpa tenaga.</i>	1	2	3	4	5
6.	Using PDM is sufficiently easy. <i>Menggunakan PDM cukup mudah.</i>	1	2	3	4	5
Safety/ Keselamatan						
1.	It is sufficiently easy to operate PDM with one hand. <i>Cukup mudah untuk beroperasi PDM dengan satu tangan.</i>	1	2	3	4	5
2.	PDM is safe to use without causing harm. <i>PDM adalah selamat untuk digunakan tanpa menyebabkan kemudaratan.</i>	1	2	3	4	5
3.	It is safe to use PDM while performing rituals of Hajj. <i>Ia adalah selamat untuk digunakan PDM ketika melaksanakan manasik haji.</i>	1	2	3	4	5
4.	PDM is suitable to use in a crowded environment like Hajj. <i>PDM adalah sesuai untuk digunakan dalam persekitaran yang sesak seperti haji.</i>	1	2	3	4	5
Flexibility/ Fleksibiliti						
1.	It is easy to move from one part of a task to another. <i>Ia adalah mudah untuk bergerak dari satu bahagian satu tugas yang lain.</i>	1	2	3	4	5
2.	I do not notice any inconsistency as I use PDM. <i>Saya tidak melihat apa-apa yang tidak konsisten seperti yang saya gunakan PDM.</i>	1	2	3	4	5

3.	The interface of PDM is consistent with other products I have used. <i>Antara muka PDM adalah konsisten dengan produk-produk lain yang saya telah digunakan.</i>	1	2	3	4	5
4.	In PDM, the control matches user skills. <i>Dalam PDM, kawalan perlawanan kemahiran pengguna.</i>	1	2	3	4	5
5.	The visual representation in PDM is consistent with familiar conventions <i>Perwakilan visual di PDM adalah selaras dengan konvensyen biasa.</i>	1	2	3	4	5
6.	The wording in PDM is familiar. <i>Susunan kata dalam PDM biasa.</i>	1	2	3	4	5
7.	PDM provides zooming for display expansion. <i>PDM menyediakan zoom untuk pengembangan paparan.</i>	1	2	3	4	5
Accessibility/ Kebolehan Mencapai						
1.	It is easy to find the information I need in PDM. <i>Mudah untuk mencari maklumat yang saya perlukan di PDM.</i>	1	2	3	4	5
2.	It is easy to navigate the PDM. <i>Mudah untuk mengemudi PDM itu.</i>	1	2	3	4	5
3.	The organization of the PDM menus is sufficiently logical. <i>Penganjuran menu PDM adalah cukup logik.</i>	1	2	3	4	5
4.	The buttons are sufficiently easy to locate. <i>Butang yang cukup mudah untuk mencari.</i>	1	2	3	4	5
5.	The sequence of PDM screens is clear and logical. <i>Rentetan skrin PDM adalah jelas dan logik.</i>	1	2	3	4	5
6.	The characters on PDM screens are easy to read. <i>Watak-watak di skrin PDM adalah mudah untuk dibaca.</i>	1	2	3	4	5
7.	The terminologies used in PDM are always related to the task. <i>Istilah yang digunakan dalam PDM sentiasa berkaitan dengan tugas.</i>	1	2	3	4	5
SATISFACTION/ KEPUASAN						
Attitude/ Sifat						
1.	I feel I need to have PDM / <i>Saya rasa saya perlu mempunyai PDM.</i>	1	2	3	4	5
2.	I feel comfortable using PDM/ <i>Saya berasa selesa menggunakan PDM.</i>	1	2	3	4	5
3.	I feel confident using PDM/ <i>Saya merasa yakin menggunakan PDM.</i>	1	2	3	4	5
4.	I feel excited when using PDM/ <i>Saya rasa teruja apabila menggunakan PDM.</i>	1	2	3	4	5
5.	I would recommend PDM to my friends/ <i>Saya akan mengesyorkan PDM kepada rakan-rakan saya.</i>	1	2	3	4	5
Acceptability						
1.	The interface of PDM is attractive/ <i>Antara muka PDM adalah menarik</i>	1	2	3	4	5
2.	PDM is pleasant to use/ <i>PDM adalah senang untuk digunakan</i>	1	2	3	4	5
3.	PDM is wonderful/ <i>PDM adalah indah.</i>	1	2	3	4	5
4.	Overall, I am satisfied with PDM/ <i>Secara keseluruhan, saya berpuas hati dengan PDM.</i>	1	2	3	4	5

END OF QUESTIONS /TAMAT SOALAN

THANK YOU FOR PARTICIPATING! /TERIMA KASIH KERANA MENYERTAI!