

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.



**DATA MODELING FOR WEB-BASED MOBILE TRACKING  
SYSTEM OF INTERNALLY DISPLACED PERSON DURING  
CONFLICT**



**TALIB MUHSEN ELEBE**

**UUM**  
Universiti Utara Malaysia

**MASTER OF SCIENCE (INFORMATION TECHNOLOGY)**

**UNIVERSITI UTARA MALAYSIA**

**2017**

## **Permission to Use**

In presenting this dissertation in fulfillment 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 dissertation in any manner, in whole or in part, for the 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 dissertation 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 dissertation.

Requests for permission to copy or to make other use of materials in this dissertation, 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

## Abstrak

Dalam tempoh dua dekad yang lalu, keluarga pelarian telah menjadi isu utama kepada banyak negara kerana peningkatan bencana alam, konflik bersenjata atau serangan pengganas. Ia memberi cabaran besar kepada kerajaan dan juga agensi yang menguruskan mereka. Banyak agensi melaporkan kesukaran menyediakan bantuan untuk keluarga berkenaan kerana mereka tidak dapat dikesan selepas mereka mendaftar di pusat atau kem perlindungan. Ini disebabkan oleh pergerakan rawak mereka atau kem yang terdedah kepada bencana alam atau serangan bersenjata. Kajian ini mencadangkan satu model keperluan untuk orang pelarian (IDP) berdasarkan temu bual dalam talian dengan pakar dari Pertubuhan Antarabangsa bagi Migrasi dan Pegawai Kerajaan yang bekerja secara langsung dengan keluarga pelarian ini. Keperluan ini digunakan untuk membangunkan aplikasi mudah alih berasaskan web untuk mengesan, mencari, mendokumenkan dan mengesahkan IDP. Penilaian telah dijalankan untuk mengukur kebolegunaan aplikasi mudah alih ini. Hasil penilaian mendapati bahawa aplikasi mudah alih tersebut adalah relevan dan sesuai utk mengesan IDP. Hasil penilaian mendapati bahawa aplikasi mudah alih tersebut adalah relevan dan sesuai untuk mengesan IDP. Sumbangan utama kajian ini adalah keperluan untuk aplikasi mudah alih yang direka khas untuk mengesan IDP.

**Kata kunci:** Pemodelan data, Sistem pengesanan, Orang pelarian.



UUM  
Universiti Utara Malaysia

## Abstract

The displaced families in the last two decades has become major issues in many countries due to the increase of natural disasters, armed conflicts or terrorist attacks. It presents great challenges to governments as well as the agencies which manage them. Many agencies reported the difficulty of providing relief to these families because they cannot be tracked after they registered in shelters or camps. It is due to random movement of the families, or the camp is exposed to natural disasters or armed attacks. This study proposes a requirement model for an internally displaced person (IDP) based on online interviews with experts from the International Organization for Migration and Government Officials who worked in direct contact with the displaced families. The requirements were used to develop a web-based mobile application to track, locate, document and verify IDP. An evaluation was conducted to measure the usability of the mobile application. The result of the evaluation suggested that the mobile application is relevant and suitable for tracking IDP. The main contribution of this study is the requirements for a mobile application that is designed specifically to track IDP.

**Keywords:** Data modeling, Tracking system, Internally displaced persons.



## Acknowledgment

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

First of all, I would like to thank ALLAH for giving me the strength and health to accomplish this research.

My deepest thanks to my supervisor Prof. Madya Dr. Wan Rozaini Bt Sheik Osman for tireless efforts, suggestions, and guidance to make this work successfully with attention and care.

My deepest grateful to the international organization of migration and national operation center for the help to complete my Master program. I would also like to thank the Ministry of Migration and Displacement who help me and were enthusiastic about participating in the study.

Deepest appreciation and heartfelt thankful go to the Expert, Dr. Nafishah Binti Othman, Dr. Siti Sakira Kamaruddin, Dr. Mustafa Muwafak Already, Dr. Mohamad Farhan Mohamad Mohsin, Dr. Mazida Binti Ahmad, Assoc. Prof. Dr. Azham Hussain and Prof. Madya Dr. Yuhanis Binti Yusof who supported me throughout my research process with their vital support and knowledge.

I want to express my gratitude and dedicate this thesis to my mother. My goal would not have been achieved without her. She has supported and is continually praying for me during my studies. And I pray to Allah to keep her safe and well.

I want to express my gratitude and dedicate this thesis to my friend Aqeel Fadhil Hashoosh. Without him, I would not reach this level.

I dedicate this thesis to my wife and my kids who unremittingly supported me during my years of study. They made this work possible.

Finally, I express my deepest thanks to my government and the staff of the school of computing, College of Arts and Science, Universiti Utara Malaysia and those that contributed indirectly towards the success of my studies for help and support me during my study.

## Table of Contents

Abstrak.....	ii
Abstract.....	iii
Acknowledgment.....	iv
Table of Contents.....	v
List of Tables.....	ix
List of Figures.....	xi
List of Appendices.....	xiii
<b>CHAPTER ONE INTRODUCTION.....</b>	<b>1</b>
1.1 Introduction.....	1
1.2 Background of Study.....	4
1.3 Problem Statement.....	8
1.4 Research Questions.....	10
1.5 Research Objectives.....	10
1.6 Significance of Study.....	10
1.7 Scope of the Study.....	11
1.8 Definition of Terms.....	12
1.9 Organisation of the Dissertation.....	14
<b>CHAPTER TWO LITERATURE REVIEW.....</b>	<b>15</b>
2.1 Introduction.....	15
2.2 Data Modeling.....	15
2.2.1 Data Models Specification.....	19
2.3 Information and Communications Technology/Technologies (ICT).....	22
2.4 Mobile Applications.....	25
2.4.1 Related Work (Mobile Application).....	28
2.5 Tracking Systems.....	31
2.5.1 Relevant Work (Mobile-Based Tracking).....	33

2.5.2 Data Modeling (Mobile-Based Tracking) .....	36
2.6 E-Government and M-Government .....	41
2.6.1 E-Government .....	41
2.6.2 M-Government .....	44
2.7 Mobile Services in Iraq .....	47
2.8 Displaced Families .....	50
2.8.1 Effect on Displaced Families .....	50
2.8.2 Iraqi Government Policy on IDPs .....	52
2.8.3 Problems Facing Supporting Families .....	54
2.8.4 Issues with Data Collection Involving Internally Displaced Persons .....	57
2.9 Summary .....	58
<b>CHAPTER THREE RESEARCH METHODOLOGY .....</b>	<b>59</b>
3.1 Introduction .....	59
3.2 Research Procedures .....	59
3.2.1 Awareness of Problem .....	61
3.2.2 Suggestions .....	62
3.2.3 Development .....	62
3.2.3.1 Validation Instrument (TeamViewer) .....	63
3.2.4 Evaluation .....	65
3.2.4.1 Evaluation Method .....	65
3.2.4.2 Evaluation of Mobile Tracking System (IOM TS) .....	65
3.2.4.3 Evaluating by the Functionality .....	66
3.2.4.4 Evaluating by the Usability Elements .....	66
3.2.4.5 Instrument of the Data Collection .....	66
3.2.4.6 Data Collection .....	68
3.2.4.7 Data Analysis .....	68
3.3 Summary .....	68



<b>CHAPTER FOUR MODEL DESIGN AND DEVELOPMENT .....</b>	<b>70</b>
4.1 Introduction.....	70
4.2 Requirements Gathering for IOM TS .....	70
4.2.1 Functional Requirements.....	72
4.2.2 Non-Functional Requirements .....	75
4.3 Requirements Elicitation and Data Collection.....	76
4.4 Internally Displaced Person Management Model.....	77
4.5 Requirements Analysis for IOM TS .....	79
4.5.1 Design.....	80
4.5.1.1 Use Case Diagram .....	80
4.5.1.2 Activity Diagram .....	82
4.5.1.3 Class Diagram.....	83
4.5.1.4 Logical design.....	84
4.6 Development.....	86
4.6.1 Home Page .....	86
4.6.2 Manage IDPs .....	87
4.6.3 Track IDPs.....	88
4.6.4 Manage Fund and Supplement.....	89
4.6.5 Manage Authorized User .....	90
4.6.6 IOM TS Mobile Application .....	92
4.7 Summary .....	93
<b>CHAPTER FIVE MODEL EVALUATION .....</b>	<b>94</b>
5.1 Introduction.....	94
5.2 Evaluation Procedure .....	94
5.2.1 Functionality Test.....	95
5.2.2 Usability Test .....	95
5.3 Reliability For Easy to Use and Usefulness.....	96

5.3.1 Cronbach's Alpha .....	97
5.4 Testing Result .....	98
5.4.1 Results of Functionality Test.....	98
5.4.2 Results of User Usability Test.....	98
5.4.2.1 Demographic Profile.....	98
5.4.2.2 Perceive Usefulness .....	102
5.4.2.3 Perceive Easy to Use .....	105
5.5 Results Discussion .....	112
5.6 Summary .....	114
<b>CHAPTER SIX CONCLUSION .....</b>	<b>115</b>
6.1 Introduction.....	115
6.2 Objectives Achievement .....	115
6.2.1 Objective 1 .....	115
6.2.2 Objective 2 .....	116
6.2.3 Objective 3 .....	116
6.2.3.1 Evaluation by Experts.....	117
6.2.3.2 Evaluation by practitioners .....	118
6.3 Contribution .....	118
6.3.1 Theoretical.....	118
6.3.2 Practical contribution .....	118
6.4 Limitations and Recommendations.....	119
6.5 Summary .....	120
<b>REFERENCES.....</b>	<b>121</b>

## List of Tables

Table 2.1: M-Technological Applications Used by Governments.....	27
Table 2.2: Analysis of Various Mobile Applications. ....	29
Table 2.3: Mobile-Based Tracking Systems and Functions.....	34
Table 3.1: Prototype Development Environment.....	63
Table 3.2: Instrument Used to Evaluate Usability.....	67
Table 4.1: Functional Requirement.....	72
Table 4.2: Non-Functional Requirement.....	76
Table 4.3: IOM TS management process.....	78
Table 5.1: Descriptive Statistics.....	96
Table 5.2: Reliability Statistics.....	97
Table 5.3: Gender.....	99
Table 5.4: Age .....	99
Table 5.5: Years of experience .....	100
Table 5.6: Designation.....	101
Table 5.7: The IOM TS is useful.....	102
Table 5.8: When I use the IOM TS, I save my time.....	102
Table 5.9: It saves my effort when I use it the IOM TS.....	103
Table 5.10: The IOM TS gives me more control over the activities in my work.....	103
Table 5.11: Using the IOM TS reach the user goal efficiently.....	104
Table 5.12: The IOM TS makes the things I want to accomplish easier to get.....	104
Table 5.13: It does everything I would expect it to do.....	105
Table 5.14: IOM TS is easy to use.....	106
Table 5.15: IOM TS is flexible to use.....	106

Table 5.16: IOM TS is Simple to Use.....	107
Table 5.17: IOM TS is User-Friendly.....	107
Table 5.18: IOM TS Requires the fewest steps possible to accomplish.....	108
Table 5.19: I can use it without written instructions.....	109
Table 5.20: I learned to use it quickly.....	109
Table 5.21: Easily remember how to use it.....	110
Table 5.22: I can use it successfully every time.....	110
Table 5.23: I always felt I knew what it was possible to do next.....	111
Table 5.24: IOM TS feedback: It is helpful in the error message.....	111
Table 5.25: My mistakes were easy to correct.....	112



## List of Figures

Figure 2.1: levels of Data Modeling.....	21
Figure 2.2: Use Case Diagram.....	37
Figure 2.3: Class Diagram.....	38
Figure 2.4: mTracker Requirements.....	39
Figure 2.5: mTracker UML Diagram.....	40
Figure 2.6: Use-Case Diagram shows the Requirements of Receiver.....	40
Figure 2.7: Use-case Diagram shows the Requirements of DBA.....	41
Figure 2.8: IDPS Families count by District of Displacement, November 2015.....	52
Figure 3.1: the Research Procedure .....	60
Figure 3.2: TeamViewer main interface.....	64
Figure 4.1: IOM TS management process.....	77
Figure 4.2: IOM TS Use case Diagram.....	81
Figure 4.3: IOM TS mobile application Use case Diagram.....	81
Figure 4.4: IOM TS Activity Diagram.....	82
Figure 4.5: Class Diagram.....	83
Figure 4.6: guideline to design data modeling.....	84
Figure 4.7: logical design for IOM TS.....	85
Figure 4.8: Home Page Interface.....	87
Figure 4.9: IOM TS login Interface.....	87
Figure 4.10: Manage IDP main Interface.....	88
Figure 4.11: Location Details of the IDP Interface.....	89
Figure 4.12: Location of each IDP Interface.....	89
Figure 4.13: Manage Fund and Supplement main Interface.....	90

Figure 4.14: Manage Authorized User main Interface.....	91
Figure 4.15: Add Authorized User main Interface.....	91
Figure 4.16: IOM TS mobile application login Interface.....	92
Figure 4.17: IOM TS mobile application registration Interface.....	93
Figure 5.1: Gender Distribution.....	99
Figure 5.2: Chart for Age Distribution.....	100
Figure 5.3: Years of experience.....	100
Figure 5.4: Designation.....	101



## List of Appendices

Appendix A: Letters of UML approval.....	134
Appendix B: Requirement Questionnaire.....	151
Appendix C: Functionality Test.....	154
Appendix D: Usability Questionnaire.....	159



# CHAPTER ONE

## INTRODUCTION

### 1.1 Introduction

ICT (which stands for information and communications technology) is a generic definition which is common to any and every communication technology or application. The usage of ICTs is found not only in technologies such as television, radio, cell phones and computers (along with network, hardware, and software) but also their auxiliaries in the form of services linked to them, such as video conference solutions and online learning. ICTs are usually mentioned in reference to particular categories such as healthcare, education, or libraries [1].

Large data gathering using ICT has seen an exponential rise in the past ten years or so. Political personnel requires it, organizations use it and can observe that the areas of logistics, finance, healthcare, etc. are resorting to data capture, and this is increasing rapidly. Social platforms such as Facebook and Twitter collect data on massive scales, and in all forms: photos, video, audio, as well as PI (personal information). Developments in ICT have resulted in extraordinary enhancements on mobile and smartphones. a mobile or smartphone can prove to be helpful to make calls in the absence of a fixed line. Smartphones have proved to be tools nonpareil in trade and commerce also. The inbuilt GPS facility can guide the users safely to their destination, and thus ensure that to attend the important appointments on time. It does so by coordinating GPS data with a focal mobile mast triangulation [2].



The contents of  
the thesis is for  
internal user  
only

## REFERENCES

- [1] K. L. Chin and E. Chang, "A sustainable ICT education ontology," *IEEE Int. Conf. Digit. Ecosyst. Technol.*, vol. 5, no. June, pp. 350–354, 2011.
- [2] S. Lee, G. Tewolde, and J. Kwon, "Design and implementation of vehicle tracking system using GPS/GSM/GPRS technology and smartphone application," *Internet Things (WF-IoT), 2014 IEEE World Forum*, vol. 2, no. March, pp. 353–358, 2014.
- [3] M. Price, D. Griffin, and I. Al-marashi, "Toward an understanding of media policy and media systems in Iraq : A foreword and two reports," in *CGCS Occasional Paper Series*, 2007, no. May, p. 101.
- [4] L. C. M. Varandas, J. J. P. C. Rodrigues, and B. Vaidya, "mTracker: A mobile tracking application for pervasive environment," *24th IEEE Int. Conf. Adv. Inf. Netw. Appl. Work. WAINA 2010*, pp. 962–967, 2010.
- [5] Q. Xu, Y. Liao, S. Miskovic, Z. M. Mao, M. Baldi, A. Nucci, and T. Andrews, "Automatic generation of mobile app signatures from traffic observations," *Comput. Commun. (INFOCOM), 2015 IEEE Conf.*, pp. 1481–1489, 2015.
- [6] M. O. F. Science, "Requirements for Redesigning the Interface of Iraqi E-Government Portal Requirements for Redesigning the Interface of Iraqi E-Government," 2015.
- [7] "A Big Push to Expand Mobile Service in Iraq - The New York Times." [Online]. Available: [http://www.nytimes.com/2011/03/03/world/middleeast/03iht-M03B-ZAIN.html?\\_r=0](http://www.nytimes.com/2011/03/03/world/middleeast/03iht-M03B-ZAIN.html?_r=0). [Accessed: 13-Mar-2016].
- [8] U. Nations, "Iraq-11-E.pdf," no. November, 2011.
- [9] The Brookings Institution, "Resolving Iraqi Displacement: Humanitarian and Development Perspectives," 2009. [Online]. Available: <http://www.brookings.edu/research/reports/2010/04/1119-iraqi-displacement>. [Accessed: 13-Mar-2016].
- [10] R. Heeks, "Implementing and Managing eGovernment," *SAGE Publ. Ltd*, p. 304, 2006.
- [11] B. Berenbach, F. Schneider, and H. Naughton, "The use of a requirements modeling language for industrial applications," *Requir. Eng. Conf. (RE), 2012 20th IEEE Int.*, pp. 285–290, 2012.
- [12] IOM, "Displacement Tracking Matrix V2.0 Uptadate," *Iom*, no. November, 2010.
- [13] "Questions and answers about IDPs." [Online]. Available: <http://www.ohchr.org/EN/Issues/IDPersons/Pages/Issues.aspx>. [Accessed: 13-Mar-

2016].

- [14] UNHCR, “Mid-Year Trends 2015,” 2015.
- [15] A. R. Plan, “Global Appeal 2015,” pp. 1–6, 2015.
- [16] H. S. Abdulwahida, A. A. Mutaliba, S. Affendi, M. Yusofa, and S. J. Alib, “Designing and Implementation Iraqi E- Government Front Office Online System,” vol. IV, no. 2, pp. 1–11, 2014.
- [17] “وزارة الداخلية العراقية:: The Iraqi Ministry of Interior.” [Online]. Available: <http://moi.gov.iq/default.aspx>. [Accessed: 13-Mar-2016].
- [18] M. Chen, M. Song, J. Han, and E. Haihong, “Survey on data quality,” *Proc. 2012 World Congr. Inf. Commun. Technol. WICT 2012*, pp. 1009–1013, 2012.
- [19] F. Shull, “How Do You Keep Up to Date?,” *IEEE Softw.*, vol. 28, no. 3, pp. 2–5, 2011.
- [20] “Response to the Anbar Crisis in Iraq Displacement Tracking Matrix | DTM round III Report,” no. May, 2014.
- [21] D. Dolk, T. Anderson, F. Busalacchi, and D. Tinsley, “GINA: System interoperability for enabling smart mobile system services in network decision support systems,” *Proc. Annu. Hawaii Int. Conf. Syst. Sci.*, pp. 1472–1481, 2011.
- [22] N. J. Al-Khafaji, A. J. K. Shittuline, and W. R. B. S. Osman, “The effect of resistance to change in the application of e-Government in Iraq,” *2012 Tenth Int. Conf. ICT Knowl. Eng.*, pp. 99–103, 2012.
- [23] I. Taleb, R. Dssouli, and M. A. Serhani, “Big Data Pre-processing: A Quality Framework,” *2015 IEEE Int. Congr. Big Data*, pp. 191–198, 2015.
- [24] F. Sidi, P. H. Shariat Panahy, L. S. Affendey, M. A. Jabar, H. Ibrahim, and A. Mustapha, “Data quality: A survey of data quality dimensions,” pp. 300–304, 2012.
- [25] Al-Hammadany, H. Firas. and A. Heshmati, “Determinants of internet use in Iraq,” *Int. J. Commun.*, vol. 5, pp. 1967–1989, 2011.
- [26] “Displaced Iraqis Face New Set of Challenges Upon Return | International Organization for Migration.” [Online]. Available: <https://www.iom.int/news/displaced-iraqis-face-new-set-challenges-upon-return>. [Accessed: 14-May-2016].
- [27] G. Panayotova, P. Petrov, G. P. Dimitrov, and T. Shevchenko, “Modeling and data processing of information systems,” pp. 154–158, 2016.
- [28] N. Azaiez and J. Akaichi, “How Trajectory Data Modeling Improves Decision

Making ?”

- [29] P. Heudtlass, N. Speybroeck, D. Guha-Sapir, M. Toole, R. Waldman, C. Raleigh, A. Linke, H. Hegre, J. Karlsen, J. Leaning, D. Guha-Sapir, P. Salama, P. Spiegel, L. Talley, R. Waldman, F. Checchi, L. Roberts, O. Degomme, D. Guha-Sapir, P. Heudtlass, P. Kodrou, and D. Guha-Sapir, “Excess mortality in refugees, internally displaced persons and resident populations in complex humanitarian emergencies (1998–2012) – insights from operational data,” *Confl. Health*, vol. 10, no. 1, p. 15, Dec. 2016.
- [30] Y. Ding, H. Tan, W. Luo, and L. M. Ni, “Exploring the use of diverse replicas for big location tracking data,” *Proc. - Int. Conf. Distrib. Comput. Syst.*, pp. 83–92, 2014.
- [31] M. A. M. Assal, “Displaced persons in Khartoum: current realities and post-war scenarios,” no. May, 2004.
- [32] Norwegian Refugee Council. IDMC, “Global overview 2015, people internally displaced by conflict and violence,” no. 2, pp. 210–239, 2015.
- [33] N. Khajiev, C. Lee, K. Kim, S. Kim, and R. Oh, “Development of Multiple Tracking System for Smart VIP Car Placement and Monitoring,” 2016.
- [34] D. O. N. Migration and A. I. N. Development, “and Asylum in Development Finding Solutions To Protracted Displacement : the Eu ’ S Role and Ways Forward,” 2014.
- [35] E. J. B. Giryn, G. M. C. Ryos, and C. R. Olarte, “Framework for data model to personalized health systems,” *Telemat. Inf. Syst. (EATIS), 2016 8th Euro Am. Conf.*, 2016.
- [36] M. F. M. Mukelas and E. A. Zawawi, “Theoretical framework for ICT implementation in the Malaysian construction industry: Issues and challenges,” *2012 Int. Conf. Innov. Manag. Technol. Res.*, pp. 275–279, 2012.
- [37] A. B. Sjögren and B. Carlson, “Sustainable livelihoods of internally displaced persons : case study of Soacha ,” 2013.
- [38] P. J. Noonan, J. M. Anton-Rodriguez, T. F. Cootes, W. A. Hallett, and R. Hinz, “Multiple target marker tracking for real-time, accurate, and robust rigid body motion tracking of the head for brain PET,” *2013 IEEE Nucl. Sci. Symp. Med. Imaging Conf. (2013 NSS/MIC)*, pp. 1–6, 2013.
- [39] “Iraq Mission | International Organization for Migration.” [Online]. Available: <http://iomiraq.net/>. [Accessed: 13-Mar-2016].
- [40] “UNHCR -.” [Online]. Available: <http://www.unhcr.org/553644e69.html>.

[Accessed: 21-Dec-2015].

- [41] A. F. Zakaria and S. C. J. Lim, "A preliminary survey on modeling customer requirements from product reviews under preference uncertainty," *IEEE Int. Conf. Ind. Eng. Eng. Manag.*, vol. 2015–Janua, pp. 1096–1100, 2015.
- [42] A. Goknil, I. Kurtev, and J. V. Millo, "A metamodeling approach for reasoning on multiple requirements models," *Proc. - IEEE Int. Enterp. Distrib. Object Comput. Work. EDOC*, pp. 159–166, 2013.
- [43] M. Kujala, "Combining Process Modeling and Requirements Engineering," 2015.
- [44] J. Kuriakose and J. Parsons, "How Do Open Source Software ( OSS ) Developers Practice and Perceive Requirements Engineering ? An Empirical Study," pp. 49–56, 2015.
- [45] A. D. Hou and Ruilian, "The Research and Application of Object-Oriented Requirements Modeling Based on UML," *Electron. Mech. Eng. Inf. Technol. (EMEIT), 2011 Int. Conf.*, pp. 4062–4065, 2011.
- [46] A. Ali, Z. I. Malik, N. Riaz, M. Jaffer, and K. Usmani, "The UML meta modeling extension mechanism by using Aspect Oriented Modeling (AOM)," *Souvenir 2014 IEEE Int. Adv. Comput. Conf. IACC 2014*, pp. 1373–1378, 2014.
- [47] M. Lora, F. Martinelli, and F. Fummi, "Hardware synthesis from software-oriented UML descriptions," *Proc. - Int. Work. Microprocess. Test Verif.*, vol. 2015–April, pp. 33–38, 2015.
- [48] L. Zhang, "Applying Case Method Approach to a Unified Modeling Language Curriculum Teaching Strategy - Using a Case Method A . V4-419," pp. 418–421, 2010.
- [49] W. N. Liu, L. J. Zheng, and D. H. Sun, "A data processing model for improving RFID application reliability in logistics tracking system," *2010 Int. Conf. Logist. Syst. Intell. Manag. ICLSIM 2010*, vol. 3, pp. 1643–1647, 2010.
- [50] H. Hashem and D. Ranc, "Data Modeling and Case-Based Reasoning for Social Monitoring," *2016 IEEE 4th Int. Conf. Futur. Internet Things Cloud Work.*, pp. 194–199, 2016.
- [51] Y. Liu and C. Lin, "Model Predictive Control with Repetitive Control for Periodic Signal Tracking and Constraint Handling of Fast Sampled-Data Control Systems," no. 1, pp. 626–631, 2010.
- [52] S. Nurjanah and Z. A. Hasibuan, "Analysis of ICT context for building conceptual understanding amongst research: A literature review," *Proc. - Int. Conf. ICT Smart*

*Soc. 2013 "Think Ecosyst. Act Converg. ICISS 2013*, pp. 258–262, 2013.

- [53] A. Osseiran, K. Doppler, and C. Ribeiro, “Advances in Device-to-Device communications and network coding for IMT-Advanced,” *ICT Mob. ...*, no. February 2016, pp. 1–8, 2009.
- [54] S. M. Daud and H. Abas, “‘Dyslexia baca’ mobile app - The learning ecosystem for dyslexic children,” *Proc. - 2013 Int. Conf. Adv. Comput. Sci. Appl. Technol. ACSAT 2013*, pp. 412–416, 2014.
- [55] N. Jere and L. R. Erastus, “An analysis of current ICT trends for sustainable strategic plan for Southern Africa,” *2015 IST-Africa Conf. IST-Africa 2015*, pp. 1–12, 2015.
- [56] M. W. L. Fong, “Digital Divide : The Case of Developing Countries,” *Issues Informing Sci. Inf. Technol.*, vol. 6, pp. 471–478, 2009.
- [57] S. Rachman, M. A. Gregory, and S. W. Narayan, “The role of ICT services on indonesian Small to Medium Enterprise productivity,” *2015 Int. Telecommun. Networks Appl. Conf.*, pp. 166–172, 2015.
- [58] R. Gupta and R. Garg, “Mobile Applications Modelling and Security Handling in Cloud-Centric Internet of Things,” *2015 Second Int. Conf. Adv. Comput. Commun. Eng.*, pp. 285–290, 2015.
- [59] V. & Kumar, “A Comprehensive Mobile Application Development and Testing Lifecycle,” 2014.
- [60] N. A. Fadhil, R. W. A. N. S. Osman, I. T. Nather, T. A. L. I. Al-saadi, and N. J. Al-khafaji, “Mobile Technology in the Iraq Context : Design Mobile Application Prototype for the Election of Directors for Departments in the Ministry of Science and,” *proceeding 5th SARC-IRF Int. Conf.*, pp. 97–103, 2014.
- [61] A. Goncalves, C. Silva, and P. Morreale, “Design of a Mobile Ad Hoc Network Communication App for Disaster Recovery,” *2014 28th Int. Conf. Adv. Inf. Netw. Appl. Work.*, pp. 121–126, 2014.
- [62] T. Dang, Z. Yan, F. Tong, and W. Zhang, “Implementation of a Trust-Behavior based Reputation System for Mobile Applications,” 2014.
- [63] A. G. Hameed and H. A. Al-farhan, “Utilizing Mobile Applications As a Channel of Interaction Between the Citizens and the Government : Design M-Police in Iraq,” pp. 1–7, 2014.
- [64] R. Harrison, D. Flood, and D. Duce, “USABILITY OF MOBILE APPLICATIONS Usability of Mobile Applications: Literature Review and Rationale for A New Usability Model Usability of Mobile Applications: Literature Review and Rationale

- for A New Usability Model,” pp. 1–16, 2013.
- [65] P. L. Festersen and A. Corradini, “re : Mind A mobile application for bipolar disorder patients,” pp. 343–346, 2014.
- [66] S. M. Yusof, “Personal Financial Planner : A Mobile Application that Implementing Forward Chaining Technique for Notification Mechanism,” pp. 65–69, 2014.
- [67] E. M. A. Fenty, K. Hulliyah, and M. Ekafitri, “Applying Mobile Application Development Life Cycle in the Development of Zakat Maal Mobile Web Application Using JQuery Mobile Framework,” *Cyber IT Serv. Manag. (CITSM), 2014 Int. Conf.*, pp. 89–92, 2014.
- [68] X. Feng, Y. Wu, and X. Yan, “Mobile application protection solution based on 3G security architecture and openID,” *Proc. - 7th Int. Conf. Softw. Secur. Reliab. Companion, SERE-C 2013*, pp. 1–7, 2013.
- [69] D. H. Setiabudi and L. J. Tjahyana, “Mobile learning application based on hybrid mobile application technology running on Android smartphone and Blackberry,” *Int. Conf. ICT Smart Soc.*, pp. 1–5, 2013.
- [70] S. Unnikrishnan and A. Ajith, “a Mobile Based Tracking System for,” no. 2, pp. 19–25, 2014.
- [71] R. Deddy and H. Tobing, “Mobile Tourism Application for Samosir Regency on Android Platform,” pp. 249–253, 2015.
- [72] T. Howl, J. Cheel, E. Wanl, and A. Mihailidis, “MyWalk : A Mobile App for Gait Asymmetry Rehabilitation in the Community,” pp. 73–76, 2013.
- [73] F. Year, C. Engineering, and S. V. I. T. Nashik, “Research Article Spotter : a Mobile Tracking Android Application,” vol. 4, no. 3, pp. 425–429, 2015.
- [74] R. Zhang, “Applying RFID and GPS tracker for signal processing in a cargo security system,” *2013 IEEE Int. Conf. Signal Process. Commun. Comput. ICSPCC 2013*, 2013.
- [75] I. M. Almomani, N. Y. Alkhalil, E. M. Ahmad, and R. M. Jodeh, “Ubiquitous GPS Vehicle Tracking and Management System,” 2011.
- [76] S. Sankarananrajan and P. Hamilton, “Mobile enabled bus tracking and ticketing system,” *2014 2nd Int. Conf. Inf. Commun. Technol. ICoICT 2014*, pp. 475–480, 2014.
- [77] K. Grifantini, “How’s My Sleep?,” *IEEE Pulse*, no. october, pp. 14–18, 2014.
- [78] I. M. Almomani, N. Y. Alkhalil, E. M. Ahmad, and R. M. Jodeh, “Ubiquitous GPS

- vehicle tracking and management system,” *2011 IEEE Jordan Conf. Appl. Electr. Eng. Comput. Technol. AEECT 2011*, 2011.
- [79] J. Aghav, S. Sonawane, and H. Bhambhlani, “Health Track,” *2014 Int. Conf. Adv. Eng. Technol. Res. ICAETR 2014*, pp. 0–4, 2015.
- [80] M. Zank, T. Nescher, and A. Kunz, “Tracking human locomotion by relative positional feet tracking,” *Virtual Real. (VR), 2015 IEEE*, vol. 1, pp. 317–318, 2015.
- [81] D. Punetha and V. Mehta, “Protection of the child/ elderly/ disabled/ pet by smart and intelligent GSM and GPS based automatic tracking and alert system,” *Proc. 2014 Int. Conf. Adv. Comput. Commun. Informatics, ICACCI 2014*, pp. 2349–2354, 2014.
- [82] “GPS Trackers, GPS Tracking Device, GPS Tracking Software | TrackingTheWorld.” [Online]. Available: <http://www.trackingtheworld.com/>. [Accessed: 19-May-2016].
- [83] A. Shamsuzzoha, R. Addo-Tenkorang, D. Phuong, and P. Helo, “Logistics tracking: An implementation issue for delivery network,” *Technol. Manag. Energy Smart World (PICMET), 2011 Proc. PICMET '11*, pp. 1–10, 2011.
- [84] N. Kasim, A. Shamsuddin, R. Zainal, and N. C. Kamarudin, “Implementation of RFID technology for real-time materials tracking process in construction projects,” *CHUSER 2012 - 2012 IEEE Colloq. Humanit. Sci. Eng. Res.*, no. Chuser, pp. 699–703, 2012.
- [85] P. Subpratatsavee, “Official Document Tracking System with iPhone using GPS and RFID Technology Case Study: Kasetsart University Si Racha Campus, Thailand,” 2014.
- [86] B. K. Grifantini, “How’s My Sleep?,” no. october, pp. 14–18, 2014.
- [87] K. A. Kamaruddin, N. S. M. Yusop, and M. A. M. Ali, “Using activity theory in analyzing requirements for mobile phone application,” *2011 5th Malaysian Conf. Softw. Eng. MySEC 2011*, pp. 7–13, 2011.
- [88] A. M. M. Altrad, “Web Based Post Flood Disaster Missing People Tracking Information System,” 2011.
- [89] L. C. M. Varandas, “mTracker: A Mobile Tracking Application for Pervasive Environment,” 2010.
- [90] Y. Zhou and S. Li, “Research on outsourcing security engineering of E/M-government,” *2011 Int. Conf. Comput. Sci. Serv. Syst. CSSS 2011 - Proc.*, pp. 653–656, 2011.



- [91] T. Almarabeh and A. AbuAli, "A General Framework for E-Government : Definition Maturity Challenges , Opportunities , and Success," *Eur. J. Sci. Res.*, vol. 39, no. 1, pp. 29–42, 2010.
- [92] L. Sun, "A Study on E-government Success Framework Based on IS Success Model," pp. 2255–2258, 2009.
- [93] United-Nation, *E-Government Survey 2014*. 2014.
- [94] "IRAQ e-GOV Portal." [Online]. Available: <http://www.egov.gov.iq/egov-iraq/index.jsp?&lng=en>. [Accessed: 20-Dec-2015].
- [95] "وزارة التعليم العالي والبحث العلمي :: Ministry of Higher Education & Scientific Research." [Online]. Available: <http://www.mohe.sr.gov.iq/>. [Accessed: 24-Dec-2015].
- [96] "وزارة الموارد المائية." [Online]. Available: <http://www.mowr.gov.iq/>. [Accessed: 24-Dec-2015].
- [97] U. N. E. Survey and U. N. E-gov-, "World e-government rankings Chapter 1," 2014.
- [98] A. Althunibat, T. a. Alrawashdeh, and M. Muhairat, "The acceptance of using M-government services in Jordan," *J. Theor. Appl. Inf. Technol.*, vol. 63, no. 3, pp. 733–740, 2014.
- [99] E. T. van der Velde, D. E. Atsma, H. Foeken, T. A. Witterman, M. J. Schaliq, and E. E. van der Wall, "Improvement in quality of care by mobile access to always-up-to-date clinical guidelines and documentation of the decision process," *Comput. Cardiol. 2003, Vol 30*, vol. 30, pp. 761–764, 2003.
- [100] K. Amailef and J. Lu, "m-Government: A framework of mobile-based emergency response systems," *Proc. 2008 3rd Int. Conf. Intell. Syst. Knowl. Eng. ISKE 2008*, pp. 1398–1403, 2008.
- [101] "communications and media commission." [Online]. Available: <http://www.cmc.iq/en/RFP.html>. [Accessed: 16-Dec-2015].
- [102] "order65.pdf." .
- [103] "Iraq - Telecoms, Mobile and Broadband - BuddeComm - BuddeComm." [Online]. Available: <http://www.budde.com.au/Research/Iraq-Telecoms-Mobile-and-Broadband.html>. [Accessed: 23-Dec-2015].
- [104] ITU, "ICT Adoption and Prospects in the Arab Region," p. 170, 2012.
- [105] "Iraq: Delivering life-saving kits for displaced families - European Commission." [Online]. Available: [http://ec.europa.eu/echo/blog/iraq-delivering-life-saving-kits-displaced-families\\_en](http://ec.europa.eu/echo/blog/iraq-delivering-life-saving-kits-displaced-families_en). [Accessed: 13-Mar-2016].

- [106] “Displacement Continues in Iraq, Amid Return Movements: IOM | International Organization for Migration.” [Online]. Available: <https://www.iom.int/news/displacement-continues-iraq-amid-return-movements-iom>. [Accessed: 27-Dec-2015].
- [107] “جمهورية العراق - وزارة الهجرة والمهجرين” [Online]. Available: <http://momd.gov.iq/Default.aspx>. [Accessed: 14-Nov-2015].
- [108] “Iraq: Don’t forget displaced (Opinion) - CNN.com.” [Online]. Available: <http://edition.cnn.com/2014/11/11/opinion/evers-iraq-villages/>. [Accessed: 13-Mar-2016].
- [109] V. Vaishnavi and W. Kuechler, *Design Science Research Methods and Patterns*. 2015.
- [110] J. S. Valacich, J. F. George, and J. a. Hoffer, *Essentials of Systems Analysis and Design (5th Edition)*. 2012.
- [111] D. J. Balar, “Report Information from ProQuest,” no. January, 2016.
- [112] Y. Shin, S. Seol, and K. Lee, “A study on quality of experience of controlling a device remotely in an IoT environment,” *Int. Conf. Ubiquitous Futur. Networks, ICUFN*, vol. 2016–August, pp. 699–702, 2016.
- [113] X. Wang, J. He, and Y. Yang, “Identifying P2P network activities on encrypted traffic,” *Proc. - 2014 IEEE 13th Int. Conf. Trust. Secur. Priv. Comput. Commun. Trust. 2014*, no. Im, pp. 893–899, 2015.
- [114] “TeamViewer – Remote Support, Remote Access, Service Desk, Online Collaboration and Meetings.” [Online]. Available: <https://www.teamviewer.com/en/>.
- [115] R. Altschaffel, R. Clausing, C. Kraetzer, T. Hoppe, S. Kiltz, and J. Dittmann, “Statistical Pattern Recognition Based Content Analysis on Encrypted Network: Traffic for the TeamViewer Application,” *2013 Seventh Int. Conf. IT Secur. Incid. Manag. IT Forensics*, pp. 113–121, 2013.
- [116] U. Sekaran, *Research methods for business: A skill building approach*. John Wiley & Sons, 2006.
- [117] N. Jailani, Z. Abdullah, M. Abu Bakar, and H. R. Haron, “Usability guidelines for developing mobile application in the construction industry,” *2015 Int. Conf. Electr. Eng. Informatics*, pp. 411–416, 2015.
- [118] “Functionality of web-based e-journal,” 2004.
- [119] I. Färnlycke, “An approach to automating mobile application testing on Symbian

Smartphones : Functional testing through log file analysis of test cases developed from use cases,” 2013.

- [120] “Chapter 16: Quality Attributes.” [Online]. Available: <https://msdn.microsoft.com/en-us/library/ee658094.aspx>. [Accessed: 15-Mar-2016].
- [121] A. A. A. A, “Designing an Appointment Management System for the Mother and Child Health Department of the Klinik Kesihatan Changlun,” 2011.
- [122] F. D. Davis, “Perceived usefulness, perceived ease of use, and user acceptance of information technology,” *MIS Q.*, pp. 319–340, 1989.
- [123] M. A. H. Alzughoul, “Usability Evaluation of Web-Based Online Airline Booking System.” 2010.
- [124] I. Decisions, “Using Surveys for Data Collection in Continuous Improvement,” *Innov. Insights*, vol. 4, no. 14, pp. 1–7, 2006.
- [125] F. D. Davis, “Information Technology Introduction,” vol. 13, no. 3, pp. 319–340, 2011.
- [126] C. Sibona and S. Walczak, “Purposive sampling on Twitter: A case study,” *Proc. Annu. Hawaii Int. Conf. Syst. Sci.*, pp. 3510–3519, 2011.
- [127] M. S. Wind, P. C. Usfd, and J. Gonzalo, “MultiMatch - D1.2 User Requirements Analysis,” no. 33104, p. 134, 2006.
- [128] B. Collection and B. Collection, *eBook Collection*. .
- [129] A. M. V Kumar, B. Naik, D. K. Guddemane, P. Bhat, N. Wilson, A. N. Sreenivas, J. M. Lauritsen, and H. L. Rieder, “Efficient, quality-assured data capture in operational research through innovative use of open-access technology.,” *Public Heal. action*, vol. 3, no. 1, pp. 60–2, 2013.
- [130] B. Banire, N. Jomhari, and R. Ahmad, “Visual Hybrid Development Learning System (VHDLS) Framework for Children with Autism,” *J. Autism Dev. Disord.*, vol. 45, no. 10, pp. 3069–3084, 2015.
- [131] M. Tavakol and R. Dennick, “Making sense of Cronbach’s alpha,” *Int. J. Med. Educ.*, vol. 2, pp. 53–55, 2011.
- [132] J. Park and G. Cho, “An Improved Mobile Object Tracking Scheme Combining Range-Hybrid Localizations and Prediction Mechanisms,” *2010 Int. Conf. Cyber-Enabled Distrib. Comput. Knowl. Discov.*, pp. 160–167, 2010.