

# KOLEJ SASTERA DAN SAINS (College of Arts and Sciences) Universiti Utara Malaysia

# PERAKUAN KERJA KERTAS PROJEK (Certificate of Project Paper)

Saya, yang bertandatangan, memperakukan bahawa (I, the undersigned, certify that)

# AHMED YOUNES KHAIRO SHDEFAT (802320)

calon untuk Ijazah (candidate for the degree of ) MSc. (Information Technology)

telah mengemukakan kertas projek yang bertajuk (has presented his/her project paper of the following title)

### MEDICAL E-CONSULTATION SYSTEM (MECS)

seperti yang tercatat di muka surat tajuk dan kulit kertas projek (as it appears on the title page and front cover of project paper)

bahawa kertas projek tersebut boleh diterima dari segi bentuk serta kandungan dan meliputi bidang ilmu dengan memuaskan.

(that the project paper acceptable in form and content, and that a satisfactory knowledge of the field is covered by the project paper).

Nama Penyelia Utama

(Name of Main Supervisor): ASSOC. PROF. ABDUL NASIR ZULKIFLI

Tandatangan (Signature)

THE ABOUL NASIR ZULKIFLI

apd. Nam

ر: /arah

Tarikh (Date) Bidang Sains Gunaan Kolej Saste/a &/Sains Universiti/Usara Malaysia

# Medical E-Consultation System (MECS)

A Thesis submitted to Faculty of Information Technology in partial Fulfillment of the requirements for Master Degree (Information Technology),
University Utara Malaysia

By Ahmed Younes Khairo Shdefat

Ahmed Younes Khairo Shdefat, 2010. All rights reserved ©.

### PERMISSON TO USE

In presenting this thesis in partial fulfillment of the requirement for a postgraduate degree from University Utara Malaysia, I agree that the University Library may take it freely available for inspection. I further agree that permission for copying of this thesis in any manner, in whole or in part, for scholarly purposes may be granted by my supervisor or, in their absence, by the dean of the graduate school. It is understood that any copying or publishing 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 University 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 part, should be addressed to:

Dean of Faculty of Information Technology
University Utara Malaysia
06010 UUM Sintok
Kedah Darul Aman

### **ABSTRACT**

This study aims at establishing a medical consultation system using web-based tools such as PHP and MYSQL. The development of the system will be associated with the linking the website to a knowledge base rather than an ordinary database, using some popular framework like MYSQL. In addition, some expert system techniques are included through the application of intelligent database terms during the matching process of the symptoms provided by users. Features of the system include providing survey-based online diagnoses for patients, such as that produced by doctors. Furthermore, the system will provide information about various diseases, presenting them in the format of online materials. Moreover, it will also provide an online forum where specialists, trainees and patients can interact with each other using questions-answers information sharing technique. On the other hand, users of the system will be able to take advantage of online system-access. Consequently, the system will be meeting the user needs through better understanding of system requirements from the developers' perspectives according to the user needs in the correct and proper way.

**ACKNOWLEDGEMENT** 

I would like to express my thanks and gratitude to Allah, the most beneficent, the most

merciful who granted me the ability and willing to start and complete this project.

Special thanks to my supervisor, Prof Madya Abdul Nasir Zulkifli of University Utara

Malaysia (UUM), Malaysia. I appreciate his excellent supervision of my master project

and very kind support during the past four months of the project period. He is creative in

research and I have learnt a lot from him, not only knowledge but also enthusiasm in

research and kindness to students. This thesis completion is only the first step in our long

term cooperation in research. I would like to advance the research to further stage and

extend it to wider areas in medical field. I am sure that Prof Madya Abdul Nasir Zulkifli

will give me generous and continuous direction. Moreover, I want to pass my greeting to

the Malaysian community for their hospitality and kindness during the past one year and

half of my resident in Malaysia. Eventually, I would like to thanks Jordanian government

and community as well specially the ministry of education, that they empowering me with

the required skills during the school time, which make me be able to adapt and success in

my study.

With all regards to UUM Academic staff......

Ahmed Shdefat 2010,

iii

# **DEDICATION**

In the name of Allah, most merciful, most gracious. Praise be to Allah, lord of the worlds and peace the almighty. Blessing be upon our master Mohammad, the honest and truthful. O Allah! we have no knowledge except what you have taught us, you are the all-knower and the all-wise. O Allah! Teach us what benefits us and benefit us from what you've taught us and enhance our knowledge. Show us the true as true and enable us to follow it and show us the falsehood as falsehood and enable us to avoid it. Make us from those who listen to the saying and follow the best thereof, and make us by your mercy from your righteous worshippers. Bring us out from the darkness of ignorance and illusion to the light of knowledge and science and from mires of vain desires to heavens of pious acts.

Furthermore, I would like to express my thanks to the source that gives me inspiration in this life, which is my family, specially my father and mother, for their continuous support, start from my childhood until now, along with health, financial, mental, moral care and more. Without their precious encouragement and support I could not finish my study. Eventually, a greats greeting to those whom made a special flavor to my life; my friends Mohammad, Mahmoud, Samer, Ahmed, Lith, Alaa, Bilal, Morad, Jehad, Fadi, Hamzah, Ayman, Al-hareath, Omer, Hisham, Iessa, deia, Osama, Yousef, Bashar and to everyone who consider himself as my friend and I forgot to list him in the dedication, thank you for

Thanks All.....

life.

the precious back up in every circumstances that we were through during this evanescent

# TABLE OF CONTENTS

PERMISSON TO USE				
ABST	RACT	ii		
ACKN	ACKNOWLEDGEMENTii			
DEDIC	ATION	.iv		
LIST C	.IST OF TABLESvi			
LIST C	F FIGURES	.ix		
CHAP <sup>-</sup>	TER ONE : INTRODUCTION	. 1		
1.1	Introduction	. 1		
1.2	Study over view	. 2		
1.2	1 Web-base technology and medical application	. 2		
1.2	2 Expert systems contributions on medical field	. 3		
1.3	Problem statement	. 5		
1.4	Research questions	. 6		
1.5	Project objectives	. 6		
1.6	Scope of the study	. 7		
1.7	Significance of the study	. 7		
CHAP <sup>-</sup>	TER TWO : LITERATURE REVIEW	. 8		
2.1 Ba	ck ground	. 8		
2.2 M	edical E-Consultation System	. 9		
2.3 Ar	n internet-based telemedicine system in Nigeria	10		
2.4 E-	mail Consultation	11		
2.5 Ele	ectronic patient-provider communication	12		
2.6 Ac	curacy of consultations performed by infectious diseases	13		
2.7 Te	.7 Text-based medical consultations on the internet14			
2 8 Inc	creasing the use of e-consultation in primary care	16		

CHAPTER THREE : METHODOLOGY	20
3.1 Information gathering	20
3.2 Design	21
3.2.1 Structural design	21
3.2.2 Interface design	24
3.2.3 Knowledgebase schema design	25
3.3 Development	26
3.3.1 Rational Unified Process (RUP)	26
3.3.2 Rapid Application Development (RAD)	28
3.4 Evaluation	29
CHAPTER FOUR : SYSTEM ANALYSIS AND DESIGN	31
4.1 System requirements	31
4.1.1 FUNCTIONAL REQUIREMENTS	31
4.1.2 NON-FUNCTIONAL REQUIREMENTS	34
4.2 Use case diagram	35
4.3 Explore website use case specification (MECS_01)	36
4.4 Use materials use case specification (MECS_02)	38
4.5 Apply consultation use case specification (MECS_03)	40
4.6 Enter forum use case specification (MECS_04)	42
4.7 Evaluate website use case specification (MECS_05)	44
4.8 Activity diagram	46
4.9 Sequence Diagram	47
4.9.1 Explore website Sequence diagram	47
4.9.2 Use Materials Sequence diagram	48
4.9.3 Apply consultation Sequence diagram	49
4.9.4 Enter forum Sequence diagram	50
4.9.5 Evaluate website Sequence diagram	51
4.10 Collaboration diagrams	52
4.10.1 Collaboration diagram for Explore website	52
4.10.2 Collaboration diagram for Use materials	52

4.10.3 Collaboration diagram for Apply consultation	53
4.10.4 Collaboration diagram for Enter forum	54
4.10.5 Collaboration diagram for Evaluation	54
4.11 Class diagram	55
4.11.1 Package diagram	55
4.11.2 Class diagram for interface package	55
4.11.3 Class diagram for control package	56
4.11.4 Class diagram for Entity package	56
4.12 System Flowchart	57
4.12.1 Diagnosis flowchart	. 57
4.12.2 Materials flowchart	58
4.12.3 Forum flowchart	59
CHAPTER FIVE : FINDINGS AND RESULTS	. 60
5.1 Findings	. 60
5.2 Results	. 61
5.2.1 Usefulness Scale	. 61
5.2.2 Ease of use Scale	. 63
5.2.3 Information quality Scale	. 64
5.2.4 Interface quality and Design Scale	. 66
5.2.5 Functionality and Reliability Scale	. 67
CHAPTER SIX : CONCLUSION AND FUTURE WORK	. 69
6.1 Limitations	. 69
6.2 Recommendations and future work	. 69
6.3 Conclusion	. 70
REFERENCES	. 71
APPENDIX A	. 77
APPENDIX B	. 89
ADDENDIVC	99

# LIST OF TABLE

Table 2.1 : Literature review	18
Table 3.1 : Diseases.	25
Table 3.2 : Evaluation	25
Table 3.3 : User	25
Table 3.4 : Comment.	26
Table 4.1 : Functional requirements.	31
Table 4.2: Non-functional requirements	34
Table 5.1 : Usefulness Scale Descriptive Statistics	61
Table 5.2 : Usefulness Scale Statistics	62
Table 5.3: Ease of use Descriptive Statistics	63
Table 5.4 : Ease of use Scale Statistics	63
Table 5.5: Information quality Descriptive Statistics	64
Table 5.6: Information quality Scale Statistics	65
Table 5.7: Interface Quality Descriptive Statistics	66
Table 5.8: Interface Quality Scale Statistics	66

# LIST OF FIGURES

Figure 3.1: Basic expert system parts, (source http://student.dcu.ie/ 2010)	21
Figure 3.2: Rule base components (source http://student.dcu.ie 2010)	22
Figure 3.3: IF/AND/THEN in rule based (source http://student.dcu.ie 2010)	23
Figure 3.4: Interface parts	24
Figure 3.5: RUP diagram (source http://edn.embarcadero.com/ 2010)	27
Figure 3.6: Iterative Incremental Development (source http://staffs.ac.uk/ 2010)	29
Figure 4.1 : Use case diagram	35
Figure 4.2 : Explore website use case	36
Figure 4.3 : Use materials use case	38
Figure 4.4 : Apply consultation use case	40
Figure 4.5 : Enter forum use case	42
Figure 4.6 : Evaluate website use case	44
Figure 4.7 : Activity diagram	46
Figure 4.8 : Explore website sequence diagram	47
Figure 4.9 : Use materials sequence diagram	48
Figure 4.10 : Apply consultation sequence diagram	49
Figure 4.11 : Enter forum sequence diagram	50
Figure 4.12 : Evaluate website sequence diagram	51
Figure 4.13 : Explore website collaboration diagram	52
Figure 4.14: Use materials website collaboration diagram	52
Figure 4.15 : Apply consultation collaboration diagram	53
Figure 4.16 : Enter forum collaboration diagram	54
Figure 4.17 : Evaluation collaboration diagram	
Figure 4.18 : Package diagram	55
Figure 4.19 : Class diagram for interface Package	55
Figure 4.20 : Class diagram for control Package	56
Figure 4.21 : Class diagram for Entity Package	56
Figure 4.22 : Diagnosis flowchart	57
Figure 4.23 : Materials flowchart	58
Figure 4.24 : Forum flowchart	59
Figure 5.1 : Usefulness scale	62
Figure 5.2 : Ease of use scale	64
Figure 5.3 : Information quality scale	
Figure 5.4 : Interface Quality Scale	
Figure 5.5 : Functionality and Reliability Scale	68

### **CHAPTER ONE**

## INTRODUCTION

### 1.1 Introduction

Since human beings are all potential patients. Unfortunately, none of them can assume that good health is indefinitely granted. Their visits to the doctor can be either planned on a regular basis or unplanned as in cases of unexpected health conditions. Whatever the case, sooner or later all of them will need to communicate with a physician regarding their health state. Their well-being relies, to a variable extent, on the successful accomplishment of such communication. Therefore, to gain high quality communication with doctors, already available recent technologies should be utilized.

The dialogue between the physician and the patient during the consultation has always been fundamental in the practice of medicine. With the introduction of Internet, new opportunities have been provided for communication between a physician and a patient through internet—based consultation. Internet-based medical consultation might have an impact on individuals as well as on health care providers. Thus, it is important to understand the opportunities and the limitations of this new method, the usability of such a service, and the perspectives of the physicians carrying out the consultations.

# The contents of the thesis is for internal user only

### REFERENCES

- Adewale, O. S. (2004). An internet-based telemedicine system in Nigeria, *International Journal of Information Management*, 24, 221–234.
- Bacon, J., (2008). Practical PHP and MYSQL. United States of America: Prentice Hall. pp. 1-110.
- Baker, L., Wagner, T. H., Singer, S., & Bundorf, M. K. (2003). Use of the Internet and e-mail for health care information: results from a national survey, *JAMA*, 289, 2400-2406.
- Bergmo, T. S., Kummervold, P. E., Gammon, D., & Dahl, L. B.(2005). Electronic patient—provider communication: Will it offset office visits and telephone consultations in primary care?, *International Journal of Medical Informatics*, 74, 705-710.
- Boegl, K., Adlassnig, K.P., Hayashi, Y., Rothenfluh, T.E. and Leitich, H.,(2004).
  Knowledge acquisition in the fuzzy knowledge representation framework of a
  Medical consultation system, Artificial Intelligence in Medicine, 30(1), 1-26.
- Eysenbach, G., Kohler, C. (2002, March). How do consumers search for and appraise ealth information on the world wide web? Qualitative study using focus groups, husability tests, and in-depth interviews, Heidelberg, Germany.

- Eva, M.(2001). Requirement acquisition for rapid application development, *Information & Management*, 39, 101-107.
- Feigenbaum, E. A. (1977). The art of artificial intelligence: Themes and case studies of knowledge engineering. In Proc Nat Comput Conf New York: AFIPS, p. 221.
- Hersh, W. R., Hickam, D. H., Severance, S. M., Dana, T. L., Krages, K. P., & Helfand,
  M. (2006) . Diagnosis, Access and Outcomes: Update of a Systematic Review of
  Telemedicine Services, *journal of Telemedicine and Telecare*, 12(2), 3-31.
- Holland, C. R. (1990). Trends in expert systems, Southeastcon '90, IEEE, 1, 282 285.
- Koch S.(2006). Home telehealth-Current state and future trends, *Int J Med Inform*, 75(8), 565-76.
- Kruchten, P., (2003). The Rational Unified Process: An Introduction. Boston: Addison-Wesley .pp. 1-40.
- Lai, V. S., & Li, H.(2005). Technology acceptance model for internet banking: an invariance analysis, *Information & Management*, 42, 373-386.
- Lee, K. C., Cho, H.R., & Kim, J. S.(2008). An expert system using an extended AND—OR graph, *Knowledge-Based Systems*, 2,38-51.

- 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.
- Li, X., Su, Y., & Peng, J., (2009, November). Exploration to Medical Process-oriented Information Quality Evaluation System, Fourth International Conference on Cooperation and Promotion of Information Resources in Science and Technology, Beijing, China.
- Lu, X.L. (2005, August). system design and development for a cscw based remote oral medical diagnosis system, Proceedings of the Fourth International Conference on Machine Learning and Cybernetics, Guangzhou, China.
- Nijland, N., Pijnen, J. E.W.C. V. G., Boer, H., Steehouder, M. F., & Seydel, E.R. (2009).

  Increasing the use of e-consultation in primary care: Results of an online survey

  Among non-users of e-consultation, *international journal of medical informatics*,78(10),688-703.
- Nirit Weiss, M. D.(2004). E-mail Consultation: clinical, financial, legal, and ethical Implications, *Surg Neurol*, 61(5), 455-9.
- Payne, P. R. O., Mendonça, E. A., Johnson, S. B., & Starren, J. B., (2007). Conceptual knowledge acquisition in biomedicine: A methodological review, *Journal of Biomedical Informatics*, 40(5), 582-602.

- Pew Internet & American Life Project, Online Health Search .(2006). Fox, S. Retrieved march 5, 2010, from <a href="http://www.pewinternet.org/pdfs/PIP Online Health">http://www.pewinternet.org/pdfs/PIP Online Health</a> 2006.pdf.
- Powell, J. A., Darvell, M., & Gray, J. A. (2003). The doctor, the patient and the world-wide web: how the internet is changing healthcare, *Journal of the real society of medicine*, 96, 74-76.
- Sipahi, O. R., Tasbakan, M., Pullukcu, H., Arda, B., Yamazhan, T., Mizrakci, S., Senol, S., Atalay, A., Koseli, D., Arsu G., Calik, S., Sipahi, H., Buke, C., & Ulusoy S., (2007). Accuracy of consultations performed by infectious diseases trainees and Factors associated with adherence to them, *International Journal of Infectious Diseases*, 11, 518-523.
- Souza, M. A. F., & Ferreira, M. A. G. V. (2002). Designing reusable rule-based architectures with design patterns, *Expert Systems with Applications*, 23(4), 395-403.
- Tierney, L. M., Mcphee, S. J., & Papadakis, M. A. (Eds.). (2005). Current Medical Diagnosis & Treatment. United States of America: McGraw-Hill Companies, Inc.

- Tseng, S. S. & lin S. C.,(2009). VODKA: Variant objects discovering knowledge acquisition, *Expert System with Applications*, 36(2), 2433-2450.
- Tung, Y. H., Tseng, S. S., Weng, J. F., Lee, T. P., Liao, A. Y. H., & Tsai, W. N. (2010).

  A rule-based CBR approach for expert finding and problem diagnosis, *Expert Systems with Applications*, 37(3), 2427-2438.
- Umefjord, G., Sandstrom, H., Malker, H. & Petersson, G., (2008). Medical text-based consultations on the Internet, *international journal of medical informatics*, 77,114-121.
- Varcoe, C., Browne, A. J., Wong, S., & Smye, V. L.(2009). Harms and benefits:
  Collecting ethnicity data in a clinical context, *Social Science & Medicine*, 68, 1659–1666.
- Vassallo, D.J., Swinfen, P., Swinfen, R. & Wootton, R., (2001). Experience with a Low-Cost Telemedicine System in Three Developing Countries, *journal of Telemedicine and Telecare*, 7, 56-58.
- Wand, Y., & Wang, R. Y. (1996). Anchoring data quality dimensions in ontological foundations. New York: Communications of the Acm. pp. 86-95.
- Wössner, U., Schulze, J. P., Walz, S.P., & Lang, U.,(2002). Evaluation of a collaborative volume rendering application in a distributed virtual environment, Switzerland: Eurographics Association Aire-la-Ville. pp. 113-118.