

**INTELLIGENT WEB BASED EXPERT SYSTEM FOR RESPIRATORY  
DISEASE**

A Project submitted to the Graduate School in partial  
fulfillment of the requirements for the degree  
Master of Science (Intelligent Knowledge Based System)  
Universiti Utara Malaysia

By  
Munirah Mohd Yusof

©Munirah Mohd Yusof, 2002. All rights reserved

## **PERMISSION TO USE**

In presenting this thesis in partial fulfillment of the requirement for a postgraduate degree from Universiti Utara Malaysia, I agree that the University Library may make 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 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 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 part, should be addressed to:

**Dean of Graduate School  
Universiti Utara Malaysia  
06010 UUM Sintok  
Kedah Darul Aman**

## ABSTRAK (BAHASA MELAYU)

Kajian ini merangkumi pembangunan prototaip sistem pakar berasaskan web untuk penyakit-penyakit pernafasan yang dinamakan WebResEX. Ia telah dibina di dalam persekitaran web bagi memudahkan proses capaian di kalangan pengguna melalui *World Wide Web* (WWW). Tujuan utama sistem ini adalah untuk mendiagnosis penyakit-penyakit pernafasan pada peringkat awal. Sistem ini mampu untuk mengenalpasti 7 jenis penyakit pernafasan iaitu asma, radang paru-paru (*pneumonia*), penyakit batuk kering (*tuberculosis*), '*chronic bronchitis*', '*occupational lung disease*', barah paru-paru dan serangan jantung. Pengetahuan perubatan akan di simpan di dalam bentuk petua pengeluaran *IF THEN* di bahagian pangkalan pengetahuan. Fakta-fakta bagi masalah-masalah pula akan di simpan di bahagian '*working memory*', manakala bahagian pena'kulan pula di proses di bahagian '*inference engine*'. Tulang belakang sistem ini telah dibangunkan menggunakan Cold Fusion 4.5 dan Javascript. Bahagian antaramuka telah menggunakan Adobe Photoshop dan Swish 2.0 manakala bahagian pangkalan data pula telah dibangunkan menggunakan Microsoft Access 2000.

## ABSTRACT (ENGLISH)

This study involves the development of a prototype web based expert system for respiratory diseases: WebResEX. The system was developed in web-based environment that can be accessed globally through the World Wide Web (WWW). The main purpose of this system is to provide early diagnosis of respiratory disease such as asthma, pneumonia, tuberculosis, chronic bronchitis, occupational lung diseases, lung cancer and heart attack. The medical knowledge is store in the knowledge base in the form of production rules (IF/THEN), while the facts of the problem are store in the working memory. The reasoning processes are located in the inference engine. The backbone of the system was implemented using two web based programming language; Cold Fusion 4.5 and JavaScript. The interface has been developed using Swish 2.0 and Adobe Photoshop while the database has been developed using Microsoft Access 2000.

## ACKNOWLEDGEMENTS

I would like to express my thanks and gratitude to Allah, the Most Beneficent, the Most Merciful whom granted me the ability and willing to start and complete this project.

Special thanks to my supervisor, En. Azizi bin Zakaria that guides and provides fruitful suggestions during the project development and the writing of this final report.

I would also like to express my gratitude to Dr. Nishwan Huzaimi in providing the invaluable experience and knowledge in respiratory disease. Nevertheless, thanks to my friend Siti Nordiana Dollah, a final year medical student at Univesiti Sains Malaysia in supporting me to gain more understanding in the diagnosing respiratory diseases. My former IKBS classmates' batch May 2001 and IKBS lecturers who have supported me towards the completion of this project as well as my friends Ecah, Teh, Hida, Jumi, Aina, Yong, Mar, Idzwan, Ismandi, IKBS and AI juniors. I wish to thank all of them for all their help, support, interest and valuable hints.

Especially to my beloved husband, Rosmadi Husin whose love and patient make me feels strong in developing this project. Lastly but not the least, to my beloved parents Mohd Yusof Hassan and Fatimah Ali and my family, thanks for your encouragement, advices and love. May God Bless You.

# TABLE OF CONTENTS

	<b>Page</b>
PERMISSION TO USE	i
ABSTRACT (BAHASA MELAYU)	ii
ABSTRACT (ENGLISH)	iii
ACKNOWLEDGMENTS	iv
LIST OF TABLES	v
LIST OF FIGURES	vi
<b>CHAPTER 1: INTRODUCTION</b>	
1.1 Overview	1
1.2 Problem Statement	4
1.3 Objective of the Study	5
1.4 Scope of the Study	6
1.5 Significance of the Study	7
<b>CHAPTER 2: LITERATURE REVIEW</b>	
2.1 Overview	9
2.2 Expert System	10
2.3 Web Based Expert System	11
2.4 Current Medical Expert System Application	13

## **CHAPTER 3: METHODOLOGY**

3.1	Overview	22
3.2	Assessment	24
3.3	Knowledge Acquisition	24
3.2.1	Collect	25
3.2.2	Interpret	25
3.2.3	Analyze	26
3.4	Design	27
3.5	Testing and Verification	27

## **CHAPTER 4: WebResEX**

4.1	System Analysis	28
4.1.1	Context Diagram	28
4.1.3	System Flowchart	29
4.2	System Design	31
4.2.1	Database Schema	31
4.2.2	System Modules	35
4.2.3	The Interface	38
4.2.4	The Main Menu	39
4.2.5	The Diagnose Menu	40
4.2.6	The Admin Menu	42
4.3	System Architecture	43
4.3.1	Knowledge Base	45

4.3.2	Working Memory	45
4.3.3	Inference Engine	45

## **CHAPTER 5: CONCLUSION**

5.1	Limitations	47
5.2	Recommendations	48

REFERENCES	49
------------	----

## APPENDIXES

APPENDIX A	53
APPENDIX B	61
APPENDIX C	66
APPENDIX D	86
APPENDIX E	97



## LIST OF TABLES

<b>Table No.</b>	<b>Name of Table</b>	<b>Page No.</b>
1.1	Top Causes of Death for the Year 1990 and 2020	2
4.1	Table for Knowledge Base	31
4.2	Table for Question	31
4.3	Table for Diseases	32
4.4	Table for Respond	32
4.5	Table for Discussion	32
4.6	Table for Glossary	33
4.7	Table for Diseasedisplay	33
4.8	Table for Login	33
4.9	Table for User_details	34
4.10	Table for Treatment	34

## LIST OF FIGURES

<b>Figure No.</b>	<b>Name of Figure</b>	<b>Page No.</b>
2.1	Expert System Block Diagram	10
3.1	Expert System Development Life Cycle	23
3.2	Natural Cycle in Knowledge Elicitation Tasks	25
4.1	Context Diagram	29
4.2	System Flowchart	30
4.3	System Modules	35
4.4	The System Interface	38
4.5	The Main Menu	39
4.6a	The Diagnose Menu Question	40
4.6b	Series of Question in Diagnose Module	41
4.7	The Diagnose Menu Result	41
4.8	The Admin Module	42
4.9	Update Glossary Module	43
4.10	System Model	44

## **CHAPTER 1**

### **INTRODUCTION**

This chapter discuss about the research and project contexts. This will cover the overview of the study, the problem statement, objective, scope and the significance of the study.

#### **1.1 Overview**

Respiratory diseases describe all kinds of diseases that related to our lung and respiratory system. This includes asthma, chronic bronchitis, pneumonia, tuberculosis, chronic obstructive pulmonary disease, bronchus and lung diseases and many others. In Malaysia, respiratory disease is the primary cause of visits to health clinics and outpatient hospital clinic ([http://www.goldcopd.com/Gold\\_guidelines/facts1.html](http://www.goldcopd.com/Gold_guidelines/facts1.html)).

The contents of  
the thesis is for  
internal user  
only

## REFERENCES

- Amanda Reeve, P. Ramnarayan, Joseph Britto (2002). Special Report: Isabel. WebWatch. Practice Nursing, 2002, Vol 13, No.,2.
- Bielawski, L. and Lewand, R. (1991). *Intelligent Systems Design: Integrating Expert System, Hypermedia and Database Technologies*. Wiley Professional Computing.
- Bonfa, I., Maioli, C., Sarti, F., Milandri, G.L. & Dal Monte, P. R. (1993). *HERMES: An Expert System for the Prognosis of Hepatic Disease*. Bologna, Italy : University of Bologna.
- Cancer Research Campaign, (June, 2001). *CRC CancerStats: Lung cancer and Smoking*. - UK.
- Darmoni, S. J., Massari, P., Droy, J. M., Mahe, N., Blanc, T. Moiro, E. & Leroy, J. (1993). *SETH: An Expert System for the Management on Acute Drug Poisoning in Adults*. Computer Methods Programs BioMedical.; Vol. 43, pp. 171-176.
- Department of Public Health (1998). *Stay Ahead of Cancer*. [http://dph.gov.my/Division/he/campaign/pl\\_1998/cancer/index.htm](http://dph.gov.my/Division/he/campaign/pl_1998/cancer/index.htm)
- Durkin, J. (1994). *Expert System: Design and Development*. Prentice Hall International Edition.
- EasyDiagnosis System. <http://www.easydiagnosis.com>
- Facts About Chronic Obstructive Pulmonary Disease (COPD). [http://www.goldcopd.com/Gold\\_guidelines/facts1.html](http://www.goldcopd.com/Gold_guidelines/facts1.html)
- Fact Sheet No. 5, (July, 2001). *Smoking & Respiratory Disease*. [http://www.ash.org.uk/html/factsheets/html/fact05.html#\\_ednref4](http://www.ash.org.uk/html/factsheets/html/fact05.html#_ednref4)
- Federal Telemedicine Newss (2000). <http://www.federaltelemedicine.com/news0810.htm>

Field MJ. (1996). *Telemedicine: A Guide To Assessing Telecommunications In Health Care*. Washington, DC: National Academy Pr.

Grigsby, J. & Sanders, J.H. (1998). *Telemedicine: Where It Is and Where It's Going*. *Annals of Internal Medicine*, 15 July 1998. 129:123-127.

Harvard Medical School (1999). *Dxplain*. <http://www.lcs.mgh.harvard.edu/>

Jackson, P. (1999). *Introduction of Expert System*. Addison Wesley Longman Ltd.

Kroening, M., Robinson, S. & Hegge, F. (1998). *Expanding WebLS to Support Breast Cancer Decision Guide*. *PCAIMagazine*, Vol 12, No 2 Mar/April.

Pediatric Clinical Decision Support Tool (1999). *Isabel*. <http://www.isabel.org.uk/>

Louise Simpson (2001). *PRODIGY*. Sowerby Centre for Health Informatics at Newcastle (SCHIN).

Luger, G. F., and Stubblefield, W. A. (1989). *Artificial Intelligence and the Design of Expert Systems*. Benjamin/Cummings Publications Co.

Manikam, S. and Abidi, S.S.R. (1999). Experienced Based Medical Diagnostic System Over The World Wide Web (WWW), *Proceedings of The First National Conference on Artificial Intelligence Application in Industry*, Kuala Lumpur, pp. 47-56.

*Medical Expert System: Doctor Silent Partner*  
<http://www.computer.privateweb.at/judith/>

Ravi D. Shankar, Susana B. Martins, Samson W. Tu, Mary K. Goldstein, Mark A. Musen (2001). *Building an Explanation Function for a Hypertension Decision-Support System*. Stanford Medical Informatics, Stanford University School of Medicine, Stanford, California, USA.

Santamaria, N. & Clayton, L. (2000). *The Development of The Alfred Medseed Wound Imaging System*. *Collegian*. 7(4):14-18.  
[http://www.medseed.com/wound\\_imaging/](http://www.medseed.com/wound_imaging/)

Sawar, M. J., Brennan, T. G., Cole, A. J & Stewart, J. (1992). *An Expert System PostOperative Care*. Leeds, UK : Leeds University.

Shortliffe, E. H. (1987). Computer Programs to Support Clinical Decision Making. *Journal of the American Medical Association*, Vol. 258, No. 1.

Sowerby Centre for Health Informatics at Newcastle (1998). *PRODIGY*.  
<http://www.prodigy.nhs.uk/>

Top 10 Causes of Death. <http://www.asiaweek.com/asiaweek/99/0820/cs13.html>

Turban, E. (1995). *Decision Support and Expert System: Management Support Systems*. Prentice Hall.