INTELLIGENT SCHOOL COMPUTER LABORATORY RESERVATION SYSTEM BY USING MULTIPLE AGENTS BASED

A thesis submitted to the College of Arts and Sciences in partial fulfillment of the requirements for the degree of Master of Science (Intelligent System) Universiti Utara Malaysia

by

Sulaiman Mahzan

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)

SULAIMAN MAHZAN
(89048)

calon untuk Ijazah
(candidate for the degree of) **MSc. (Intelligent System)**

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

INTELLIGENT SCHOOL COMPUTER LABORATORY RESERVATION SYSTEM BY USING MULTIPLE AGENTS BASED

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): **MR. MOHD. ZABIDIN HUSIN**

Tandatangan
(Signature) : 

Tarikh
(Date) : 3/12/09

PERMISSION TO USE

In presenting this thesis in partial fulfillment of requirement for a postgraduate degree from Universiti Utara Malaysia, I agree that the University Library may make it freely available for inpesction. I further agree that permission for 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 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 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 College of Arts and Sciences
Universiti Utara Malaysia
06010 UUM Sintok
Kedah Darul Aman

ABSTRACT

One of the problems about school computer laboratory is to handle the reservation for class subject (non-computer based relation) or any events in Malaysia. The reservation process was still using manual approach. To make reservation, a user must fill the form; meet the administrator to check lab availability and lastly the admin will approve it. A computer system must be developed to manage the reservation for user request. This system was used multiple intelligent agents that assist the user and the admin to manage the lab reservation based on a few constraints such as holiday and permanent classes. The agents also try to give alternative session if the request session is not available. The agents have ability to evaluate user authentication based on inconsistent action on the system and will keep up the security level based on individual authentication. The collection of user action pattern is recorded then gives direction to the agent to reconstruct its internal action related to user behavior. FIPA-ACL as communication standard between the agents to make them able to be socializes in their environment.

This system was developed by using JAVA computer programming language. JAVA programming is the best choice to create multi-agent functions and reacted base on intelligent agents approach. The system will be deployed as a stand-alone system and also might share through internal local area network (LAN). MS Access was used as the database for storing the data and might it easy to integrate with Education Management Information System (EMIS) that already exist. The level of user' acceptance was determined using Technology Acceptance Model (TAM) by Davis (1989) where data is gathered through a set of designed questionnaire. In conclusion, this system has a great potential to encounter school computer lab reservation problem by using intelligent multi-agent as human behalf.

ABSTRAK

Salah satu masalah mengenai makmal komputer sekolah ialah menangani tempahan untuk kelas (mata pelajaran yang bukan berorientasikan komputer) atau apa-apa majlis di sekolah di Malaysia. Proses tempahan makmal masih lagi menggunakan pendekatan manual. Untuk membuat tempahan, seseorang pengguna perlu mengisi boring khas; bertemu dengan penyelia makmal untuk memeriksa jadual makmal komputer dan seterusnya penyelia akan meluluskan permohonan tersebut. Oleh yang demikian, salah satu untuk menguruskan tempahan yang dibuat oleh pengguna ialah dengan membangun sebuah system komputer untuk tujuan tersebut. Sistem ini menggunakan agent-agent pintar yang membantu pengguna dan penyelia makmal untuk menguruskan tempahan makmal komputer dengan mengambil kira beberapa kekangan seperti cuti dan kelas makmal tetap. Agen-agen pintar ini akan mengambil initiatif untuk memberikan pendapat atau alternatif sesi yang sesuai sekiranya sesi yang dipilih tidak kosong. Agen-agen juga mahir untuk menentukan tahap capaian pengguna berdasarkan tindakan yang tidak konsisten semasa menggunakan system. Satu set koleksi paten tindakan pengguna akan direkodkan dan ia akan memberi panduan kepada agen-agen untuk membina semula tindakan dalamannya yang bersesuaian dengan kelakuan pengguna. Piawaian komunikasi FIPA-ACL dipilih sebagai komunikasi piawai untuk perhubungan antara agen dengan agen yang lain dan seterusnya membolehkan mereka saling berinteraksi dalam persekitaran sistem.

Sistem ini dibangunkan dengan menggunakan bahasa pengaturcaraan JAVA. Bahasa pengaturcaraan JAVA merupakan pilihan yang terbaik dalam pembangunan agen-agen pintar dan fungsian-fungsiannya. Sistem ini akan dipasang ke dalam komputer sebagai system berdiri-sendiri (stand-alone) dan akan dikongsi oleh pengguna-pengguna lain melalui rangkaian komputer dalaman (LAN). MS Access juga digunakan sebagai pangkalan data dan ia memudahkan system untuk integrasi dengan system pangkalan data yang sedia ada iaitu Sistem Maklumat Pengurusan Sekolah (EMIS). Tahap penerimaan pengguna diukur dengan menggunakan Technology Acceptance Model (TAM) oleh Davis (1989) dan set data dikumpulan berpandukan satu set soal selidik yang direka untuk pengguna. Kesimpulannya,

system ini mempunyai potensi yang besar untuk menangani masalah tempahan makma komputer sekolah dengan menggunakan pendekatan agen pintar yang mewakili pengguna.

ACKNOWLEDGEMENT

"IN THE NAME OF ALLAH S.W.T, THE MOST GRACIOUS, THE MERCIFUL"

Alhamdulillah, I have finally completed my Project for my master. I would like to express my highest gratefulness to Allah S.W.T. for encourage me and giving me extra patient and strength to complete this project.

First of all, I would like to address special appreciation to my beloved parent for their loving, caring, and supporting me by giving their moral support. Without them I will not be able to complete his project.

A special thanks goes to En Mohd Zabidin bin Husin as my dedicated Supervisor for this project. Thanks for his support, guidance, patience and tolerance whenever I need it towards the completeness of this project. Thanks also to other lecturers for helping me in some ways or another for giving his guidance, comment and encouragement.

Special thanks also for to my fellow friends for their kindness in sharing knowledge and given their moral support towards making this project. Last but not least, I would like to express my deep appreciation to those who involved directly or indirectly in completing the project.

Thank you.

TABLE OF CONTENT

APPROVAL		ii
DECLARATION		iii
ACKNOWLEDGEMENT		iv
ABSTRACT		V
ABSTRAK		v
TABLE OF CONTENTS		vii
LIST OF TABLES		x
LIST OF FIGURES		xii
LIST OF ABBREVIATIONS		xiii
CHAPTER ONE: INTRODUCTION		
1.0	Introduction	1
1.1	Project Overview	1
1.2	Problem Statement	2
1.3	Project Objectives	3
1.4	Project Scope	4
1.5	Project Significance	4
1.6	Outline Project	5
1.7	Conclusion	6
CHAPTER TWO: LITERATURE REVIEW		
2.0	Introduction	7
2.1	User Acceptance	7
	2.1.1 Technology Acceptance Model	8
2.2	JAVA	9
2.3	Artificial Intelligent	11
	2.3.1 Intelligent Agent	13
	2.3.1.1 Communication Agent	14
2.4	Similarities from the previous studies	17
	2.4.1 UUM Web-Based Computer Laboratory Reservation System: A Prototype	17
	2.4.2 Intelligent Parking System	18
	2.4.3 Online Intelligent Hotel Reservation (IHR) using WAP-enabled mobile devices	18
2.5	Conclusion	19
CHAPTER THREE: RESEARCH APPROACH AND METHODOLOGY		
3.0	Introduction	20
3.1	Project Methodology	21
	3.1.1 Project Planning	21
	3.1.1.1 Primary Data Collection	21
	3.1.1.2 Secondary Data Collection	21
	3.1.1.3 Project Framework	21
	3.1.2 Requirement Analysis	22

3.1.2.1 Hardware Requirement 22
3.1.2.2 Software Requirement 22
3.1.2.2 User Requirement 23
3.1.3 Project Design 23
3.1.3.1 Database Development 24
3.1.3.2 System Architecture 29
3.1.4 Phase 4 : Implementation 37
3.1.5 Phase 5 : Testing 37
3.1.6 Phase 6 : Maintenance 38
3.2 Research on Evaluation of User Acceptance 38
3.2.1 Conceptual Framework 38
3.2.2 Research design 39
3.2.3 Research Variable 39
3.2.4 Data Collection and Instrumentation 40
3.2.5 Benchmarking and Scale of Scores 40
3.3 Conclusion 40

CHAPTER FOUR: SYSTEM OVERVIEW
4.0 Introduction 41
4.1 Overview of the system 41
4.2 Interface Design 42
4.2.1 User's Login 42
4.2.2 Computer Lab Reservation by the User 44
4.2.2.1 First Time User or New User 44
4.2.2.2 The User with Reservation History 46
4.2.2.3 The user with Reservation History but Not Available in That Day 47
4.2.2.4 The user with have already made reservation 47
4.2.2.5 The User with Selected Date is Holiday or Event Date 48
4.2.2.6 The User with Selected Date is not available 49
4.2.3 System Monitor by Admin 50
4.2.3.1 Insert New Holiday or Event Date 50
4.2.3.2 Remove a Holiday or Event Date 51
4.3 Conclusion 52

CHAPTER FIVE: RESULT AND FINDING
5.0 Introduction 53
5.1 Survey analysis 53
5.1.1 Section 1: Demographic Profile 53
5.1.2 User Acceptance Factor 54
5.2 Result Discussion 58
5.3 Conclusion 59

CHAPTER SIX: CONCLUSION AND RECOMMENDATION
6.0 Introduction 60
6.1 Conclusion 60
6.2 Recommendation 61
6.3 Future Work 62

REFERENCES 64

APPENDICES 70

LIST OF TABLES

FIGURE		PAGE
Table 2.1	Java Versions	11
Table 2.2	FIPA-ACL message elements.	15
Table 2.3	FIPA-ACL performative's message	16
Table 3.1	Hardware Requirement	22
Table 3.2	Software Requirement	22
Table 3.3	Com 1 (A5 – A7)	34
Table 3.4	Com 2 (A5 – A6)	34
Table 3.5	Com 3 (A6 – A3)	34
Table 3.6	Com 4 (A7 – A4)	35
Table 3.7	Com 5 (A7 – A2)	35
Table 3.8	Com 6 (A6 – A8)	35
Table 3.9	Com 7 (A8 – A2)	36
Table 3.10	Com 8 (A8 – A2)	36
Table 3.11	Com 9 (A7 – A1)	36
Table 3.12	Com 10 (A4 – A3)	36
Table 3.13	Com Error	36
Table 3.14	Lists of Independent and Dependent Variables	39
Table 5.1	Gender	53
Table 5.2	Group of Age	54
Table 5.3	Academic Background	54
Table 5.4	Working Experience in Computing Area	54
Table 5.5	Respondent's Perceive Ease of Use Analysis	56
Table 5.6	Respondent's Perceived Usefulness Analysis	57
Table 5.7	Summary of Result Finding	58

LIST OF FIGURES

FIGURE		PAGE
Figure 2.1	Theory of Reasoned Action (from Fishbein and Ajzen, 1975)	8
Figure 2.2	Technology acceptance model (Davis, Bagozzi & Warshaw,1989)	9
Figure 2.3	Java bytecode can be executed on any computer with a JVM	10
Figure 2.4	Dimensions in AI (Russell and Norvig, 2003).	12
Figure 2.5	An agent with its environment	13
Figure 3.1	Waterfall Model of the System Development Life Cycle	20
Figure 3.2	Use Case Diagram	21
Figure 3.3	Databases interaction with i-Cors internal environment	24
Figure 3.4	The Comp Lab database's tables	25
Figure 3.5	Table structure in Event database	26
Figure 3.6	The EMIS's database architecture	26
Figure 3.7	TGStaf table with its associated tables in EMIS	27
Figure 3.8	List of fields in TGStaf table in EMIS	28
Figure 3.9	The system architecture	29
Figure 3.10	The agents' relationship and communication among them in the internal system architecture	30
Figure 4.1	System Overview	41
Figure 4.2	Loading Page	42
Figure 4.3	Login Window	43
Figure 4.4	Unable Access Window	43
Figure 4.5	First page for a new user	44
Figure 4.6	"Buat Tempahan" or Make Reservation panel	45
Figure 4.7	i-Cors Agent panel	45
Figure 4.8	Computer Lab Weekly Schedule panel	46
Figure 4.9	i-Cors agent ask for reservation base on history pattern	47
Figure 4.10	i-Cors agent brief that regularly reservation date is not available	47
Figure 4.11	i-Cors agent ask for cancelation	47
Figure 4.12	The Selected Date and Time is Holiday	48
Figure 4.13	The Selected Date and Time is have the Class	49

Figure 4.14	System admin window	50
Figure 4.15	Insert a new Holiday or Event day	51
Figure 4.16	i-Cors saved confirmation	51
Figure 4.17	Remove a Holiday or Event day	51
Figure 4.18	i-Cors deleted confirmation	52

SQL	-	Structured Query Language
TAM	-	Technology Acceptance Model
TCP	-	Transmission Control Protocol
TRA	-	Theory of Reasoned Action
UAT	-	User Acceptance Testing
URL	-	Uniform Process Locator
UUM	-	Universiti Utara Malaysia
XML	-	Extensible Markup Language
WAP	-	Wireless Application Protocol

CHAPTER 1
INTRODUCTION

1.0 INTRODUCTION

This chapter provides some overview of the project. It covers the scope and the objectives of the project. It also covers the significance of developing a School Computer Laboratory Reservation System. Besides, the project framework was included in this chapter.

1.1 PROJECT OVERVIEW

In the new era of information age, computer skill becomes important skills that anyone must be have it. ICT would change human work and increase the efficiency itself. Knowing about the important of ICT, Malaysia wants to become one of the most role players in ICT technology by developing MSC strategies. MSC was established on 1995 in order to become one of global hub for ICT and multimedia innovation, operation and services, transforms Malaysia into a knowledge-economy and achieve Vision 2020 to become developed nation (Multimedia Super Corridor (MSC) Malaysia, 2009). One of the core strategies is to develop human capital in ICT. It was brings the motivation for government to improve education quality that supports this new transformation. The government was taken the initiatives like building the particular emphasis to science and IT learning facilities for schools; increased educational support programs; revising the syllabus for mathematics and science; introducing Computer Literacy Program and computer aided learning methods; teacher training on computer usage (Ramasamy, *e.t al*, 2004). A part of its strategy is to develop at least a computer laboratory for each school and there is around more than 10,000 schools in Malaysia. According to Saadiyah & Luin, (2008) many secondary schools in Malaysia were supplied with computers, notebooks, LCD projectors and software and at the same time many new schools also have rooms that specially equipped with computers for students to attend classes. Every student will have chances to learn about computer technology and how to use it efficiency.

The contents of the thesis is for internal user only

REFERENCES

Alonso, E., Kudenko, D., & Kazakov, D. (2003). *Adaptive Agents and Multi-Agent Systems : Adaption and Multi-Agent Learning.* Heidelberg: Springer.

Amandi, A., Campo, M., & Zunino, A. (2005). JavaLog: a Framework-Based Integration of Java and Prolog for Agent-Oriented Programming. *Computer Languages, Systems & Structures, Vol. 31, Issue 1*, 17-33.

Bagherzadeh, J., & Arun-Kumar, S. (2006). Flexible Communication of Agents based on FIPA-ACL. *Electronic Notes in Theorical Computer Science 159*, 23-39.

Baloch, H. Z. (2003). Online Intelligent Hotel Reservation (IHR) using WAP-Enabled Mobile Devices. *1st Conference on Information & Knowledge Technology.* Tehran, Iran.

Bothner, P. (1998). Kawa - Compiling Dynamic Language to the Java VM. *1998 USENIX Annual Technical Conference.* Louisiana, USA.

Bradshow, J. M. (1997). *Software Agent.* Cambridge: MIT Press.

Brown, M. H., & Raisamo, R. (1997). JCAT: Collaborative Active Textbooks using Java. *Computer Networks and ISDN Systems, Vol. 29, Issue 14* , 1577-1586.

Cernuzzi, L., Cossentino, M., & Zambonelli, F. (2005). Process Models for Agent-Based Development. *Engineering Applications of Artificial Intelligence, Vol. 18, Issue 2* , 205-222.

Chang, H. H. (2008). Intelligent Agent's Technology Characteristics Applied to Online Auctions' Task: A Combined Model of TTF and TAM. *Tehcnovation, Vol. 28, Issue 9* , 564-577.

Chira, C. (2003). *Software Agent.* IDIMS Report. Retrieved August 12, 2009, from http://pan.nuigalway.ie/code/docs/agents.pdf.

Cooper, W., & Jarvis, C. (2004). A Java-based Intelligent Advisor for Selecting a Context-appropriate Spatial Interpolation Algorithm. *Computers & Geoscienes, Vol. 30, Issues 9-10* , 1003-1018.

Covington, M. A. (1998). Speech acts, electronic commerce, and KQML. *Decision Support System 22* , 203-211.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13(3)* , 319.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User Acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35(8)* , 982.

Demong, R. (2003). *UUM Web-Based Computer Laboratory Reservation System: A Prototype.* Sintok, Kedah: EPrints, UUM.

Dogac, & Cingil. (2003). *B2B e-Commerce Technology: Frameworks, Standards and Emerging Issues.* Addison Wesley.

Evripidou, P., Samaras, G., Panayiotou, C., & Pitoura, E. (2001). The PaCMAn Metacomputer: Parallel Computing with Java Mobile Agents. *Future Generation Computer Systems, Vol. 18, Issue 2* , 265-280.

Finin, T. (1999, March 23). *Software Agents and Agent Communication Language.* Retrieved August 15, 1999, from Unicom Seminar on Implementing Agents: http://www.csee.umbc.edu/~finin/talks/unicom99/unicom99.pdf

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research.* Reading, MA: Addison-Wesley.

Flynt, J. P. (2007). *Java Programming : Second Edition.* Boston: Thompson Course Technology.

Fujita, H., Ktari, B., & Mejri, M. (2006). Implementing Lyee-Calculus in Java. *Knowledge-Based Systems, Vol 19, Issue 2* , 116-129.

Gao, S., Wang, H., Wu, D., & Wang, Y. (2007). An Intelligent Agent-Assisted Decision Support System for Family Financial Planning. *Decision Support Systems, Vol. 44, Issue 1* , 60-78.

Guerra-Hernandez, A., Fallah-Seghrouchni, A. E., & Soldano, H. (2005). Learning in BDI Multi-agent Systems. In *Computational Logic in Multi-Agent Systems* (pp. 218-233). Berlin / Heidelberg: Springer.

Haddadi, A. (1995). *Communication and Cooperation in Agent Systems : A Pragmatic Theory.* Heidelberg: Springer.

Hansen, T., Jensen, J. M., & Solgaard, S. (2004). Predicting online grocery buying intention: a comparison of the theory of reasoned action and the theory of planned behavior. *International Journal of Information Management, Vol. 24, Issue 6* , 539-550.

Horstmann, C. S. (2008). *Java Concepts : Compactible with Java 5 & 6, 5th Edition.* New Jersey: John Wiley & Sons.

Jaber, A., Guarnieri, F., & Wybo, J. L. (2001). Intelligent Software Agents for Forecasting Fire Prevention and Fighting. *Safety Science, Vol. 39, Issue 1-2* , 3-17.

Jiang, M. F., Tseng, S. S., & Tsai, C. J. (1999). Intelligent Query Agent for Structural Documnet Databases. *Expert Systems with Applications, Vol. 17, Issue 2* , 105-113.

Jennings, N. R., Faratin, P., Lomuscio, A. R., Parsons, S., Wooldridge, M. J., & Sierra, C. (2001). Automated Negotiation: Prospects, Methods and Challange. *Group Decision and Negotiation, Vol. 10, No. 2* , 199-215.

Jennings, N., & Wooldridge, M. (1996). Software Agents. *IEEE Review* , 17-20.

Johar, H. V. (1997). SoftCord: An Intelligence Agent for Coordination in Software Development Projects. *Decision Support Systems, Vol. 20, Issue 1* , 65-81.

Liang, Y. D. (2007). *Introduction to Java Programming : Sixth Edition.* Upper Saddle River: Pearson Prentice Hall.

Lopez-Morales, V., Lopez-Ortega, O., Ramos-Fernandez, J., & Munoz, L. B. (2008). JAPIEST: An Integral Intelligent System for the Diagnosis and Control of Tomatoes Diseases and Pests in Hydroponic Greenhouses. *Expert System with Applications, Vol. 35, Issue 4* , 1506-1512.

Li, S. (2007). AgentStra : an Internet-Based Multi-Agent Intelligent Systems for Strategic Decision-Making. *Expert Systems with Applications, Vol. 33, Issue 3* , 565-571.

Luger, G. F. (2005). *Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Fifth Edition.* New York, USA: Addison-Wesley.

Manvi, S. S., & Venkataram, P. (2004). Applications of Agent Technology in Communications: A Review. *Computer Communications, Vol. 27, Issue 15* , 1493-1508.

McConnell, S. (2006). *Software Estimation: Demystifying the Black Art.* US: Microsoft Press.

Multimedia Super Corridor (MSC) Malaysia. (2009). Retrieved September 30, 2009, from NITC: http://www.nitc.org.my/index.cfm?&menuid=28

Negnevitsky, M. (2004). *Artificial Intelligence: A Guide to Intelligent Systems Second Edition.* Essex: Addison Wesley.

Oliveira, E., Fischer, K., & Stepankova, O. (1999). Multi-Agent Systems: Which Reseacrh for Which Applications. *Robotics and Autonomous Systems, Vol. 27, Issue 1-2* , 91-106.

O'Learly, T. J., & O'Learly, L. I. (2005). *Computing Essentials 2005.* Singapore: McGraw-Hill Education (Asia).

Padgham, L., & Winikoff, M. (2004). *Developing Intelligent Agent Systems : A Practical Guide.* West Sussex: John Wiley & Sons.
Papadimitriou, S., & Terzidis, K. (2009). jLab: Integrating a Scripting Intepreter with Java Technology for Flexible and Efficient Scientific Computation. *Computer Languages, Systems & Structures, Vol. 35, Issue 3* , 217-240.

Park, S., & Sugumaran, V. (2005). Designing Multi-Agent Systems : A Framework and Application. *Expert Systems with Applications, Vol. 28, Issue 2* , 259-271.

Pendharkar, P. C. (2007). The Theory and Experiments of Designing Cooperative Intelligent Systems. *Decision Support Systems, Vol. 43, Issue 3* , 1014-1030.

Pereira, F. C. (2007). *Creativity and Artificial Intelligence : A Conceptual Blending Approach.* Berlin: Mouton de Gruyter.

Phung, T., Winikoff, M., & Padgham, L. (2005). Learning Within the BDI Framework: An Empirical Analysis. In *Knowledge-Based Intelligent Information and Engineering Systems, Vol. 3683* (pp. 282-288). Heidelberg: Springer Berlin.

Pokahr, A., Braubach, L., & Lamersdorf, W. (2005). JADEX : A BDI Reasoning Engine. In *Multi-Agent Programming : Languages, Platforms and Applications, Vol. 15* (pp. 149-174). New York: Springer US.

Poslad, Bourne, Hayzelden, & Buckle. (2000). *Agent Technology for Communications Infrastructure: An Introduction.* John Wiley and Sons.

Querra-Hernandez, A., Fallah-Seghrouchni, A. E., & Soldano, H. (2005). Learning in BDI Multi-agent Systems. In *Computational Logic in Multi-Agent System, Vol. 3259* (pp. 218-233). Heidelberg: Springer Berlin.

Ramasamy, B., Chakrabarty, A., & Cheah, M. (2004). Malaysia's Leap Into the Future: An Evaluation of the Multimedia Super Corridor. *Technovation, Vol. 24, Issue 11, Nov 2004* , 871-883.

Ramayah, T., Rouibah, K., Gopi, M., & Rangel, G. J. (2009). A decomposed theory of reasoned action to explain intention to use Internet stock trading among Malaysia investors. *Computers is Human Behavior, Vol. 25, Issue 6* , 1222-1230.

Rao, A., & Georgeff, M. P. (1995). BDI Agents: From Theory to Practice. *1st International Conference on Multi-agent Systems (ICMAS-95)*, (pp. 312-319). San Francisco, CA.

Royce, W. W. (1970). Managing the Development of Large Software Systems. *IEEE Wescon* (pp. 1-9). TRW.

Ryoke, M., & Nakamori, Y. (2005). Chapter 5 - An Agent-Based Rules Discovery from Complex Database. *Systems and Human Science* , 77-87.

Saadé, R. G., Nebebe, F., & Tan, W. (2007). Viability of the "Technology Acceptance Model" in Multimedia Learning Environments: . *Interdisciplinary Journal of Knowledge and Learning Objects, Vol. 3* .

Saadiyah, D., & Luin, H. W. (2008). Investigating Teachers' Use of Computers in Teaching English: A Case Study. *Teaching English with Technology: A Journal for Teachers of English, Vol. 8, Issue 1* .

Sardina, S., Silva, L. d., & Padgham, L. (2006). Heirarchical Planning in BDI Agent Programming Languages: A Formal Approach. *International Conference on Autonomous Agents* (pp. 1001-1008). Hakodate, Japan: ACM.

Schleiffer, R. (2005). An Intelligent Agent Model. *European Journal of Operational Research, Vol. 166, Issue 3* , 666-693.

Schneider, G. P., & Evans, J. (2007). *New Perspectives on The Internet, 6th Edition - Comprehensive.* Boston, Massachusetts: Thomson Course Technology.

Sonar, R. M. (1999). Integrating Intelligent Systems using an SQL-database. *Expert Systems with Applications, Vol. 17, Issue 1* , 45-49.

Sterling, L. S., & Taveter, K. (2009). *The Art of Agent-Oriented Modeling.* Cambridge: The MIT Pres.

Sugumaran, V. (2007). *Application of Agents and Intelligent Information Technologies.* Hershey: Idea Group Publishing.

Sugumaran, V. (2009). *Distributed Artificial Intelligence, Agent Technology, and Collaborative Applications.* Hershey: Information Science Reference.

Siegel, J. G., Shim, J. K., Walker, J. P., Qureshi, A. A., O'Callaghan, S., & Koku, P. (2003). *the Artificial Intelligence Handbook: Business Applications in Accounting, Banking, Finance, Management, and Marketing.* Ohio: Thomson South-Western.

Simic, G., & Devedzic, V. (2003). Building an Intelligent System using Modern Internet Technologies. *Expert System with Applications 25* , 231-246.

Teodorović, D., & Lučić, P. (2005). Intelligent Parking System. *European Journal of Operational Research, Volume 175, Issue 3, 16 December 2006* , 1666-1681.

Tweedale J., *et. al.* (2007). Inovations in Multi-Agent Systems. *Journal of Network and Computer Applications, Vol. 30, Issue 3* , 1089-1115.

Uraikul, V., Chan, C. W., & Tontiwachwuthikul, P. (2007). Artificial Intelligence for Monitoring and Supervisory Control of Process Systems. *Engineering Applications of Artificial Intelligence* , 115-131.

Vicari, R. M., Flores, C. D., Silvestre, A. M., Seixas, L. J., Ladeira, M., & Coelho, H. (2003). A Multi-Agent Intelligent Environment for Medical Knowledge. *Artificial Intelligence in Medicine, Vol. 27, Issue 3* , 335-336.

Weigang, L., Dib, M. V., Alves, D. P., & Ferreira, A. M. (2009). Intelligent Computing Methods in Air Traffic Flow Management. *Transportation Research Part C: Emerging Technologies, Artical in Press, Corrected Proof*, Note to Users.

Wolff, J. G. (2007). Towards an Intelligent Database System Founded on the SP Theory of Computing and Cognition. *Data & Knowledge Engineering, Vol. 60, Issue 3* , 596-624

Wooldridge, M. (2002). *An Introduction to Multiagent Systems.* Chichester, England: J. Wiley.

Wooldridge, M., & Jennings, N. R. (1995). Intelligent Agents: Theory and Practice. *The Knowledge Engineering Review, Vol. 10, Issue 2* , 115-152.

Zhang, Z., & Zhang, C. (2005). *Agent-Based Hybrid Intelligent Systems : An Agent-Based Framework for Complex Problem Solving.* Heidelberg: Springer.