

**I-CHOOSE U: DEVELOPMENT OF DECISION SUPPORT SYSTEM
USING SKYLINE TECHNIQUE (PREFERENCE QUERY
TECHNIQUE): THE CASE OF CHOOSING MALAYSIAN HIGHER
LEARNING INSTITUTIONS**

Omer Ibrahim Elkhder Elhassan

UNIVERSITI UTARA MALAYSIA

2011

**I-CHOOSE U: DEVELOPMENT OF DECISION SUPPORT
SYSTEM USING SKYLINE TECHNIQUE (PREFERENCE
QUERY TECHNIQUE): THE CASE OF CHOOSING
MALAYSIAN HIGHER LEARNING INSTITUTIONS**

A project submitted to the Dean of Awang Had Salleh Graduate
School in partial Fulfillment of the requirement for the degree of
Master of Science (Information Technology)
Universiti Utara Malaysia

By

Omer Ibrahim Elkhder Elhassan
(807001)

Copyright © Omer Ibrahim Elkhder.2011. All rights reserved.



**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, certifies that)

OMER IBRAHIM ELKHDER ELHASSAN
(807001)

(candidate for the degree of) **MSc. (Information Technology)**

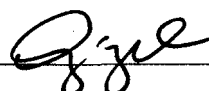
telah mengemukakan kertas projek yang bertajuk
(has presented his/ her project of the following title)

**I-CHOOSE U: DEVELOPMENT OF DECISION SUPPORT SYSTEM USING
SKYLINE TECHNIQUE (PREFERENCE QUERY TECHNIQUE) :**
THE CASE OF CHOOSING MALAYSIAN HIGHER LEARNING INSTITUTIONS

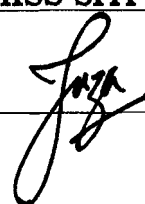
seperti yang tercatat di muka surat tajuk dan kulit kertas projek
(as it appears on the title page and front cover of project)

bahawa kertas projek tersebut boleh diterima dari segi bentuk serta kandungan
dan meliputi bidang ilmu dengan memuaskan.
(that this project is in acceptable form and content, and that a satisfactory
knowledge of the field is covered by the project).

Nama Penyelia
(Name of Supervisor) : **DR. AZIZAH HJ. AHMAD**

Tandatangan
(Signature) :  Tarikh (Date) : 26/6/11

Nama Penilai
(Name of Evaluator) : **MISS SITI MAHFUZAH SARIF**

Tandatangan
(Signature) :  Tarikh (Date) : 26/6/11

PERMISSION TO USE

In presenting this thesis of the requirements for a Master of Science in Information Technology (MSc. IT) from University Utara Malaysia, I agree that the University library may make it freely available for inspection. I further agree that permission for copying of this project 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 Awang Had Salleh 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 University Utara Malaysia for any scholarly use which may be made of any material from my project. Request for permission to copy or make other use of materials in this thesis, in whole or in part, should be addressed to:

Dean of Awang Had Salleh Graduate School

Colleges of Arts and Sciences

Universiti Utara Malaysia

06010 UUM, Sintok

Kedah Darul Aman

Malaysia

ABSTRACT

This study focuses on Malaysian public universities marketing strategies which mainly used to attract international students who have the intention to enroll in higher learning institutions in Malaysia. The main objective of this study is to develop decision support system prototype (DSS) using preferences queries technique (skyline technique), in order to solve the issue of facing challenges that can be consequences of wrong selection of universities or colleges that had been made by students and may influence in their performance. This system aim to help international students to choose suitable college based on their criteria as well as to help them to make the right decision when they want to select one of the public universities in Malaysia. In this research; we used rapid application development (RAD) method. The DSS prototype (i-choose u) in this study constructed by using Java Server Pages (JSP) and MYSQL for database development, which are open sources software. The DSS prototype (i-choose u) suggests maximum five universities to international students that are most suitable to students based on student's criteria.

ACKNOWLEDGEMENT

All praises and thanks are to Allah, the Lord of the 'Alamin'

First, I would like to express my gratitude to my supervisor, Dr. Azizah Bt Haji Ahmad for her expertise, guidance and encouragement, which ensure that progress of this study was continuously maintained. Our discussions have contributed to the completion of this work.

I would also like to express my thanks to the University Utara Malaysia, especially to lecturers and my colleagues of the Faculty of Information Technology, for the enjoyable working environment, and for their support.

Last, but not least, I would like to thank my father, Dr. Ibrahim Elkhder and my mother, Mwahib Abd Alhalim for their endless encouragement, also my brothers, my sisters, my uncles, my aunts, my brothers in law, my nephew, my niece and all the people close to myself, for their strong support, encouragement, friendship and love.

Sincerely Grateful

Omer Ibrahim Elkhder

TABLE OF CONTENTS

ABSTRACT	iii
ACKNOWLEDGEMENT	v
TABLE OF CONTENTS.....	v
LIST OF FIGURES	ixx
LIST OF TABLES	xii

CHAPTER ONE

INTRODUCTION

1.1 Background.....	1
1.2 Problem Statement.....	5
1.3 Research Questions.....	6
1.4 Objectives	6
1.5 Scope of the Study.....	6
1.6 Significance of the Study.....	7
1.7 Thesis Organization.....	8

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction.....	9
2.2.1 Applications of Decision Support Systems	10
2.3 Types of Decision Support Systems	11
2.3.1 Data-driven DSS.....	12

2.3.2 Model-driven DSS	12
2.3.3 Knowledge-driven DSS	12
2.3.4 Document-driven DSS.....	13
2.3.5 Communication-driven DSS.....	13
2.3.6 Web-based DSS	13
2.4 Preference Queries Background	14
2.4.1 Supporting Preference Queries in Database Systems	16
2.4.2 Techniques of Preference Queries	18
2.4.2.1 Skyline Query.....	18
2.4.2.1.1 Translating a Skyline Query into a Nested SQL Query	20
2.4.2.2 Top-k Queries	21
2.5 Base preferences (Criteria)	22
2.5.1 User-Definable Explicit Preference	22
2.5.2 Predefined Base Preferences.....	23
2.5.3 Combination of Preferences.....	25
2.5.3.1 Accumulation of Preferences	25
2.5.3.2 Prioritization of Preferences	26
2.6 Malaysian Public Universities	27
2.6.1 List of Public Universities in Malaysia.....	27

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Methodology	38
3.2 Life cycle of RAD.....	39
3.2.1 Planning Stage	40

3.2.1.1 DSS Architecture.....	40
3.2.1.1.1 Malaysian Public University Data Source and Collection.....	41
3.2.1.1.2 Preference Query Techniques (Model).....	42
3.2.1.1.3 Suggested Universities (Knowledge).....	42
3.2.1.1.4 Interfaces	42
3.2.2 Analysis Stage	42
3.2.3.1 Unified Modeling Language.....	43
3.2.4 Implementation Stage	44
3.3 Summary	44

CHAPTER FOUR

ANALYSIS, DESIGN AND IMPLEMENTATION

4.1 Introduction.....	45
4.2 Designing Web-based DSS.....	45
4.2.1 DSS Determines User Requirements.....	45
4.2.2 DSS Analysis and Design.....	48
4.2.2.1 Use Case Diagram	49
4.2.2.1.1 Use Case Specifications.....	50
4.2.2.2 Activity Diagram	60
4.2.2.2.1 DSS Search Engine Activity Diagram.....	60
4.2.2.2.2 System Log-in Activity Diagram	61
4.2.2.2.3 Manage Universities Information Activity Diagram	62
4.2.2.2.4 Manage Course Information Activity Diagram	64
4.2.2.3 Sequence Diagram	65
4.2.2.3.1 Syatem Login Sequence Diagram	65

4.2.2.3.2 Manage Universities Information Sequence Diagram	66
4.2.2.3.3 Manage Universities Information Sequence Diagram	68
4.2.2.3.4 DSS Search Engine Sequence Diagram	72
4.2.2.4 Class Diagram.....	73
4.3 Implementation of DSS Prototype.....	74
4.3.1 Main Page and Login Interface.....	74
4.3.2 Administrator Main Interface.....	75
4.3.2.1 Insert University Information Interface	75
4.3.2.2 Update University Information Interface	76
4.3.2.3 Delete University Information Interface	78
4.3.3 Search Engine Interface based on Student Criteria.....	79
4.3.3.1 Search Engine for PhD and Suggested Universities Interfaces	79
4.3.3.2 Search Engine for Master Degree and Suggested Universities Interfaces.	81
4.3.3.3 Search Engine for Undergraduate and Suggested Universities Interfaces.	84
4.4 Summary.....	86

CHAPTER FIVE

CONCLUSIONS AND FUTURE WORK

5.1 Conclusion of the study	87
5.2 Limitations of the study	88
5.3 Recommendation	88
5.4 Future Work.....	89
REFERENCES	90

LIST OF FIGURES

Figure 2.1 : Skyline Algorithm	19
Figure 2.2 : Base preference as a used-definable explicit partial order	22
Figure 2.3 Three Categories of Public Universities in Malaysia	28
Figure 3.1: Prototyping Development Process: A RAD Method	39
Figure 4.1: Use Case Diagram	50
Figure 4.2: Use Case View Information	50
Figure 4.3: Use Case View University	51
Figure 4.4: Use Case Search for Suitable University	52
Figure 4.5: Use Case Log-in	53
Figure 4.6: Use Case Manage Universities Information Information	55
Figure 4.7: Use Case Manage Web Information	58
Figure 4.8: Use Case Log-Out	59
Figure 4.9 Activity diagram shapes.....	60
Figure 4.10: DSS Search Engine Activity Diagram	61
Figure 4.11: System log-in Activity Diagram	62
Figure 4.12: Manage University Information Activity Diagram	63
Figure 4.13: Manage Course Information Activity Diagram	64
Figure 4.14: System Login Sequence Diagram.....	65
Figure 4.15: Insert New University Information Sequence Diagram.....	66
Figure 4.16: Update University Information Sequence Diagram.....	67
Figure 4.17: Delete University Information Sequence Diagram.....	68
Figure 4.18: Create New Course Information Sequence Diagram.....	69
Figure 4.19: Update Course Information Sequence Diagram.....	70
Figure 4.20: Delete Course Information Sequence Diagram.....	71
Figure 4.21 DSS Search Engine Sequence Diagram	72

Figure 4.22 Class Diagram of Choosing Malaysian Public Universities.....	73
Figure 4.23: Main Page and Login Interface	74
Figure 4.24: Admin Main Interface	75
Figure 4.25: Insert University Information Interface.....	76
Figure 4.26: Insert University Information Confirmation Interface	76
Figure 4.27: Update University Information Interface	77
Figure 4.28: Update University Information Confirmation Interface.....	77
Figure 4.29: Delete University Information Interface	78
Figure 4.30: Delete University Information Confirmation Interface.....	78
Figure 4.31: Search by PhD students Based on Certain Criteria	80
Figure 4.32: Suggested Universities Interface	81
Figure 4.33: Suggested University Information Interface	81
Figure 4.34: Search by Master Students Based on Certain Criteria.....	82
Figure 4.35: Suggested Universities Interface.....	83
Figure 4.36: Suggested University Information Interface	83
Figure 4.37: Search by Degree Students Based on Certain Criteria	84
Figure 4.38: Suggested Universities Interface.....	85
Figure 4.39: Suggested University Information Interface	85

LIST OF TABLES

Table 3.1: Data type as Input in the DSS prototype	41
Table 4.1: Functional requirements	46
Table 4.2: Non-functional requirements	47

CHAPTER ONE

INTRODUCTION

Selecting a higher learning institution (HLI) is a crucial decision that may shape the life and success of a student's career. There are many important criteria that have a strong influence on international students' decision-making process such as: quality of learning environment, customer focus, cost, facilities, socialization and location. A study concluded that customer focus and facilities are the main criteria used by respondents in their decisions (Padlee & Kamaruddin, 2010).

These factors should be considered by colleges to develop their marketing strategies in attracting foreign students to enroll at their institutions. It is also important for positioning strategy and strengthening HLI offerings to the foreign market (Padlee,S & Kamaruddin, 2010).

1.1 Background

Malaysia is a fascinating and enchanting nation of different races, cultures and religions, co-existing in harmony in a tropical paradise in the heart of Southeast Asia. Malaysia comprises two distinct land areas, West Malaysia and East Malaysia. West Malaysia is a peninsula, flanked by the South China Sea on the east and the Straits of Malacca on the west, with Thailand as its northern neighbour and Singapore sitting at the south. West and East Malaysia cover a total land area of about 329,758 km² and are separated by approximately 40 miles of sea.

The contents of
the thesis is for
internal user
only

REFERENCES

- Berchtold, S., Bohm, C., Keim, D., & Kriegel, H. (1997). A cost model for nearest neighbor search in high dimensional data space. In Proc. *ACM SIGMOD/SIGACT Conf. on Princ. of Database Syst. (PODS)*, Tucson, AZ, USA, 78–86.
- Braumandl, R., Claussen, J., & Kemper, A. (1998). Evaluating functional joins along nested reference sets in object-relational and object-oriented databases. In *Proc. of the Conf. on Very Large Data Bases (VLDB)*, New York, USA, 110–121.
- Bitton, D., & Dewitt, D. (1983) Duplicate record elimination in large data files. *ACM Trans. on Database Systems*, 8(2), 255–265.
- Bently, J., Kung, H., Schkolnick, M., & Thompson, C. (1987). On the average number of maxima in a set of vectors and applications. *Journal of the ACM*, 25(4), 536–543.
- Boreisha, Y., & Myronovych, O. (2009). Web-Based Decision Support Systems As Knowledge Repositories For Knowledge Management. Unpublished master's thesis, University Moorhead, USA.
- Babcock, B., Babu, S., Datar, M., Motwani, R., & Widom, J. (2002). Models and Issues in Data Stream Systems. In Proc. *of PODS*, 1–16.

- Chomicki, J. (2002). Preference Queries in Relational Databases , Unpublished master's thesis, Dept. of Computer Science and Engineering, University at Buffalo, Buffalo, NY 14260-2000.
- Maltz, N., Murphy, E., & Hand, M. (2007) Decision support for university enrollment management: Implementation and experience. *Decision Support Systems* ,44(1), 106-123
- Koudas, N., & Srivastava, D. (2003): Data Stream Query Processing: a Tutorial. In Proc. of *VLDB*. 11-49.
- Kopackova, H. & Skrobackova, M. (2005). Decision Support Systems or Business Intelligence What Can Help in Decision. Unpublished master's thesis, Institute of System Engineering and Informatics, Faculty of Economics and Administration, University of Pardubice.
- Kosavinta, S., Kanongchaiyos , P. , & Jinuntuya, P. (2007). Integration of CAD Software with DSS for Engineering and Architectural Project Design. *Computer-Aided Design & Applications*. 4, 114-129.
- Kiebling, W & Kostler, K . (1994). Database reasoning - a deductive framework for solving large and complex problems by means of subsumption. In *IS/KI*, 118-138.

Kiebling,W.(2002). Foundations of Preferences in Database Systems. In VLDB 2002, *Proceedings of 28th International Conference on Very Large Data Bases*, August 20-23, 2002, Hong Kong, China, 311–322.

Kiebling,W.(2005). Preference Queries with SV-Semantics. *Proceedings of the Eleventh International Conference on Management of Data*, January 6, 7, and 8, 2005, Goa, India, 15–26.

Kiebling,W., Hafenrichter,B., Fischer,S., & Holland,S. (2001).Preference XPath: A Query Language for E-Commerce. In Hans U. Buhl, Andreas Huther, and Bernd Reitweisner, editors, 5th International Conference on Wirtschaftsinformatik – *Information Age Economy*, Augsburg, Germany, Heidelberg. Physica-Verlag, 427–440.

Kwang, P. (2005). Skyline/ Preference Query Processing. Unpublished master's thesis . Department of Computer Science, School of Computing, National University of Singapore. Singapore.

Kothari, R. (2005). *Research Methodology Methods and Techniques*, Delhi: Wiley Eastern Limited.

Lin, G., & Yi, K. (1997). Asian International Students' Adjustment: Issues and Program Suggestions. *College Student Journal*, 31(4), 473-479.

Maria , N. (2010). Continuous Processing of Preference Queries in Data Stream. Unpublished master's thesis. Department of Informatics, Aristotle University.

- Mori, S. (2000). Addressing the mental health concerns of international students. *Journal of Counseling and Development*, 78, 137-144.
- MOHE (2010). Perangkaan Pengajian Tinggi Malaysia, Kuala Lumpur: Kementerian Pengajian Tinggi.
- Poyrazli, S., & Grahame, M. (2007). Barriers to Adjustment: Needs of International Students Within a Semiurban Campus Community. *Journal of Instructional Psychology*, 34(1), 28-46.
- Padlee, S., & Kamaruddin, A. (2010). International Students' Choice Behavior for Higher Education at Malaysian Private Universities. *International Journal of Marketing Studies*, 202-210.
- Sirat, M. (2008). The Impact of September 11 on International Student Flow into Malaysia: Lessons Learned. *IJAPS*, 4(1), 87-101.
- Buorzsonyi, S., Kossmann, D., & Stocker, K. (2001) . Skyline Operator. *ICDE'01* , 421-430.
- Study abroad in Malaysia. (2010). QS Quacquarelli Symonds Limited .
- Tseng, C & Newton, B. (2002). International Students' Strategies for Well-Being. *College Student Journal*, 36(4), 591-597.

Tunban, E., Aronson, E., Liang, P., & Sharda, R. (2007). *Decision Support and Business Intelligence Systems, 8th Edition, Pearson International Edition*. New Jersey: Pearson education, Inc., Upper Saddle River.

Mahmuda, Z. (2010). Challenges for International Students in Malaysia: Culture, Climate and Care. *International Conference on Learner Diversity Procedia Social and Behavioral Sciences 7(C)*, 289–293.

Davey, A., & Priestley, H.(1990) Introduction to Lattices and Order. *Cambridge University Press*.

Universiti Putra Malaysia (UPM). Retrieved 15, 6, 2011, from <http://www.upm.edu.my>.

Universiti Utara Malaysia (UUM). Retrieved 15, 6, 2011, from <http://www.uum.edu.my>.

Universiti Sains Malaysia (USM). Retrieved 15, 6, 2011, from <http://www.usm.edu.my>.

Universiti Malaya (UM). Retrieved 15, 6, 2011, from <http://www.um.edu.my>.

Universiti Kebangsaan Malaysia (UKM). Retrieved 15, 6, 2011, from
<http://www.ukm.edu.my>.

Universiti Malaysia Pahang (UMP). Retrieved 15, 6, 2011, from <http://www.ump.edu.my>.

Universiti Malaysia Perlis (UniMAP). Retrieved 15, 6, 2011, from

<http://www.unimap.edu.my>.

Universiti Malaysia Sabah (UMS). Retrieved 15, 6, 2011, from <http://www.ums.edu.my>.

Universiti Malaysia Sarawak (UNIMAS). Retrieved 15, 6, 2011, from

<http://www.unimas.edu.my>.

Universiti Malaysia Terengganu (UMT). Retrieved 15, 6, 2011, from

<http://www.umt.edu.my>.

Universiti Pendidikan Sultan Idris (UPSI). Retrieved 15, 6, 2011, from

<http://www.upsi.edu.my>.

Universiti Pertahanan Nasional Malaysia (UPNM). Retrieved 15, 6, 2011, from

<http://www.upnm.edu.my>.

Universiti Sains Islam Malaysia (USIM). Retrieved 15, 6, 2011, from

<http://www.usim.edu.my>.

Universiti Teknikal Malaysia Melaka (UTeM). Retrieved 15, 6, 2011, from

<http://www.utm.edu.my>.

Universiti Teknologi Malaysia (UTM). Retrieved 15, 6, 2011, from <http://www.utm.edu.my>.

Universiti Teknologi MARA (UiTM). Retrieved 15, 6, 2011, from <http://www.uitm.edu.my>.

Universiti Malaysia Kelantan (UMK). Retrieved 15, 6, 2011, from <http://www.umk.edu.my>.

Universiti Tun Hussein Onn Malaysia(UTHM). Retrieved 15, 6, 2011, from

<http://www.uthm.edu.my>.