

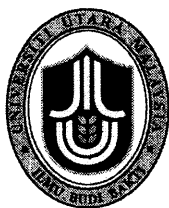
**Mobile Computing at Sultanah Bahiyah Library:  
Mapping Physical Book Rack Location Using Handheld Devices**

**This thesis is presented to the Graduate School  
In fulfillment of the requirements for  
Master of Science (Information Technology)  
Universiti Utara Malaysia**

**By**

**AHMAD NURZID BIN ROSLI**

©Ahmad Nurzid Bin Rosli, October 2002. All Rights Reserved



**JABATAN HAL EHWAL AKADEMIK**  
*(Department of Academic Affairs)*  
**Universiti Utara Malaysia**

**PERAKUAN KERJA KERTAS PROJEK**  
*(Certificate of Project Paper)*

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

**AHMAD NURZID BIN ROSLI**

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

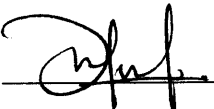
telah mengemukakan kertas projek yang bertajuk  
*(has presented his/ her project paper of the following title)*

**MOBILE COMPUTING AT SULTANAH BAHYAH LIBRARY:  
MAPPING PHYSICAL BOOK RACK LOCATION  
USING HANDHELD DEVICES**

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 filed is covered by the project paper).*

Nama Penyelia Utama  
*(Name of Main Supervisor):* **MR. MOHAMAD AMIR ABU SEMAN**

Tandatangan  
*(Signature)* :  Tarikh (Date): 12.10.2004

Nama Penyelia Kedua  
*(Name of 2<sup>nd</sup> Supervisor):* **MR. AHMAD HISHAM ZAINAL ABIDIN**

Tandatangan  
*(Signature)* :  Tarikh (Date): 12.10.2004

## **PERMISSION TO USE**

In presenting this thesis in partial fulfillment of the requirements 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 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 Graduate School

Universiti Utara Malaysia

06010 UUM Sintok

Kedah Darul Aman.

## **ABSTRACT**

Handheld computers offer the flexibility and mobility to be “ready at hand” tools that can facilitate learning environment. This paper describes an experimental mobile rack locating application. It allows an intelligent way to assist the user of Sultanah Bahiyah Library at Universiti Utara Malaysia (UUM) to locate the exact location of the books by using the local call number using handheld devices. It presents the rack location using the mapping technique. The expert review has been conducted in the development process in finding the usability of the prototype application. A study on user has been conducted in finding how the application has assisting the user in finding books in the library.

## ABSTRAK

*“Handheld Computer”* menawarkan ciri-ciri yang fleksibel dan mobil. Kebolehan seperti ini membolehkan ia dibawa ke mana-mana. Oleh ia menjadi sebahagian daripada pemangkin untuk meningkatkan kemudahan pembelajaran. Kertas kajian ini membincangkan eksperimen aplikasi carian rak buku. Aplikasi ini membantu pengguna-pengguna Perpustakaan Sultanah Bahiyah, Universiti Utara Malaysia (UUM) untuk mencari rak buku dengan lebih tepat dan cepat dengan menggunakan *“local call number”* sebagai input. Sesi temubual bersama pakar telah dijalankan untuk mendapatkan maklumat dan pandangan mereka mengenai aplikasi tersebut yang berkaitan kepenggunaan, terutama sekali dalam proses membangunkan aplikasi ini. Kajian terhadap pengguna juga telah dilaksanakan dalam usaha mengenalpasti samada aplikasi ini benar-benar dapat membantu pengguna-pengguna Perpustakaan Sultanah Bahiyah untuk membuat carian rak buku.

## ACKNOWLEDGEMENT

In the name of Allah, the Most Gracious and the Most Merciful.

I would like to extend my thanks and gratitude to:

Allah the Almighty for giving me the excellent health and mind for doing the research;

The University Utara Malaysia for the facilities and resources provided;

Both of my supervisors, Mr. Mohamad Amir Bin Abu Seman and Mr. Ahmad Hisham Bin Zainal Abidin for their wonderful support and efforts in assisting me carrying out these research and thesis become reality;

My beloved parents, Mr. Rosli Bin Ab. Rahim and Mrs. Rosnah Bte Kaskandar for their love and patience;

My colleagues, Mr. Mohd Jasrihanizan Bin Badol and Mr. Prasit Abdulwahab, for their kindness, support and the wonderful series of discussion we had;

And all individuals involved in the establishment of this research.

# CONTENTS

<b>PERMISSION TO USE</b> .....	i
<b>ABSTRACT</b> .....	ii
<b>ABSTRAK</b> .....	iii
<b>ACKNOWLEDGEMENT</b> .....	iv
<b>CONTENTS</b> .....	v
<b>LIST OF FIGURES</b> .....	viii
<b>LIST OF TABLES</b> .....	ix
<b>LIST OF ABBREVIATIONS</b> .....	x

## **CHAPTER ONE : INTRODUCTION**

1.1 Problem Statement .....	3
1.2 Objectives .....	4
1.3 Scope Of Study .....	4
1.4 Research Significant .....	5
1.5 Research Outcomes .....	5
1.6 Organization Of The Thesis .....	5
1.7 Summary .....	6

## **CHAPTER TWO : LITERATURE REVIEW**

2.1 Handheld Device and Mobile Application .....	9
2.2 Web-OPAC .....	14
2.3 Mapping Technique .....	15
2.4 Summary .....	15

## **CHAPTER THREE : RESEARCH METHODS**

3.1	System Development Research Methodology .....	16
3.2	Construct a Conceptual Framework .....	18
3.3	Develop a System Architecture .....	19
3.4	Analyze And Design The System .....	19
3.5	Build The Prototype System .....	19
3.6	Observe And Evaluate The System .....	20
3.7	Summary .....	22

## **CHAPTER FOUR : ANALYSIS AND DESIGN**

4.1	A Proposed Framework Architecture .....	24
4.2	System Characteristics .....	30
4.2.1	Purpose And Functionality .....	30
4.2.2	Typical User .....	30
4.2.3	The Environment .....	30
4.3	Application Requirements .....	31
4.3.1	Functional Requirement.....	31
4.3.2	Usability Requirements.....	31
4.4	Application Design .....	32
4.5	Summary .....	33

## **CHAPTER FIVE : DEVELOPMENT OF THE BOOK RACK LOCATING APPLICATION**

5.1	Form Design .....	34
5.1.1	Additional Interface.....	36
5.2	Designing Button .....	38
5.3	Development Tool .....	38
5.4	The Prototype .....	38



5.6	Summary .....	39
-----	---------------	----

## **CHAPTER SIX : EVALUATION**

6.1	Expert Review .....	41
6.2	Field Experiment .....	44
6.3	Conducting The Field Test .....	45
6.4	Analysis Of Results .....	45
6.5	Interpretation And Recommendation .....	46
	6.5.1 Menu .....	46
	6.5.2 Interface .....	47
	6.5.3 Function .....	47
	6.5.4 Terminology.....	47
	6.5.5 General Remarks.....	48
6.6	Summary .....	48

## **CHAPTER SEVEN : DISCUSSIONS AND CONCLUSIONS**

7.2	Conclusions and Future Work .....	50
-----	-----------------------------------	----

<b>REFERENCES</b> .....	51
-------------------------	----

<b>APPENDICES</b> .....	52
-------------------------	----

### **APPENDIX A: BENCHMARK TASKS**

### **APPENDIX B: GENERAL INFORMATION AND INTERVIEW QUESTIONS**

## LIST OF FIGURES

Figure 1.0: A Process for Systems Development Research (Nunamaker et al., 1991)	18
Figure 2.0: Web-OPAC query form	25
Figure 3.0: Web-OPAC result of query form	26
Figure 4.0: Web-OPAC bibliography details result of query form	26
Figure 5.0: Interface of local call number input	34
Figure 6.0: Interface that shows level floor of book rack location	35
Figure 7.0: Interface that shows book rack location	36
Figure 8.0: Interface of instructions	37
Figure 9.0: Interface of map legends	37

## LIST OF TABLES

Table 1.0	: A Glance of PDAs (Lee, 2002) .....	12
Table 2.0	: Overview of the Cognitive Walkthrough Process .....	21
Table 3.0	: Item Directory .....	27
Table 4.0	: Expert Reviewer Behaviors.....	43
Table 5.0	: Users Background .....	44
Table 6.0	: User Handheld Literacy .....	44
Table 7.0	: Time taken for locating the books.....	45

## **LIST OF ABBREVIATIONS**

<b>PDA</b> s	- Personal Digital Assistants
<b>H/PC</b>	- Handheld Personal Computer
<b>Web-OPAC</b>	- Web Online Public Access Catalogues
<b>UUM</b>	- Universiti Utara Malaysia
<b>PC</b> s	- Personal Computers
<b>SA/SD</b>	- Structured Analysis/Structured Designed
<b>DFD</b>	- Data Flow Diagrams
<b>ERD</b>	- Entity-Relationship Diagrams

# **CHAPTER 1**

## **INTRODUCTION**

Future computing environments promise to free the user from the constraints of stationary desktop computing, yet relatively few researcher are investigating what application maximally benefit from mobility (Abowd et al., 1997). Application for a mobile application should take advantage of contextual information, such as position, to offer greater service to the user. However, the majority emergences of an application and software are focusing on desktop computing systems.

Nowadays, small screen computing devices, such as a Personal Digital Assistants (PDAs), Handheld Personal Computer (H/PC) or cellular phones, enjoy enormous popularity. The phenomenal growth and rising demand as well as reliance of nomadic users to access Internet content anywhere at any time have further driven the future of computers towards to mobile and ubiquitous computing.

As demand for mobility and capability, especially in work and lifestyle increases, handheld devices have offered many types of application in fueling this convergence. Some of them are associates with other technologies to provide more constructive

The contents of  
the thesis is for  
internal user  
only

## REFERENCES

- Abowd, G. D., Atkeson, C. G., Hong, J., Long, S., Kooper, R., & Pinkerton, M. (1997). Cyberguide: A Mobile Context-Aware Tour Guide. *Wireless Networks*, 3, 421-433.
- Barnum, C. M. (2002). *USABILITY TESTING AND RESEARCH* (First ed. Vol. 1). Texas: Longman.
- Berghel, H., Deaton, E., Hedric, G., & Roach, D. (1992). *Design and functions of DUO: the first Italian academic OPAC*. Paper presented at the ACM/SIGAPP Symposium on Applied Computing.
- Brighthand. (2002). "*Handheld Sales To See Healthy Increases Through 2006*". Retrieved 14 July 2004, 2004, from [http://www.brighthand.com/article/InStat\\_Handheld\\_Predictions](http://www.brighthand.com/article/InStat_Handheld_Predictions)
- Carey, J. (1999). Mobile Professionals and Their Proactive Handheld Purchase Habits, *Mobile Computing & Communication*.
- Dumas, Joseph, S., & Redish, J. C. (1993). *A Practical Guide to Usability Testing*.
- Hascoet, M. (1998). Using Maps as a User Interface to a Digital Library. 339.
- Hennessy, S. (1997). *Portable technologies and graphing investigation: review of the literature* (CALRG Technical Report). Milton Keynes: Institute of Educational Technology, The Open University.
- Lee, P. (2002). *Top Five Mobile and Wireless Maturing technologies now relevant for practical enterprise applications*. Unpublished Deloitte Research.
- Lettieri, P., & Srivasta, M. B. (1999). Advances in wireless terminals: *IEEE Personal Communications*. 6-18.

- Luchini, K., Quintana, C., & Soloway, E. (2003). Pocket PiCoMap: A Case Study in Designing and Assessing a Handheld Concept Mapping Tool for Learners. 321-328.
- Myers, B. A. (2004). Handheld Devices for Control of PCs and Appliances.
- Newcomb, E., Pashley, T., & Stasco, J. (2003). Mobile Computing in the Retail Arena. 337-344.
- Nunamaker, J. F. J., Chen, M., & Purdin, T. D. M. (1991). Systems Development in Information Systems Research. *Journal of Management Information Systems*, 7(3), 89-106.
- Ohshima, Y., Maloney, J., & Ogden, A. (2003). The Parks PDA: A Handheld Device for Theme Park Guests in Squeak.
- P.Thakkar, Ceaparu, I., & Yilmaz, C. (2001). Visualizing Directions and Schedules on Handheld Devices A Pilot Study of Maps vs. Text and Color vs. Monochrome.
- Ramesh, B., & Ann, O. (2000). *Web OPAC interfaces: an overview*. Retrieved 12 July, 2004, from <http://www-sp.ebsco.com/online/direct.asp>
- Vandenham, N. (2004). The Handheld Classroom: Educational Implications of Mobile Computing. *Australian Journal of Emerging Technologies and Society*(2), 13.