

A REQUIREMENT MODEL FOR WAP-BASED MOBILE BANKING SERVICES IN
MALAYSIA

A dissertation submitted to the Faculty of Information Technology
in partial fulfillment of the requirements for the degree
Master of Science (Information Technology)
Universiti Utara Malaysia

By

Rami Obedallah Radi Rawashdeh

Copyright © Rami Obedallah Radi Rawashdeh, 2008.

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, certify that)

RAMI ABEDALLAH RADI RAWASHDEH

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)

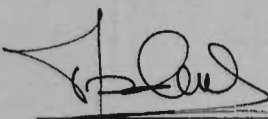
A REQUIREMENT MODEL FOR WAP-BASED MOBILE BANKING SERVICES IN MALAYSIA

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. ABDUL RAZAK RAHMAT**

Tandatangan
(Signature)

: 

Tarikh
(Date)

: 18/5/2008

PERMISSION TO USE

In presenting this thesis in partial fulfilment 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 Faculty of Information Technology. 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.

Request for permission to copy or to make use of material in thesis in whole or in part should be addressed to:

Dean of Faculty of Information Technology

Universiti Utara Malaysia

06010 UUM Sintok

Kedah Darul Aman

ABSTRACT

Mobile banking has emerged as a wireless service delivery channel in order to create added value for customers' banking transactions. Previous studies indicate that factors contributing to the adoption of mobile banking are related to convenience, access to the service regardless of time and place, privacy and savings in time and effort. This study proposes a WAP-based application that can be used to provide banking services anytime anywhere while protecting the customers' security. Implementing this model will return in many benefit for both banking institutions and their customers at the same time.

ACKNOWLEDGMENT

I want to thank my supervisor Mr. Abdul Razak Bin Rahmat, thank you very much for your patience, advices, and suggestions that had a great influence on me and the way I constructed this piece of work. Also I want to thank my university and my tutors for their efforts.

Many thanks. No, I do not think that the word “thanks” is enough to appreciate the persons who dedicated their life and efforts for me, the persons who gave all what I have and asked me if I want more, persons who never lost the faith in me and my abilities, and persons who encouraged and supported me to fulfil and finish this research. Those persons are my parents Mr. Obedallah Al-Rawashdeh, and Mrs. Sakha Al-Rawashdeh thank you, thank you very much in-deed.

I want also to thank my brothers Mr.Hadi Al-Rawashdeh, Dr. Asa'd Al-Rawashdeh, Nu'man Al-Rawashdeh, Anas Al-Rawashdeh, and Wesam Al-Rawashdeh, Thanks for all of you for your support and trust. I wish all of you the best in every thing.

Finally, I would like to extend my deepest love to my family especially my parents for their loving, support and trust. I dedicate this work to my parents who gifted me their lives and to my brothers

TABLE OF CONTENTS

PERMISSION TO USE.....	i
ABSTRACT	ii
ACKNOWLEDGMENT	iii
.TABLE OF CONTENTS	iii
TABLE OF CONTENTS	iv
LIST OF FIGURES	vi
LIST OF TABLE	vi
CHAPTER ONE.....	1
INTRODUCTION	1
1.1 Background.....	1
1.2 Problem Statement.....	3
1.3 Research Objectives.....	4
1.4 Scope of the Research.....	5
1.5 Significance of the Research	5
1.6 Report Structure.....	6
1.7 Summary.....	7
CHAPTER TWO	8
LITRERATURE REVIEW	8
2.1 Mobile Devices.....	8
2.2 Physical Characteristics of Mobile Devices	8
2.3 Types of Mobile Applications	9
2.4 Mobile Financial Services	11
2.5 Mobile Payments Services.....	11
2.6 Mobile Banking Services.....	16
2.7 Mobile Banking Institutions in Malaysia	18
2.8 WAP Concept and Definition.....	20
2.9 WAP architecture.....	22
2.10 Wireless Application Environment (WAE)	23
2.11 Wireless Session Protocol (WSP)	23
2.12 Wireless Transaction Protocol (WTP)	23
2.13 Wireless Transport Layer Security (WTLS).....	24
2.14 Wireless Datagram Protocol (WDP).....	24
2.15 WAP Session.....	24
CHAPTER THREE	27
RESEARCH METHODOLOGY	27
3.1 Introduction.....	27
3.2 Process Steps	29
3.2.1 Awareness of Problem Phase.....	29
3.2.2 Suggestion Phase	30
3.2.3 Development Phase	31
3.2.4 Evaluation	32
3.3 Summary.....	33
CHAPTER FOUR	34
FINDINGS AND RESULTS.....	34
4.1 Introduction.....	34

4.2	System Requirements	34
4.3	System Design	37
4.4	System Architecture.....	47
4.5	M-Banking Prototype Design	49
4.5.1	Login & Home Page	49
4.5.2	Balance Enquiry page	51
4.5.3	Bills Payment and Money Transfer Pages.....	52
4.5.4	Exchange Rates Page	53
4.6	M-Banking Prototype Database Design	54
4.7	Testing and Results	54
4.7.1	System Usefulness	55
4.7.2	Information or Content Quality	55
4.7.3	Interface Quality	55
4.7.4	Overall Satisfaction	55
4.8	Recommendations and Remarks.....	56
4.8.1	Interface	56
4.8.2	Functionality	56
4.8.3	General Remarks	56
4.9	Summary.....	57
CHAPTER FIVE		58
CONCLUSION.....		58
5.1	Introduction.....	58
5.2	Problems and Limitations	58
5.3	Recommendations.....	59
5.4	Conclusion	60
References.....		62

LIST OF FIGURES

Figure 2.1: WAP Protocol Stack (Source: WAP Forum, 2002)	23
Figure 3.1: The General Methodology of Design Research	28
(Source: Vaishnavi & Kuechler, 2007).	28
Figure 4.1: Use Case Diagram	37
Figure 4.2: Balance Enquiry Sequence Diagram.....	39
Figure 4.3: Balance Enquiry Collaboration Diagram	40
Figure 4.4: Bills Payment Sequence Diagram	41
Figure 4.5: Bills Payment Collaboration Diagram	42
Figure 4.6: Money Transfer Sequence Diagram.....	43
Figure 4.7: Money Transfer Collaboration Diagram	44
Figure 4.8: Exchange Rates Sequence Diagram	45
Figure 4.9: Exchange Rates Collaboration Diagram	46
Figure 4.10: Class Diagram	47
Figure 4.11: System Architecture	49
Figure 4.12: Login and Home Pages	50
Figure 4.13: Balance Enquiry Pages 1 and 2	51
Figure 4.14: Bills Payment and Money Transfer Pages	52
Figure 4.15: Exchange Rates Page 1 and 2.....	53
Figure 4.16: M-Banking Data Model	54
Figure 4.17: Usability Evaluation.....	55

LIST OF TABLE

Table 4.1: M-Banking Model functional requirements	35
---	----

CHAPTER ONE

INTRODUCTION

1.1 Background

Mobile phone has revolutionized our life, from the way we communicate to the way we conduct business, the mobility of mobile phone make it easier for user to make a call from almost anywhere and anytime. The price of mobile phone can range from as low as RM80.00 to as high as RM5000.00, the enormous benefit and low price tag make it available to almost every level of consumer.

The Malaysian Communications and Multimedia Commission reported that in 2005, there are 16.551 millions mobile phone subscribers in Malaysia from its 26.13 millions populations compared to only 2.150 million mobile phone subscribers in 1998 with 22.18 millions populations, that is on average 63.3 mobile phone subscribers for every 100 inhabitants for the year 2005 (Mcmc.gov, 2005). Another study reported that 180.6 million phones were sold world wide 2005 from January to March, while the Gartner predicts that total of 750 million phones will be sold worldwide (Sayer, 2005).

Electronic banking is seen as one of the most successful business-to-consumer applications in electronic commerce. Recent years' researches have focused on Internet banking which today includes the option for multiple service transactions conducted via Internet. The use of Internet banking, especially in developed countries, has grown rapidly. Low fees, time

References

- Adams, C. and Millard, P. (2003). Personal Trust Space and Devices : Geography will not be history” in the m-commerce future. Honolulu, *Hawaii International Conference on Business*.
- Antovski, L. and Gusev, M. (2003). M-Payments. Information Technology Interfaces, 2003. ITI 2003. *Proceedings of the 25th International Conference*, 95 – 100.
- Asano, H., Sumi, A.O., Ramzan, Z. & Zhu, J. *Wireless Electronic Commerce Security Sponsored by Nokia*. Retrieved 22 Jan 2008 from <http://theory.lcs.mit.edu/~zulfikar/papers/NokiaFinalNoConclusion1205.pdf>
- Agosti, M & Ferro, N. (2003). Managing the interaction between handheld devices, mobile applications and users. In Lim, E. P. & Siau, K. (Ed.), *Advances in Mobile Commerce Technologies* (pp. 205-234), Hershey, PA : Idea Group Publishing.
- Ashri, R., Atkinson, S., Ayers, D., Haglind, M., Ray, B., Machin, R., Nashi, N., Taylor, R. & Wiggers, C. (2001). Java Mobile Programming United States: Wrox Press.
- Barnes, S., & Corbitt, B. (2003). Mobile banking: concept and potential. *International Journal of Mobile Communications*. 1(3), 273-288.
- Beaulieu, M. (2002). *Wireless Internet Applications And Architecture*. Canada: Addison- Wesley
- Bennett, S., McRobb, S. & Farmer R. (2002). *Object-oriented Systems Analysis and Design using UML*. United Kingdom: McGraw-Hill.
- Bodendorf, F., & Schobert, A. (2004). Enhancing e-CRM in the Insurance Industry by Mobile e-Services. *Proceeding of the IEEE International Conference*.
- Booch, G., Rumbaugh, J., Jacobson, I. (1999). *The Unified Modeling Language: User Guide*, Addison- Wesley, Boston.
- Businesslink.gov (2005). *The essential of mobile commerce*. Retrieved Jan 10, 2008 from: <http://www.businesslink.gov.uk/bdotg/action/detail?type=RESOURCES&itemId=1075387127>
- Bulbrook, D. (2001). *WAP A beginner's guide*. California: Osborne McGraw-Hill.
- Carlsson, C., Hyvonen K., Repo P. & Walden P. (2005). *Asynchronous Adoption*

- Patterns of Mobile Services. Proceeding of the 38th Hawaii International Conference on System Sciences 2005.
- Cellular news.com (2005) *Mobile content market set to triple within a year*. Retrieved Jan 10, 2008 from <http://www.cellular-news.com/search/index.php?term=malaysia>
- Chen, J. J. & Adams, C. (2004). Short-range wireless technologies with mobile payments systems. *ICEC'04, Sixth International Conference on Electronic Commerce*, 649-656.
- Chi, E. (1997) *Evaluation of Micropayment Schemes*. Retrieved Jan 10, 2008 from <http://www.hpl.hp.com/techreports/97/HPL-97-14.html>
- Cervera, A. (2002). Analysis of J2ME for developing Mobile payment Systems. Retrieved December 03, 2007 from www.microjava.com/articles/techtalk/mpayment?content_id=3734
- Connaway, L. S. (2003). Electronic Books (eBooks): Current Trends and Future Directions. *DESIDOC Bulletin of Information Technology* 23,1 (January):13-18.
- Conallen. J. (2001). *Building Web Applications with UML*, 2nd ed., Pearson Education. Inc.
- Danielyan, A. (2005), *The Internet Protocol Journal*. Retrieved Jan 12, 2008 from http://www.cisco.com/en/US/about/ac123/ac147/ac174/ac235/about_cisco_ipj_archive_article09186a00801a0cc1.html
- Deitel, H., Deitel., P., & Kate. S. (2001). *E-business and e-commerce for managers*. Prentice-Hall, Inc.
- Deitel, H., Deitel., P., Nieto, T. R., & Steinbuhler, K. (2002). *Wireless Internet & Mobile Business How to Program*: Pearson Education, Inc.
- Elliott, G.. & Phillips, N. (2004). *Mobile Commerce And Wireless Computing Systems*: Pearson Education Limited.
- Farahwahida, & Salyani. (n.d.). *Towards The Future of Mobile Commerce (M-Commerce) in Malaysia*. Retrieved February 12, 2008, from [Http://sts.um.edu.my/seminar/PersidanganS&T-KertasKerja/Farahwida.pdf](http://sts.um.edu.my/seminar/PersidanganS&T-KertasKerja/Farahwida.pdf)
- Furht, B., Ilyas, M. (2003). *Wireless Internet handbook, Technologies, Standards and Applications*. Florida: CRC Pres.
- Foo, S. M., Hoover, C. & Lee, W.M. (2001). *Dynamic WAP application development*. Greenwich: Manning Publication Co.
- Haaker, T., Faber E., & Bouwrnan, H. (2004). Balancing strategic interests and

- technological requirements for mobile services. Proceeding of the ICEC704, Sixth International Conference on Electronic Commerce.
- Herzberg, A. (2003), Payments and Banking with Mobile Personal Devices. *Communications of the ACM*, May 2003/Vol. 46, No. 5.
- Hoffman, J. (2003). *GPRS Demystified*. New York: McGraw-Hill.
- Jones, L. W. M., Robert H. R., Treadwell T. & Geri G. (2000). Live from the Stacks: User Feedback on Mobile Computers and Wireless Tools for Library Patrons. Retrieved December 04, 2007, from:
<http://www.acm.com>.
- Jordan, P., W. (1998). *An Introduction to Usability*, Taylor & Francis Ltd.
- Juang, Y.,R., Chen Y., H., Chen Y., F. & Chan T.,W.(2004). Design of Learning Content Development Framework and System for Mobile Technology Enhanced Environment. Proceeding of the IEEE International Conference on Advanced Learning Technologies (ICALT704).
- Kang, M., Wang, L. & Taguchi K.(2005). Modeling Mobile Agent Applications in UML 2.0. Retrieved January 01,2008, from:
www.auml.org/_auml_supplements_UML2-AD.pdf.
- Kerem. K. (2003). Internet Banking in Estonia. PRAXIS Center. Retrieved March 30, 2008. from:
<http://unpani.un.org/intradoc/groups/public/documents/UNTC/UNPANO18529.pdf>
- Kalliola, M. (2005), *Mobile payment*. Retrieved Jan 10, 2008 from:
http://www.tml.hut.fi/Opinnot/T109.551/2005/reports/Mobile_payments.doc
- Kurose, J. F., Ross, K.W. (2005). *Computer networking, a top down approach featuring the internet*. USA: Pearson Education.
- Kothari, C. R. (1985). *Research Methodology, Methods and Techniques*. Delhi: Wiley Eastern Limited.
- Ktkm.gov (2002) *Launch of TM Cellular Mobile Banking and Payment Via SMS*. A speech by Datuk Amar Leo Moggie. Retrived Jan 10, 2008 from
<http://www.ktkm.gov.my/template02.asp?SpeechID=295&tt=SPEECH>
- Lee, W. M., Foo, S. M., Watson, K. & Wufofski, T. (2000). *Beginning WAP, WML & WMLScript*. Canada: Wrox press.
- Longueuil, D. (2003). *Wireless Messaging Demystified*. New York: McGraw-Hill.
- Lizani. A. and M. Othman (2004). *SMSBanking: An M-Commerce Application*

Based on (User Requirement Survey. Retrieved January 15, 2008. from <http://perdana.fsktm.um.edu.my/~mazzliza~papers/SMSbanking.pdf>

- Mallat. N., Rossi. M., & Tuunainen, V. K. (2004). Mobile Banking Services. *Communications of The ACM*. 47, 42-46. Retrieved March 3 . 2008. from Http://portal.acrn.org.eservice.uum.edu.my/ft_gateway.cfm?id=986236&type=pdf&coll=Portal&dl=GUIDE&CFID=46080717&CFTOKEN=763942
- McKitterick, D. and Dowling, J. (2003). State of the Art, Review of Mobile Payment Technology. Retrieved Jan 10, 2008 from www.cs.tcd.ie/publications/tech-reports/reports.03/TCD-CS-2003-24.pdf
- Mcmc.gov (2005) *Facts & Figures, Statistics & Records*. Retrieved Jan 30, 2008 from http://mcmc.gov.my/facts_figures/stats/index.asp
- Micro payment methods and techniques*. (2002). Retrieved Jan 10, 2008 from www.cs.hut.fi/Opinnot/T-106.850/PMRG/k2002/Mikromaksu.pdf
- Mobile payment forum (2002) *Mobile Payment- Enabling Secure, Interoperable, user friendly Mobile payment*. Retrieved Jan 10, 2008 from http://www.mobilepaymentforum.org/pdfs/mpf_whitepaper.pdf
- Mueller. I., Hamilton, I., & Melley. K. (2000, August 29). Bank of America launches I .S. Wireless Financial Services. New posted to <http://www.bankofamerica.com/newsroom/press/press.cfm?Prss1D=press.2000829.05.htm&LOBID=1>
- Nielsen. J. (2000). Why You Only Need to Test With 5 Users, Retrieved January 28, 2008, from <http://www.useit.com/alertbox/20000319.html>
- Nielsen. L. B. (2004), Post Disney experience paradigm? Some implications for the development of content to mobile tourist services. *Proceeding of the Proceeding of the ICEC704, Sixth International Conference on Electronic Commerce*.
- Ondrus, J. and Pigneur, Y. (2005). A Disruption Analysis in the Mobile Payment Market. *Proceedings of the 38th Hawaii International Conference on System Sciences – 2005*.
- Pantis, S., Morphis, N., Felt, E., Reufenheuser, B. & Bohm, A. (2002). Service Scenario and Business Model for Mobile Commerce. *Proceeding of IST Mobile & Wireless Telecommunications Summit, June 2002*.
- Sasidhar, B., & Kumar, B. V. D. (2005). The Effects of Mobile Devices and Wireless Technology on E-Learning. *Sunway Academic Journal*, 2, 45–53. Retrieved: March 23, 2008. From: <http://www.sunway.edu.my/others/vol2/sasidhar45.pdf>

- Sayer, P.(2005). Mobile phone sales reached new records in first quarter. Retrieved: February 10,2008 from <http://www.computerworld.com.my/ShowPage.aspx?pagetype=2&articleid=1301&pubid=3&issuedid=49>.
- Schmuller, J. (2002). SAMS Teach Yourself UML in 24 Hours, 2nd Edition, SAMS Publishing, Indiana.
- Sommerville, I. (2004). Software Engineering, 7th Edition, Pearson Education Limited, Essex, England.
- Sohail, M., & Shanmugham, B. (2003). E-banking and customer preferences in Malaysia: An empirical investigation. *Journal of Information Sciences*. 150(3), 207-217
- Smith, G. (2004). A Formal Framework for Modelling and Analysing Mobile Systems. *Conferences in Research and Practice in Information Technology Australasian Computer Science Conference (ACSC2004)*, Vol. 26. Vladimir Estivill-Castro, Ed. Reproduction for academic, Retrieved January 10,2008, from: www.itee.uq.edu.au/~smithpapers_acsc2004.pdf
- Suganthi, S. Balachandher and K.G. Balachandran (2001). E-banking patronage: An empirical investigation of Malaysia. *Journal of International Banking and Commerce* 6 1.
- Thanh, D. V. (2003). Mobile e-commerce on mobile phone. In Lim, E. P. & Siau, K. (Ed.), *Advances in Mobile Commerce Technologies* (pp. 19-43), Hershey, PA : Idea Group Publishing.
- The Wap Protocol. (2000). *The Wap Protocol*. Retrieved Jan 10, 2008 from <http://194.51.152.252/WML/wapdocangl.htm>.
- Vaishnavi & Kuechler (2007). Design Research in information system. Retrieved March 15, 2008, from: <http://www.isworld.org/Researchdesign/drisISworld.htm>
- Vilmos, A. & Karnouskos, S. (2003). SEMOPS: Design of a New Payment Service. *Proceedings of the 14th international Workshop on Database and Expert Systems Applications (DEXA '03)*, 865-869.
- Wap Forum (2002). *What is WAP*. Retrieved Jan 10, 2008 from <http://www.wapforum.org/faqs/index.htm>.
- W3schools.com. (2005). *Introduction to WAP*. Retrieved Jan 11, 2008 from http://www.w3schools.com/wap/wap_intro.asp.
- Yacoub, M. D. (2002). *Wireless Technology: Protocols, Standards, and Techniques*: CRC Press.