

**MOBILE CHINESE DICTIONARY APPLICATION ENHANCED WITH
AUGMENTED REALITY (AR) - WORDAR**

KHO WEI LIP

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS TESIS*

JUDUL : MOBILE CHINESE DICTIONARY APPLICATION

ENHANCED WITH AUGMENTED REALITY (AR) - WORDAR

SESI PENGAJIAN : 2012 / 2013

Saya KHO WEI LIP

mengaku membenarkan tesis Projek Sarjana Muda ini disimpan di Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dengan syarat-syarat kegunaan seperti berikut:

Tesis dan projek adalah hakmilik Universiti Teknikal Malaysia Melaka.

Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan untuk tujuan pengajian sahaja.

Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.

** Sila tandakan (/)

_____ SULIT

(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

_____ TERHAD

(Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

_____ TIDAK TERHAD

(TANDATANGAN PENULIS)

(TANDATANGAN PENYELIA)

Alamat tetap: _____

Nama Penyelia

Tarikh: _____

Tarikh: _____

CATATAN: * Tesis dimaksudkan sebagai Laporan Projek Sarjana Muda (PSM).

** Jika tesis ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa.

**MOBILE CHINESE DICTIONARY APPLICATION ENHANCED WITH
AUGMENTED REALITY (AR) - WORDAR**

KHO WEI LIP

This report is submitted in partial fulfillment of the requirements for the
Bachelor of Computer Science (Interactive Media)

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2013

DECLARATION

I hereby declare that this project report entitled
**MOBILE CHINESE DICTIONARY APPLICATION ENHANCED WITH
AUGMENTED REALITY (AR) - WORDAR**

Is written by me and is my own effort and that no part has been plagiarized without
citations.

STUDENT : _____ Date: _____
(STUDENT'S NAME)

SUPERVISOR : _____ Date: _____
(SUPERVISOR'S NAME)

DEDICATION

This thesis is dedicated to my parent and the loved ones for their continuous support and not forgetting my supervisor, Pn Shahrul Badariah, for her guidance throughout the whole development of the project.

This thesis is dedicated to all my friends that have been through all the ups and downs together with me during my university moment.

Last but not least, I also appreciate all the knowledge and helps that comes from everyone who has contribute even a little thing in the development of this project.

ACKNOWLEDGEMENT

First, I would like to thank my supervisor, Puan Shahrul Badariah for giving me the guidance and support in completing this project. Then I also want to thank the Faculty of Information and Communication Technology for giving this chance to carry out this project. Next, I would like to express my appreciation towards all the lecturers for the lessons you guys have taught me and I apologize for any mistakes that I have made before. I could not have completed my studies all this year without the knowledge that you guys has delivered to me.

Also, not forgetting my friends that has accompany me all along this 3 years, thank you for sharing all the goods and bads with me within this 3 years and also the support and helps that you guys have given to me, I could have never returned all that you. Last but not least, I would like to thank my family for their support and forgiveness all these years and that is the motivation that pushes me towards the end of this project.

ABSTRACT

The purpose of this project is to implement a mobile Chinese dictionary that is enhanced with Augmented Reality (AR). The primary objective of this project is to identify the problem of inputting method for non-alphabetical characters while searching for the definition of the words. Then a mobile Chinese dictionary application with AR will be developed and after that will compare the effectiveness towards learning process between the conventional mobile dictionary and the new developed mobile AR dictionary.

This thesis consists of seven chapters. Chapter 1 is the introduction which will discuss why this project is being initialized and developed. Chapter 2 will discuss the literature review that is related to this project such as the AR technology, mobile learning and a comparison between similar applications. Chapter 3 will discuss the methodology used in executing this project which is Agile methodology and Extreme Programming and will also discuss the project requirement. Chapter 4 will review the analysis on user and system requirement. Chapter 5 will discuss the design and implementation of a product. Chapter 6 is testing the prototype and evaluates the acceptance criteria that are obtained from the user acceptance test. Chapter 7 is the conclusion that will conclude the whole project and propose the future improvement and enhancement that can be done to the product.

ABSTRAK

Projek ini adalah bertujuan untuk melaksanakan satu kamus Cina telefon bimbit yang diperkukuhkan dengan Augmented Reality (AR). Objektif utama projek ini adalah untuk mengenalpasti masalah yang pengguna dihadapi tentang cara memasukkan perkataan bukan huruf abjad semasa menggunakan kamus telefon bimbit. Selepas itu, satu kamus Cina telefon bimbit akan dibangunkan dan keberkesanan kamus Cina AR dengan kamus conventional terhadap proses pembelajaran akan dibandingkan.

Tesis ini mengandungi tujuh bab. Bab 1 adalah pengenalan dimana sebab-sebab projek ini dimulakan dan dibangunkan akan dibincang. Bab 2 akan membincang kajian kesusasteraan dan ulasan karya yang berkaitan dengan projek ini seperti Teknologi AR, pembelajaran bimbit dan aplikasi yang seumpamanya akan dibandingkan. Manakala bab 3 akan membincangkan metodologi yang digunakan semasa melaksanakan projek ini iaitu metodologi *Agile* dan *Extreme Programming (XP)* dan syarat-syarat tentang projek ini juga akan dibincangkan. Bab 4 akan mengkaji analisis tentang pengguna dan keperluan system. Bab 5 akan membincangkan rekabentuk dan pelaksanaan produk. Bab 6 adalah pengujian prototaip dan penilaian tentang kriteria penerimaan pengguna terhadap produk akan dijalani dan diperolehi. Dalam bab yang terakhir iaitu bab 7, kesimpulan akan dibuat terhadap keseluruhan projek dan penambahbaikan akan dicadang untuk pembangunan masa depan.

TABLE OF CONTENT

CHAPTER	SUBJECT	PAGE
	DEDICATION	i
	ACKNOWLEDGEMENT	ii
	ABSTRACT	iii
	ABSTRAK	iv
	TABLE OF CONTENT	v
	LIST OF FIGURE	vi
	LIST OF TABLE	vii
CHAPTER 1	INTRODUCTION	1
	1.1 Project Background	2
	1.2 Problem Statement	3
	1.3 Objectives	4
	1.4 Research Question	5
	1.5 Project Scope	6
	1.6 Project Framework	7
	1.7 Project Significance	8
	SUMMARY	8
CHAPTER 2	LITERATURE REVIEW	9
	2.1 Application	10
	2.1.1 Mobile Language Learning	10
	2.1.2 Augmented Reality (AR)	12
	2.1.2.1 Marker-based AR	13
	2.1.2.2 Markerless AR	13

2.1.3	Mobile Augmented Reality	15
2.2	Current system/tools/output	16
2.2.1	Pleco Chinese Dictionary	16
2.2.2	trainchinese Dictionary	17
2.2.3	海词词典 (HaiCi dictionary)	18
2.3	Comparison of Existing Systems	19
	SUMMARY	19
CHAPTER 3	METHODOLOGY	20
3.1	Research Activities	21
3.1.1	Data Gathering/Collection	21
3.1.2	Analysis of the Data	22
3.2	Product Development Methodology	23
3.2.1	Extreme Programming	25
3.3	Project Requirement	27
3.3.1	Hardware Requirement	27
3.3.2	Software Requirement	27
3.3.3	Hardware and Software Requirement Analysis	28
3.4	Gantt Chart/ Milestone	31
	SUMMARY	31
CHAPTER 4	ANALYSIS	32
4.1	Project/Product Analysis	33
4.0.1	User Requirement	33
4.0.2	System Requirement	34
	SUMMARY	35
CHAPTER 5	DESIGN AND IMPLEMENTATION	36
5.1	Product Design	37
5.1.1	Product Architecture	37
5.1.1.1	Overall System Architecture	37
5.1.1.2	Application Flow Chart	39

5.1.2	Product Development Process	41
5.1.2.1	Optical Character Recognition (OCR)	41
	Tesseract Libraries	42
5.1.2.2	Augmented Reality (AR)	42
	Metaio SDK	
5.1.2.3	Marker Design	43
5.2	Product Implementation	43
5.2.1	Product Integration Process	46
	Version 1: Implementation of wordAR	46
	using OCR library	46
5.2.1.1	Installation and implementation of library and software	47
5.2.1.2	Version 1 Final Output	52
	Version 2: Implementation of wordAR	
	using AR library	54
5.2.1.1	Installation and implementation of library and software	55
5.2.1.2	Version 2 Final Output	
5.2.2	Comparison of Libraries	60
	SUMMARY	61
		61
CHAPTER 6	TESTING AND EVALUATION	62
6.1	Testing Plan	63
6.1.1	Unit Testing	63
6.1.1.1	Hardware	63
6.1.1.2	Software	64
6.1.1.3	Unit Test Case	65
6.1.2	Integration Testing	65

6.1.2.1	Functions/ Modules	65
6.1.2.2	Navigation Structure	67
6.1.2.3	Integration Test Case	68
6.1.3	System Testing	68
6.1.3.1	System Test Case	68
6.1.4	Acceptance Test	69
6.1.5	Testing Organization	69
6.1.6	Test Environment	70
6.1.7	Test Schedule	70
6.2	Testing Implementation Process	71
6.2.1	Test Description	71
6.2.2	Test Data	73
6.3	Testing Result and Analysis	73
6.3.1	Analysis of User Acceptance Test (UAT)	74
6.3.2	Conclusion on UAT	83
	SUMMARY	84
CHAPTER 7	CONCLUSION	85
7.1	Observation of Strength and Weakness	86
7.1.1	Weakness	86
7.1.2	Strength	87
7.2	Proposition for Future Improvement	87
7.3	Contribution	88
7.4	Future Work	88
	SUMMARY	89
	REFERENCES	90
	APPENDIX A: Gantt Chart and Milestone	93
	APPENDIX B: Unit Test Case	98
	APPENDIX C: Integration Test Case	99
	APPENDIX D: System Test Case	100
	APPENDIX E: Questionnaire	103
	ATTACHMENT: Marker Design	

LIST OF FIGURE

FIGURE	TITLE	PAGE
1.1	Project Framework	7
2.1	Architecture of AR	12
2.2	Marker-based Augmented Reality	13
2.3	Markerless AR	14
2.4	Pleco Chinese Dictionary	16
2.5	trainchinese Dictionary	17
2.6	海词词典 (HaiCi dictionary)	18
3.1	Agile Methodology	23
3.2	Life cycle of Extreme Programming	25
5.1	System Architecture	38
5.2	System Flow Chart	38
5.3	Flow Chart of the wordAR application	40
5.4	Example of the marker	44
5.5	tess-two folder and NDK builder	47
5.6	A list of compiled files	48
5.7	Import the libraries and project	49
5.8	Checked as library	49
5.9	Add the libraries	50
5.10	Install the Android API	50
5.11	Develop the source code	51
5.12	Scan the word	52
5.13	The algorithm detects the word	52
5.14	Options to perform after detecting the words	53
5.15	Save the word as PNG file format	53

5.16	Installation of Metaio SDK	55
5.17	Import Metaio SDK library	55
5.18	Tutorial examples from Metaio SDK	56
5.19	wordAR project using Metaio SDK library	56
5.20	“assets” folder	57
5.21	Apply for an application signature	58
5.22	An email will be sent to inbox	58
5.23	Include the signature in the application	59
5.24	Develop the source code	59
5.25	Main interface	60
5.26	3D model button	60
5.27	Definition button	60
5.28	Sample sentence button	60
6.1	Main module process	66
6.2	Interaction/Tracking module	67
6.3	Navigation Structure	67
6.4	The file is uploaded onto dropbox	72
6.5	Response on acceptance test via online distribution	72

LIST OF TABLE

Table	Title	Page
2.1	Comparison between 3 applications	19
5.1	Comparison of Libraries	61
6.1	Specification of hardware	64
6.2	Specification of software	64
6.3	Test Schedule	70
6.4	Participants detail	73

CHAPTER 1

INTRODUCTION

The overall capabilities of mobile devices have rapidly increased in recent year in terms of processing power, connectivity and available sensor. With the help of these useful advancements, together with the increasing prevalence of smartphone, this has made the smartphone feasible and almost every tasks and programs are possible to run on the mobile platform. There was then the Augmented Reality (AR) has been introduced. AR offers a new approach to exploration and learning by blending real world condition with digital data. Running AR on mobile platform has opened a new market to most of the developers. For some people, this new technique is preferable comparing to the conventional method, for example, in the use of traditional dictionary. Connecting the spatial world with the digital information can also help when mastering a new language. The purpose of this paper is to discover the difficulties faced by users when using the conventional mobile dictionary and then propose a solution in order to overcome the difficulties. This chapter will explain the information required for the development purpose.

1.1 Project Background

Dictionary has no doubt to be the place where people consult to when they came across some words that they do not understand. In this immersive technology era, everything seems to be digitalized. Not only the conventional huge computers have emerged into a smaller and portable size, but the same concept also applied to the conventional dictionary. Dictionary has always be the place where people consult to when they encounter the words that they do not understand; regardless of conventional dictionary or digital dictionary.

Over the past few decades, Chinese language has become popularized and also being ranked as one of the most commonly spoken language. When it comes to Chinese characters, there are hundreds of thousands of characters that are currently recognized. Studies indicate that functional literacy requires only 3000 to 4000 characters. However, the number is too large to be learned in a short time.

1.2 Problem Statement

Digital dictionary is the most common application that people will install in their portable device, for example, smartphone. In order to use a digital dictionary, the application will ask the users to input the alphabetical characters to search for the definition. With the technology nowadays, users are able to input the words that they want to search by either text-inputting or even just simple voice over. For most users, there is no problem if they were asked to input the alphabetical characters to search for the definition. On the other hand, they may face some difficulties if they were asked to input non-alphabetical characters such as Chinese characters, Japanese characters, Korean characters and others. It is difficult for them to input the words by either using text-inputting or voice over as they do not write and speak the language. Hence, users need something that could help them in solving the problem.

1.3 Objectives

- i. **To identify the problems of text-inputting for non-alphabetical characters while searching for the definition of the words.**

While using the mobile dictionary, there are various ways to input the words that we want to search, such as text-inputting and voice over and others. When it comes to the language that users do not understand or non-alphabetical characters, it is difficult for them to either input the words by text-inputting or voice over as they do not know how to write and read the words. So the problems will be gathered and analyzed and eventually a solution will be proposed to overcome this issue.

- ii. **To develop a mobile dictionary application enhanced with augmented reality on Android platform.**

There are a lot of mobile dictionary applications that can be found and downloaded to the smartphone, be it on Android or IOS or Windows; but somehow the application did not meet the requirement for certain people. Thus, a mobile dictionary that is enhanced with Augmented Reality (AR) will be developed on Android platform to fulfill the requirements.

- iii. **To investigate the effectiveness of implementing augmented reality into mobile dictionary application on Android platform.**

Once the application has been developed, it will be tested with a group of tester to find out the effectiveness of the mobile dictionary application that is enhanced with AR will be helpful in terms of searching and understanding the definition of the words.

1.4 Research Question

i. How mobile AR dictionary change the way the conventional mobile dictionary works in terms of text inputting?

Since the mobile dictionary has been introduced a few years back, the touch screen smartphone has not yet being popularized; there were only the keypad phone. So when users use the dictionary, they have to type in the words in order to search the meaning. With the help of AR technology, instead of inputting the words manually, users will only have to move their smartphone's camera on top of the words that they want to search; the AR technology will do the rest of the work for users.

ii. How mobile AR dictionary can be developed on Android platform?

By using Android Development Tools (ADT). ADT is a plugin for Eclipse IDE that is designed with integrated environment in which to build Android applications. It enables the users to quickly set up Android project, create an application user interface, debug the application using the SDK tools and distribute the application by exporting the .APK file.

iii. How AR dictionary perform better than the conventional mobile dictionary in terms of learning environment?

Dictionary can be somehow boring in the traditional way. Instead of displaying texts and pictures, AR provides an interesting and interactive learning environment by augmenting the 3d model or animation which makes the learning process livelier.

1.5 Project Scope

i. Target audience

The target user for the wordAR project will be young adult aged 20 to 24 whom Chinese language proficiency is low or novice learners for Chinese language. Users will only be able to look for the definition by scanning the Chinese characters with their smartphone.

ii. Application

Since the wordAR application is in the initial phase, the application will be tested with only 5 Chinese characters which represent different “Transportations” which are commonly used in Chinese language. Due to the capacity and time constraint, only typed Chinese characters will be used throughout this project.

1.6 Project Framework

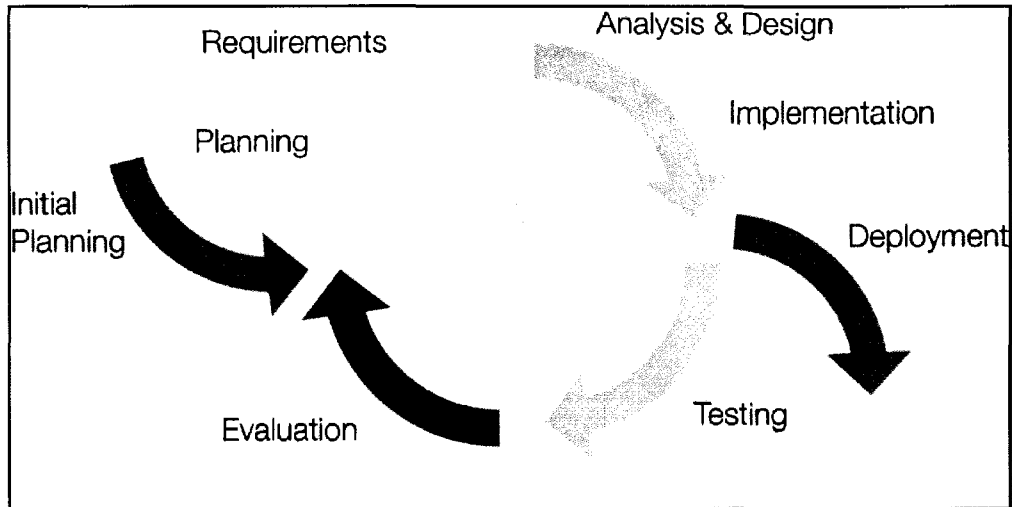


Fig 1.1: Project Framework

In this project, the Agile methodology is approached. It consists of several phases which are project initiation (requirement), technical design (architecture and design), development and test and feedback. One of the benefits from this methodology is that the project will never get out of track because the constant involvement of users.

There are few practices that primarily based on Agile methodologies. The extreme programming is used in this project. The extreme programming consists of 5 phases: exploration, planning, productionising, death and maintenance. The iteration of development and testing will be repeated until a requirement is accomplished. This will be further explained in Chapter 3 later.

1.7 Project Significance

This project is a significant advance to the existed mobile dictionary application. The combination between AR technique and dictionary function will create an interactive environment and a whole new interesting experience that could engage and motivate users towards the usage of dictionary. WordAR is a simple application to use and easy to remember and at the same time, easy to understand as the related virtual 3D object will be augmented upon the Chinese characters.

Summary

In conclusion, the purpose of this research paper is to discover the difficulties faced by users when using the conventional mobile dictionary and then propose a solution in order to overcome the difficulties. This project is significant advance to the existing mobile dictionary application. The wordAR application will change the perspective of users towards the usage of mobile dictionary. It is believed that the mobile AR dictionary will engage and motivate users in using the dictionary.

In the next chapter, research or studies that are related to mobile augmented reality for language learning purposes will be reviewed and discussed.