



Faculty of Computer Science and Information Technology

IOT BASED AUTOMATED MOBILE BOARD SIGN FOR TOURISM ATTRACTION

Tang Si King

Bachelor of Computer Science with Honors

(Network Computing)

2020

UNIVERSITI MALAYSIA SARAWAK

THESIS STATUS ENDORSEMENT FORM

TITLE **IoT based Automated Mobile Board Sign for Tourism Attraction**

ACADEMIC SESSION: 2019/2020

TANG SI KING
(CAPITAL LETTERS)

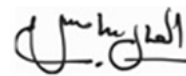
hereby agree that this Thesis* shall be kept at the Centre for Academic Information Services, Universiti Malaysia Sarawak, subject to the following terms and conditions:

1. The Thesis is solely owned by Universiti Malaysia Sarawak
2. The Centre for Academic Information Services is given full rights to produce copies for educational purposes only
3. The Centre for Academic Information Services is given full rights to do digitization in order to develop local content database
4. The Centre for Academic Information Services is given full rights to produce copies of this Thesis as part of its exchange item program between Higher Learning Institutions [or for the purpose of interlibrary loan between HLI]
5. ** Please tick (✓)

- CONFIDENTIAL (Contains classified information bounded by the OFFICIAL SECRETS ACT 1972)
- RESTRICTED (Contains restricted information as dictated by the body or organization where the research was conducted)
- UNRESTRICTED

Validated by

TANG



(AUTHOR'S SIGNATURE)

(SUPERVISOR'S SIGNATURE)

Permanent Address
No 2i, Lorong 16B, Jalan Wong King
Huo, 96000, Sibul, Sarawak

Date: 27/7/2020

Date: 27/7/2020

Note * Thesis refers to PhD, Master, and Bachelor Degree

** For Confidential or Restricted materials, please attach relevant documents from relevant organizations / authorities

IOT BASED AUTOMATED MOBILE BOARD SIGN FOR TOURISM ATTRACTION

TANG SI KING

This project is submitted in partial fulfilment of the
requirements for the degree of
Bachelor of Computer Science with Honors (Network Computing)

Faculty of Computer Science and Information Technology

UNIVERSITI MALAYSIA SARAWAK

2020

TANDA PAPAN MUDAH ALIH BERASASKAN IOT UNTUK TARIKAN PELANCONGAN

TANG SI KING

Projek ini merupakan salah satu keperluan untuk
Ijazah Sarjana Muda Sains Komputer dengan Kepujian
(Pengkomputeran Rangkaian)

Fakulti Sains Komputer dan Teknologi Maklumat

UNIVERSITI MALAYSIA SARAWAK

2020

DECLARATION

I hereby declare that this project is my original work. I have not copied from any other student's work or from any other sources except where due references or acknowledgement is not made explicitly in the text, nor has any part had been written for me by another person.

Signed,

A handwritten signature in blue ink, appearing to read "TANG SI KING".

.....

(TANG SI KING, 59955)

17th December 2019

Faculty of Computer Science and Information Technology

Universiti Malaysia Sarawak

Acknowledgement

I would like to express my sincere appreciation to all who have contributed towards the completion of this final year project. First of all, I would like to show my deepest gratitude from the bottom of my heart to my supervisor, Dr. Adnan Shahid Khan for this time in the meeting, guiding me throughout conducting this project and for his extraordinary efforts in providing guidance and motivation to make this project successful.

I would like to thank the final year project coordinator Professor Dr Wang Yin Chai. I gained a lot of valuable knowledge during his class. I am very grateful to Madam Nurfauzah bt Jali for being my examiner. She was providing project guidelines and information for the completion of my final year project.

Furthermore, I would also like to express my appreciation to Universiti Malaysia Sarawak and my faculty, Faculty of Computer Science and Information Technology (FCSIT) for allowing me to gain experience in conducting this project and also borrowing the equipment.

Last but not least, I would like to thank my fellow friends for being there and for their moral support during this period. I dedicate all my success to each one of them who gave their contribution for completing my project.

Abstract

This study will design an automated mobile board sign that will capable of following a designed path in a tourist attraction that are indoor. This board sign is different from the regular board sign. It can move in specific places as well as on specific routes. This is because the two IR sensors are used to determine if the robot is in track with a line or not. In this way, people are more likely to pay attention to the board sign. People also save time looking around for traditional board sign. The mobile function also increases the visitors on walking have the opportunity to view the information from the automated mobile board. In addition, the visitors can view through the display screen and know the information about the specific place. The automated mobile board sign also will stop when detecting the obstacles.

Abstrak

Kajian ini akan merancang tentang tanda papan mudah alih automatik yang akan dapat mengikuti jalan yang direka dalam tarikan pelancong yang berada dalam bangunan. Tanda papan ini berbeza dengan papan tanda biasa. Ia boleh bergerak di tempat-tempat tertentu serta pada laluan tertentu. Keadaan ini disebabkan kedua-dua sensor IR digunakan untuk menentukan sama ada robot berada dalam landasan dengan garis atau tidak. Dengan cara ini, orang ramai akan lebih cenderung untuk memberi perhatian kepada papan tanda. Orang ramai juga dapat menjimatkan masa untuk mencari papan tanda tradisional. Fungsi mudah alih juga dapat meningkatkan perhatian pengunjung sambil berjalan sambil berpeluang untuk melihat maklumat dari papan mudah alih automatik. Di samping itu, pelawat boleh melihat melalui skrin paparan dan mengetahui maklumat mengenai tempat tertentu. Tanda papan mudah alih automatik juga akan berhenti apabila mengesan halangan.

Table of Contents

DECLARATION	i
Acknowledgement	ii
Abstract	iii
Abstrak	iv
List of Figures	ix
List of Tables	xii
CHAPTER 1: Introduction	1
1.1 Introduction	1
1.2 Problem statement	2
1.3 Scope.....	2
1.4 Limitation.....	2
1.5 Objectives.....	3
1.6 Methodology	3
1.7 Significant of Project	5
1.8 Project Schedule	5
1.9 Expected Outcome:.....	6
1.10 Project Report Outline	6
CHAPTER 2: Literature Review	8
2.1 Introduction	8
2.2 Review of Related Existing Project.....	8
2.2.1 Traditional Wayfinding Signage at Bluport Hua Hin Resort Mall.....	8
2.2.2 Line Follower Robot Using Raspberry Pi.....	9
2.2.3 Modern Trends In Airport Self Check-In Kiosks.....	12
2.2.4 Comparison Between The Different Projects.....	13
2.3 Hardware and Software Used In The Development Of The Project	15
2.3.1 Raspberry Pi 3 Model B +.....	15
2.3.2 Raspberry Pi 7” Touchscreen Display	15
2.3.3 IR Sensor.....	16
2.3.4 2 Channel Relay Module.....	16
2.3.5 Mu Python Editor	17
2.3.6 XAMPP	17
2.3.7 Notepad++	18
2.4 Summary	18

CHAPTER 3: Requirement Analysis and Design	19
3.1 Introduction	19
3.2 Rapid Application Development	19
3.2.1 Analysis and Quick Design	20
3.2.1.1 Hardware Implementations	20
3.2.1.2 Software Implementations.....	21
3.2.1.3 Functionality of requirement:	22
3.2.1.4 Questionnaires	23
3.2.1.5 System Architecture.....	29
3.2.1.6 Use Case Diagram	30
3.2.1.7 Use Case Description	31
3.2.1.8 Sequence Diagram	36
3.2.1.9 Activity Diagram	39
3.2.1.10 Class Diagram.....	40
3.2.1.11 Wireframe.....	41
3.2.1.12 Design prototype.....	44
3.2.2 Prototype Cycle	45
3.2.2.1 Develop	45
3.2.2.2 Demonstrate.....	45
3.2.2.3 Refine	46
3.2.3 Testing.....	46
3.2.4 Deployment	46
3.3 Summary	46
CHAPTER 4: IMPLEMENTATION	47
4.1 Introduction	47
4.2 Hardware Requirement	47
4.2.1 Raspberry Pi 3 Model B+.....	47
4.2.2 Infrared Sensor.....	48
4.2.3 2 Channel Relay Module.....	49
4.2.4 Raspberry Pi 7” Touchscreen Display	49
4.3 Software Requirement	50
4.3.1 Mu Python Editor.....	50
4.3.2 XAMPP	50
4.3.2 Notepad++	51
4.4 Hardware Assembly	52
4.4.1 Overview of Moving Part.....	52

4.4.1.1 Infrared sensor integration with Raspberry Pi.....	53
4.4.1.2 2 Channel Relay Module integration with Raspberry Pi.....	54
4.4.2 Overview of Touchscreen Display Part	55
4.5.1 Configuration for the Moving Part	57
4.5.1.1 Configuration of Infrared Sensor.....	57
4.5.1.2 Configuration of Relay Module.....	58
4.5.2 Configuration for the Touchscreen Display Part.....	59
4.6 Webpage Development.....	61
4.6.1 Home Page	62
4.6.2 About Us Page.....	62
4.6.3 Map Page.....	63
4.6.4 Contact Us Page.....	63
4.6.5 Login Page.....	64
4.6.6 Admin Page	64
4.6.7 Upload Page	65
4.6.7.1 Way to upload pictures.....	65
4.7 Complete prototype	67
4.8 Summary	68
CHAPTER 5: TESTING	69
5.1 Introduction.....	69
5.1.1 Hardware Testing.....	69
5.1.2 Functional Testing	73
5.1.2.1 Unit Testing	73
5.1.3 Non-functional Testing	81
5.1.3.1 Usability Testing.....	81
5.2 Summary	82
CHAPTER 6: CONCLUSION AND FUTURE WORKS	83
6.1 Introduction.....	83
6.2 Objective Achievement.....	83
6.3 Limitations	84
6.4 Future Works.....	84
6.4.1 Four Tires and Good Quality Motor Support.....	85
6.4.2 Waterproof Features	85
6.4.3 Long Distance Features.....	85
6.4.4 High Performance Mobile Features.....	85
6.4.5 Multiple IR Sensor Support.....	85

6.5 Contribution	85
6.6 Conclusion.....	86
REFERENCES	87
Appendix	89

List of Figures

Figure 1. 1: Rapid Application Development Methodology	3
Figure 1. 2: Gantt Chart	5
Figure 2. 1 Static Wayfinding Signage at bluport Hua Hin Resort Mall	9
Figure 2. 2: Prototype of Line Follower Robot Using Raspberry Pi	10
Figure 2. 3: Simple Block Diagram	11
Figure 2. 4: L293D	11
Figure 2. 5: Operation When Using The Touch Screen Panel	13
Figure 2. 6: Raspberry Pi 3 Model B+	15
Figure 2. 7: Raspberry Pi 7” Touchscreen Display.....	15
Figure 2. 8: IR Sensor	16
Figure 2.9: 2 Channel Relay Module.....	16
Figure 2.10: Mu Python Editor.....	17
Figure 2.11: XAMPP	17
Figure 2.12: Notepad++	18
Figure 3. 1: Do You Feel That The Board Sign In This Tourist Attraction Cannot Catch The Attention?.....	24
Figure 3. 2: Do You Ever Face Difficulties to Find A Specific Place Within The Compound of This Tourist Attraction?.....	25
Figure 3. 3: Have You Ever To Look for The Board Sign because of Could not Find The Specific Place.....	26
Figure 3. 4: The idea of Implementing An Automated Mobile Board Sign Sound Interesting.....	27
Figure 3. 5: Do You Think That Implementation of The Automated Mobile Board Sign Will Help To Solve The Problem and Make It More Convenient To Find The Specific Place.....	28
Figure 3. 6: System Architecture of IOT-Based Automated Mobile Board Sign for Tourism Attraction	29
Figure 3. 7: Use Case Diagram of IOT-Based Automated Mobile Board Sign for Tourism Attraction	30
Figure 3. 8: Sequence Diagram for Upload and Delete The Map.....	36
Figure 3. 9: Sequence Diagram for View Information.....	37
Figure 3. 10: Sequence Diagram for Moving Along The Line.....	38
Figure 3. 11: Sequence Diagram for Detect The Obstacles	38
Figure 3. 12: Activity Diagram for automated mobile board sign.....	39
Figure 3. 13: Class Diagram for The of Website.....	40
Figure 3. 14: Interface for Main Page	41
Figure 3. 15: About Us Interface	41

Figure 3. 16: Map Interface	42
Figure 3. 17: About Us Interface	42
Figure 3. 18: Login Page Interface	43
Figure 3. 19: Home Page Interface for Admin Account	43
Figure 3. 20: Design Prototype for Automated Mobile Board Sign	44
Figure 4.1: Raspberry Pi 3 Model B+	48
Figure 4.2: IR Sensor	48
Figure 4.3: 2 Channel Relay Module	49
Figure 4.4: Raspberry Pi 7" Touchscreen Display.....	49
Figure 4.5: Mu Python Editor.....	50
Figure 4.6: XAMPP	51
Figure 4.7: Notepad++	51
Figure 4.8: Complete overview of moving part.....	52
Figure 4.9: Extending 5v and GND of Raspberry Pi into breadboard	53
Figure 4.10: Integration of infrared sensors with Raspberry Pi.....	53
Figure 4.11: Integration of relay module with Raspberry Pi.....	55
Figure 4.12: Integration of touch screen with Raspberry Pi (Part 1)	56
Figure 4.13: Integration of touch screen with Raspberry Pi (Part 2)	56
Figure 4.14: Import GPIO	57
Figure 4.15: Declare the infrared sensor pins as input.....	57
Figure 4.16: Entire infrared sensor setup	58
Figure 4.17: Declare the pins as output.....	58
Figure 4.18: Relay configuration.....	59
Figure 4.19: NOOBS	59
Figure 4.20: Formatting	60
Figure 4.21: Formatting	60
Figure 4.22: Window	61
Figure 4.23: Home page.....	62
Figure 4.24: About us page	62
Figure 4.25: Map page	63
Figure 4.26: Contact us page.....	63
Figure 4.27: Login page.....	64
Figure 4.28: Admin page.....	64
Figure 4.29: Upload page.....	65
Figure 4.30: Google photo account.....	65

Figure 4.31: Photo link.....	66
Figure 4.32: Embed HTML code.....	66
Figure 4.33: Upload page in details	67
Figure 4.34: Overview of complete prototype.....	68

List of Tables

Table 2. 1: Table Of Comparison Between Existing Projects	14
Table 3. 1: Hardware Implementations For Proposed Project	21
Table 3. 2: Software Implementations For Proposed Project	22
Table 3. 3: Use Case Description For View Information	31
Table 3. 4: Use Case Description For Upload data	32
Table 3. 5: Use Case Description For Delete Data	33
Table 3. 6: Use Case Description For Detect Line.....	34
Table 3. 7: Use Case Description For Detect Obstacles.....	35
Table 4.1: Raspberry Pi pin slots with the connection to infrared sensor	54
Table 4.2: Raspberry Pi pin slots with the connection to relay module	55
Table 4.3: Raspberry Pi pin slots with the connection to touch screen.....	57
Table 5.1: Hardware test cases for proposed project.....	70
Table 5.2: Test Case for Home Page	74
Table 5.3: Test Case for About Us page.....	75
Table 5.4: Test Case for Map page.....	76
Table 5.5: Test Case for Contact us page	77
Table 5.6: Test Case for Login page	78
Table 5.7: Test Case for Admin page.....	79
Table 5.8: Test Case for Upload page	80
Table 5.9: Usability Test Results	82
Table 6.1: Achievements for the project objectives of Automated Mobile Board Sign for Tourism Attraction	84

CHAPTER 1: Introduction

1.1 Introduction

A board sign is a piece of board which has been provided with pictures or words and which gives some information about a particular place, event and so on. Board sign is any kind of visual graphics provided to display information to a specific audience. This is usually manifested in the form of way-finding information in places such as inside buildings. It does not seem to be slowing down for the board sign in everywhere, as new place has been opening all year round. Every place always has a lively place. These places are often the focus of the crowd soaring and won the attention of the crowd.

This project is aimed at developing an IOT based automated mobile board sign for tourism attraction. This board sign is different from the regular board sign. It can move in specific places as well as on specific routes. In this way, people are more likely to pay attention to the board sign. People also save time looking around for traditional board sign. In addition, this board sign can be used by the visitor to provide them with the information to go to their place easily. The visitors can view through the display screen and know the information about the specific place. The automated mobile board sign provides a mobile function. Walking tourists can view details from the interactive mobile screen.

1.2 Problem statement

A lot of visitors encounter a problem when they visit the new tourist attraction. Majority of the visitors face difficulties to find a specific place within the compound of tourist attraction. They always spend plenty of time in searching a board sign because not ever to find the specific place. Due to the board sign in tourism attraction cannot catch their attention. The problem is still going to happen on everywhere.

1.3 Scope

The targeted users for the IoT based automated mobile board sign are visitors of indoor tourism attraction. The IoT based automated mobile board sign move on specific routes and in specific places to catch the attention of the visitor. It can move around one to two metres using the solid black line. It can also stop when detecting obstacles in front of the sensor. The visitors can view through the display screen know the information. All the information display in image format. The admin can delete and upload the image from the admin account.

1.4 Limitation

The small display screen used because the motor cannot support too heavy standing board due to hardware limitation. The water can destroy the hardware part. The black line cannot be too long because they consume power. The black line can be destroyed due to the human factor and cause the board sign to stop. The board sign can only detect obstacles in front of the sensor. The height of IoT based automated mobile board sign is limited due to the balancing problem.

1.5 Objectives

1. To study and analyse the existing project on automated mobile board sign.
2. To design and assemble an automated mobile board sign.
3. To test and evaluate the project prototype's functionality and usability on revealing the information that is clear and easy to understand.

1.6 Methodology

Methodology can be defined as a specific procedure or collection of procedures to be used for research or system creation. Rapid Application Development (RAD) model is used to achieve the project's objectives and successfully develop a system. Since the requirement could change constantly throughout the development phase, this methodology is used to help ensure that each requirement is fulfilled in each prototype cycle. RAD is divided into four main sections as shown in Figure 1.1 below. The analysis and quick design phase, the prototype cycle, testing phase and the implementation or deployment phase.

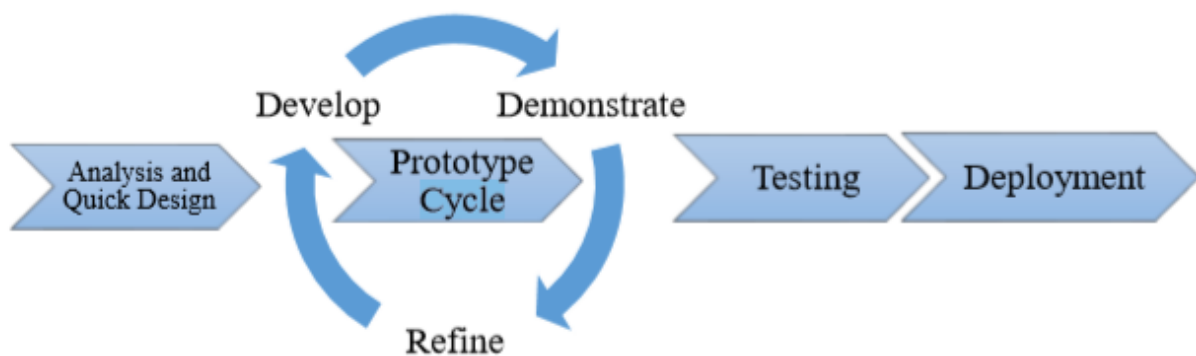


Figure 1. 1: Rapid Application Development Methodology

(adapted from Wanda, 2014)

The problem statement and objectives of developing the Automated Mobile Board sign are determined in the analysis and quick design phase. The requirements for developing the project is obtained in this phase, there will be a study of the similar project. It helps to gather valuable information for this project. A detailed plan or proposal is created to explain how the automated mobile board sign can bring benefits to the target visitors. A quick design of the automated mobile board sign will be designed, sketched and shown upon completion of analysis phase. The system architecture will be designed. It is the part of the overview of the system structure. A series of diagrams will be drawn to create a better understanding of the system design foundation. In order to prepare the materials, all materials needed are being listed down. Some of them are borrowed from the faculty and some are buying online. Raspberry Pi is a necessity to make the prototype more functional. The prototype of this project also includes a lot of material such as display screen, sensors, motor and power supply.

The next step is the prototype cycle where the prototyping process begins with the creation of the prototype based on the system design. The prototype cycle is an iterative step where once the first prototype is created, feedback is collected from visitors after presenting to the visitors. The collected feedback will be analysed and the previous prototype will be refined. This phase will be repeated until the refinement results are acceptable.

It will continue to the next phase which is the critical testing phase after the prototype is completed. It will test in the real environment once the design is successfully developed. Testing is a technique used to evaluate the prototype by testing it with the users. The Automated Mobile

Board Sign is being checked during this process to ensure it meets the targets and also performs well. The final phase is the period of deployment in which the completed Automated Mobile Board Sign is ready for deployment.

1.7 Significant of Project

By having the proposed project, the visitors will be able to know the place by viewing the information provided on the IoT based automated mobile board sign. It can also cover a specific area and catch the attention of the visitor to view the information.

1.8 Project Schedule

The following figure 1.2 shows the Gantt plan graphs for both semesters. The software will give feedback on the progress of this project.

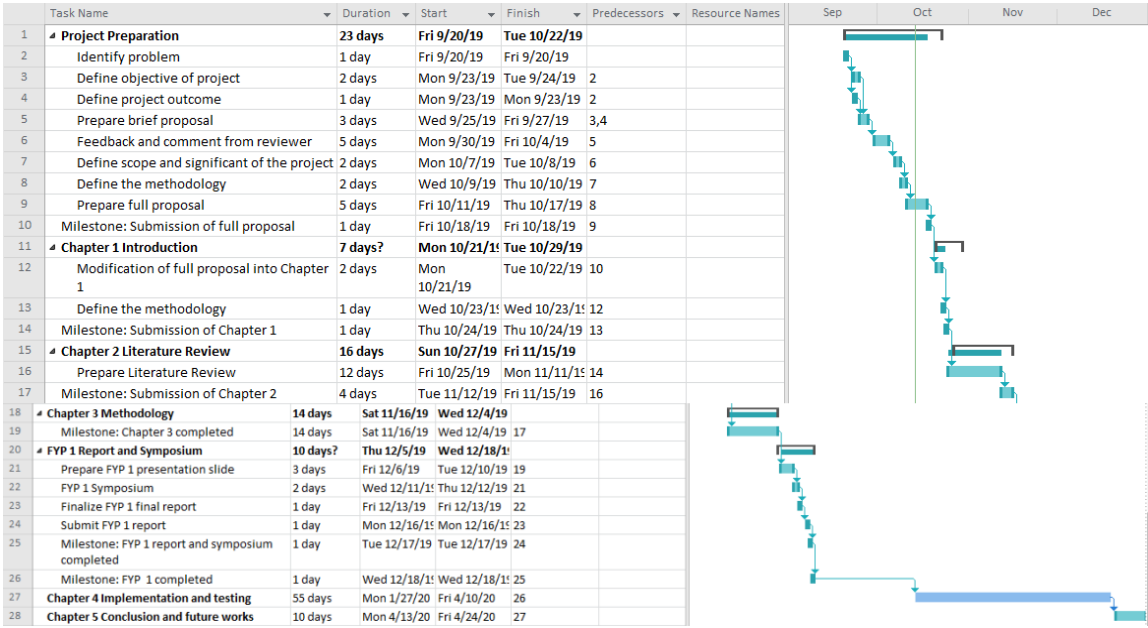


Figure 1. 2: Gantt Chart

1.9 Expected Outcome:

The automated mobile board sign will be able to move in a specified route. The visitor also can view information on the display screen.

1.10 Project Report Outline

This report consists of five different chapters, which are as follows:

(i) Chapter 1 - Introduction

This chapter provides a general understanding of this task. This chapter outlines the problem statement, the objective, the methodology used, the scope of the project, the significance of the project, the project schedule and the project's expected outcome.

(ii) Chapter 2 - Literature Review

This section provides a description of the research sources used in similar projects. It is an analysis and review based on the current project-related processes or structures. This chapter illuminates the reader regarding existing project shortcomings and how it can be enhanced. It will define the strengths and weaknesses of each project or research to be used as the project's basic foundation and expertise.

(iii) Chapter 3 - Requirement Analysis and Design

The chapter outlines the basic concept and approach to be used to fulfill the requirements of the project throughout the project development. The waterfall model will be used as a guide for the development of the proposed project. In this chapter, further explanation will be given to the design.

(iv) Chapter 4 – Implementation

This chapter provides the specifics of this project's implementation. The section provides further analysis of the technology and methods used to build the project and how the project can be applied to meet the project requirements.

(v) Chapter 5 – Testing

The prototype must check whether or not it fulfills the requirement from chapter one. Unit, functional and non-functional testing should all be conducted for prototype testing.

(vi) Chapter 6 – Conclusion and Future Work

This chapter concludes the progress made in this project and discusses future potential improvements for future use. Future work is the change that can be made in the nearest time to come for the existing design.

CHAPTER 2: Literature Review

2.1 Introduction

This chapter provides an explanation on related works applicable literature reviews. The literature review is described as a text body that reviews a particular topic's critical point of current knowledge. Therefore, the aim of the literature review is to classify, read and evaluate the literature or any studies relevant to the IoT based automated mobile board sign for tourism attraction. These references include the articles from any website, papers, journals and magazines.

2.2 Review of Related Existing Project

A good understanding of the information flow is needed for the related existing project before designing a project. In this chapter, the related existing project will be discussed. There are few examples of related existing projects and they have their own purpose and function:

2.2.1 Traditional Wayfinding Signage at Bluport Hua Hin Resort Mall

Wayfinding signage is a solution that helps users navigate through a physical environment. For example, this space may be inside a complex building like a shopping centre. Signage is a broad term that includes detailed maps, signs of direction, kiosks, and others. It also requires careful planning and an in-depth understanding of the function of a building or landscape. Visitors experience is focused on the most effective wayfinding solutions and appreciate how different visitors have different needs for wayfinding. Traditional signage for wayfinding is based on