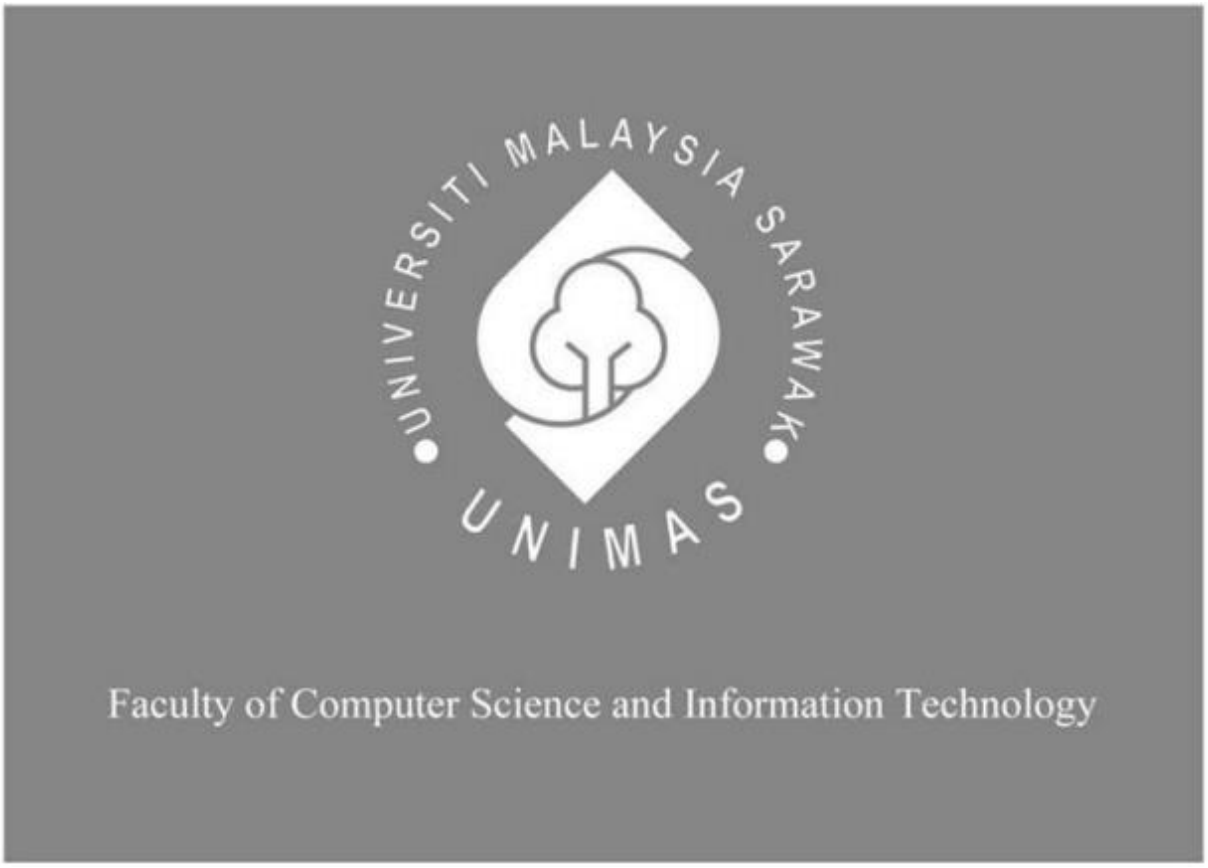

AUGMENTED REALITY FOR SARAWAK TOURISM

USING SPARK

Suhaira Binti Suhaimi

Bachelor of Computer Science with Honours (Multimedia Computing)

2020

AUGMENTED REALITY FOR SARAWAK TOURISM USING SPARK

SUHAIRA BINTI SUHAIMI

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

Faculty of Computer Science and Information Technology
UNIVERSITI MALAYSIA SARAWAK
2020

AUGMENTED REALITY FOR SARAWAK TOURISM USING SPARK

SUHAIRA BINTI SUHAIMI

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

Fakulti Sains Komputer dan Teknologi Maklumat
UNIVERSITI MALAYSIA SARAWAK
2020

UNIVERSITI MALAYSIA SARAWAK

THESIS STATUS ENDORSEMENT FORM

TITLE **AUGMENTED REALITY FOR SARAWAK TOURISM USING SPARK**

ACADEMIC SESSION: 2019/2020

SUHAJRA BINTI SUHAIMI
(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	

(AUTHOR'S SIGNATURE)

Validated by

(SUPERVISOR'S SIGNATURE)

Permanent Address

LOT 2949,
JALAN LAPANGAN TERBANG,
23000 DUNGUN, TERENGGANU

Date: 12 August 2020

Date: 12 AUG 2020

Note * Thesis refers to PhD, Master, and Bachelor Degree
** For Confidential or Restricted materials, please attach relevant documents from relevant organizations / authorities

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 reference or acknowledgement is not made explicitly in the text, nor has any part had been written for me by another person.

…….

(SUHAIRA BINTI SUHAIMI) DATE: 15TH JULY 2020

Matric No: 58003

ACKNOWLEDGEMENT

First of all, I would like to thank the supreme power the Almighty God who is obviously the one has always guided me to work on the right path of life. Without His grace, this project could not become a reality. Next, I would like to express my gratitude and appreciation to all those who gave me the possibility to complete this report. A special thanks to our final year project coordinator, Prof Wang whose help, stimulating suggestions and encouragement, helped me to coordinate my project especially in writing this report.

I would also like to acknowledge with much appreciation and thanks to my final year project supervisor, Mr. Lee Jun Choi who have given his full effort in achieving our goal as well as his encouragement to maintain my progress in track. I would to appreciate the guidance given by him to me. He had supported and helped me all the time when needed. He also gave right direction toward completion of this project.

At last but not least, I am thankful to all my friends who have been always helping and encouraging me throughout this project completion. I have no valuable words to express my thanks, but my heart is still full of the favours received from every person.

TABLE OF CONTENTS

ABSTRACT x
ABSTRAK xi
CHAPTER 1: INTRODUCTION 1
1.1 Introduction 1
1.2 Problem Statement 2
1.3 Aims/Objectives 2
1.4 Brief Methodology 3
1.5 Scope 5
1.6 Project Significance 5
1.7 Projects Outcomes 5
1.8 Project Schedule 6
1.9 Project Outline 6
CHAPTER 2: LITERATURE REVIEW 9
2.1 Overview 9
2.2 What is Augmented Reality (AR) 9
2.3 How Augmented Reality can promote tourism industry 10
2.4 Reviews on Existing System 10
2.4.1 Singapore Tourism Facebook AR Camera Effect 11
2.4.2 Taiwan Tourism Facebook Camera Effects 14
2.4.3 Interactive AR photo booth for Saudi Commission for Tourism and National Heritage 16
2.5 Comparison of similar AR effects project with Sarawak Tourism AR effects 18
2.6 Review of Tools and Technologies 19
2.6.1 Wikitude 19
2.6.2 ARKit 19
2.6.3 ARCore 20
2.6.4 Vuforia 20
2.6.5 AR ToolKit 20
2.6.6 Spark AR Studio 21
2.7 Discussion 21
2.8 Summary 23
CHAPTER 3: REQUIREMENT ANALYSIS AND DESIGN 24

3.1 Introduction 24
3.2 Methodology 24
3.3 Requirement Analysis 25
3.3.1 Survey 25
3.3.2 Functional Requirement 28
3.3.3 Non-Functional Requirement 29
3.3.4 Software Requirement 29
3.3.5 Hardware Requirement 29
3.4 Project Design 30
3.5 User Interface 36
3.6 Conclusion 38
CHAPTER 4: IMPLEMENTATION 39
4.1 Introduction 39
4.2 Software Installation and Configuration 39
4.2.1 Spark AR Studio 39
4.2.2 Paint 3D 40
4.2.3 PicsArt Studio Mobile App 40
4.3 Designing male and female Sarawak traditional costume 40
4.4 Importing 2D model and images into Spark AR 42
4.5 Designing effects of static background 42
4.6 Implementing AR Sarawak Traditional Costume Camera Effects 43
4.7 Implementing AR Sarawak Background Sarawak Tourism Effects 43
4.8 Designing User Interface 48
4.8.1 Sarawak Traditional Costume Camera Effects 48
4.8.2 Static background places of Sarawak City effects 50
4.9 Conclusion 54
CHAPTER 5: TESTING 55
5.1 Introduction 55
5.2 Functional Testing 55
5.2.1 Test Cases 55
5.2.1.1 Test Case 1 56
5.2.1.2 Test Case 2 56
5.2.1.3 Test Case 3 57

5.2.1.4 Test Case 4 58
5.2.1.5 Test Case 5 60
5.3 Non-Functional Testing 60
5.3.1 Usability Testing 61
5.3.2 Compatibility Testing 61
5.4 Conclusion 62
CHAPTER 6: FUTURE WORKS 63
6.1 Introduction 63
6.2 Objectives Achievement 63
6.3 Project Limitations 64
6.4 Future Works 64
6.5 Conclusions 65
References 66
Appendix A 68
Appendix B 69
Feedback 69

LIST OF FIGURES

Figure 1.1. SDLC phases ……... 3
Figure 2.1. Main page of Singapore Tourism Facebook AR filters …….. 12
Figure 2.2. User choose the AR filters…… 12
Figure 2.3. First filter of Singapore Tourism camera effects……..... 13
Figure 2.4. Second filter of Singapore Tourism camera effects …… 13
Figure 2.5. Third filter of Singapore Tourism camera effects ……... 14
Figure 2.6. Filters option main page for Taiwan Tourism camera effects……. 15
Figure 2.7. User interact with the AR photo booth using hand gestures ……... 16
Figure 2.8. User change the background using hand gestures …….. 17
Figure 2.9. User enter their email address to send the photograph…… 17
Figure 3.1. Summary Graph of Question 1 ……... 26
Figure 3.2. Summary Graph of Question 3…… 26
Figure 3.3. Summary Graph of Question 8 ……... 27
Figure 3.4. Summary Graph of Question 10 ……. 28
Figure 3.5. Architecture Design Diagram for AR Sarawak Tourism Effects ……. 30
Figure 3.6. Activity Diagram for Sarawak famous tourist points camera effects….. 31
Figure 3.7. Use Case Diagram for AR for Sarawak Tourism application…… 32
Figure 3.8. Sequence Diagram for AR for Sarawak Tourism application …… 35
Figure 3.9. Class Diagram for AR for Sarawak Tourism application …… 36
Figure 3.10. Camera effects of static famous background in Sarawak ……... 37
Figure 3.11. Camera effects of male and female Sarawak traditional costume …….. 38
Figure 4.1. Iban's crown for female costume……. 41
Figure 4.2. Marek Empang……. 41
Figure 4.3. Iban's crown for male costume…… 41
Figure 4.4. Dandong male costume…… 41
Figure 4.5. Importing 2D models asset for female costume ……... 42
Figure 4.6. Importing 2D for male costume……... 42
Figure 4.7. Add effects into image …….. 43
Figure 4.8. Add faceTracker and faceMesh into Scene…… 44
Figure 4.9. Setup for costume position …… 44

Figure 4.10. Costume movement script…….. 45
Figure 4.11. Adjusting faceTracker bug……. 45
Figure 4.12. Add canvas into scene as the background…….……. 46
Figure 4.13. Adjusting position of the background …… 47
Figure 4.14. Setup for person material…… 47
Figure 4.15. Setup for personSegmentation……..……. 48
Figure 4.16. Sarawak traditional male costume effects…….. 49
Figure 4.17. Sarawak traditional female costume effects……... 49
Figure 4.18. Picker UI in patch editor for Iban Costume effects option …… 50
Figure 4.19. DUN Building background interfaces ……..……. 51
Figure 4.20. Floating Mosque background interfaces ……..……..... 51
Figure 4.21. Old CourtHouse background interfaces ……..……..... 52
Figure 4.22. Cat Statue background interfaces ……..……..... 52
Figure 4.23. Old Post Office background interfaces ……..……..... 53
Figure 4.24. Tua Pek Kong background interfaces ……..……..... 53
Figure 4.25. Picker UI patch editor for Let's Travel Sarawak effects option features… 54
Figure 5.1 Overall usability testing survey…….. 61

LIST OF TABLES

Table 2.1 The comparison of between related AR Effects and Sarawak Tourism AR Camera Effects……... 27

Table 3.1 Software requirements for the developer …… 45

Table 3.2 Hardware requirements for the developer ……..……. 46

Table 5.1 Browse Effects Filters Test Case…….……... 56

Table 5.2 View Camera Effects Filters ……... 56

Table 5.3 Take Photo using Iban Costume Effects Filters.…… 57

Table 5.4 Take Photo using Let's Travel Sarawak……..…… 58

Table 5.5 Save Photo of Used Effects Filter ……..……. 60

Table 5.8 Compatibility Testing Result…..……. 62

Table 6.1 Outline of Objectives and Achievements …… 63

ABSTRACT

Nowadays, there are many inventions that using Augmented Reality (AR) technologies to simplify our daily life. Augmented Reality (AR) applies digital content to a live camera stream, making it look like it's part of our physical world. When the evolution of augmented reality is concerned, it has rapidly been used in the fields of business, logistics, gaming, manufacturing, retail industry, tourism and many more. For this millennia, people need something quick and interesting. This project is one of the technology that meets the requirement and what people are looking for in this current era. Before the advent of AR technology, people usually only took pictures using their device especially when they are traveling and sometimes the pictures they took were lost. It is also difficult to provide physical props for shooting tourist photographs, particularly in the city area. There are also some limitations before the advent of filters technology. It is because the use of the device does not have attractive features and user-friendly interface. Furthermore, Sarawak City is one of the biggest contributor in Malaysia's tourism industry and known as a city with full of culture. However, to maintain the Sarawak's culture in a long term is not easy because it is so challenging when it comes to promoting tourism. The new proposed technology however eradicates this problem by develop the features of AR camera effects that gives user a great experience using this AR Sarawak Tourism filters in Instagram and Facebook as they can know a lot about Sarawak Culture. Also, this project is one of the way to promote and maintaining Sarawak Tourism and Culture itself.

ABSTRAK

Pada masa kini, terdapat banyak penemuan yang menggunakan teknologi Augmented Reality (AR) untuk mempermudah kehidupan seharian kita. Augmented Reality (AR) menerapkan kandungan digital ke strim kamera langsung, menjadikannya seperti bahagian dunia fizikal kita. Ketika evolusi augmented reality bersangkutan, dengan cepat digunakan dalam bidang bisnis, logistik, permainan, pembuatan, industri runcit, pelancongan dan banyak lagi. Selama ribuan tahun ini, orang memerlukan sesuatu yang cepat dan menarik. Projek ini adalah salah satu teknologi yang memenuhi kehendak dan apa yang dicari oleh orang-orang di era sekarang ini. Sebelum munculnya teknologi AR, orang biasanya hanya mengambil gambar menggunakan peranti mereka terutama ketika mereka dalam perjalanan dan kadang-kadang gambar yang mereka ambil hilang. Juga sukar untuk menyediakan alat peraga fizikal untuk mengambil gambar pelancong, terutama di kawasan kota. Terdapat juga beberapa batasan sebelum munculnya teknologi penapis. Ini kerana penggunaan peranti ini tidak mempunyai ciri menarik dan antara muka yang mesra pengguna. Tambahan pula, Bandaraya Sarawak adalah salah satu penyumbang terbesar dalam industri pelancongan Malaysia dan dikenali sebagai bandar yang penuh dengan budaya. Walau bagaimanapun, untuk mengekalkan budaya Sarawak dalam jangka masa panjang adalah sangat mencabar untuk mempromosikan pelancongan. Teknologi yang dicadangkan baru bagaimanapun membasmi masalah ini dengan mengembangkan ciri-ciri kesan kamera AR yang memberikan pengalaman hebat kepada pengguna menggunakan penapis AR Sarawak Tourism ini di Instagram dan Facebook kerana mereka dapat mengetahui banyak tentang budaya sarawak. Juga, projek ini adalah salah satu cara untuk mempromosikan dan mengekalkan Pelancongan dan Kebudayaan Sarawak itu sendiri.

CHAPTER 1: INTRODUCTION

1.1 Introduction

Augmented Reality(AR) for Sarawak Tourism using SPARK is a project that gives a different experience to user who want to visit Sarawak City. Augmented Reality is a term of live direct or an indirect view of a physical, real-world environment. This project using AR concept will add in multimedia elements such as pictures, graphics and animations. Apart from this, social media such as Facebook and Instagram now forms an integral part of the lives of many people, not only the teens, but people of all ages and any occupation use social networking sites as a way of contact. Social networking plays an essential part in every forum, as recently observed reality.

Literally, this project combined these two elements which are the AR element and social media platform to create attractive different filters and effect that will bring user as if they are in Sarawak City. Instantly, it allows the user interact with the props and effect that represent Sarawak culture that will appear on their smartphone screen devices. It enables features that user will use their social media such as Facebook and Instagram in the 'story' function section. These filters or effects made the props come to life and give the user a chance to pose with the virtual props and effect that represent Sarawak Culture as much as they want. Then, a memorable Augmented Reality photo that represents Sarawak City will save by the user in their smartphone devices.

Besides, Spark AR is a tool that allows us to create amazing interactive experiences and share it using Facebook or Instagram to promote our products or brand. This is much faster and reduces development & marketing cost immensely. So, for this project will using the Spark AR as the tools for the implementation and development.

1.2 Problem Statement

Personally, it is so important to take photos when travelling as to keep it more memorable to tourist. However, it is hard to provide physical props for tourist photo shooting especially in town area. It takes energy and time to prepare the physical props. Due to lack of acknowledgement in photography and time, the taken photo does not satisfy the tourist and the photography session started to become bored. It is because there are no attraction and interesting features in the device use. In addition, Sarawak City is one of the biggest contributor in Malaysia's tourism industry and known as a city with full of culture. However, to maintain the Sarawak's culture in a long term is not easy because it is so challenging when it comes to promoting tourism.

1.3 Aims/Objectives

The following are the project objectives:

- To develop and create AR filters for Sarawak Tourism using Spark AR as the tool in order to promote Sarawak culture.
- To develop and create static AR background of famous tourist points in Sarawak City together that able to attract tourist visits Sarawak City.
- To develop and create AR costume of famous ethnic in Sarawak.

1.4 Brief Methodology

The methodology that is utilized in this project is waterfall model. It comprises of the feasibility study, analysis phase, design phase, development phase, testing phase and maintenance phase. For the development, it will distribute the tasks in five phases as diagram below:

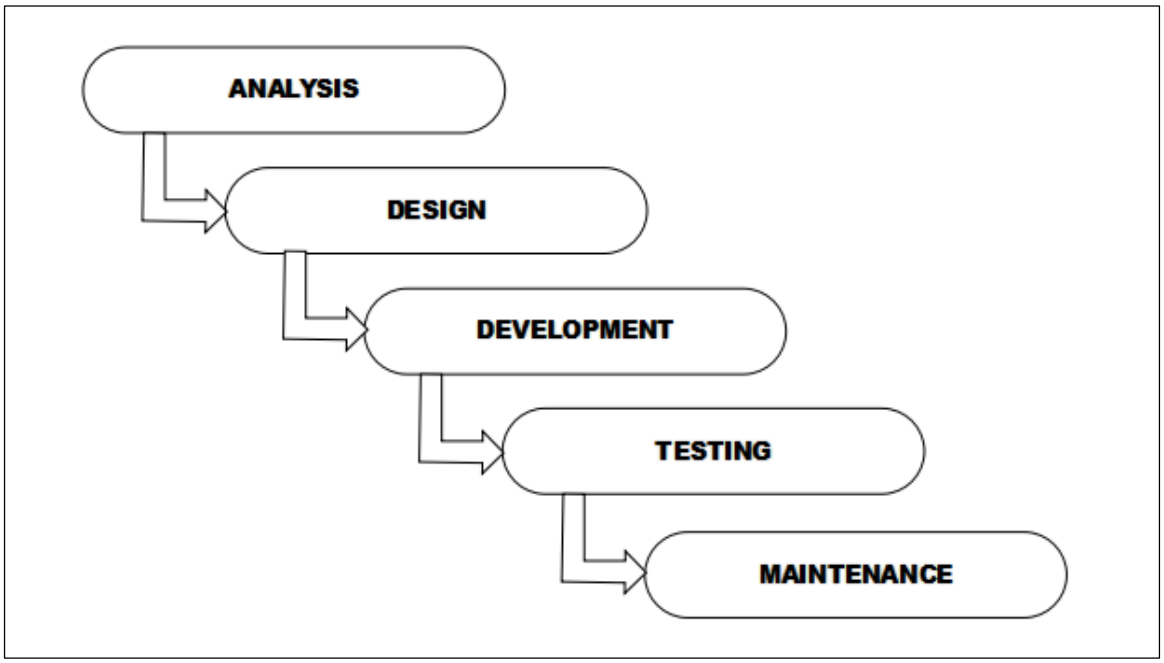

Figure 1.1 Waterfall Model System Development Life Cycle (SDLC)

1.5.1 Requirement

Requirement phase is the base for completing the project. In this phase, the initiation of project occurs. The requirements for the project are documented and the analysis process takes place to start the project. This phase will gather the necessary software program that may be needed to develop this system for instance AR development tool and graphical design tool and hardware needed such as laptop, computer and webcam.

1.5.2 Design

The project is being designed in this process. Detailed design is based on the recorded specifications from the previous stage. Development that can help define project specifications and equipment which can determine the overall design of the system architecture.

1.5.3 Development

At this stage, the project is developed based on a specific design from the previous phase. The development phase marks the end of the initial section of the process. Additionally, this phase signifies the start of production. The development stage is also characterized by instillation and change. Spark AR is the main tool needed to develop this project. Unit testing for this project required to check the functionalities of this project.

1.5.4 Testing

After testing of each unit is done, the units are integrated into a system. The designated project needs to go through continual testing to detect any errors or flaws. After the continual testing, the installation of the project takes place.

1.5.5 Maintenance

This phase occurs after the installation of the project. Modification process for the project to improve the performance takes place in this phase. The maintenance also may

occur from the request by the client. This phase takes place in order to give a resolution towards errors and flaws found in the previous phase.

1.5 Scope

This project is to develop and design interactive Facebook 'story' filters using augmented reality that features of virtual props and effect, gives the user a chance to pose with those filters that represent Sarawak culture everywhere and anywhere. User can take their photo using this function and saved the photo in their smartphones devices. It requires a lot of regions ranging from computing field to AR technology. It performs several enquiries to be able to achieve the project objectives.

1.6 Project Significance

There are several significances from the project such as:

- Augmented Reality (AR) for Sarawak Tourism significantly has become the great medium to promote Sarawak and attract local and foreign tourist to visits Sarawak City as this project includes a few famous tourist points in Sarawak City.
- The level of curiosity about Sarawak culture among local tourist specially expected to increase as this AR project show them a few details of Sarawak's traditional costume.

1.7 Projects Outcomes

Upon projects completion, this project would satisfy all the objectives proposed mentioned, and would produce a working prototype Augmented Reality (AR) for Sarawak Tourism. It allows the tourist interact with the interactive AR filters that include the static background of famous

Sarawak tourist points and the Sarawak traditional prop. This will give great experience to the user when they use those filters.

1.8 Project Schedule

Project schedule shows the schedules all along the project development. The first chapter is involving the introduction of the project, problem statements, objectives of the study, the project scopes, the utilised methodology, the significance of the project, the project schedule, and the expected outcomes of the project. The second chapter explores the review done on existing systems which are similar to the proposed project as well as comparing the techniques deployed in the involved systems. In Chapter 3, the methodology adopted in the project is further described which is the SDLC. Next, in Chapter 4, implementation activities are carried out and screenshots of the software interfaces are included. Lastly, Chapter 5 discusses testing being done to check either the system has met its requirements or done by using test cases and Chapter 6 comprises of details of objectives achievement, future works, and limitations. The Gantt Chart of the project schedules included in the Appendix A section for both Final Year Project 1 and Final Year Project 2 project schedules.

1.9 Project Outline

There are five (6) chapters included in the Final Year Project (FYP). The summary of the chapters is as explained below: -

Chapter 1 is representing the introduction of the proposed system. This chapter is inclusive of the problem statements, the objectives of the project, the methodology adopted, the significance of the project and its expected outcome, and the project schedule. The problem statements depict the obstacles faced by user as well as the existing systems' flaws. The objectives then will resolve the problems mentioned and the scope of the project describes the limitations of the project.

Chapter 2 is about the reviews on the existing or similar systems to the proposed system. The study of this chapter is mainly done on journals, articles, and conference papers. The strengths and the weaknesses of the systems are determined to help to enhance the proposed system. Moreover, a brief description of the software and the hardware used to develop the system is also covered in this chapter.

Chapter 3 discusses the methodology applied for the project development. The methodology chosen is Systems Development Life Cycle (SDLC). This chapter also includes the techniques used to obtain user requirements. Towards the last section of the chapter, UML diagrams will be designed and explained in detail.

Chapter 4 is focusing on the thorough information of the system's implementation. Screenshots and interface layouts will be used to help in explaining and demonstrating the system's structures and behaviours.

Chapter 5 discusses the testing done for the system. There are total of ten (10) test cases included in this project. Also, a usability testing and lastly a compatibility testing.

Chapter 6 concludes the project developed, constructs the future works, and comprehends the lessons learnt. Suggestions and recommendations on the system's improvement on the functionality and the performance will be covered in this chapter.

CHAPTER 2: LITERATURE REVIEW

2.1 Overview

In this chapter, an evaluation of trends and technology using Augmented Reality (AR) is discussed. The reasons for choosing AR approach and social media as a medium is explained. Other than that, the existing systems that provide similar functions and processes to the proposed system is discussed in extent. A relationship of the Augmented Reality really can improve and promote tourism industry is explained. Thorough analysis will be implemented to observe the features, strengths, and weakness of those systems. Lastly, three existing applications related to Augmented Reality (AR) that promote tourism are analysed.

2.2 What is Augmented Reality (AR)

AR technology works by superimposing (or augmenting) the digital contents onto the physical world. It is like creating a bridge between the real and virtual worlds. Augmented reality, or AR, is a digital technology that, when viewed through a virtual screen, changes a person's understanding of their physical world. There are parallels between technology and virtual reality, but AR does not replace the real-world environment, but enhances it by overlaying digital components. AR technology works in real-time and involves interactive display to view the augmented 3D graphics in real world (Liao, 2019). AR does not create virtual world nor replacing the physical world, instead it enriches and complements the real world (Kiryakova, Angelova, & Yordanova, 2018). Adding the virtual layers into physical world creates intuitive interaction between them. There are several types of AR being developed. The differences between AR system is based on the usage of hardware devices. The types of AR listed by Kiryakova et al. (2018) are stationary augmented reality, spatial augmented reality, desktop augmented reality, augmented reality using

handheld device and mounted displays. AR consists of three elements such as the component for tracking, rendering process and interaction (Grubert, Langlotz, Zollmann, & Regenbrecht, 2017). In AR application these elements play essential roles. The tracking function is to locate the location of the system to be used on the physical environment to make digital components. Then, the multimedia content can be rendered using the tracking data. The interaction component helps the user to control digital and physical content, and communicate with it. Besides, there are many AR software that gives platform that provide AR features and function using them such as Vuforia, ARCore, AR Tool Kit and Spark AR.

2.3 How Augmented Reality can promote tourism industry

Based on the above statement, this project will use AR technology as its backbone and apply it in the system software. A post by BorneoPost Online prove that Augmented Reality technology should can promote tourism industry in a country. AR Digital Mural has been launched at Indian Street, Kuching Sarawak. Abang Johari also launched an AR digital mural at India Street which is aiming to make it into Malaysia Book of Records for the largest AR mural in the country (Chua, 2019). From here, we can see that Augmented Reality technology really can help to promote tourism in a country. As wish, this project also can achieve the objectives of this project so that it can help to promote tourism industry especially in Sarawak tourism.

2.4 Reviews on Existing System

There are projects that have similarities with the Sarawak Tourism Interactive Photo Booth which are Facebook Spark AR Camera Filter for Singapore Tourism, Taiwan Tourism AR Camera Effects and Interactive AR Photobooth for Saudi Commission for Tourism and National Heritage (SCTH). The review of the three AR for tourism mentioned is provided in this chapter.