UNIVERSITI TEKNIKAL MALAYSIA MELAKA

IMMERSIVE MALAYSIA HISTORICAL VISUAL STORYTELLING IN VIRTUAL REALITY

MUHAMMAD AIZAT SYAMIL BIN AHMAD SANUSI

BACHELOR'S DEGREE IN COMPUTER SCIENCE (INTERACTIVE MEDIA) WITH HONS.

2024

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

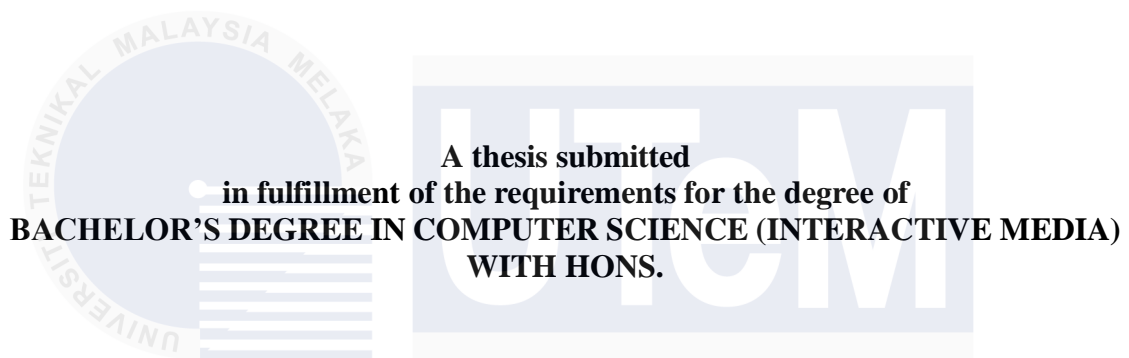## IMMERSIVE MALAYSIAN HISTORICAL VISUAL STORYTELLING IN VIRTUAL REALITY

MUHAMMAD AIZAT SYAMIL BIN AHMAD SANUSI

BACHELOR'S DEGREE IN COMPUTER SCIENCE (INTERACTIVE MEDIA) WITH HONS.

2024

**IMMERSIVE MALAYSIAN HISTORICAL STORYTELLING
IN VIRTUAL REALITY**

MUHAMMAD AIZAT SYAMIL BIN AHMAD SANUSI

**A thesis submitted
in fulfillment of the requirements for the degree of
BACHELOR'S DEGREE IN COMPUTER SCIENCE (INTERACTIVE MEDIA)
WITH HONS.**

Faculty of Information and Communication Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2024

DECLARATION

I declare that this thesis entitled "IMMERSIVE MALAYSIAN HISTORICAL VISUAL STORYTELLING IN VIRTUAL REALITY" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : *Aizat* ....

Name :MUHAMMAD AIZAT SYAMIL BIN AHMAD SANUSI...

Date :.....6/9/2024...

APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of BACHELOR'S IN COMPUTER SCIENCE (INTERACTIVE MEDIA) WITH HON.

IKMAL FAIQ ALBAKRI BIN MUSTAFA ALBAKRI
Pensyarah
Jabatan Media Interaktif
Fakulti Teknologi Maklumat dan Komunikasi
Universiti Teknikal Malaysia Melaka (UTeM)

Signature   :..

Supervisor Name   : IKMAL FAIQ ALBAKRI BIN MUSTAFA ALBAKRI

Date   : 6/9/2024

DEDICATION

This work is dedicated to my family, whose unwavering support and encouragement have been my strength throughout this journey. To my parents, thank you for your endless love, sacrifices, and for believing in my dreams. Your guidance and faith in me have been invaluable.

To my friends and peers, thank you for your support, camaraderie, and for making this journey more enjoyable and memorable. Your encouragement and shared experiences have been a source of motivation.

I would also like to dedicate this project to my mentors and educators, whose knowledge, patience, and guidance have been crucial to my academic and personal growth. Your dedication to education and your commitment to fostering a love for learning have inspired me to strive for excellence.

Lastly, I dedicate this work to the future generations of learners. May this project contribute to making history education more engaging and impactful, and may it inspire others to explore and appreciate the rich heritage of our world.

ABSTRACT

Technology has moved so fast and it has changed many fields including education. Traditional way of teaching history such as textbooks and documentaries often fail to engage modern learners and lead to decline of interest and retention of historical knowledge. This project aims to address this challenge by using Virtual Reality (VR) to create an immersive and interactive educational experience on Malaysian history.In this project, a Virtual Reality environment was created to present significant historical events and cultural heritage of Malaysia. The VR experience will transport users to different historical periods, to explore historical sites, interact with virtual artifacts and engage with dynamic storytelling elements. This immersive approach makes learning more fun and enhances retention of historical information by giving users a first person perspective of historical events. The development of the VR experience went through several stages. First, extensive research was done to identify and curate historical content that is educational and engaging. This content was then adapted into interactive VR narratives using Unreal Engine 5, a powerful tool for creating high fidelity virtual environments. The narratives were designed to be interactive, allowing users to make choices and explore different aspects of Malaysian history at their own pace. To test the VR experience, user engagement and learning outcomes were measured through a series of user tests. Participants, consisting of teenagers and adults, were asked to use the VR application and provide feedback on their experience. The results showed a significant increase in engagement and interest in Malaysian history compared to traditional way of learning. Users also showed higher retention of historical facts and deeper understanding of cultural heritage. The project also developed generic peak engagement metrics to measure the level of user interaction and immersion. These metrics looked at duration of engagement, frequency of interactions and user feedback on the VR experience. The results from the user tests showed that the VR experience grabbed and held users' attention, a strong case for using VR in historical education. The main advantage of the VR-based approach in this project is its flexibility and scalability. The VR experience can be applied to different historical periods and themes, making it a versatile tool for educational institutions. The VR application can also be easily updated with new content, so it stays relevant and engaging for users over time. Overall, this project shows that Virtual Reality is a powerful tool for historical education. By making history more immersive and interactive, the VR experience makes it more accessible and fun for modern learners. The results of this project is for educators and developers to use in their teaching methods, to innovate education for the digital age.

Penceritaan Visual Sejarah Malaysia yang Mengasyikkan Dalam Realiti Maya

ABSTRAK

Teknologi telah bergerak begitu pantas dan ia telah mengubah banyak bidang termasuk pendidikan. Cara tradisional mengajar sejarah seperti buku teks dan dokumentari sering gagal menarik minat pelajar moden dan menyebabkan penurunan minat dan pengekalan pengetahuan sejarah. Projek ini bertujuan untuk menangani cabaran ini dengan menggunakan Realiti Maya (VR) untuk mencipta pengalaman pendidikan yang mengasyikkan dan interaktif tentang sejarah Malaysia. Dalam projek ini, persekitaran Realiti Maya dicipta untuk mempersembahkan peristiwa bersejarah dan warisan budaya Malaysia yang penting. Pengalaman VR akan membawa pengguna ke tempoh sejarah yang berbeza, untuk meneroka tapak bersejarah, berinteraksi dengan artifak maya dan terlibat dengan elemen penceritaan yang dinamik. Pendekatan mendalam ini menjadikan pembelajaran lebih menyeronokkan dan meningkatkan pengekalan maklumat sejarah dengan memberi pengguna perspektif orang pertama tentang peristiwa bersejarah. Pembangunan pengalaman VR melalui beberapa peringkat. Pertama, penyelidikan meluas telah dilakukan untuk mengenal pasti dan menyusun kandungan sejarah yang mendidik dan menarik. Kandungan ini kemudiannya disesuaikan ke dalam naratif VR interaktif menggunakan Unreal Engine 5, alat yang berkuasa untuk mencipta persekitaran maya kesetiaan tinggi. Naratif direka bentuk untuk menjadi interaktif, membolehkan pengguna membuat pilihan dan meneroka pelbagai aspek sejarah Malaysia mengikut rentak mereka sendiri. Untuk menguji pengalaman VR, penglibatan pengguna dan hasil pembelajaran diukur melalui satu siri ujian pengguna. Peserta, yang terdiri daripada remaja dan dewasa, diminta menggunakan aplikasi VR dan memberikan maklum balas tentang pengalaman mereka. Keputusan menunjukkan peningkatan ketara dalam penglibatan dan minat dalam sejarah

ii

Malaysia berbanding cara pembelajaran tradisional. Pengguna juga menunjukkan pengekalan fakta sejarah yang lebih tinggi dan pemahaman yang lebih mendalam tentang warisan budaya. Projek ini juga membangunkan metrik penglibatan puncak generik untuk mengukur tahap interaksi dan rendaman pengguna. Metrik ini melihat tempoh penglibatan, kekerapan interaksi dan maklum balas pengguna tentang pengalaman VR. Keputusan daripada ujian pengguna menunjukkan bahawa pengalaman VR menarik dan menarik perhatian pengguna, satu kes yang kukuh untuk menggunakan VR dalam pendidikan sejarah. Kelebihan utama pendekatan berasaskan VR dalam projek ini ialah fleksibiliti dan skalabilitinya. Pengalaman VR boleh digunakan pada tempoh dan tema sejarah yang berbeza, menjadikannya alat serba boleh untuk institusi pendidikan. Aplikasi VR juga boleh dikemas kini dengan mudah dengan kandungan baharu, jadi ia kekal relevan dan menarik untuk pengguna dari semasa ke semasa. Secara keseluruhan, projek ini menunjukkan bahawa Realiti Maya ialah alat yang berkuasa untuk pendidikan sejarah. Dengan menjadikan sejarah lebih mengasyikkan dan interaktif, pengalaman VR menjadikannya lebih mudah diakses dan menyeronokkan untuk pelajar moden. Hasil projek ini adalah untuk pendidik dan pembangun menggunakan kaedah pengajaran mereka, untuk menginovasi pendidikan untuk era digital.

ACKNOWLEDGEMENT

Alhamdulillah, all praises to Almighty God for the opportunity to complete this thesis just in time. Even though, I have face with a lot of difficulties along this task, He guided me to in the right path and I could not be more grateful.

Then, the completion of this thesis will not be possible without the help of my awesome supervisor, Mr, Ikmal Faiq Albakri bin Mustafa Albakri. Without his kind direction and proper guidance, this thesis will not be shaped completely as it would be today. Not forgotten to University Teknikal Malaysia Melaka for the opportunities and guidance especially in terms of research facilities and related support.

iv

TABLE OF CONTENTS

LIST OF TABLES

TABLE   **TITLE**   **PAGE**

LIST OF FIGURES

LIST OF ABBREVIATIONS

Type equation here.   -

    -

    -

    -

    -

    -

    -

LIST OF SYMBOLS

Type equation here. -

-

-

-

-

-

-

-

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1   Background

Keeping and sharing old knowledge is really important for making sure
our culture sticks around and for helping the next folks get why the past is key.
The way we often teach about the old days using books and talks just does not
grab today's people, who want more hands-on and cool stuff. If we tell stories
with pics, vids, and fun bits, it works way better for students (McIver, 2016). If
we add VR, it gets even better, 'cause it puts folks right in the scene and makes it
fun to learn about old times. It's been shown that VR can make school more fun
and help folks learn more (Korallo, 2010; Yildirim, Elban, & Yildirim, 2018).

When it comes to the past of Malaysia, VR is a cool chance to save and
show all the neat stuff that's come from the mix of folks and their ways. By using
VR for cool trips through time, we can help folks learn in a fun way about
Malaysia's past and get more close to what we come from (Remolar, Rebollo, &
Fernández-Moyano, 2021). This lines up with the new way we teach, which wants
folks to learn by doing and thinks tech can help with that, making school fit more
folks and work better for them (Ibrahim, Al-Rababah, & Bani Baker, 2021;
Soroko & Lytvynova, 2021).

1

1.2   Problem Statement

Young people today are not very interested in studying history using old-fashioned ways like books and things that don't move. This is a big problem because it means they don't know a lot about what happened in the past and the things that make their culture special. Books are boring for them and this makes it likely that they will forget about important things that happened in history. To fix this, we need to use cool technology like VR to tell stories about history in a way that is fun and exciting. When we use VR, we can show history in a way that young people really like. Many studies have proved that using VR helps students to like history more and understand it better.

1.3   Research Question

This research aims to propose an immersive Malaysian historical visual storytelling experience in Virtual Reality (VR) with the goal of raising awareness about Malaysian history while giving an unforgettable experience of stepping into the past. Specifically, the objectives are as follows:

i) How does the use of virtual reality (VR) technology enhance the understanding and retention of Malaysian historical events among teenagers and adults compared to traditional learning methods?

ii) What are the key elements of storytelling that effectively engage users in a virtual reality environment, and how can these be applied to narrate Malaysian historical stories?

iii) What impact does an immersive VR experience have on the interest and motivation of users in learning about Malaysian history and culture?

1.4 Research Objective

The main aim of this research is to create immasive and engaging Virtual Reality experiences enhances the learning and appreciate. Specifically, the objectives are as follows:

i) To study various Malaysian historical stories and how it can be enhance in Virtual Reality.

ii) To develope stories for VR that teach about history and culture in a fun way.

iii) To evaluate how VR experiences effect people's learning and interest in Malaysian history stories.

1.5 Scope of Research

The scope of this research are as follows:

- Research and compilation of accurate historical facts.

- Collaboration with historians and VR experts to create authentic 3D representations of historical events.

- Development of the VR environement using advanced software.

- Testing and evaluating of the VR tool with a diverse group of users to assess engagement, usability, and learning outcomes.

- Analysis of potentiol limitations and challenges in using VR for educational purpose

1.6   Thesis Outline

Based on the objectives previously presented and on the approach proposed before, this thesis is made up of (6) chapters, which contents are summarized as follows:

- Chapter 1 elaborated the introduction of the research project, covering the problem background, problem statement, research aim, objectives of the research, research scopes, and the significance of the research.

- Chapter 2 discussed the literature review of the research, including the analysis of past research on virtual reality applications in education, with a focus on historical storytelling and related issues.

- Chapter 3 explained the research methodology of the research. This chapter presented the research methodology framework that consists of several vital phases, acting as the research guideline to sort the implementation process to achieve the research aim and objectives.

- Chapter 4 presented the implementation of "Immersive Malaysian Historical Visual Storytelling in Virtual Reality." The details of each approach are explained succinctly.

- Chapter 5 Chapter 5 discussed the testing and evaluation phase, including the feedback from users and the effectiveness of the VR tool in enhancing historical knowledge retention and engagement.

- Chapter 6 summarized the findings, discussed the limitations of the study, and provided recommendations for future work in the field of VR-based education.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This part talks about the study of "Immersive Malaysian Historical Visual Storytelling in Virtual Reality. It starts with why it is important to keep historical and cultural things, especially in Malaysia. It also says how it is hard to get people interested in history with how things are usually taught. Then it talks about how can use virtual reality (VR) to teach people about history. It says VR is good for learning and talks about past projects that used VR to tell historical stories. Finally, it looks at what has been learned and what it means for making the VR experience they want to make.

2.2 Immersive Storytelling and Virtual Reality

Immersive storytelling is the combination of narrative techniques and interactivity alongside new types of media has lately become a massive interest area. With VR, people are placed in their stories (within the plot) allowing them to interact with people and objects around them thus making it a different experience altogether. According to some studies conducted by Slater (2017) or Lanier (2018), immersion experiences such as those offered by virtual reality enhance user commitment, emotional links between users and what they see, and success during holding back information from different angles altogether.

2.2.1 Definition and Principles of Immersive Storytelling

The principles of immersive storytelling are presence, interactivity, and narrative agency; this section outlines them in details. Immersive storytelling is creating narratives that draw users into their own worlds using technology as a means for establishing multi-sensory experiences.

2.2.2 Technological Advancements in VR for Storytelling

It will also look at the emergence of platforms like Unreal Engine 5 that have made it easy to create complex virtual environments. In addition, technological advancements that enable immersive storytelling such as high-resolution displays, motion-tracking systems, and spatial audio will be discussed.

2.3 Virtual Reality in Education

In schools and universities across the world, virtual reality (VR) is becoming an integral part of teaching because it simulates real-life surroundings and makes lessons motivating. In this fragment we assess how VR influences education by considering its consequences for learning achievements and students' involvement levels.

2.3.1 The Role of VR in Enhancing Learning Outcomes

VR enables exciting learning experience that can't be replicated in any traditional classroom, and thus improved academic performance is a practical possibility. This section reviews research on the effectiveness of virtual reality in improving memory, comprehension and application skills (Dalgarno & Lee, 2010; Merchant et al., 2014).

2.3.2 Case study of VR in Historical Education

There are multiple instances that show how VR can be used to teach history. The VR applications like "Anne Frank House VR" and "1943 Berlin Blitz VR" have successfully involved students in learning about particular historical events. The analysis of these cases reveals the potentials and limits of virtual reality in teaching history.

2.4 Extended Reality

Since a long time, divers sorts of technology that make immersive spatial interfaces such as virtual reality (VR), augmented reality (AR), and mixed reality (MR). Recently these technologies have been broadened their field from laboratories or specialized areas to civil defense, civil aviation, emergency evacuation planning, education among others while also increasing their utilization in various private sectors.

The major implication is that XR technologies mainly VR are not just about 3D visualizations or photorealistic environments but they create an opportunity for exploring the past through folds where movement in both time and space is possible by allowing the viewers perception of those areas to change with respect to perspective. Thus one can have

historical awareness through XR which gives them almost same feeling and whereabouts as the actual world. This advancement in technology proves how specifically VR can create an immersive narrative experience that no other art medium has ever provided by allowing us to live out history itself.

2.4.1   Extended Reality Technology

Extended Reality, in well-known terms XR, refers to three types of immersive media that are different namely- Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR). These have their own specific uses and applications. In fact, XR technology started as early as the 1960s when Charles Wyckoff submitted his patent for silver halide "xr" film meant to be used in recording events with light brighter than that from the sun: for instance nuclear explosions.

2.4.1.1   Virtual Reality

In the middle of the twentieth century, Virtual Reality (VR) started to take shape when researchers ventured into the field of immersive simulated environments. Creators like Morton Heilig brought forth early concepts of VR such as the Sensorama that were designed in the 1950s for basic immersive experiences with stereo visuals, sound and other senses (Alnagrat et al., 2022). The term "virtual reality" did not attain wide spread recognition until 1990s; a decade which witnessed great advancements in technology that made these earlier dreams possible. It was not until the 1990s that there was an explosion of interest in VR as companies such as Sega and Nintendo developed gaming systems

utilizing this form of technology (Alnagrat et al., 2022). However, these initial models were often cumbersome, costly and lacked powerful enough processors to provide fully immersive experiences thus leading to loss of interest by end of decade.

During the 2000s and thereafter, developments in computing power, graphics technology, and mobile devices rekindled interest in VR. By creating affordable and high-quality VR headsets, companies like Oculus that were established in 2012 played a critical role in revitalizing this sector. Nowadays, various industries including gaming, entertainment, healthcare, education and training employ VR technology to give an immersive experience that was once just a fantasy. It was a game-changing moment for the VR industry when Oculus Rift was initially funded by a Kickstarter campaign that netted $2.4 million; thereby making it synonymous to VR technology. Below shows the early release of Oculus.

2.4.1.2 Augmented Reality

Augmented Reality (AR) is a real-life environment where a computer-generated image is superimposed on a screen that the user can manipulate, but does not change the real world. AR is a digital interface that overlays computer-generated perceptual data onto the real environment. Augmented reality was first defined in 1992 by Thomas Preston Caudell who was a researcher with Boeing and by concluding an AR application for viewing assembly diagrams (Arena et al. , 2022). AR technology employs software, application, and hardware like, AR glasses that overlay digital information on top of real-life images. The basic functions of AR encompass making direct or even indirect links between offline surroundings and the digital information shared by a device (Arena et al. , 2022).

2.4.1.3 Mixed Reality

Mixed Reality (MR) is an advanced technology that integrates a live view of the physical environment with an overlay of interactive virtual objects, allowing users to engage with the digital world as if it were part of their real surroundings. According to Rokhsaritalemi et al. (2020), three key features define any MR system: the combination of real-world and virtual objects, real-time interaction, and the ability to map virtual objects onto real-world objects to facilitate interaction between them. For example, in a mixed

reality setting, a user can physically hold a real-world object, such as a water bottle, and use it to interact with a virtual character in a game. This blend of imagination and reality creates a deeply immersive digital experience. Figure 2.7 below illustrates the framework of mixed reality.

2.4.1.4 Difference between VR, AR, MR

2.4.2 Application of XR Technology in Education

Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) – collectively known as Extended Reality (XR) technology – have potential in the area of education. XR can help foster effective hands-on training that is not necessarily possible in real-life scenarios or contexts. For instance, through VR, learners can take virtual tours to ancient structures, other planets, or even the human body to gain real-life experiences apart from the text.

AR enriches the learning experience by integrating virtual information on real-life items. This may contain diagrams that the student has to complete as a part of the lesson, a 3D model of a certain phenomenon, or real time data that makes complex concepts easier to grasp. For instance, AR applications can transform a learning point into a fun area where the learners can engage an imaginary space that can improve their understanding of the subjects like biology, chemistry, or geometry.

While MR is quite related to both AR and VR, it incorporates the features of both in order to be even more engaging and immersive to the learners. Students can perform actions with objects in the classroom environment, which helps to apply the appropriate theoretical concepts easily. For example, MR can be adopted in engineering and design classes in a manner that enables students to model actual prototypes with real materials as well as those in the virtual world.

In conclusion, XR is a multifaceted technology that offers diverse approaches to learning that is effective, engaging, and creative in delivering educational content and reaching students. Thus, with the help of XR, educators get a unique opportunity to provide students with effective, practical, and appealing educational experiences.

2.5   Existing System

Pre-established ways of conveying information about Malaysian history are normally through verbal presentations, printed material, and classroom debates. Students also use textbooks that contain historical information, and teachers tell the class stories or explain important events and people. Discussions help in analyzing various aspects of history in class, while objects like maps or photographs add depth to the discussion.

On the other hand, the use of virtual reality provides an engaging means of learning Malaysian history. The use of VR technology can make it easy for students to be placed in the historical scenes and historical setting physically. This method takes the opportunity of

an environment wherein the student can visit actual historical places, meet actual historical characters, and take part in historical occurrence as they take place. Virtual reality promotes learning by increasing students' involvement and adding a perspective that contributes to spatial learning.

2.5.1 Textbook

Textbooks utilized in educational settings for historical study contain extensive details and visual elements. These materials present information chronologically or thematically, covering numerous historical events, figures, and concepts. Incorporated within are features such as questions and activities designed to reinforce learning. However, textbooks may not effectively engage all learning styles due to their static nature. The fixed format can limit interactivity and may not appeal to students who prefer more dynamic or hands-on approaches to learning. Despite providing comprehensive content, the effectiveness of textbooks in history education can vary depending on individual learning preferences and the specific layout and presentation of the material.

2.5.2 Lectures

Teachers talk about history in class using pictures and notes. This helps to explain hard things and give meaning to past events. Also, students can ask and talk about it. But some people do not like this way of learning. If the teacher is good and the students listen, it works well.

2.6 Comparison of Existing System

Feature	Traditional Methods	VR-Based Methods
Interactivity	Low	High
Immersion	Low – relies in text, images and videos	High – creates a sense of presence and realism
Engagement	Often passive and less engaging	Highly engaging through active participation
Retention	Moderate - depends on reading and listening	High – improved retention through active participation

Learning style	Primarily auditory and visual	Multi-sensory – auditory, visual and kinesthetic
Flexibility	Fixed content and pace	Adjustable content and pace bae=sed on user interaction
Feedback	Limited – primarily through assessment	Immediate – Interactive feedback within the VR environment
Accessibility	Wide – requires basic learning tools	Limited – requires specific VR hardware and software
Cost	Generally low	Potentially high initial cost for VR setup
Adaptability	Less adaptable to different learning paces	Highly adaptable to individual learning needs

CHAPTER 3

METHODOLOGY

3.1   Introduction

In This chapter outlines the methodology employed to develop and evaluate the Virtual Reality (VR) experience focused on Malaysian history. The aim is to develop a helpful and interesting tool using VR to improve learning. The steps taken for content research, VR development, and testing are discussed. The setup, measurements, equipment used, and any issues encountered are also described.

The methodology is important. The approach integrates history with new technology to make learning enjoyable. Continuous improvement is achieved through feedback and the adoption of new technology. This section provides a clear view of all the steps and the rationale behind their selection.

The plan, the tests conducted, the criteria used to evaluate the VR, the tools and software employed, and the challenges faced are covered. This structured approach ensures the VR experience is engaging and beneficial for a diverse audience.

3.2 Research Design

The plan for this project consists of multiple parts, each crucial for creating an engaging and educational VR experience. The initial phase involves gathering information about Malaysia's history and culture. This involves examining books, shows, and research papers. Collaboration with history professionals ensures that the information is accurate and relevant for the audience. This phase establishes the foundation for the subsequent steps.

Following the information-gathering phase, the collected facts will be used to create an immersive VR world. The narrative flow and user interactions will be carefully planned. 3D models and animations of historical sites, artifacts, and figures will be developed using advanced tools. High-tech software will be employed to achieve realistic visuals. Interactive elements will be integrated, allowing users to engage and explore as they navigate the VR environment. Each aspect of the VR world will be meticulously designed to be both educational and enjoyable.

3.2.1 Proposed Methodology

The proposed methodology outlines a systematic approach to developing and evaluating the VR-based educational tool for Malaysian history. This methodology ensures that the project is structured, thorough, and capable of achieving its objectives. The key components of the proposed methodology include the experimental setup, parameters, data collection, data analysis, and identification of potential limitations.

3.2.2 Experimental Setup

i) Design of experiments to evaluate the VR experience.

ii) Setup includes hardware like VR headsets and controllers, and software like VR development platforms (e.g., Unity or Unreal Engine).

3.2.3 Parameters

Defining parameters for the experiments, such as duration of VR sessions, types of historical narratives presented, and user demographics.

3.2.4 Limitation of Proposed Methdology

i) Discussing potential limitations of the proposed methodology.

ii) Addressing issues such as technical challenges, user variability, and the scope of historical content covered.

18

3.3   Summary

This This part detailed the creation of a Virtual Reality (VR) experience for learning about Malaysian history. It began with the project's aims and the need to combine history with modern technology to create an engaging educational tool. The plan was outlined, from researching historical facts and collaborating with experts to building 3D worlds using advanced software. The setup for testing and the technology used were described. Measures were established to assess user engagement, usage frequency, and retention of historical knowledge. The necessary gear and software for a high-quality VR experience were listed. Potential limitations were discussed, including technical issues, variability among users, and the scope of content created. Overall, this section provided a solid foundation for understanding the development of a VR experience.

CHAPTER 4

IMPLEMENTATION

4.1   Introduction

This chapter explained the implementation of theimmersive Malaysian historical visual storytelling in vietual reality based on the methodology discussed in Chapter 3. The implementations are discussed in detail for each phase.

4.2   Phase 1 Pre Production

In this phase, the proposed research commenced with creating a template for the project using Unreal Engine 5.3 as the main software of the research. The initial process includes preparing character model sketches, environment sketches and element assets that need to be used.

4.2.1   Design

First world is design for main menu and first level after start the game. For main menu, consist of 3 user widget actor placed in the world which is start, control and quit button.

Main menu level in a game is the initial screen or interface that user encounter when launch the game. It serves as a hub from which players can access a button. The

control button will lead user to a widget "how to use controller" with description on how the button are mapped and what are the input method used.

The level 1 acted as an introduction level for user to explore the room and search for 2 different book that will lead to the second level. In the room have 2 different book which is mean have 2 different story of animation. First book 'Leftenan Adnan'is located near the television while the second book 'Parameswara' is located on the bed.

The level 2 have two same level but different type of Malaysian history animation will display. For the first one is short animation of Leftenan Adnan and second is short animation of Paramesawara.

Level 3 have 2 different 360 world video. This world is a 360 video which is user will start this level at the center and can rotate 360 degree to feel like in the video.

4.2.2 Game Mechanics

The game mechanics for a VR project are almost identical to a normal game project in Unreal Engine with a little modification to the enhanced input like movements and actions. The proposed research pickup and drop items. For pickup and drop item, user need to use the button on the index finger and 3 fingers below the index finger. For movement just use the left joystick.

4.3 Phase 2-Production

In the second phase, the production process is carried out in the research. This phase includes the making of model character using a ready player me, movement animation by using mixamo, GUI and some custom animations for progressing the animation.

4.3.1 VR Project

The second objective of the research is to develop an immersive simulation game using VR of how autistic individuals go through their daily life. The setup of the proposed research is also presented.

4.3.1.1 Motion Controls

For locomotion movement, the VR pawn must be configured properly. The suggested input method begins by creating an input action blueprint named "XAxis" for simulating left and right movements and "YAxis" for simulating forward and backward movements. These inputs will be connected to a default "enhanced input" system based on the virtual headset controller's button mapping.

Following the steps outlined above, the input must be activated within the VR pawn to ensure the control scheme functions correctly. By invoking the "YAxis" and "XAxis" inputs, the controller can operate smoothly with the headset-mounted display (HMD) and align with the head's rotational orientation.

4.4 Summary

The implementation of the research methodology mentioned before in Chapter 3 was discussed further in this chapter. The implementation of mmersive Malaysian historical visual storytelling in virtual reality were explained in depth especially in term of the procedures and executions.

CHAPTER 5

RESULT AND EVALUATION

5.1   Introduction

This chapter delves into the comprehensive results and detailed evaluation process conducted during the study. The focus is on the insights gathered through the use of questionnaires, which were designed to capture feedback from both users and experts during the testing phase. Specifically, the System Usability Scale (SUS) was employed to assess overall usability, while pre- and post-Session Simulator Sickness Questionnaires (SSQ) were used to evaluate any potential discomfort or symptoms experienced before and after the virtual reality experience. By analyzing the responses from both user and expert perspectives, a thorough understanding of the system's performance, user satisfaction, and the effectiveness of the virtual reality storytelling is provided. This chapter presents these findings in detail, highlighting key trends, observations, and areas for improvement based on the collected data.

5.2   Quantitative Analysis

The quantitative analysis was conducted in this phase. The research proposed method is evaluated for the usability and simulation sickness study. The first method is to test the usability using System Usability Scales (SUS) method. Lastly, participant susceptibility is evaluated using Simulation Sickness Questionnaire (SSQ) to see if the participant gets any sickness when using the VR headset with proposed research input method.

24

5.2.1 Participants

This section presented the results of participants' background. 25 participants were recruited. The participants are 15 males (60%) and 10 females (40%).20 of the participants are students at Sekolah Berasrama Penuh Integrasi Rawang and 10 of the participants are Degree students from different university. The all highschool participants' ages are 17 while the degree students are 22 to 25.

5.2.2 SUS Results

Twenty five participants who participated in testing the research proposed method are picked and have filled in the SUS survey forms. Table 5.1 shows SUS results with the total result and the SUS means scores. Q stands for SUS number items while P stands for participants' number. Based on the result of the usability study, the SUS scores results are 68.7. Based on the Table 3.2 in section 3.5.1.2, the result shows that the research proposed method falls in grade B and has good usability scores.

Table 5.1   SUS scores from 25 participants for the proposed research method

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Final Score
P1	4	3	3	4	3	2	4	2	3	3	57.5
P2	3	2	3	3	3	3	4	2	4	3	60
P3	5	3	4	4	3	4	4	4	5	4	55
P4	4	1	4	1	4	2	5	3	4	1	82.5
P5	3	2	4	2	4	1	4	3	4	2	72.5
P6	2	3	4	2	4	2	4	2	4	3	65
P7	3	2	4	3	4	3	4	4	4	4	57.5
P8	4	4	5	2	5	1	5	1	5	2	85
P9	5	1	1	1	5	1	4	1	4	1	85
P10	4	2	5	4	3	2	5	1	5	5	70
P11	3	2	3	3	4	2	4	3	4	2	65
P12	5	1	2	3	5	1	4	1	5	4	77.5
P13	5	5	5	3	5	1	5	1	5	4	80
P14	3	2	3	4	5	4	3	3	4	2	57.5
P15	5	4	1	4	4	3	5	5	4	5	45
P16	4	1	4	3	5	1	5	5	5	2	77.5
P17	5	3	4	4	5	2	5	4	4	1	72.5
P18	5	3	4	2	5	3	5	4	5	2	75
P19	5	2	4	2	5	2	4	3	5	2	80
P20	4	2	3	5	4	3	3	3	4	4	52.5
P21	5	1	5	1	5	2	5	3	5	2	90
P22	5	2	4	4	4	2	4	5	5	5	60
P23	4	3	4	4	4	1	4	4	4	3	62.5
P24	4	3	5		5	2	5	2	4	3	75
P25	4	3	4	3	5	5	4	2	4	5	57.5
Average											68.7

5.3 Qualitative Analysis

One experts were chosen from Universiti Teknikal Malaysia Melaka and another two is historical teachers from Sekolah Berasrama Penuh Integrasi Rawang. A set of questionnaires was prepared to obtain general information based on virtual reality and history points of view. The questions consist of 5 points Likert scale rating and are open-ended. The Likert scale is from strongly disagree to agree strongly. The question is asked about the experience effectively, suitable for educational purpose, accurated and well-researched, good representation, and easiness of usage. An open-ended suggestion was prepared at the end of the questionnaire for the experts to give comments and suggestions to improve storytelling VR application further.

5.3.1 Result of Expert Review

Expert testing involved a select group of VR specialists and usability experts. These participants were chosen for their extensive experience in evaluating virtual environments and their ability to provide in-depth feedback on system performance. The expert testing followed a similar procedure to the user testing, with additional emphasis on technical and design aspects.

Figure 5.2 Expert evaluation on usability questionnaire.

5.4 Result and Analysis

Overall, the proposed research method shows positive outcomes from the usability scores and the simulation sickness results. The participant's feedback also strongly suggested that the VR application must be applied in educational methods. The experts also give good results and opinions for Malaysian historical visual storytelling in virtual reality. Lastly, the proposed research has presented the Malaysian historical visual storytelling in virtual reality to experts in the educational field, the public and lecturers from the Faculty of Information and Technology. The following section discusses the limitations and future works of the proposed research method.

CHAPTER 6

PROJECT CONCLUSION

6.1   Research contributions

So this section gives an overview of what we found out during our research and VR development concerning historical storytelling in Malaysia. The objective of this project was to investigate new methods of presenting Malaysian history by using Virtual Reality (VR), create captivating educational materials, as well as assess how these virtual reality experiences affect students' interest in and understanding of Malaysian history.

Research objective 1: To study various Malaysian historical stories and how it can be enhance in Virtual Reality.

There are several methods to enhance the depiction of Malaysian historical narratives in VR environments, which this study will explore. Much of the existing research has concentrated on historical storytelling using conventional media while little has been done to examine the immersiveness of VR technology for engaging users with history. Most current Historical VRs lack interactivity and substance, thereby offering limited perspectives for their users. Ways in which user experience can be improved include advanced Virtual Reality techniques like 6 Degrees of Freedom (DOF) for movement control as well as interactive narrative formats. Free navigation within virtual environments is provided through a locomotion-based movement technique adopted by this project enhancing authenticity in

historical exploration. more engaging and educational VR experience aimed at enabling users to thoroughly experience both virtual and real histories while serving as an alternative to conventional methods of learning about history By looking back at past studies related to historical narratives in virtual reality and their educational impacts, this study has been founded.

Research objective 2: To develope stories for VR that teach about history and culture in a fun way.

The aim of this research is to develop and create VR-based stories that educate and entertain about Malaysian history and culture. Even though there have been earlier attempts at telling historical stories using different media, dynamic storytelling that is both educational and entertaining through VR is still an unexplored area. Most current methods are based on static presentations or videos which cannot engage users or aid their learning capacity. The objective of the current research is to produce interactive VR tales that utilize sophisticated narrative techniques and all-encompassing settings as additional stimuli for their audience. This initiative uses virtual reality's potential for interactivity characterised by branching storylines and total interactivity in 360° environments to achieve more attractive learning possibilities. Various narrative designs are examined as well as some interactive aspects intended to inspire user participation and improve memory retention of past events. With these aspects in mind, this investigation seeks a new direction in history education, which should be both enjoyable and significant. This study also looks back at past research on educational VR experiences focusing on how interactive storytelling is environmentally friendly when it comes to carpets made from a virtual world

Research objective 3: To evaluate how VR experiences effect people's learning and interest in Malaysian history stories.

The study aims to one end only - evaluate how VR progresses the learning outcomes and interests in Malaysian history. It is true that history has been taught using different tools, but the effectiveness of VR as an educational medium for historical content remains under-researched. On the contrary, traditional forms of education do not catch most users' attention as much as this new-age type does; therefore they leave much to be desired from perspective of user engagement and retention of learnt facts. This research attempts to analyze user's reactions concerning various historical scenarios available through VR; which include aspects like interactivity and immersion affecting their learning experience alongside interest within those topics offered. The techniques for measuring the effectiveness of VR in improving historical knowledge or maintaining user interest include qualitative and quantitative methods, such as user surveys or cognitive assessments. For this reason, the research intends to provide insights into the pedagogical value of VR in history education and suggest improvements for future VR educational tools. Previously conducted studies on the influence of virtual environments on education and motivation are reviewed in order to fortify research findings.

6.2 Limitation

Based on the observations, there are several limitations to the proposed method that need to be addressed for future improvements. Firstly, the current PC setup does not have enough processing power required for rendering high-quality animations at 4K or 8K resolutions. Rendering in high resolution is demanding of a lot of resources including strong graphics card and enough RAM which this particular system lacks. This limit therefore leads to reducing output resolution of animations thus affecting their visual effects and overall user interface in a virtual reality environment. At the same time, this failure to render high definition moves a project away from the full usage of capabilities offered by modern day VR headsets that are meant to show crisp and clear images. Low-quality textures or less defined scenes might be observed by users thereby impacting on virtual reality experience in terms of both immersion and realism.

On the other hand, due to huge sizes of files and high-quality assets, it experiences many sudden halts. VR projects frequently include complex 3D models; highly detailed textures; elaborate environmental effects that need large storage space as well as memory to manage properly and effectively. Whenever an asset's quality is too good or file size is excessive this will stress system memory and CPU causing instability or crashes. This does not only interrupt the entire development process but also risks data loss which can further stall any progress. A way to solve this problem would be if we were able to improve asset quality without compromising size by compressing textures, reducing models' complexity where possible or getting rid of minor features that don't affect the user experience much at

all. A possible option is breaking down the task into smaller segments, thereby helping reduce some of the pressure on the computer system.

To commence playing the game, a fresh calibration of the VR system is required which is another challenge. Users' height would be detected by way of measuring the distance from the eye level to the floor, this forming part of the proposed research method. That way, it becomes difficult for shorter than 140 cm or taller than 170 cm players, since this game is meant to represent a child's point of view. Individuals' heights may therefore lead to difference in experiences when playing a video game: such as seeing characters' different sizes or reaching objects. As such, players must adjust their heights using the built-in calibration feature found in headsets before starting the game.

6.3 Future Work

For future work, The rug must include an overall approach to the overall realism of the VR project in order to make considerable progress on this matter. It is important here to upgrade the character modeling such that they have life like proportions and facial structures as well as subtle body movements and expressions. With advanced animating techniques and tools, characters can show a full range of emotions and interactions that are appropriate for any historical context. Also, to create a truly immersive experience it is critical to improve the environmental details. This will involve adding quality textures, lighting effects that resemble real life scenarios, along with ancient artifacts that help evoke the right feeling

about our past days. When paying attention to these issues, the project will deliver a more realistic and interesting representation of history bringing its users closer to it through experiential learning opportunities.

The proposed research can be enhancing rendering quality is of utmost importance to attain a refined and esthetically pleasing virtual reality (VR) experience. It includes upgrading the graphics engine so as to produce fluid animations and clearer images. High resolution textures, sophisticated shading techniques and increased frame rates are essential for making sure that the visual components of the VR application are sharp and smooth. If rendering technologies are improved and performance optimized, users will experience less visual artifacts as well as more fluid transitions, leading to an enjoyable and immersive experience. Higher rendering quality leads to better engagement by users in addition to minimizing motion sickness; thus creating a more comfortable virtual environment with realistic feel.

Lastly, what can be improve in future work is incorporating a variety of interactive elements in the VR application is essential for improving its engagement and immersion. This may involve adding more interactive objects, characters, and scenarios that enable users to be actively involved in the storytelling. For instance, interactive learning tools, decision-making scenarios as well as hands-on activities can make learning more dynamic and memorable. Creating opportunities for users to meaningfully engage with the content (especially students) can help them develop a deeper understanding of history and retain it.

More interactivity makes not only the experience more pleasurable but also accommodates different learning styles while stimulating learners' active participation in education.

REFERENCES

Yildirim, G., Elban, M., & Yildirim, S. (2018). Analysis of use of virtual reality technologies in history education: A case study. Asian Journal of Education and Training, 4(2), 62-69.

Remolar, I., Rebollo, C., & Fernández-Moyano, J. A. (2021). Learning history using virtual and augmented reality. Computers, 10(11), 146.

Ibrahim, A., Al-Rababah, A. I., & Bani Baker, Q. (2021). Integrating virtual reality technology into architecture education: the case of architectural history courses. Open House International, 46(4), 498-509.

rallo, L. (2010). Use of virtual reality environments to improve the learning of historical chronology (Doctoral dissertation, Middlesex University).

Dixon, S. (2006). A history of virtual reality in performance. International Journal of Performance Arts and Digital Media, 2(1), 23-54.

McIver, G. (2016). Art history for filmmakers: The art of visual storytelling. Bloomsbury Publishing.

Dusi, N., Ferretti, I., & Furini, M. (2017). A transmedia storytelling system to transform recorded film memories into visual history. Entertainment computing, 21, 65-75.

Farmer, A., & Cooper, C. (2002). Storytelling in history. In History and English in the Primary School (pp. 35-51). Routledge.

Carvalho Mano, R. M. (2019). The benefits of Virtual Reality in Education (Doctoral dissertation, Hochschule für angewandte Wissenschaften Hamburg).

Soroko, N. V., & Lytvynova, S. H. (2021, September). The Benefits of Using Immersive Technologies at General School. In International Conference on Information and Communication Technologies in Education, Research, and Industrial Applications (pp. 247-257). Cham: Springer International Publishing.

Appendix A Pre-Test Questionnaire

Faculty/School:

_____

Highest Qualification: High School / Bachelor's Degree / Master / PhD / etc.

Gender: Male / Female

Do you have any experience with VR before this? Yes / No

If yes, state the device you have used before:

_____

Dominant Hand: right-handed / left-handed

Please answer the Simulator Sickness Questionnaire (SSQ) question below:

No.	Question	1 None	2 Slight	3 Moderate	4 Critical
1	Do you feel pain before using the VR app?				
2	Do you feel tired before using the Vr app?				
3	Do you feel headache before using the VR app?				
4	Do you have eyestrain before using VR app?				
5	Do you feel is it difficult focusing before using VR app?				
6	Do you feel you want to vomit before using the app?				
7	Does your head feel heavy before using the VR app?				
8	Is the VR app look blur to you?				
9	Do you feel a loss of balance before using the VR app				

Appendix B System Usability Scale (SUS) Questionnaire

Post-Test

Please answer the System Usability Scale (SUS) question below:

1 – Strongly disagree | 2 – Disagree | 3 – Neutral | 4 – Agree | 5 – Strongly Agree

No	Question	1	2	3	4	5
1	I think that I would like to use this VR system frequently.					
2	I found the VR system unnecessarily complex.					
3	I thought the VR system was easy to use.					
4	I think that I would need the support of a technical person to be able to use this VR system.					
5	I found the various functions in this VR system were well integrated.					
6	I thought there was too much inconsistency in this VR system.					
7	I would imagine that most people would learn to use this VR system very quickly.					
8	I found the VR system very cumbersome to use.					
9	I felt very confident using the VR system.					
10	I needed to learn a lot of things before I could get going with this VR system					

Appendix C Simulation Sickness Questionnaire (SSQ)

Post-test

Please answer the System Usability Scale (SUS) question below:

No.	Question	1 None	2 Slight	3 Moderate	4 Critical
1	Do you feel pain before using the VR app?				
2	Do you feel tired before using the Vr app?				
3	Do you feel headache before using the VR app?				
4	Do you have eyestrain before using VR app?				
5	Do you feel is it difficult focusing before using VR app?				
6	Do you feel you want to vomit before using the app?				
7	Does your head feel heavy before using the VR app?				
8	Is the VR app look blur to you?				
9	Do you feel a loss of balance before using the VR app				

Expert Evaluation

B *I* U ⊂⊃ 𝕏

Immersive Malaysian Historical Visual Storytelling in Virtual Reality: Usability Testing for Experts in Terms of Educational Impact and Historical Representation.

Name *

Short-answer text

Expertise in: *

Short-answer text

The VR experience effectively present Malaysian historical content in an engaging and immersive way. Ex: Realistic environment, historical accuracy, interactive storytelling elements.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

The VR application is suitable for educational purposes. Ex: Enhances understanding of historical events, suitable for classroom use, encourages interest in history.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

The historical content within the VR application is accurate and well-researched. Ex: Historical timelines, cultural representation, authenticity of the environment and characters.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

The application provides a good representation of Malaysian cultural heritage. Ex: Depition of traditional customs, clothing and architecture, inclusion of multiple ethnic groups.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

The user interface and controls of the VR application are intutive and user-friendly. Ex: Easy navigation, responsive controls, clear instruction.

|	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

To what extent does this VR application contribute to the preservation and promotion of Malaysian history? (Consider its impact on awareness, education and cultural appreciation)

Long-answer text

Please provide your suggestion to further improve the VR application in terms of content, usability, and educational value.

Long-answer text

Appendix E Expert Testing (VR Expert)
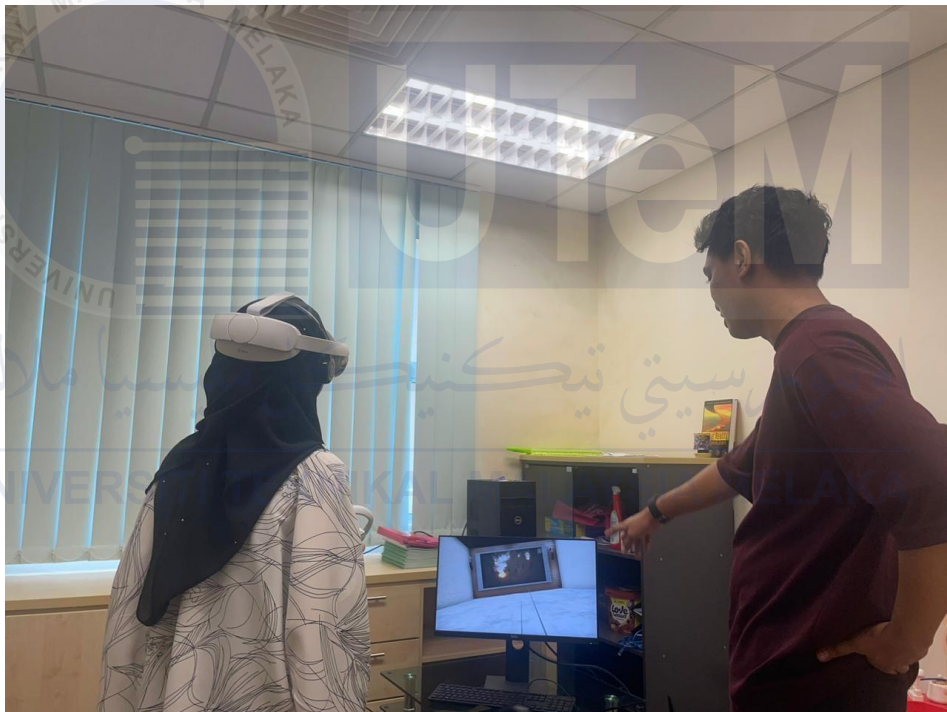
APPENDIX F Expert Testing (Historical teacher)

APPENDIX G USER TESTING

APPENDIX H SHOWCASE (G2DID)

45