



Journal of Advanced Research in Applied Sciences and Engineering Technology

Journal homepage:
https://semarakilmu.com.my/journals/index.php/applied_sciences_eng_tech/index
ISSN: 2462-1943



Profound Emotional Experience in 3D Walk Through: A Resurrection of the Legend of Melaka

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ABSTRACT

In today's technologically advanced society, the majority of information is being disseminated through new media technology. One of the featured technologies is 3D animation using a walkthrough technique. This method aims to provide a simulated improvement of reality in the field of architectural 3D modelling. Despite the widespread use of 3D modelling in projections, the authenticity of historical buildings in Malaysia remains uncertain. Therefore, we have offered a comprehensive analysis of Malay history, specifically focusing on the prosperous Melaka era, using extensive market research data. The objective of this work is to resurrect a realistic experience an authentic representation of the Melaka City Wall, Melaka River, and Sultanate Melaka Palace during the period of Portuguese military colonisation using 3D Walkthrough animation. The authors provide a detailed account of the implementation steps, the methodology used, and the use of extensive modelling to reconstruct the architecture of the historical structure that was demolished. The utilisation of 3D Walkthrough enhances the dissemination of information and educational value of the historic site for the public.

Keywords:

Architecture; Building; Heritage; History; 3D Animation; Melaka; Replica; Unity 3D; Walkthrough

1. Introduction

Walkthrough Animation refers to the deliberate movement of a camera in order to visually present the entirety of an environment or object. This project employs the Walkthrough Animation 3D technique to visually depict the authentic state and architectural architecture of the Melaka Fortress, Melaka River, and Sultanate Melaka Palace during ancient times. Animation has a long history, evolving from an illusionary form to the emergence of anime, 2D animation, and 3D animation [7]. Animation has proven to be a powerful means of visual communication since its inception [11,9]. Animation serves a wide range of purposes beyond amusement, including architectural design and historical preservation. Animation can enhance comprehension of concepts that are difficult to articulate verbally by conveying them in a more profound manner, imbued with emotional significance. The progression of animation has advanced gradually throughout the years due to the time-consuming nature of achieving optimal outcomes in this field.

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This provides a more distinct depiction of the city and river of Melaka during the period of British military control. The Fortress of Melaka, also referred to as A Famosa. The Portuguese constructed the city of A Famosa, which means "Famous" in Portuguese, subsequent to their conquest of Melaka in 1511 [6]. A Famosa is situated in the lower part of the city of Melaka, adjacent to the reproduction of the Palace of the Melaka Sultanate and the Church of St. Paul [19]. This architectural structure is the most ancient example of European construction that remains intact on the continent of Asia. A Famosa is the appellation of a stronghold constructed by the Portuguese subsequent to their conquest of Melaka in 1511. After seizing Melaka, the Portuguese employed coerced labour to construct temporary encampments as a defence against Malay invasions, while simultaneously constructing the stronghold fortress known as "A Famosa" or, formally, the Fort of Melaka (Fortaleza de Melaka). The construction of A Famosa City required a duration of 5 months. A significant number of forced labourers perished during the construction of the city as a result of the intense heat and limited food supply [1]. The city's construction materials were sourced from the remnants of mosques and other structures. In addition to providing an overview of the Melaka City Wall, the project also depicts the state of the Melaka River during that period. The Melaka River is a renowned hub for commerce operations, attracting merchants from as far as European countries. However, the Melaka River has transformed into a tourist attraction. The purpose of this initiative was to redefine the Melaka River during that period.

The Melaka Sultanate Palace is located at the base of St. Paul Hills [19]. This is a reproduction of the palace belonging to Sultan Mansur Shah, who was the ruler of Melaka from 1456 until 1477. The original structure was built in 1985 using information and writings from ancient Malay history [18]. Presently, the edifice functions as a museum, widely recognised as the Museum of Culture [15]. The museum exhibits the historical objects, prints, photographs, and paintings that depict the history of the Melaka Sultanate. This study emphasises the feeling of presence by immersing the user in the environment through the use of 3D Walkthrough animation of historical locations. This allows the user to experience the emotional [5] atmosphere of being in Melaka.

Through the use of 3D walkthrough animation, the objective is to provide a realistic depiction of the Portuguese military colony's Melaka City Wall and Melaka River in order to educate the current generation about the historical significance of the Melaka Wall, Melaka River, and the Melaka Sultanate Palace, which no longer exists.

1.1 Problem Statement

Many tourists from around the world often struggle to mentally grasp the historical significance of the great landmarks they see. They lack the ability to visualise the appearance of the historical setting of the Melaka Fortress and are unaware of the atmosphere of the Melaka River during the reign of the Sultan of Melaka. The creation of this concept was principally motivated by the Sultanate Palace. Even the residents are curious about the precise location of the Palace. The primary motivation for initiating this project was to disseminate this knowledge among the local population. Indeed, there was uncertainty on the accurate design of the Melaka City Fortress due to a lack of knowledge [14]. This issue arises due to the insufficient information available regarding this structure.

Presently, the prevailing 3D animation models in Malaysia predominantly cater to the amusement needs of young children. Consequently, there is a noticeable scarcity of 3D media that explores Malaysian history, culture, and legacy. It is widely acknowledged that certain locations in Malaysia have been officially designated as world historic sites by UNESCO [4]. One of the main areas of interest is the Historic Cities located along the Straits of Melaka. Earlier, a 3D animator reconstructed 3D models of historical Melaka [2]. Prior research was primarily concerned with the construction of historical Melaka, which encompassed the Melaka Sultanate Palace. The old artwork

appears intriguing due to the inclusion of numerous uncertain structures and unconnected models in the depiction. However, it requires updating to align with a more historically accurate representation. This project focuses on creating a 3D representation of the Melaka Fortress, Melaka River, and the Sultanate Palace. The virtual model is one of the historical architecture items accessible in Malaysia.

1.2 Related Work

Malaysia has a deficiency in 3D modelling animation, namely in the areas of historical representation and the restoration of historical landmarks. Several countries have utilised 3D modelling animation to repair ancient landmarks, like the Colosseum (Figure 1) in Rome (Figure 2), Italy [16].



Fig. 1. Colosseum in Rome, Italy before restoring with 3D modelling
Source: [20]

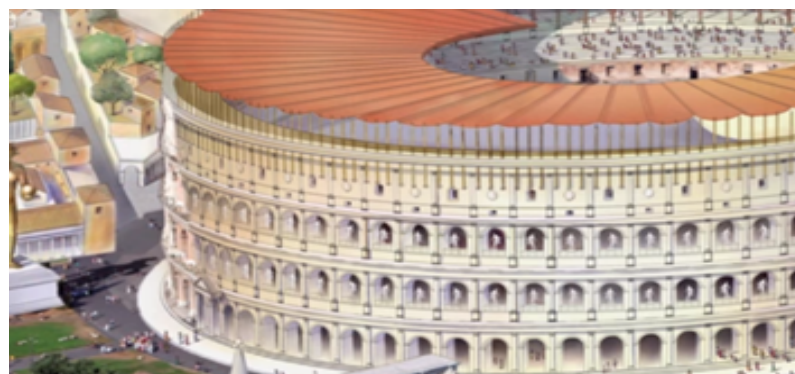


Fig. 2. Colosseum in Rome, Italy after restoring with 3D modelling
Source: [20]

Due to the irreparable damage to half of the colosseum, modern construction methods are unable to reconstruct it. Consequently, certain 3D artists have employed 3D modelling techniques to recreate the colosseum, providing tourists with a comprehensive visual representation of its appearance during ancient times. Similarly, the graph depicting the number of monthly arrivals in tourist accommodations in Italy experienced a significant and rapid increase from mid-2019 [13]. However, in early 2020, it dropped significantly to 4.7% compared to the previous year, primarily due to the global impact of the COVID-19 epidemic. While it is true, the number of tourist visits is steadily increasing by 13% from May to June 2020.

Despite the ongoing pandemic, the utilisation of 3D modelling has facilitated the repair of historical buildings. This has enabled tourists to obtain information and derive value from visiting

sites in a digital format. In addition, 3D modelling facilitates scholarly investigation of historical buildings and structures. Regardless of the circumstances, 3D animation is an essential tool [9] for conveying visual information.

Malaysia is home to skilled 3D artists that specialise in creating detailed 3D models depicting historical events, such as the iconic Kota Melaka. By leveraging architectural expertise, it crafts a visually striking portrayal of the mediaeval Kota Melaka. The artist's efforts in recreating Kota Melaka are remarkable, as they rely on 60% knowledge derived from research and 40% imagination (Figure 3).

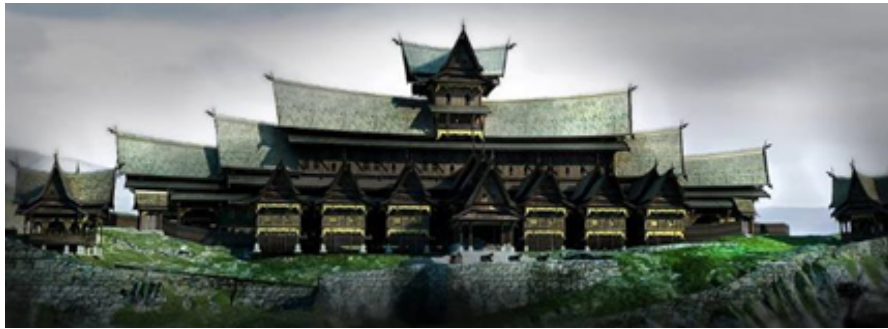


Fig. 3. The 3D modelling of Melaka Sultanate Palace by artist Faizal Rahmat
Source: [21]



Fig. 4. The 3D modelling of Kota Melaka in daylight by artist Faizal Rahmat
Source: [21]

Nevertheless, the 3D representation of Kota Melaka (Figure 4) is not being marketed by the Melaka Government of Tourism due to the project being abandoned, which resulted in the artist taking on the responsibility of completing the artwork independently. This project aims to capitalise on the aesthetic appeal of the authentic Melaka City Wall, Melaka River, and Melaka Sultanate Palace in order to attract tourists to visit Melaka [10].

2. Methodology

2.1 Project Overview

This section provides a detailed explanation of the walkthrough of Melaka City Wall, Melaka River, and Sultanate Melaka Palace in a 3D virtual environment. The ensuing parts outline the 3D model's creation process and real design, which is divided into three stages: pre-production, production, and post-production.

The development process comprises three stages: pre-production, production, and post-production. These three stages are a fundamental notion in the creation of any animated process.

Figure 5 illustrates the progression of creating a 3D Walkthrough showcasing historical sites in Melaka.

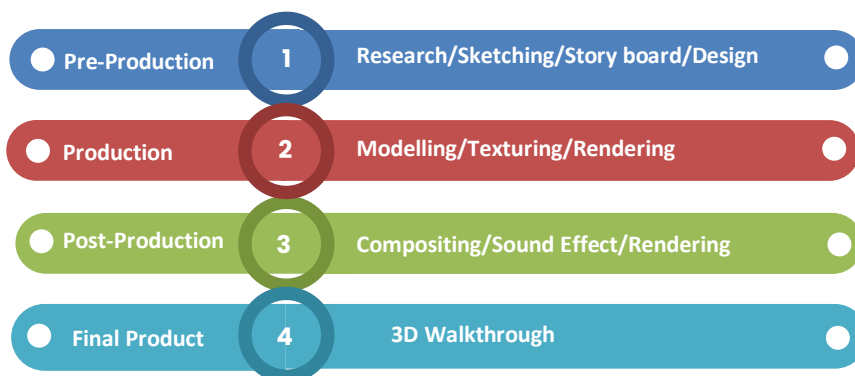


Fig. 5. Development process

A comprehensive investigation of Melaka has been conducted. Initiating this phase is crucial as it addresses the lack of knowledge with the topic matter. Conducting research allows us to acquire historical knowledge and gather facts and information for this study. The majority of the information we acquired was sourced from secondary sources, including journal articles, books [3], and data collected from the Melaka museum. The production specifics are as follows:

2.2 Pre-Production

2.2.1 Data gathering/market research

Conducting market research is necessary to successfully execute the 3D Walkthrough animation project. This is because it aims to uncover the authentic architecture and state of the Melaka Fortress, Melaka River, and Sultanate Palace [12,17], during the Portuguese era.

A study was conducted by conducting research on the architectural construction of the three historical structures located in the Portuguese military colony. This aided us in comprehending the precise architecture of the walls and environs of the City of Melaka [10].

Conversely, information regarding the Melaka Sultanate Palace was obtained from a contemporary facsimile that was constructed in Melaka City. The portrayal of the golden past of the Sultanate era was based on the description and reference from the Malay annals [18].

Facebook has contributed to the acquisition of certain facts regarding the design and history of Melaka. Social media has facilitated the promotion of this project by showcasing the design of the 3D Walkthrough animation from many historical locations.

2.2.2 Target user

The walkthrough animation project includes several specific objectives aimed at disseminating information to the general public about this initiative. The objective of this market is to both broaden awareness of 3D Walkthrough animation and offer insights into the history of Melaka. The consumer demographic priority is the younger generation. The lack of historical knowledge about Melaka [14] is due to the limited understanding of the current generation. Furthermore, by employing 3D animation walkthrough technology, the younger generation will gain a comprehensive and precise comprehension of the historical significance and architectural intricacies of the Melaka Fortress, Melaka River, and Sultanate Palace during the Portuguese era.

Furthermore, the project's intended demographic encompasses both international and local tourists. The initiative facilitates a more intimate examination of the architectural design of the

selected historical buildings and locations for tourists. Additionally, it facilitates travellers in gaining a more precise understanding of the architectural layout of the city of Melaka during the Portuguese military administration. Moreover, the project has the capability to appeal to enthusiasts of 3D design and walkthrough animations. Regarding this matter, the project has the potential to provide enthusiasts of 3D technology with the opportunity to create their own concepts for designing a 3D object or a historical setting for a virtual tour.

Ultimately, field-based observational study was conducted to finalise this project. This approach necessitates meticulous examination of the architecture of Melaka for the relevant topic in the State of Melaka. This strategy was selected specifically due to the significance of study in uncovering the distinction between the former Melaka City wall and the modern Melaka City Wall.

2.2.3 Storyboard

Sketching is a method used to consolidate ideas and concentrate on many aspects and intricacies of a project. Sketching necessitates an idea derived from prior examination of the subjects. Following the collection of research on market users and historical places, as well as the establishment of project objectives, the subsequent task involved strategizing the implementation of the animation. The process commences with the creation of a storyboard. Initial drafts were created using the initial concept of the architecture or model, informed by market research. These sketches encompassed various aspects such as the model's details, architectural elements, and interior and exterior decorations. They served as a translation of these elements into visual representations before the actual modelling process commenced. In addition, the camera angles for each scene of the walkthrough were carefully established and laid out on the storyboard, with the aim of providing consumers with a powerful and deeply moving emotional experience. After compiling the basic sketches (Figure 6), the next stage involved thorough development and polishing.

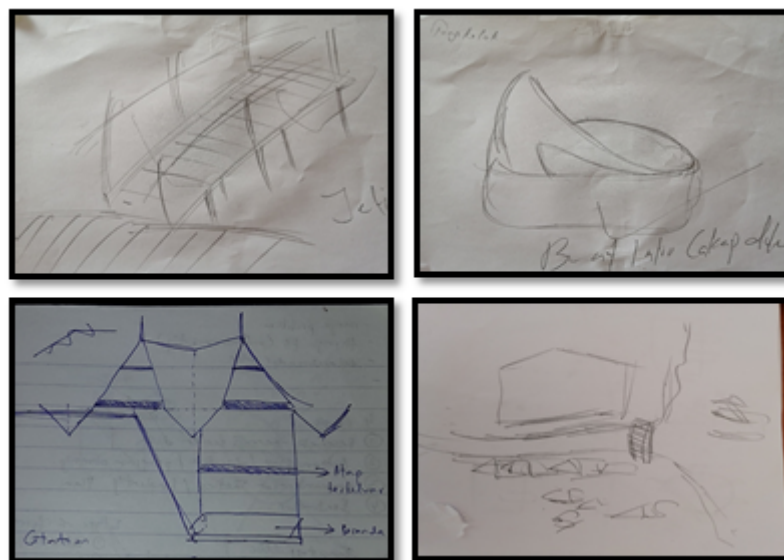


Fig. 6. Samples of sketches

2.3 Production

2.3.1 Modelling

Modelling is the main approach to initiate production through the utilisation of various animation and modelling applications, including Blender version 2.79, AutoDesk 3ds Max 2018, and Lumion 10.

Modelling is the transformative procedure of converting physical items into three-dimensional representations. The modelling process consists of two components: the item and the environment. Object and environment modelling involves the utilisation of two distinct software applications, namely Autodesk 3ds Max 2018. Production is the subsequent stage in the animation creation process, following pre-production. This technique is meticulously adhered to in order to ensure the precise formation of the objects' design. Considering this, texturing plays a crucial role in creating a vibrant experience in the historical period, being equally significant as the ambiance of the specific buildings. Similarly, the situation was replicated based on the previous setting seen in the old images. All the ships, cannons, personnel, costumes, and bridges were created entirely from scratch (Figure 7).

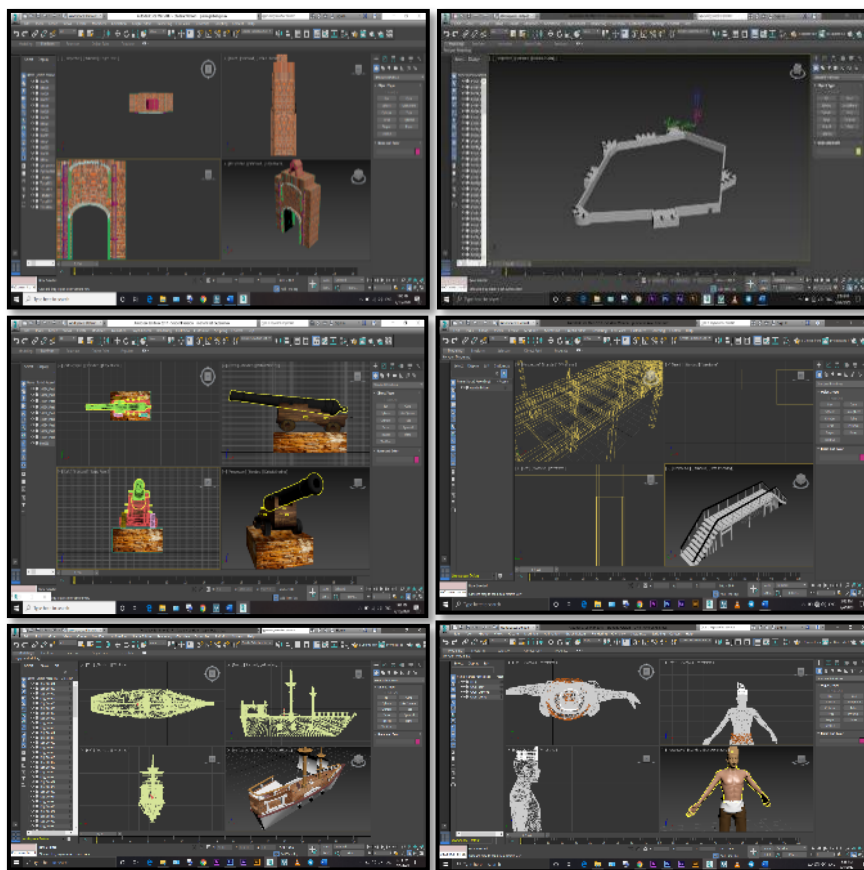


Fig. 7. Examples of 3D models

2.3.2 Texturing

Texturing is the procedure of ascertaining the hue of an entity using the three-dimensional method. This walkthrough animation project utilises two software applications for texturing: 3ds Max 2018 and Lumion 10.0 (Figure 8).

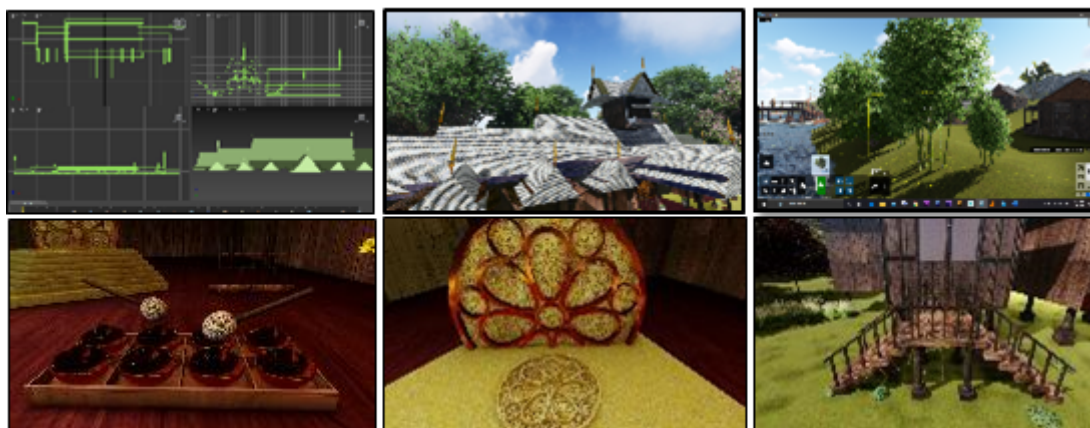


Fig. 8. Texture mapping

2.4 Post-production

2.4.1 Compositing/editing

The final stages of the production of the 3D Melaka Sultanate Palace involve the post-production editing process. Prior to editing, the initial render of the animation is imported into Lumion 8 in order to obtain a brief video clip. The final complete walkthrough video of Melaka Fortress, Melaka River, and Melaka Sultanate Palace is ready for publication, thanks to the use of Filmora 9.0 Video Editor to edit the film. The angles for each scene have been stored in .avi file format. Every scene is imported into Filmora 9.0 with the purpose of combining and connecting them together. The composition was previously reviewed in the storyboard phase to ascertain the specific camera angles and scenes that were integrated. Figure 9 demonstrates the insertion and linking of audio with the scene number to enhance the impact during the walkthrough.

The method commences by generating a fresh composition and assigning a name to the file. Next, we loaded the brief video clip of the palace into the editing interface of the software. Subsequently, we included transitions to enhance the cinematography of the Melaka Sultanate Palace video, resulting in a more seamless visual experience. In order to enhance the watching experience of the walkthrough movie, various instances of background music were incorporated to complement the footage of the palace. In order to create an authentic ambiance reminiscent of the ancient days in Melaka, traditional musical instruments such as Cak Lempong, Serunai, Gong, and Dondang Sayang were employed to incorporate traditional music [8].

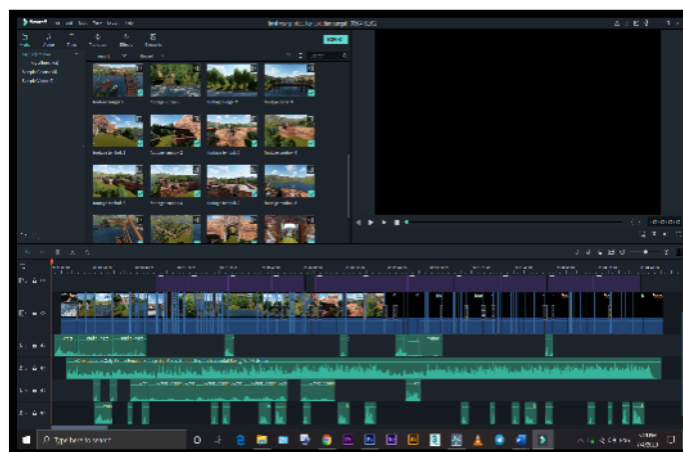


Fig. 9. Compositing

2.4.2 Render

Once all the models have been positioned in their appropriate video timeline, cameras were employed to record all the desired perspectives. Subsequently, the rendering procedure is prepared. This process requires a significant amount of time to complete, particularly when aiming for a superior and high-resolution (HD) quality outcome.

Furthermore, the inclusion of a 3D representation of Melaka Fortress, Melaka River, and Sultanate Palace is expected to provide advantages to various stakeholders, such as researchers, local residents, and tourists. The utilisation of texture in this project significantly enhances its realism and vibrancy. The utilisation of Lumion 8 software enables the incorporation of realistic models and assets, such as plants, flowers, and birds, which provide the audience with an authentic visual experience. The captivating elements of the exterior, like the sunlight, clouds, and sea water, vividly depict the authentic scenery of Melaka during its heyday as a bustling trading hub.

3. Results

This project is to show appreciation to historical buildings in Malaysia, highlighting on Melaka Heritage. To obtain a tangible result, this project requires a thorough analysis with the following analyses:

3.1 Reliability

A questionnaire is employed to assess the research variables in order to fulfil the requirements of the 3D Walkthrough's functionality. The scale consisted of 5 sub-scales, each assessed by multiple items that were rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The 5 sub-scales specifically addressed in the study are interface, virtual aspects, interactivity, and test results. The Cronbach's alpha score for the psychological health metric is $\alpha = 0.946$.

3.2 Data Analysis

The questionnaire is divided into two sections: the first section collects data regarding the participants' background, including gender, age, education, and other relevant information. The second section comprises five categories, each including many items. The study consisted of 69 participants (94.5%) who were under the age of 25, and 4 participants (5.5%) who were over the age of 25 (Figure 10). Among the study participants, females (14, 19.2%) outnumbered males (59, 80.8%) in terms of population representation (Figure 11).

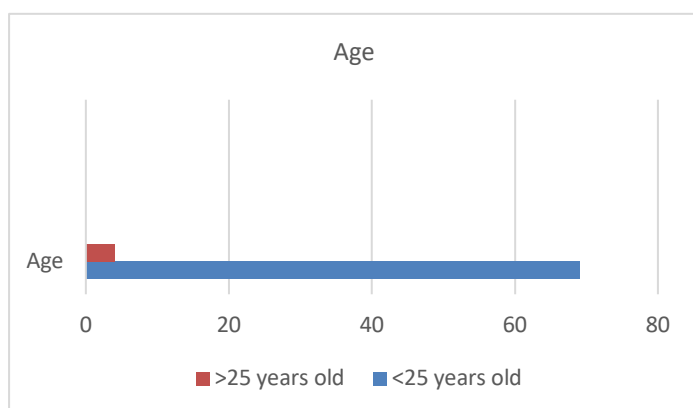


Fig. 10. Age participation

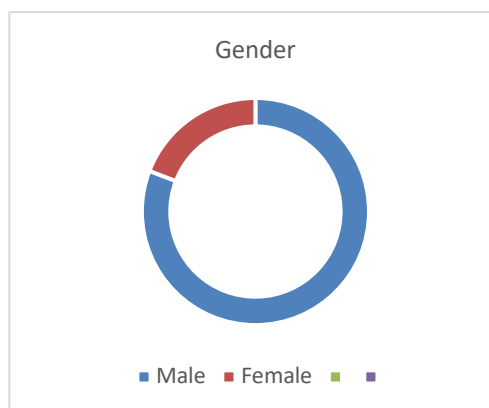


Fig. 11. Gender distribution

Out of the total participants, 42 (57.5%) reported having a college degree, while 31 (42.5%) reported having a university degree. Furthermore, the majority of participants (76.7%) used a smartphone as their primary device, while a smaller percentage (21.9%) used both a smartphone and tablet. Only a negligible proportion (1.4%) used a tablet exclusively.

Nevertheless, a majority of the participants (57%) said that they had not previously experienced a 3D Walkthrough tour of a heritage site, while only a small percentage (21.9%) stated that they had (Figure 12). Among the respondents, the majority (38.4%) reported using their smartphone as a means to access information about cultural heritage. The use of laptops accounted for 24.7%, followed by museums at 23.3%. Reference books, desktop computers, and textbooks were used less frequently, with percentages of 5.5%, 5.5%, and 1.4% respectively (Figure 13).



Fig. 12. Experience of 3D Walkthrough

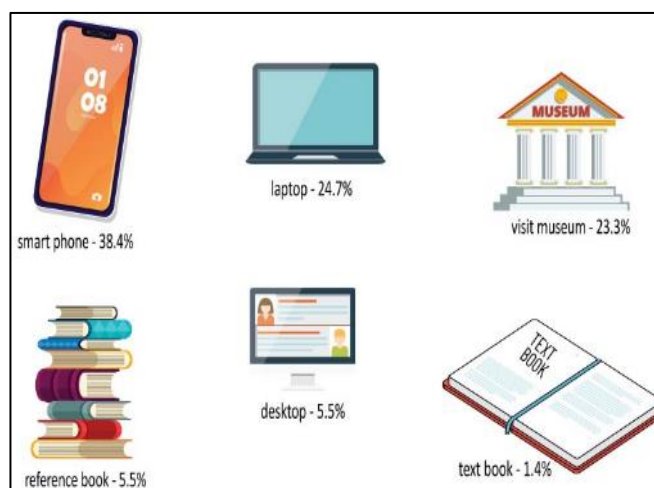


Fig. 13. Access information about cultural heritage

According to Table 1, question 1 aims to determine if the interface of the 3D Walkthrough allows respondents to see the Melaka fortress and river, as well as the Melaka sultanate palace. The purpose of this evaluation is to determine the extent to which the 3D Walkthrough interface accurately represents the intricate details of the Melaka citadel, river, and Melaka sultanate palace. The questionnaire results indicated that the participants were in agreement on the 3D Walkthrough showcasing the Melaka fortress and river, as well as the Melaka sultanate palace. The results indicated that the average score of the interface in the first category was 4.22, with a standard deviation of 0.615. The frequency analysis for question 1 revealed that 37 respondents (50.7%) replied agree, 28 respondents (38.4%) answered strongly agree, and just 8 participants (11%) answered neutral. With respect to issue 2 in the interface category, 43 respondents (58.9%) agreed, 23 (31.5%) strongly agreed, 5 (6.8%) were neutral, and just 2 (2.7%) disagreed. Out of the respondents, 46.6% agreed, 45.2% strongly agreed, 5.5% were neutral, and only 2.7% disagreed with question 3. The final question in the interface category revealed that 35 respondents (47.9%) agreed, 24 (32.9%) strongly agreed, 11 (15.1%) remained neutral, and a mere 3 participants (4.1%) disagreed.

Table 1

Questionnaire Items

Dimension	Item
Interface 1	<ul style="list-style-type: none"> • The 3D Walkthrough tour reflects the environment and the subject matter. • The graphics and 3D model used to represent 3D Walkthrough tour is advanced. • The 3D Walkthrough has a good graphics and the 3D Walkthrough tour is in high definition HD. • The overall 3D model met my expectation of how a 3D Walkthrough tour should look like.
Virtual/Elements	<ul style="list-style-type: none"> • I am able to feel the presence of Melaka Fortress and River/Melaka Sultanate palace from the 3D Walkthrough tour. • The 3D Walkthrough tour has a high quality of immersion. • I am able to imagine how Melaka Fortress and River/Melaka Sultanate Palace looked like in real life. • The overall feel of the Melaka Fortress and River/Melaka Sultanate Palace elements met my expectation of how a 3D Walkthrough tour should look.
Interactivity	<ul style="list-style-type: none"> • I am able to visualize well with the 3D elements from the virtual walkthrough tour.
Test Resulting	<ul style="list-style-type: none"> • I am able to feel the presence of Melaka Fortress and River/Melaka Sultanate palace from the 3D Walkthrough tour. • The 3D Walkthrough tour has a high quality of immersion. • I am able to imagine how the Melaka Fortress and River/Melaka Sultanate palace looked in real life. • The overall 3D Walkthrough elements met my expectation of how a virtual tour should look.
Conclusion	<ul style="list-style-type: none"> • The 3D Walkthrough virtual tour sufficed and is recommended as one of exhibition methods for virtual museums equipped with multimedia elements.

The Virtual-Elements survey inquired whether the 3D Walkthrough effectively convinced pupils of their presence in the Melaka fortress and river/Melaka sultanate palace environment. The results indicated that students who were able to perceive the presence of a 3D Walkthrough while viewing demonstrated a mean score of 4.19 (SD=.646) in the second category, virtual/element. The frequency analysis of responses to question 1 in the virtual/elements survey revealed that 58.9% of respondents replied agree, 28.8% answered strongly agree, 9.6% answered neutral, and 1.4% each answered disagree and strongly disagree. In relation to issue 2 in the virtual/elements category, 37 respondents (50.7%) agreed, 25 (34.2%) strongly agreed, 9 (12.3%) remained neutral, and just 2 (2.7%) disagreed. Out of the respondents, 43.8% highly agreed, 39.7% agreed, 15.1% were neutral, and just 2.7% strongly disagreed with question 3 in the virtual/elements survey. The final question in the virtual/elements category revealed that 38 respondents (52.1%) answered "agree," 27 respondents (37.0%) answered "strongly agree," 7 respondents (9.6%) scored "neutral," and just 1 participant (1.4%) answered "disagree."

The Interactivity category includes a question that assesses students' proficiency in engaging with the virtual components of a 3D Walkthrough. The participants expressed that the utilisation of the 3D Walkthrough enabled them to observe the Melaka fortress and river/Melaka Sultanate Palace in its historical state. The findings indicated that the average score for the third category of interaction was 4.10, with a standard deviation of 0.698. The frequency findings indicate that 61.6% of the respondents answered agree, 26.0% strongly agree, 11% scored indifferent, and only 1.4% of the participants answered disagree. The findings indicated that the average score for the third category of interaction was 4.20, with a standard deviation of 0.620.

The main objective of the fourth category testing results is to ascertain the individuals who derived advantages from utilising the 3D Walkthrough technology while touring the Melaka fortress and river/Melaka Sultanate Palace. The findings indicated that the utilisation of the 3D Walkthrough

facilitated a heightened sense of the Melaka castle and river/Melaka Sultanate Palace among the participants. The frequency analysis of responses to question 1 in the exam results revealed that 39 (53.4%) respondents replied "agree," 23 (31.5%) respondents answered "strongly agree," 7 (9.6%) respondents answered "neutral," and 4 (5.5%) respondents answered "disagree." In relation to issue 2 in the virtual/elements category, 41 respondents (56.2%) agreed, 24 (32.9%) strongly agreed, 6 (8.2%) were neutral, and just 1 participant (1.4%) disagreed, while another participant (1.4%) strongly disagreed. Out of the total responses, 43.8% highly agreed, 39.7% agreed, 15.1% were neutral, and just 2.7% strongly disagreed with question 3 in the testing findings. The final question in the testing results category revealed that 38 respondents, accounting for 52.1% of the total, answered "agree." Additionally, 27 respondents, or 37.0%, responded with "strongly agree." A total of 7 respondents, representing 9.6%, scored neutral, while only 1 participant, or 1.4%, answered "disagree." In summary, the participants suggested utilising the 3D Walkthrough medium as an exhibiting approach for virtual museums that are loaded with multimedia elements.

The study also investigated whether there are any notable disparities in the four categories of the 3D Walkthrough media, depending on the individuals' backgrounds. The independent sample t-test results in Table 2 indicate that there were no significant differences observed between male and female participants in terms of the mean scores for interface ($t = .693$, $df = 71$, $sig. = .532$), virtual/elements ($t = -.199$, $df = 71$, $sig. = .843$), interactivity ($t = -.226$, $df = 71$, $sig. = .822$), and testing results ($t = .994$, $df = 71$, $sig. = .324$).

Table 2
 Results of Independent Sample T-test for Variables

Variable		t	df	Sig.2 tailed
Interface	Equal variance assumed	.693	71	.523
Virtual/elements	Equal variance assumed	-.199	71	.843
Interactivity	Equal variance assumed	-.226	71	.822
Testing results	Equal variance assumed	-.994	71	.324

The independent sample t-test results in Table 3 showed that there were no significant differences found between the participant's ages in light of interface mean score of ($t = -.915$, $df = 71$, $sig. = .363$); virtual/elements mean score of ($t = -1.388$, $df = 71$, $sig. = .169$); interactivity mean score of ($t = -1.153$, $df = 71$, $sig. = .253$); and testing results mean score of ($t = -.964$, $df = 71$, $sig. = .338$).

Table 3
 Results of Independent Sample T-test for Variables

Variable		t	df	Sig.2 tailed
Interface	Equal variance assumed	-.915	71	.363
Virtual/elements	Equal variance assumed	-1.388	71	.169
Interactivity	Equal variance assumed	-1.153	71	.253
Testing results	Equal variance assumed	-.964	71	.338

Another independent sample t-test result in Table 4 showed that there were no significant differences found between the participants according to their education degree in light of interface mean score of ($t = 1.964$, $df = 71$, $sig. = .053$); and testing results mean score of ($t = 1.832$, $df = 71$, $sig. = .071$); and significant results showed for virtual/elements mean score of ($t = 2.138$, $df = 71$, $sig. = .036$); interactivity mean score of ($t = 2.228$, $df = 71$, $sig. = .029$).

Table 4
Results of Independent Sample T-test for Variables

Variable		t	df	Sig.2 tailed
Interface	Equal variance assumed	1.964	71	.053
Virtual/elements	Equal variance assumed	2.138	71	.036
Interactivity	Equal variance assumed	2.228	71	.026
Testing results	Equal variance assumed	1.832	71	.071

4. Conclusions

This study has elucidated the process by which the 3D Walkthrough has been conceived and constructed. The 3D Walkthrough animation project provides a comprehensive visualisation of the design of the Melaka Fortress, Melaka River, and Sultanate Palace. In addition, this project provides a comprehensive understanding of the historical activities of the residents of Melaka. This project has undergone three stages in order to create a 3D Walkthrough animation of the topic subjects. The process included pre-production, which required generating concepts and creating storyboards. The second phase involves the creation of models and textures for various elements such as ships, jetties, guns, roofs, pillars, walls, staircases, bridges, and other objects. The software utilised for process modelling included 3ds Max 2018 and Lumion 10.0.

According to the market study, we recommend that the arrangement and environment are crucial in facilitating the intense emotional experience in a 3D Walkthrough. We urge academics and educators to delve further into the components of historical structures that have nearly vanished. Given all factors, the design community will collaborate closely with historians to obtain more persuasive information, ultimately resulting in the creation of deeper emotions. With the utilisation of 3D Walkthrough, our generation may eagerly learn from the revival of Melaka, a renowned minor commercial port from the past. Diligent effort has been invested in ensuring the authenticity of this project. This includes both the initial rough sketches as well as subsequent sketches that are connected to the Melaka Sultanate Palace. By providing comprehensive supporting materials, we aim to enhance the project's potential for exceptional success in the future. This initiative has the potential to provide a significant contribution to individuals who require a visual representation of past environments, particularly for the present and future generations.

Essentially, both residents and visitors can have a comprehensive understanding of the historical background of Melaka City by means of a 3D Walkthrough animation.

Acknowledgment

This research was not funded by any grant.

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