

# *Virtual Tourism Application through 3D Walkthrough: Flor De La Mar*

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**Abstract**— Tourism industry with well develop virtual tour is important to promote a country iconic places of interest such as Malacca. It is essential for Malacca as part of the tourism attraction to preserve the historical value for the tourist and also for the younger generation to learn from the history. Maritime Museum is one of the must-go-see places where it is built based on a Portuguese's ship that known as Flor de La Mar (FdLM). However, based on the site visit and the peer review that has been done, the existing virtual museum in Maritime Museum Malacca does not reflect the historical identity of the ship. In this paper, we will focus on development of FdLM 3D walkthrough application that would enhance the existing virtual museum with virtual and augmented reality implementation. Results from the evaluation have shown positive feedback where users are able to imagine the FdLM in real life and they prefer FdLM 3D Walkthrough compared to the existing virtual museum. Thus FdLM 3D Walkthrough application shall be adapted in the future to the Maritime Museum Malacca as tourist attraction.

**Keywords**— *virtual tourism, virtual reality, augmented reality, Malacca, Flor de La Mar (FdLM)*

## I. INTRODUCTION

The Malacca Maritime Museum was designed as a replica of the original architecture of a Portuguese ship; Flor de La Mar (FdLM) which sank off in the coast of Malacca. The replica was constructed in 1990 and officially opens to public on June 13, 1994 [1]. It is vital to preserve this replica and its legendary historical identity in a new technological way to ensure that today and next generation keep their interest towards the ship and the history behind. This will help the Malacca State in establishing their famous Historical State title, along with the current technology interest.

Currently, there is an existing virtual museum for the FdLM in the official website. However, the current virtual museum

does not give the visitor the actual look and feel of FdLM and it looks nothing more than slide show. There are not enough multimedia elements that allow the visitor to interact with the virtual museum and provided only text with slide show. This is very disappointing as it limit the visitors' interaction due to the lack of multimedia elements. In addition, the slide show of FdLM does not help visitors to know the interior design of the ship. In term of design, this will help them on what to expect, even before they go to the Maritime Museum. Based on the initial investigation, FdLM is in desperate need of improvement.

Furthermore, there is not enough information about the ship from the virtual tour that limits the visitors' understanding. Historical information about the ship is very important to make

sure the visitors know every details of the ship. Implementing learning theory in the walkthrough will help solving this problem.

A 3D walkthrough application would be a solution to the current problem. The main purpose of FdLM 3D Walkthrough is to allow the tourist to experience the ship in a virtual environment and at the same time conveying brief history of the ship and Malacca in particular. With the help of virtual walkthrough, visitors should be able to imagine more clearly about the ship. Users are able to experience the ship in a new 3D environment where they are able to 'walk' inside the ship in a better visual. Besides, they are also able to emerge in the virtual environment and interact with the 3D objects. Users also have a better understanding and exposure about the ship from seeing a physical object in a solid form.

It is also important for the users to experience the ship in a real world environment. Users are able to have total immersion when the 3D ship overlay with their physical world with the implementation of augmented reality (AR). Engagement of FdLM 3D ship and the real world would help in maximizing the opportunity of interaction. The implementation of VR and AR for FdLM 3D Walkthrough offers a richer user experience. Information delivery of the historical side of the ship is much more entertaining and accurate. This application would also help in guiding the tourist.

## II. RELATED WORKS

### A. Virtual Reality

Oxford Dictionary defines the word virtual as almost or nearly as describe, but not completely or according to strict definition [2]. Meanwhile, the word reality is defined as a thing that is actually experience of or seen.

The word virtual reality means a vision of reality without its physical, or whatever else that is needed to build the reality [3]. VR is also a way for human to visualize, manipulate and interact with computers and extremely complex data [4]. It has been widely use in various fields, especially in medical, military and engineering. It is strongly suggests that VR is not only a medium or high end user interface, but it is an application which involves solution to real problems.

VR is an application that able to solve a particular problem with a well performed simulation that depends very much on the third 'I'; human imagination. The imaginative aspect of VR also refers to the human mind capacity to perceive non-existent things [5].

According to The Virtual Technology, Volume 1, it is also stated that VR is an integrated trio of immersion-interaction-imagination as illustrated in Fig. 1.

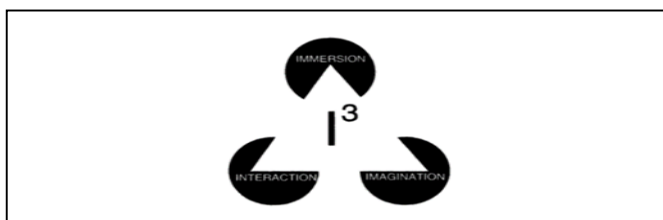


Fig. 1. The three I's of VR

The three pillars of VR would help the users to experience the look and feel of the virtual environment, thus contributes in their understanding of the historical ship.

### B. Virtual Tourism in Malaysia

Information and communication technologies (ICT) in Malaysia has transformed drastically towards the tourism industry. This enhancement has contributed to a new paradigm of tourism industry to be one of the major evolving industries here. [6].

Tourism organizations are promoting and distributing their product and services with a lower cost internet. Internet has made it possible to interact in one-on-one marketing, other than being a basis for mass marketing [7].

Along with the globalization of tourism industry, accurate information is needed so it would be convenient for the tourist around the world to easily search needed information [6]. Hence, the delivery of information with 3D virtual reality and augmented reality technology would help in making that step much more imaginable and interactive for the tourist.

Virtual tourism is a great marketing tool to promote Malaysian uniqueness to the world. In fact it is an emerging tourism tool since the launch of Virtual Malaysia in 1997, an official virtual reality website to promote the country tourism. The Chief Executive Officer, Rohizam Muhammad Yusoff, highlights the organization's goal which is to utilize the VR technology by providing virtual tours destination, service and even promoting Malaysian products [8].

From the website, viewers are able to experience a 360-degree panoramic view of many Malaysia's places of interest such as the Tempurung Cave, a tourist attraction highlighted in the State of Perak. Furthermore, the virtual tour offers the closest possible sensory experience of any tourist destination, services, and product. Besides Virtual Malaysia, Islamic Art Museum Malaysia (IAMM) is also taking a step further as compare to other local museums by offering a virtual tour which also consist of 360-degree panoramic view

However, according to a journalist Chan Chun Yew [9], the Malaysian virtual tour is rather disappointing. The writer emphasizes disappointment when it was expected to be a 3D-movement in virtual world-ala Myst but somehow it is not like how he imagined. A similar issue occurred for the existing FdLM virtual, where there are only transitioning images.

Despite the increasing in ICT awareness and public multimedia literacy, Malaysia technology needs to improve vividly in order to go parallel with other developing countries. Multimedia application with combination of 3D walkthrough virtual reality and augmented reality could be the answer in dealing with this issue.

### C. Augmented Reality (AR)

Different from virtual reality where a virtual environment replaces the physical world, AR superimposes the real world with additional information [10]. AR also helps to improve a

user perception and interaction with the physical world by supplementing with 3D virtual objects that immerse within the same space [11]. In this study, the 3D model of the ship is immersing in the real world through a marker-based detection.

There are three requirements of an AR application [12]. Combination of virtual elements such as 3D objects and the real environment is the basic requirement of AR application. According to Milgram and Kishino [13], it would be a helpful perspective to perceive AR as part of a reality-virtually continuum concept where it acts as a scale of ranging an environment to be completely real, and the other part is completely virtual. AR resides between these two ranging as shown in Fig. 2.

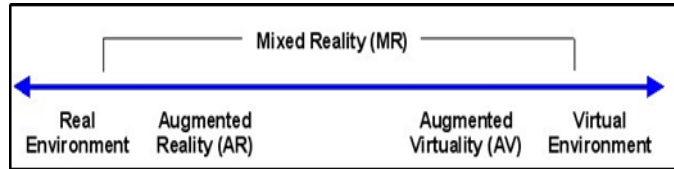


Fig. 2. Reality-virtually continuum

The second requirement of AR is the alignment of virtual elements with the real world. These means that the 3D object should have aligned and match together with the real surroundings.

Third, AR application should be in real-time interactivity to ensure that the virtual elements behave like a real element concurrent with the real space. However, this may depends on the changes in the perspective of the user, lighting conditions, occlusion and other physical laws [12].

A marked is needed to display the virtual elements as shown in Fig. 2. The purpose of this is to identify and position the 3D objects parallel with the real environment. When the registered marker is detected, the system will position the 3D coordinates of the marker pattern and place the virtual object on it [14]

Together with combination of 3D modelling and marker-based AR, visitors would be able to experience and interact with the FdLM ship as it merge with a reality perspective through a desktop camera.

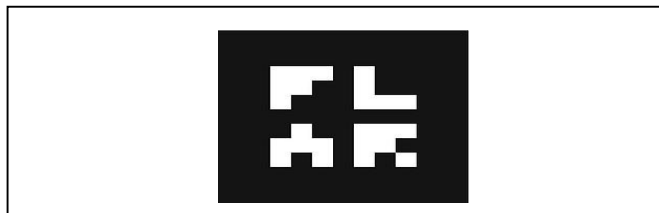


Fig. 3. Sample of AR Marker

Along with the help of a marker design for this application, the process of AR happens when the image is captured from the desktop camera. As shown in Fig. 4, a line detection method is used to find the marker edges to locate the intersection so that it will be easier to identify the marker's corner points [15].

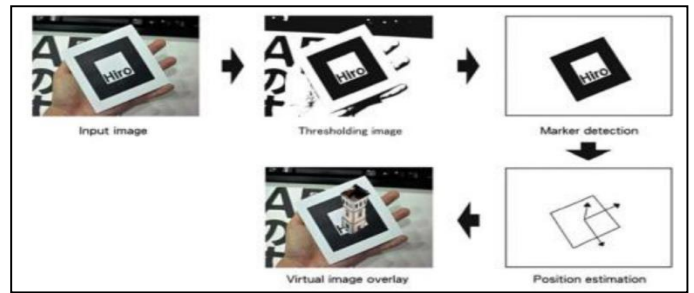


Fig. 4. Marker-based AR operates

Pattern with four corner is the most easy and accurate marker for AR process. Thus, a square based shape is the most suitable marker to be used [16].

### III. METHODOLOGY

A step by step process of developing the FdLM 3D Walkthrough is crucial in order to develop an application that serves its objective and solve the current problem. Listed are the steps taken. (a) Initial Investigation, (b) Peer review, (c) Design and development, (d) Implementation of FdLM 3D Walkthrough and (e) Testing.

#### A. Initial Investigation

This process will help in finding specific details of FdLM in order to develop a 3D walkthrough and to prevent any misinformation with the final product. Thus, initial investigation is carried out to collect the information needed. Site visit is conducted to explore the information needed to develop the application.

Site visit is one of a crucial step to have an idea or brief information about the project. According to Princeton University [17], site visit can be defined as a visit under authorized ability to examine a site to focus its suitability for some endeavor. Undergo this process helped a lot in figuring out how FdLM looks like in real life as well as imagining how the historical ship should be designed.

Based on the initial investigation during the site visit, few photos and notes are taken down in order to collect information regarding the history of the ship. These are some of the information that has been collected:

- FdLM is made up of three levels
- The captain room is at the top level.
- The other two levels include artifacts, documents, and paintings from Malacca golden era.
- The replica ship is standing 34 meters high, and 8 meters width.
- The museum highlights Malacca as the Emporium of The East.

B. Peer Review

A peer review is done to identify the problem with the current FdLM virtual tour as a data gathering to find solutions needed to be implement in order to its virtual elements.

Peer review is a documented review done of associates or peers, who is having skill in the topic to be reviewed or a subset of the topic to be reviewed at any rate proportion which at least equivalent to that need for original work and also independent for the topic that are reviewing [18].

According to Peer Review in Environmental Technology Development Program by Committee on the Department of Energy-Office of Science and Technology [18], there are two characteristic that measure the independency of the peers, and they are as follows,

- The individual or group do not involved as a participant, supervisor, technical reviewer, or advisor to the work being reviewed.
- They have the freedom from consideration, in order to make sure the topic is equally reviewed.

For this study, peer review is done by giving questionnaire to the students who already hold a Diploma in Computer Science and Mathematics, which also students of Degree in Computer Science and Mathematics, Hons Multimedia Computing from the Faculty of Computer Science and Mathematics, UiTM Jasin, Malacca, Malaysia. The purpose of choosing them is because the need for people who are very familiar with the multimedia surroundings. Their computing and multimedia background helps a lot in justifying the review.

Estimation for the sample size of peer review is a crucial need for an effective and reliable result. Calculating margin error to measure the confidence interval of the questionnaires can be done using the formula in Fig. 5 [19].

$1 / \sqrt{N}$
Where <i>N</i> is the number of participants or sample size

Fig. 5. Margin error formula

For example, if there is a 95% of confidence interval, meaning there is only 5% of margin error. The further details of how much sample size is needed parallel to the margin error is already calculated in the Table I, below.

Table I. Margin error for each sample size

Sample Size (N)	Margin Error	Margin Error (%)
10	0.316	31.6
20	0.224	22.4
50	0.141	14.1
100	0.100	10.0
200	0.071	7.1
500	0.045	4.5

1000	0.032	3.2
2000	0.022	2.2
5000	0.014	1.4
10000	0.010	1.0

Based on the Table I, it is observable how much margin error will occur for every different sample size. For a sample size of 10, the margin error is quite high with 31.6%, compare to sample size of 10,000 with margin error of only 1%. It is observable that the higher number of sample size contribute to a lesser percentage of margin error, and higher confidence interval. For this study, peer reviews with sample size of 20 are used, with confidence interval of almost 80%.

Data is gathered and analyzed from the questionnaire. A questionnaire set from Chertoff (2010) is used as a reference and only the variables are modified to meet with the functionality of FdLM 3D Walkthrough.

There are four categories in the questionnaire. Table II shows division of questionnaire is to ensure a more specific and focus questionnaire session.

Table II. The category division of questionnaire

Categories	No of Questions
Interface	4
Virtual reality elements	4
Interactivity	1
Conclusion	1

The questionnaire was conducted by asking the respondents to go to the official Malacca Maritime Museum virtual tour at <http://www.virtualmuseummelaka.com/maritime.htm>. Respondents were then asked to have a look through of the existing virtual tour.

It took about ten to twenty seconds to get attention from the users when they are browsing a website but an average of two minutes is enough for a user to interact with the website [20]. In the questionnaire session, respondents were given ten minutes to interact with the FdLM virtual tour. A longer minutes is purposely given so that the respondents able to carefully examine the existing virtual FdLM.

The result of the questionnaire is documented and analyzed as in Table III. The mean of respondents rating from each question is gathered and analyzed.

Table III. Mean of Interface questions

No	Interface Questions	Mean
1	The virtual tour reflects a detail interior design of the FdLM Ship	1.75
2	The graphic used to represent FdLM is in high definition (HD)	1.35

3	The slide shows give a good graphic representation of FdLM	1.35
4	The overall interfaces meet my expectation of how a virtual reality application should look like.	1.35

The questionnaire starts with question one asking if the interface of the virtual ship enable the respondents to understand the interior design of FdLM. This is to ensure if the interface provided gives significant value to the detail of FdLM. The frequency of response results in eight respondents rate one as strongly disagree, nine respondents rate two as disagree, while the other three as moderate. The rating resulted in mean of 1.75.

The second question emphasis on the viewing pleasure of the virtual ship, whether the respondents able to experience high definition graphic. This multimedia element is vital in ensuring a clear image while browsing through the virtual ship. Question two has mean score of 1.35 where thirteen respondents rate strongly disagree and seven respondents as disagree for the high definition aspect of the graphic used in the existing virtual ship. This shows that the existing FdLM virtual tour needs improvement in term of HD graphic.

Meanwhile, question number three would ask respondent to rate the slide show provided in the existing virtual ship, if it is able to give a good graphic representation for the ship. The main purpose for this question is to know whether the slide show act as a good interface medium in describing the FdLM. However, twelve respondents rate strongly disagrees, while the other eight disagree with the statement. Thus, result in mean score of 1.35. The mean score shows that the slides show does not help in representation of FdLM.

As all of the respondents have basic in multimedia studies, it is important for them to rate the existing virtual ship whether it meet their expectation of a virtual reality tour. Based on the questionnaire result for question four, it is observable that thirteen respondents rate strongly disagree, while the other seven rates disagree that the existing virtual ship interface meet their expectation. The rate given resulted with mean of 1.35. As a conclusion, the respondents strongly disagree that the overall interface of existing FdLM tour meet their expectation of a VR application.

Table IV. Mean of VR questions

No	VR Questions	Mean
5	I am able to feel the presence of object inside the FdLM from the virtual museum.	1.25
6	The virtual museum has a high quality of immersion.	1.20
7	I am able to imagine how FdLM looks like in real life.	1.30

8	The overall virtual reality elements meet my expectation of how a virtual application should look like.	1.35
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The second section of the questionnaire is regarding virtual reality elements as in Table IV. The fifth question would like the respondents to rate the realness of the existing virtual ship as the main purpose of virtual reality is to let the user believe that they are actually in the environment they are experiencing. Fifteen respondents vote strongly disagree and the other five votes disagree. Question five has the mean of 1.25. This indicate that the majority of respondents not able to feel the presence of object inside the FdLM from the virtual museum.

Question six has the mean of 1.20 with frequency of response sixteen respondents vote strongly disagree and the other four as disagree. While for question seven, it is scored with the mean of 1.30, with fourteen respondents vote as strongly disagree and six as disagree.

The last question for virtual reality, focus on the respondents' opinion of the existing FdLM virtual reality meet their expectation of how a virtual application should be as show in Fig. 6. Question eight score the mean of 1.35 with thirteen respondents' rate as strongly disagree and seven respondents disagree.

Table V. Mean of Interactivity question

No	Interactivity Question	Mean
9	I am able to interact well with the multimedia elements from the virtual museum. (ex: click through links and photos etc)	1

The main purpose of question number nine is to identify if respondent able to interact well with the existing virtual ship as in Table V. The current virtual ship, would not even allow the respondent to click between photos or zoom in from the photos in the slide show provided. The virtual application only allows respondents to view the photos while reading some text. The photos were automatically looped and it is display from the slide show. Thus, it results in the mean of 1 where all respondents rate this question as strongly disagree for them to interact with the multimedia elements from the virtual museum.

Table VI. Mean for Conclusion question

No	Conclusion	Mean
10	The existing virtual museum is in need of improvement especially in term of multimedia elements.	4.6

Question ten in Table VI emphasis more on the respondents' opinion whether they think the existing virtual FdLM need any improvement or otherwise. Based on the Mean, majority of respondents agree that the current FdLM virtual museum need improvement especially in term of multimedia elements.

As a conclusion, the existing virtual museum for FdLM does need a lot of improvement. A more user friendly and interactive user interface should be implemented for a more entertaining experience. In addition, modelling 3D object for FdLM would help user to feel more immerse in the virtual environment. At the same time a 3D Walkthrough will act as a visual aid for them to imagine and understand FdLM in a deeper perspective.

C. Design and Development

Navigational map provide specific information with links that show how those information are connected and interact with each other. Fig. 6 below shows the navigational map for FdLM 3D Walkthrough.

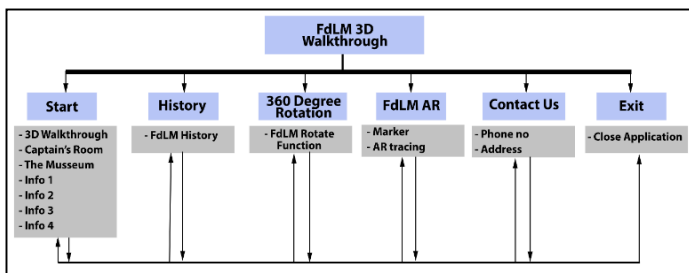


Fig. 6. Navigation map

There are six scenes from the FdLM 3D Walkthrough. The 3D Walkthrough will be at the Start scene. The History scene will introduce user to brief historical information of the FdLM ship. In order to help the user understand the ship better, they are able to see the ship in 360 degree rotation. This will help the user in knowing specifically the design of the ship. Next, an element of AR is implemented at the FdLM AR scene to let the user imagine the ships' design. This is done by connecting the application with the camera. Contact information of the Maritime Museum is available at the Contact Us scene.

Interface is important in developing an application. Interface in general should be in prospect of when a user give command to the computer, it responds back in a manner of showing what the user needs. User interface is much related to user interaction which can be delivered through input devices such as keyboard, mouse, touch screen and microphone [21]. Interface also influence in a good user experience and act as a major ingredients for a successful application today [22]. Thus, it is advised to use keyboard and mouse as a primary input devices for FdLM 3D Walkthrough since it is a desktop application.

Intel Developers has come up with desktop user interface guidelines along with the launch of Windows 8 in 2012 for a better desktop experience for their customers. Based on those

guidelines, FdLM 3D Walkthrough is designed to fit into desktop application as shown in Fig. 7.



Fig. 7.Division of Desktop Interface

There are three separated partitions with one blue partition and two pink partitions. The blue partition represent the main focus or the main content of a desktop application while the other two pink partitions are made for interaction purpose such as icons and buttons.

Besides the desktop user interface; colors also play a vital role in catching the attention from user. A complementary color method is used in the application, especially when it comes to icons. Fig. 8 shows the Complementary Color Chart.

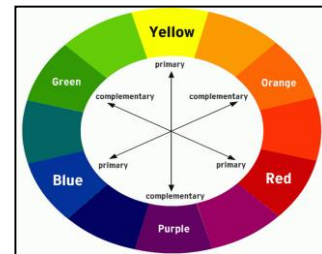


Fig 8. Complementary Color Chart

The complementary chart resembles how a developer should play with color in their application. A high contra of colors, for example orange with blue, would create a vibrant interface especially in full saturation. Complementary color also helps user to focus to a specific icons [23].

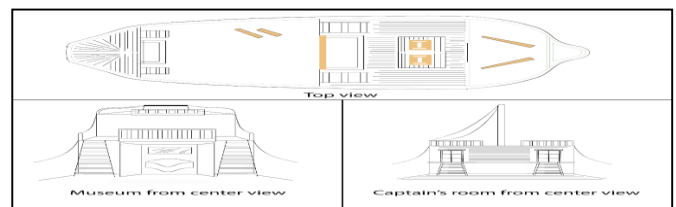


Fig. 9. Sketch of FdLM Ship

Sketching of the FdLM ship helps in specifying its look in the application. It would also give a brief view of the interior design of the ship. Development of the ship 3D model is referred to the sketch.

There are three views for the FdLM sketch as shown in Fig. 9. The top view shows the design of the ship from above, and two center views that show the Museum and Captain's Room.

The development of 3D modelling is done using 3D Studio Max. 3D Studio Max is chosen based on its capabilities and ease of use to develop 3D model and its compatibility to transfer file to other software. Fig. 10 shows the modelling process of FdLM.

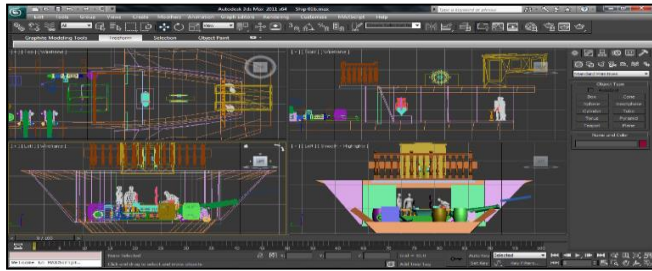


Fig. 10 Modelling Process

As modelling 3D object is the basic step of developing this application, several techniques is used in order to design the iconic ship. Some model only required to use one technique, while many other 3D objects required combination of two or more techniques. Listed in Table VII are some of the techniques used.

Table VII. Techniques used in modelling FdLM ship.

No	Techniques
1	Line tool
2	Extrude
3	Intrude
4	Slice plane
5	Editable poly/mesh with vertex, border, and polygon.
6	Texturing

Next, the finished 3D model is then converted to fbx file to be transferred to 3D Unity. Interaction and modelling setup is done within the virtual reality environment. Designing and development of the virtual surrounding happens in 3D Unity. Repositioning the 3D model is needed to place it at the right place. Incase if the model that we imported does not match with the VR environment like how it should be, adjusting the position, rotation and scale can be done at the Transform panel. Additional multimedia elements such as links and audio are inserted to enhance the look and feel of the ship.

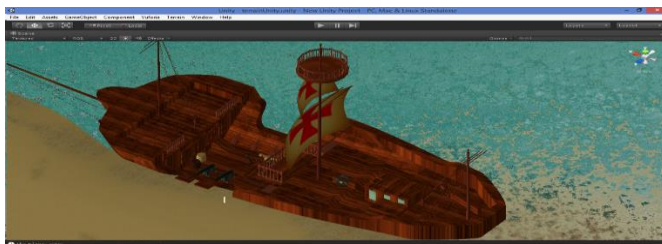


Fig. 11. FdLM from bird's eye view



Fig. 12. FdLM Information Screen

Fig. 11 and 12 shows the application interface that has been developed and enhancement are made based on the data gathered from initial investigation.

#### D. Implementation of Flor de La Mar (FdLM)

Implementation is done to know what type of hardware and software are needed in order to develop the project parallel with its functionality. Implementation process is where the design plan will be delivered into multimedia program. The suitable software and hardware selected and used in development of FdLM 3D Walkthrough.

#### E. Testing

The same 20 respondents from the previous peer review are called back to evaluate the FdLM 3D Walkthrough. The purpose of this testing is to know if FdLM 3D Walkthrough has offered improvement in term of multimedia elements compare to the existing virtual museum. Table VIII shows the mean result for interface questions.

Table VIII The mean result of FdLM Interface

No	Interface Question	Mean
Q1	The 3D Walkthrough reflects a better interior design of the FdLM Ship compare to the existing virtual museum.	4.00
Q2	The graphic used to represent FdLM is in high definition (HD)	4.10
Q3	The 3D models give a good graphic representation of FdLM	3.95
Q4	The overall interfaces meet my expectation of how a virtual reality application should look like.	4.40

The total mean score of this evaluation questionnaire is 5. For question one, its purpose is to know if the 3D Walkthrough gives significant value to the detail of FdLM ship. From the Table VIII, we could see the rating for Q1 is 4.00 out of 5. This means that the respondents do agree that the 3D Walkthrough reflects a better interior design of the FdLM Ship compare to the existing virtual museum.

As for Q2, the mean score is 4.10 out of 5. This shows that there are improvement for the representation of FdLM in term of high definition when using 3D Walkthrough. For Q3,

this question would like to evaluate if the 3D model use is effective in representing FdLM, and it scores the mean of 3.95. Meanwhile, the overall interface scores 4.40 out of 5, which means the respondents do agree that the interface used meet their expectation of how a virtual reality application should look like.

Table IX The testing result for VR

No	Virtual Reality Questions	Mean
Q5	I am able to feel the presence of object inside the FdLM from the 3D Walkthrough.	4.50
Q6	The 3D Walkthrough has a high quality of immersion.	4.55
Q7	I am able to imagine how FdLM looks like in real life.	4.70
Q8	The overall virtual reality elements meet my expectation of how a virtual application should look like.	4.60

Next, Q5 evaluates if the user able to feel the presence of object inside the FdLM and it is proven so when this question score 4.50 out of 5. For the immersion element of VR, question 6 score 4.55 which really stated that the 3D Walkthrough does effect the user in term of immersion. For Q7, it scores 4.70 out of 5 and this shows that majority of the user able to imagine how FdLM looks like in real life. As for the last question in the VR category, Q8 emphasize on the overall VR elements from the 3D Walkthrough and it has the mean of 4.60. This means that majority of the respondents do agree that the FdLM 3D Walkthrough meet their expectation of how a virtual application should look like as shown in Table IX.

Table X shows the testing result of Interactivity

No	Interactivity	Mean
Q9	I am able to interact well with the multimedia elements from the FdLM 3D Walkthrough. (ex: click through links and photos etc)	4.30

As shown in Table X for interactivity elements, Q9 evaluate of how the interactivity of the 3D Walkthrough plays its role. Interactivity from the application able to score 4.30 out of the total mean score of 5. This shows that the majority of respondents do agree that the FdLM 3D Walkthrough offer a good interactivity with multimedia elements.

Table XI shows the mean of Conclusion question

No	Conclusion	Mean
Q10	I prefer FdLM 3D Walkthrough compare to the existing virtual museum.	4.65

For the overall aspect of 3D Walkthrough, a conclusion question is asked to know the opinion of the respondents. The majority of respondents do agree that to prefer FdLM 3D Walkthrough compares to the existing virtual museum with mean rate 4.65 out of 5 as shown in Table XI.

#### IV. CONCLUSION

Virtual reality has a big opportunity to be explored especially in the tourism industry. Developing a VR application for FdLM is just a stepping stone to promote Malacca and its historical sites. Ana Serrano, a Chief Digital Officer of the Canadian Film Centre (CFC), and founder of CFC Media Lab, in her talk during TED events define virtual reality as a rich, visual, multi-sensory computer simulated environment in which user could emerge themselves in and also interact. Based on the testing result, it is observable that FdLM 3D Walkthrough serves a better interface, interaction and virtual reality element compare to the existing FdLM virtual tour.

As for the future work, the application will be tested to the random visitors of FdLM museum. The purpose of this is to get a public insight of how the application able to help them in guiding and promote understanding of the historical ship.

In conclusion, FdLM 3D Walkthrough has greatly facilitate historical understanding using multimedia elements. The application also helps user to be more immersive, imaginative and interactive, thus, offer solution to the existing FdLM virtual museum.

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