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Introduction to the Heritage Building Medan City Using Augmented Reality

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Abstract: The city of Medan is the largest city in North Sumatra and has a variety of ethnicities and diverse cultures, one of which is the Malay ethnic deli. The cultural identity of the Deli Malays in Medan is inseparable from the relics of the Malay Deli Sultanate, one of which is the heritage of the building. The lack of information on the relics of the building and the ignorance of the public about this information so that people are less familiar with the relics of the Malay Deli Sultanate building. Therefore, we need a mobile application that can help the public to find out information about the relics of the Malay sultanate and the shape of the building in 3D so that people can see 360 degrees of the architectural animation of the heritage which is equipped with the history of the building's legacy. Augmented Reality (AR) is a method between the virtual world in the form of images (2D) with 3D animation then projected in real time and so on. This application uses the Markerless Augmented Reality (User Defined Target) method, which is making the marker formation by selecting the target selected by the user using a cellphone camera. The stages in this application include design design, 3D object modeling to application development. Based on the research above, it can be concluded that the application made can provide information about the relics of the Malay Deli Sultanate building. In the future, this research will add objects from the Malay Deli Sultanate building and display the interior and exterior supporting heritage buildings such as fences, gardens, and add more details about asbabun nuzul ayat in telling historical buildings.

Keywords: Augmented Reality; 3 D; Markerless; History ; Animation

INTRODUCTION

Medan City is one of the big cities in Indonesia, located in North Sumatra, and is the third largest city after Jakarta and Surabaya. The city of Medan is characterized by many forms of multiculturalism and multiethnicity, with residents of diverse cultural and religious origins. The term field itself consists of the words "Maidhan" or "Maidhanam", both of which are Tamil words meaning "big field" or "place" and were later translated into Malay.(Prayogi et al., 2021) The city of Medan has a variety of ethnicities and diverse cultures such as Batak ethnicity, Malay ethnicity, Javanese ethnicity, Acehnese ethnicity and other ethnicities. The term Deli has its own meaning to people who are ethnically Malay, especially Deli Malays, Malays who are in North Sumatra to foreign countries.

The cultural identity of the Deli Malays in Medan is inseparable from the relics of the Malay Deli Sultanate from time to time (Laudra et al., 2021). As for one of the relics of the Malay deli sultanate is the relic of the building. The lack of information on the heritage of the building and the ignorance of the public about this information so that people are less familiar with the relics of the Malay Deli Sultanate building. Therefore, we need a mobile application that can help the public to find out information about the relics of the Malay sultanate buildings and the shape of the buildings in 3D so that people can see 360 degrees of the architectural animation of the heritage which is equipped with the history of the building's heritage.

Augmented Reality (AR) is a method between the virtual world in the form of images (2D) with 3D animation then projected in real time (Badri et al., 2022; Maidi et al., 2020; Schlagowski et al., 2018). By using an augmented reality (AR) application, it is one of the solutions in displaying real 3D objects compared to using the usual video application. 3D objects that are applied in AR become an alternative that helps the community in providing information about the shape of buildings from the relics of the Malay Deli Sultanate.

The Markerless Augmented Reality (User Defined Target) method is making a marker by selecting a target selected by the user using a cellphone camera (Maidi et al., 2020; Nurhadi et al., 2021). Using this method, users

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are no longer worried about providing special markers so that special users do not need these special markers to run their applications. This method also makes it easier for users to use markers in any area and whenever they want because there is no use of these special markers.(Güneş et al., 2015; Yee et al., 2015)

One of the relics of the Malay Deli Sultanate that will be made in this study is the Al Mahsun Grand Mosque and the Al Osmani Mosque where the two mosques are icons of the Deli Malay Sultanate building heritage. This research begins by designing the application design then designing the 3D object and then making the augmented reality application.

LITERATURE REVIEW

The issue in this study is a development based on (Sumanti, 2021) prior research titled "Conservation of the Findings of Sacred Ancient Tombs and the Development of Islam in Medan." This research examines mapping and identifying ancient tombs discovered in Martubung Village, Medan City. In their study titled "Augmented Reality (AR) System in Islamic Da'wah," Zein and Agustin The paper analyze the shortcomings of the research and Augmented Reality products in the sphere of Islamic da'wah and how they might be improved. One of the enhancements is using Augmented Reality in playing cards, novels, brochures/leaflets/posters, and digital museums(Zein & Agustin, 2020). (Laudra et al., 2021) also tried to recognize and preserve the Malay culture of Deli in Medan, North Sumatra. (A.Lubis, 2019) Related to the title of the Role of Tour Guide Communication in Promoting Islamic Tourism in Medan City. (Z. C. Rawis, V. Tulenan, 2018) There is also research on the Application of Android-Based Augmented Reality to Introduce Tountemboan Traditional Clothing to preserve traditional culture.

METHOD

The technique used in software development is a type of Multimedia Development Life Cycle (MDLC) software development. MDLC is a development method for multimedia-based systems or applications. The MDLC method is implemented in six stages: concept, design, material collection, assembly, testing, and distribution.

1. Conceptualization

The concept stage determines the goals and program users (audience identification). The application's purpose is to create an augmented reality application of verses about the history and philosophy of an object sourced from the Qur'an and Hadith in order to create a visual application that helps users in the history of the development of Islamic da'wah and the application's users are the community and Information Systems Study Program students.

2. Design Design is the stage of creating specifications for the program's architecture, style, appearance, and material requirements. At this stage, the author:

a. Creates a storyboard with elements such as titles, subtitles, visuals, audio, dialogue, and properties.
b. Application background user interface design.

3. Material Gathering

Material Collecting is the data collection stage tailored to the application's requirements. The following steps have been taken:

a. creation of 3D objects
b. creation of 2D objects
c. Collection of verses from the Qur'an and Hadith about an object's history and philosophy to form a three-dimensional object for a digital museum collection
d. Reference library - reference books on creating three-dimensional objects and augmented reality.

4. Gathering

All multimedia objects or materials are put together using the necessary software in the assembly stage. The design stage is the foundation for application development. At this point, the author does the following:

a. Import assets to create augmented reality.
b. Creating augmented reality apps from storyboards.

5. Evaluation

At this point, the assembly is finished, and the application/program is run to see if there are any errors. This is also known as the alpha testing stage (alpha test), in which testing is performed by the maker or the maker's environment.

6. Distribution

The application will be saved in a storage medium at this point. If there are insufficient storage media to accommodate the application, compression will be performed iteratively without stopping and for a short period. Binanto (2010).

A. Augmented Reality

*name of corresponding author

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According (Lorenz et al., 2020) Augmented Reality (AR) is a real-time combination of the visible and virtual world, a real environment that combines three-dimensional objects, i.e. virtual objects integrated with the real world, known as augmented reality, or simply AR. technology that allows for precise merging of real and virtual objects, is interactive through certain input devices, and requires effective tracking for proper integration.

AR is a method of interacting with 3D objects and data, and is defined as a concept that combines virtual reality and real-world reality. In terms of two-dimensional (2D) or three-dimensional (3D) virtual objects that are designed to resemble and blend with nature.

Users will see virtual objects generated by AR technology as accurate. AR works by making use of image recognition, also known as markers. A calibrated camera, for example, can detect certain markers. The camera will then search for the marker in the previously created database. If the markers match, it will display the previously created 3D object in front of the user's screen; however, if the marker does not match the marker in the previous database, the marker information cannot be processed.(Miyazaki & Komuro, 2019)

According to (Maidi et al., 2020) technology must have three characteristics to be able to apply the concept of augmented reality:

a) Able to combine the physical world and the virtual world.
b) Able to provide interesting information and direct response.
c) Able to display in 3D.

B. Markeles Method

The Markerless method is an AR method where the detected marker is the position, orientation, or position of the device. As a criterion, the tracking process without markers in AR technology uses feature detection of the target object or tracking of the target object based on camera poses. If we use this method, users no longer need to use Scan markers to display digital elements, nor do they need to print markers to display them. The marker in this case is recognized as a point of device position, orientation, or position (Haryani, 2017a).

The Markerless Augmented Reality (User Defined Target) technique involves creating a marker that is generated when the camera scans a target that has been selected by the user. As a result, users no longer have to worry about the availability of unique bookmarks when using the program, making it easier to use them whenever and wherever they want.

Markerless AR is classified into two types, according to

a. Pose Tracking Method

This method observes a moving environment while using augmented reality hardware. This technology can be found in GPS (Global Positioning System), sensors, and digital applications. AR devices do not require markers to capture virtual positions when using pose tracking, but augmented reality devices must have very high sensing sensitivity to incorporate virtual objects into the real world.

b. Pattern Recognition

Pattern Matching is similar to marker-based tracking in that it uses an image instead of a marker in the form of a black-and-white grid illustration. It works by observing the real world with image pattern recognition while using AR hardware. Pattern Matcher can detect patterns without using tags. In this case, an augmented reality application will be made using several applications, namely Blender 3D, Vuforia, and Unity 3D.

RESULT

In this section, as for this stage is the stage of research results using storyboards in the design of Augmented Reality, which in this storyboard will explain the stages and processes of running research results using Augmented Reality.

A. Storyboard Design

The storyboard design is as follows:

Table 1 Application Storyboard

No	Scene	Image	Description

*name of corresponding author

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4	AR Collection Details		AR collection details contain 3D collection objects, collection name boxes, and buttons consisting of setting buttons, pause explanation sound, ar camera, restart explanation sound. In the description area, the collection contains explanatory material and a button consisting of an info button, left arrow and right arrow to view and continue the description.
5	Collection Menu		The Collection menu contains a preview of the collection's 3D objects, the name of the collection as well as a button to view the AR collection and its description.

B. Interface Design

1.) Collection Menu Interface Design

Collection details are sub menus that display augmented reality pages of selected collections such as the Medan Grand Mosque, Al-Osmani Mosque, Datuk Tongah Tomb, Syekh Said Bachrin's Tomb, and Ki Hajar Dewantara Monument. The info button can display historical descriptions and verses of the Koran and Hadith related to the visualization of 3D objects of this historic building. Then this sub menu is also equipped with an explanation voice as a learning support that can be played back or paused using the play and pause buttons. At the very top of this menu there is a bar measuring the quality of the marker used. The AR sub menu interface design for the collection details can be seen in the image below.

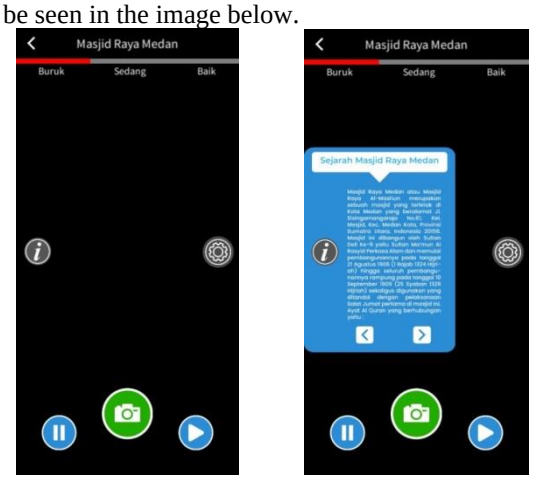

Figure 1 AR Menu Interface Collection Details

*name of corresponding author

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2.) Collection Menu Interface Design

The collection menu is a menu that displays a preview page of the collection of relics of the Malay deli Sultanate building. This menu aims to tell what collections are in the heritage of this building. If we press the View AR collection and explanation button, we will be directed to the floor plan and museum collection page. The collection menu interface design can be seen in the image below:

Figure 2 Collection Menu Interface

C. 3D Object Modeling

3D object modeling is the process of making 3D objects from objects that have been collected for augmented reality applications to be created. The following is a modeling of the object

1.) Medan Grand Mosque

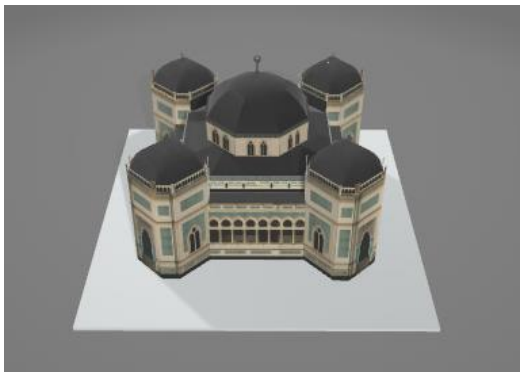

Figure 3. Medan Grand Mosque 3D Object

2.) Al-Osmani Mosque

*name of corresponding author

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Fugure 4. Al-Osmani Mosque 3D Object

D. Application View

1.) Details Collection Application View

In the AR sub menu, the details of the Al-Osmani Mosque museum collection display 3D augmented reality objects of the Al-Osmani Mosque by displaying historical descriptions along with related Al-Quran or Hadith verses accompanied by audio explanations that can be paused and restarted. The AR sub menu for the details of the Al-Osmani Mosque collection can be seen in the image below.

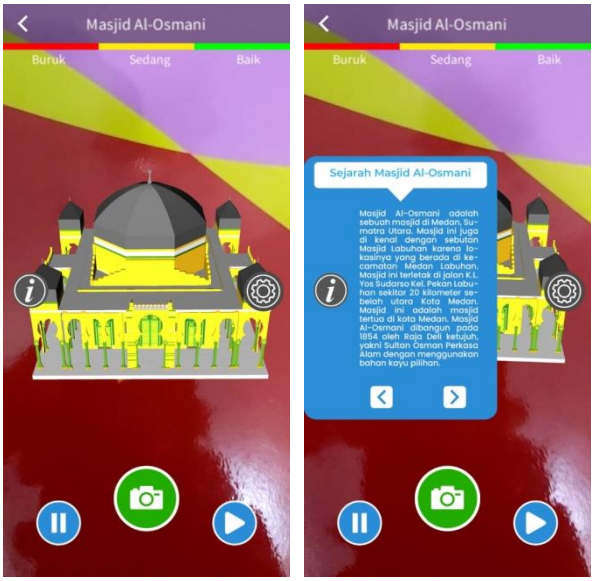

Figure 5. Museum Collection Application View

2.) Collection Menu Application View

The collection menu is a menu that displays a page with a preview of the appearance of each 3D object. If we press the move button to the right or to the left, it will switch views between the available collection menus. If we press the button to view floor plans and museum collections, we will be directed to the museum floor plan menu which displays the floor plans of the museum collections. Here is what the collection menu looks like:

*name of corresponding author

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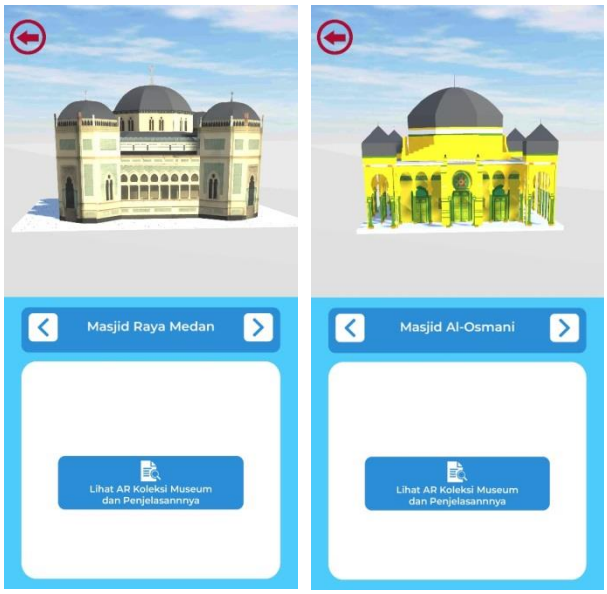

Figure 6. Collection Menu Application View

DISCUSSIONS

In this section, are the findings of our research into developing an Islamic digital museum that includes 3D renderings of Islamic historical buildings or events. There are also sound effects to help you understand what information is in the building or event. and it can be used as a medium of da'wah in imparting the symbols of the Islamic religion through the introduction of historical structures and places in the city of Medan by employing this Augmented Reality approach. The study will be used as one of the media for Islamic da'wah regarding Islamic history.

CONCLUSION

Based on the research above, it can be concluded that the application made can provide information about the relics of the Malay Deli Sultanate building. The information included is the history of the building's heritage which contains information on the location of the building's heritage, the period of whose sultanate it was built and other information relating to the relics of the Malay deli sultanate building. In this application, it contains 3D animations of the relics of the Malay Deli Sultanate building. The 3D animation design has been adjusted according to the relics of buildings in the real world so that people can see animated 3D objects that are almost similar to real buildings. This application is also equipped with sound effects that discuss information about building heritage in accordance with the text information displayed on the application. It is hoped that in the future objects of the Malay deli sultanate building heritage will be added as well as displaying interior and exterior supporting heritage buildings such as fences, gardens, and others.

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