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Integration of Augmented Reality and Game Technology First Person in the Rukun Hajj Simulation Application with MDLC Method for Introduction Basics About the Rukun of the Hajj Children

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Abstract

The pilgrimage (Hajj) is one of the pillars of Islam, consisting of several important stages that need to be understood from an early age. To assist children in learning and understanding the rituals of Hajj interactively, this study develops an application based on Augmented Reality (AR) and First Person Gaming using the *Multimedia Development Life Cycle* (MDLC) development method. The application aims to provide an enjoyable and educational learning experience through visual simulation and direct interaction with Hajj elements. The use of AR allows children to view and interact with three-dimensional objects of various Hajj rituals in a real-world environment, while the first-person game approach offers a more immersive simulation experience. The results of testing show that the application effectively enhances children's understanding of the Hajj rituals in an engaging and accessible way. This application is expected to serve as an innovative alternative educational medium for introducing the Hajj pillars to younger generations.

Keywords: *Augmented Reality, First Person Game, Hajj Rituals, MDLC, Children's Education*

1. Introduction

Hajj is one of the five pillars of Islam that every physically, mentally and financially able Muslim must undertake at least once in their lifetime. The Hajj includes a series of rituals performed in Mecca and its surroundings, including tawaf, arafah, sa'i, and uqf. Augmented Reality encourages students to utilize their five senses when using the application, making the learning process more attractive and enjoyable so that the reception of the material will be more optimal because it involves visual, auditory and kinesthetic learning styles.[1].

AR technology allows you to combine virtual elements with the real world to create a more immersive and interactive learning experience. Augmented Reality (AR) is a new field of Virtual Reality, a technology that allows users to interact with computer simulated environments, imitating real world environments, or new environments that only exist within a computer[2]. First Person games offer a more personal and direct perspective, so that children can experience the implementation of the Pillars of Hajj as if they were in a real place. The MDLC (Multimedia Development Life Cycle) methodology consists of six phases, namely the first phase of conceptualization, the second phase of design, the third phase of material collection, the fourth phase of assembly, and the fifth phase of testing, and the sixth phase is distribution[3].

2. Theoritical Basic

2.1. Augmented Reality

Augmented Reality (AR) is a technology that combines digital elements with the real world in an interactive way. In contrast to Virtual Reality (VR), which creates a completely virtual environment, AR preserves the real world and adds digital elements to it. This technology allows users to see digital objects as if they were present in the environment around them, thus creating an immersive experience without separating the user from the real world[4]. Marker Bassed Tracking (MBT) is an object detection method in Augmented Reality (AR) that requires markers (images) as a reference for detecting objects that will display AR information and effects. This method allows the AR system to precisely place virtual objects on or around markers in the user's field of view. This Augmented Reality system requires markers in the form of images that can be analyzed to form a reality called an image with markers.

2.2. Game First Person

First-Person Games are a game genre that presents a perspective from the protagonist's point of view and allows the player to see the game world through that character's eyes. Elements commonly found in First-Person Games include the use of weapons, puzzle elements, interaction with the environment, and story elements that lead the player on a narrative path. The game designed falls into the FPS (First Person Shooter) category. FPS is a type of video game that places the player in a first person perspective. This means that players will see the game world through the eyes of the game's protagonist[5].

2.3. Multimedia Development Life Cycle

Multimedia Development Life Cycle (MDLC) is a method for developing multimedia learning media. This method was developed by Luther and adopted by Stopo, and is one of the most complete and accurate learning media design methods. MDLC is used for various multimedia applications, including the development of interactive learning media, alphabet and number recognition applications, as well as educational media to support people with intellectual disabilities. This method is very useful for designing and developing effective and efficient multimedia applications.

2.4. Unfied Modelling Language

UML (Unified Modeling Language) is a visual modeling language used in the field of software development to provide a general and intuitive way to visualize system designs. UML helps represent, visualize, create, and document software system artifacts as well as business models and other non-software systems[6].

2.5. Story Board

A storyboard is a series of thumbnails that tell you what happens in your video from beginning to end. It contains notes about what happens in each frame and is similar to a comic. Storyboards are created by providing information or explanations about commands in an application. This is intended to make the relationship between individual menus in the application more systematic, so that errors can be immediately recognized and corrected[7].

2.6. Unity

Unity is a very popular game development platform (Game Engine) that is mainly used to create 2D, 3D, Virtual Reality (VR), and Augmented Reality (AR) games. Apart from game development, Unity is widely used in other fields such as simulation, animation, architectural visualization, and even animated films. The platform supports cross-platform development.

2.7. Hajj

The Hajj is a pilgrimage to the holy city of Mecca, one of the five pillars of Islam, and is mandatory for all Muslims who are physically, mentally, and financially able to undertake it at least once in their lives. The Hajj takes place every year in the month of Zulhijah, the last month of the Islamic calendar, and involves a series of rituals performed at certain holy places such as the Kaaba of the Grand Mosque, Padang Arafa, Muzdalifah, and Mina. Hajj is an obligation for every Muslim who is physically and financially able to perform it at least once in their lifetime[8].

3. System Analysis and Design

3.1. Problem Analysis

System analysis is carried out to understand the needs and specifications of the system being developed. The system analyzed is a pilgrimage simulation application that combines Augmented Reality (AR) technology and First-Person Game elements. The purpose of this analysis is to evaluate functional and non-functional requirements and determine the various components needed for the application to work optimally.

3.2. System Requirements Analysis

Designing this application requires hardware and software. This is necessary not only to ensure the design process runs as desired, but also to select appropriate hardware specifications to make the design process more efficient and effective.

3.2.1. Hardware Used

Hardware is the physical parts of a computer. Its function is as a container or medium for running software. The hardware used in this research includes.

Table 1: Hardware Used

Perangkat	Keterangan
Laptops	MSI Thin -15
Procecor	Intel I5 Gen 13h
Memory	RAM 8GB
Mouse	Logitech

Smartphone	Tecno Pova 4 Pro
Graphics Procecing Unit	NVIDIA Geforce RTX 4050

3.2.2. Software Used

Software is a program or part of a computer that can be seen but does not have a physical form and acts as a link between the user and the hardware, so that it can display instructions or commands carried out by the user. The following is the software used in application design.

Table 2: Software Used

Perangkat Lunak	Keterangan
Operating System	Windows 11 Home
Unity	Unity 2022.3.39.f1
Blender	Blender 4.2
Canva	Web Version
Visual Studio	Visual Studio 2022

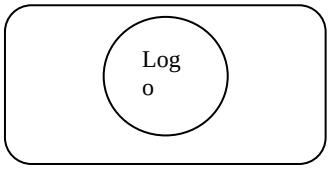
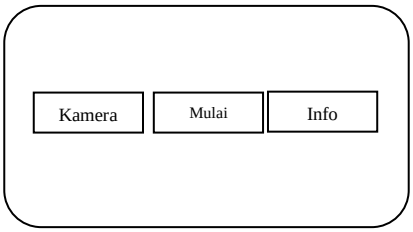
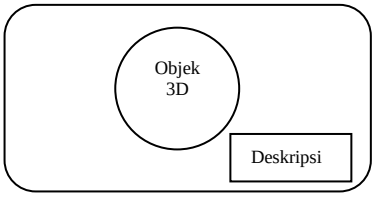
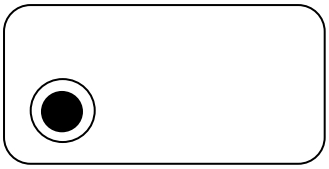
3.3. Application Design

System design is to provide an overview of a system that includes both the operational steps of a data processing process and the process steps that support the operation of the system. The aim of system design is to meet the needs of system users and provide a clear picture and complete design to the experts involved. This design aims to produce a structure that is efficient and effective, while functioning well.

3.4. Story Board

This phase was created as a guide to create an application design representation that shows how the application is designed.

Table 3: Storyboard Application

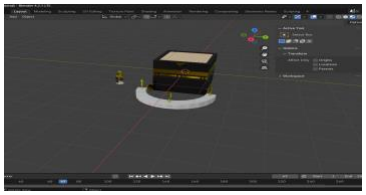
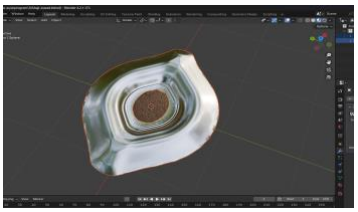
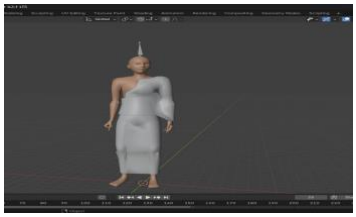
Scenario	Display	Description
Scenario 1		Displays the unity logo splash screen for 3 seconds.
Scenario 2		The menu display in the application is as follows. 1. Start Camera 2. Start 3. Info 4. Exit button
Scenario 3		The AR camera start view will change when a marker is detected. This display will display a rotating 3D object which will display a marker, a description box that explains the meaning of the 3D object, a box for the name of the 3D object.
Scenario 4		First Person Game Display where there is an analogue in it

Scenario 5		Tampilan Info penggunaan kamera *Augmented Reality* berisi tata cara penggunaan kamera AR

3.5. Asset Collection

Asset collection is done for application display. This phase is very important because it affects the user interface and affects the user when the application is run.

Lanjutan Tabel 4: Aset Yang Digunakan Perancangan

Jenis Aset	Tampilan	Keterangan
3D Asset		The 3D Kaaba asset was created using the 3D blender application. This 3D object will later be projected into Augmented Reality and can be seen clearly when starting the game.
3D Asset		Hajr Aswad 3D assets were created using a 3D blender application. These 3D objects can be seen clearly when starting the game. .
3D Asset		3D Character Assets created using a 3D blender application. These 3D objects can be seen on the Augmented Reality camera clearly when starting the game.
UI Asset		This UI asset is the background for the application display. These UI assets were created using the Canva application.

Marker Asset		This marker asset is used as a target for AR projection. This UI asset was created on Canvas.

3.6. Flow Procces Code

Flow Process Code refers to a way of representing the flow of a process or steps in code or diagrams that show the execution sequence of a system or algorithm. In the context of programming or systems development, it is a method for describing how a process proceeds from one step to the next. Basically, Flow Process Code is a visual or textual representation of how a program, system, or workflow will be executed.

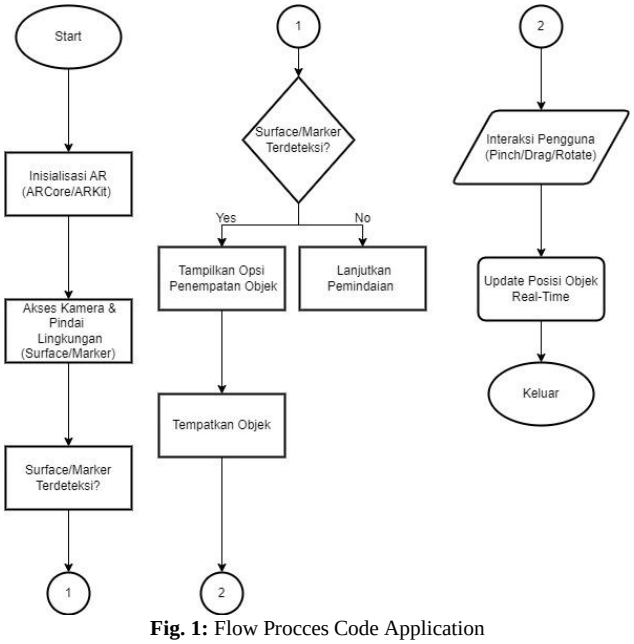


Fig. 1: Flow Procces Code Application

3.7. Use Case Diagram

Use Case can describe the type of interaction between system users and the system. Use case diagrams are models for implementing the information system that will be created. Use cases work by describing typical interactions between system users and their own systems through narratives about how the system is used.

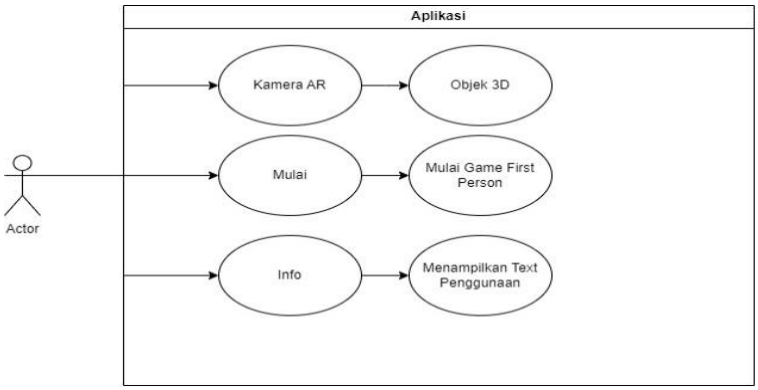


Fig. 2: Use Case Diagram Application

3.8. Activity Diagram

Activity Diagram, This Activity Diagram is designed to understand the system flow and actions taken by users when using the application. In it there are components with certain shapes that are connected via arrows. The arrow then points to the sequence of activities performed from start to finish.

3.9. Interface Design

Interface design is the process of creating a display design to serve as an illustration for designing the appearance of an application. Application design must look at the efficiency of user interaction with the application so that a user friendly appearance is created. The aim of creating an application with a user friendly appearance is so that users can understand and easily understand the function of the application and its use.

4. Result And Discussion

At this stage the results of the designed application are displayed. This is used to check whether the application is running as expected. Several views are available in the application including.

4.1. Initial View

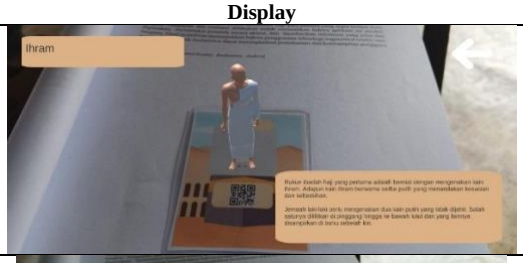
This is the first screen of the application screen, and this screen contains menu buttons that take you to different pages.

Fig. 3: Initial View

4.2. How The Tool Works

AR is projected onto this display. When the camera aims and detects a marker, it projects a 3D object, followed by a description and name of the displayed object.

Table 5: Tampilan 3D Objek

NO	Display	Information
1		When the ihram marker is scanned, it will display a person wearing ihram clothing, along with an explanation of what ihram is.
2		When the wukuf is scanned, it will display the tent which is the place for the congregation while they are on Arafah, as well as an explanation of what the wukuf is.
3		When tawaf is scanned, it will show someone who is performing tawaf, as well as an explanation of what tawaf is.

4				When sa'i is scanned, it will show someone who is doing sa'i, as well as an explanation of what sa'i is.
5				When tahallul is scanned, it will show someone being shaved, and an explanation of what tahallul is.
6				When orderly is scanned it will display an explanation of the order of the pillars of the Hajj, as well as an explanation of what orderly means.

4.3. Usage Information Page Display

This page contains text that explains to users how to use AR. This view only displays text and a button to return to the menu page.

Fig 4: Usage Information Page Display

4.4. First Person Game Display

Apart from AR, there are simulation games with the First Person type, here there are several objects at the Grand Mosque.

Fig 5: First Person Gane Display

5. Conclusion

From the research results along with explanations from the previous chapters, a conclusion can be made, namely.

1. The use of Augmented Reality (AR) technology has proven to be more effective in increasing children's understanding of the pillars of Hajj compared to traditional teaching methods. Based on the survey results of respondents, 89% gave positive responses, 8% gave normal responses, and 3% responded negatively. With a more visual and interactive approach, AR is able to present information in a more interesting way and makes it easier for children to understand abstract concepts through real simulations.
2. AR technology provides a new, more fun and immersive way of learning. Based on the results of a survey of respondents, 71% of people felt helped by the application. Children not only learn through texts or lectures, but can also engage directly in virtual experiences that allow them to "see" and "experience" the pillars of the Hajj practically. This contributes to increasing their motivation and engagement in learning.
3. From the results of testing and analysis, the Augmented Reality system is proven to be efficient in increasing children's knowledge about the Hajj pilgrimage. This can be seen from the overall results of respondents' answers showing that 89% gave positive responses, 8% gave normal responses, and 3% responded negatively. Additionally, AR offers an approach that is time-saving and accessible to children with varying levels of understanding.

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