

**DEPARTMENT OF INFORMATION AND COMMUNICATION
TECHNOLOGY**

**DIPLOMA IN INFORMATION TECHNOLOGY
(DIGITAL TECHNOLOGY)**

DFT50114: INTEGRATED PROJECT

HAJJ SIMULATOUR

SIMULATOR FOR HAJJ

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SESSION: II 2022/2023

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1.0 Abstract

Hajj Simulatour is a VR-based simulator project. Initially, the client, SMK Bandar Rinching has a field site that's called 'Laman Haji'. Laman Haji is a compound where the students can simulate the six required steps of performing hajj. While this implementation is helpful enough, the compound might not be available for some reasons such as time or weather limitation, which has led to inaccessibility difficulties for the SMK Bandar Rinching students. Hence, this project aims to develop a VR hajj simulator to engage students in their syllabus learning, develop voice interaction and information labelling, as well as develop virtual instructions that replace the demand for human instructors in a training environment. This project uses Agile as the methodology being employed, with 3 main modules developed which are Hajj Simulation module, Mini Quiz module and Learning Room module.

2.0 PROJECT PLAN

2.1 Introduction

HAJJ SIMULATOUR is a VR-based simulator project where the virtual reality environment is presented to the end-users. Virtual Reality (VR) by any means, is a use of computer technology to create simulated environments. Virtual reality places the user inside a three-dimensional experience, instead of viewing a screen in front of them, users are immersed in and interact with 3D worlds. Nowadays, VR trends in education have allowed students to move seamlessly from the workplace to a pixelated practice space where they can build stronger muscle memory about what they're learning. Hence, we've proposed this project to **SMK Bandar Rinching**, a potential client that could benefit the most once the project has been completely developed and ready to be used.

VR technology that has been proposed to the client has promising functionalities and benefits. With the right equipment such as a VR headset, users are good to go to explore the functionalities. The VR simulator proposed has focused on functions such as presenting a 360° VR environment of Hajj simulation. That way, users will be able to immerse themselves in scenes and objects that appear to be real through the screen. Not only that, the VR simulator will be able to help users to interact closely with each module as if they're performing Hajj in real time. The VR simulator will also be able to display virtual interfaces of useful information and instructions through the user's virtual screen. This project would be beneficial for the students of SMK Bandar Rinching as it can improve students' learning outcomes.

CLIENT:**Table 2.1.1 Client Background**

	
DETAIL	DESCRIPTION
NAME	SMK Bandar Rinchang
LOCATION	SMK Bandar Rinchang, 41, Jalan 5/42, 43500 Semenyih, Selangor.
CORE SERVICE	Education
PRINCIPAL	Mr. Mashudi Bin Khailani
ACADEMIC SENIOR ASSISTANT	Mrs. Che Tom Binti Ahmad
CO-CURRICULAR SENIOR ASSISTANT	Mrs. Masijah Binti Maskob
HEAD PANEL OF UNIT PENDIDIKAN ISLAM	Mrs. Suzaimi Binti Masri
EMPLOYEES	90
STUDENTS	1525
CLIENT UNIT	Unit Pendidikan Islam

A few fact-finding techniques have been conducted in order to support the investigation and requirement gatherings of the project, including the observation technique, research technique and documentation review technique. From the fact-findings managed, it is found that the topic 'Hajj and Umrah' is included in SPM Pendidikan Islam's syllabus.

Initially, SMK Bandar Rinchang has a field site that's called 'Laman Haji'. Laman Haji is a compound where the students can simulate the six (6) required steps of performing Hajj from the Jeddah International Airport, to the Kaaba. While this implementation is helpful enough, there are still a few problems that have been found which include :

- i. SMK Bandar Rinchang's students won't be able to experience the Hajj simulation unless they're outdoors at the Laman Haji themselves.
- ii. The compound might not be available for some reasons such as time or weather limitation, which led to inaccessibility difficulties for the SMK Bandar Rinchang students.

‘Laman Haji’ that has been built since 2017



Figure 2.1.1 : Jeddah International Airport



Figure 2.1.2 : Hotels in Mecca



Figure 2.1.3 : Jamarat



Figure 2.1.4 : Ka'abah Replica

The requirement gatherings have involved the SMK Bandar Rinching's Unit Pendidikan Islam, along with the end-users, SPM Pendidikan Islam candidates of SMK Bandar Rinching. After all, Hajj Simulatour is closely significant to the client as this project will produce valuable outcomes that could be implemented not only for the SPM examination, but also for future real-world situations.

2.2 Problem Statement

The problem statements for the project are as follows:

i. Limited access for students who want to learn topic Hajj.

SMK Bandar Rinching's students won't be able to experience the Hajj simulation unless they're outdoors at the Laman Haji themselves. Additionally, the Laman Haji might not be available for some reasons such as time or weather limitation.

ii. The information boards of Laman Haji get blurry, and the information given during the process of learning is not attractive.

The work environment at Laman Haji consists of the steps and instructions for the Hajj pilgrimage that are displayed to users. Some of the writings on the instruction boards are getting blurry and hard to read, while the other instructions boards are taking up a lot of space.

iii. Simulants need a human guide to learn to use Laman Haji.

When using the Laman Haji, students require a teaching guide to instruct them and demonstrate each of the hajj steps. This results in the usage of more manpower and energy by the trainee and the students themselves.

2.3 Objectives

The objectives of the project are as follows:

- i. To develop a Hajj simulator using VR Technology for students to learn the topic, Hajj.
- ii. To develop voice interaction and information labelling for Hajj Simulatour virtual interfaces.
- iii. To develop virtual instructions that replace the demand for human instructors in a training environment.

2.4 Scope

User Scope

- i. Users are able to view virtual interfaces that show information and guides about the topic 'Hajj and Umrah' from the virtual screen.
- ii. Users are able to perform any detectable physical motion and gestures on to the VR environment.
- iii. Users are able to listen to the learning audio materials while performing the Hajj simulation.
- iv. Users are able to answer mini quizzes after simulating the Hajj simulation.

System Scope

- i. The Hajj Simulatour able to deliver 3D spaces of Hajj simulation that follows the required steps of performing a Hajj pilgrimage.
- ii. The Hajj Simulatour able to display interesting and engaging interfaces about information and instructions of the Hajj simulation.
- iii. The Hajj Simulatour able to provide users with responsive and interactive virtual interfaces.
- iv. The Hajj Simulatour able to navigate users from main page to the Simulation Area and to the Quiz Room.

2.5 Literature Review

Table 2.5.1 Literature Review of VR Hajj comparison

Project	Hajji VR 	Labbaik VR 	MUSLIM 3D 
Link Resources	Hajji VR on Steam (steampowered.com)	https://www.labbaikvr.com/demo/	Muslim 3D on Steam (steampowered.com)
Programming Language Used	C#	C#	C#
Hardware	Oculus Quest(VR)	Oculus Quest(VR)	Oculus Quest(VR)
Software	Unity	Unity	Unity
Advantages	i. Using controllers and teleports to move. ii. Interface design that is interesting and has information for users to read.	i. Information and guides are available for users. ii. Audio materials like 'niat' and prayers are available.	i. Audio materials like 'niat' and prayers are available.
Disadvantages	i. The size of VR applications is significantly bigger.	i. The size of VR applications is significantly bigger.	i. Too much work to do. For example, user needs to select avatar character before starts.

Based on the Table 2.5.1, it shows the overview of the previously published works and projects of Hajj Simulator. With that, the team members have found some disadvantages that may be an advantage to the ongoing VR project. Some of the shortcomings found are, the previous projects are using more hand movements throughout the game. As for ongoing projects, project members will increase the use of feet where the user's footsteps can be detected within a certain distance from the VR workspace. For example, using foot movements while moving in a circle around the Kaaba. Therefore, students need to equally use both hands and feet during the simulation process on Hajj Simulatour. In addition, one of the projects requires too much work. For example, the user needs to first select the avatar character before the simulator starts. That said, Hajj Simulatour will be focusing on keeping the interfaces simple yet attractive while ensuring the layouts consistency and use common UI elements. Lastly, to overcome the disadvantage of the previous project with the size of VR applications that is significantly bigger, the Hajj Simulatour project will be removing unnecessary generated code and compressing the APK file of the simulator.

2.6 Methodology

The project's methodology is Agile. The methodology was chosen because it is appropriate for both small and large projects. Agile enabled the development team to concentrate on the software rather than its design and documentation. This can cause a fast development timeline. Because of incremental release, Agile provides a flexible timeline. Agile is better suited for application development, where system requirements frequently change during the development process. It provides higher customer satisfaction because clients are involved throughout the project.



Figure 2.5.1: Agile Methodology

The following are some of the major benefits of Agile methodology :

- i. Flexibility:** The Agile Scrum methodology is highly adaptable and allows for changes to be made at any time during the development process. This means that if requirements change or new ideas suddenly appear, the team can make adjustments.
- ii. Increased collaboration:** The Agile Scrum methodology encourages collaboration among team members as well as with stakeholders and customers. This can lead to improved communication and a better understanding of the project's goals and objectives.
- iii. Increase team morale:** The Agile Scrum methodology encourages teamwork and empowers individuals to take responsibility for their work. As a result, team members may feel more togetherness and more satisfied with their work.
- iv. Continuous Feedback:** The Agile Scrum methodology encourages stakeholders, customers, and team members to provide continuous feedback. This can assist teams in identifying and addressing issues early in the development process, resulting in better outcomes.

Table 2.5.2 Agile Methodology Phase

No.	Phase	Activities
1	Meet & Plan	i. Project team brainstorm for ideas. ii. Meet clients to perform fact finding and gathering requirements. iii. Conduct preliminary investigation. iv. Analyze preliminary investigation outcome.
2	Design	i. Designing the architecture of the project ii. Designing UML diagrams, data flow diagrams (DFD) and Gantt chart to understand the functions, system boundaries and the overall flow/progress of the project. iii. Designing Hajj Simulatour interface using Unity Software iv. based on client requirements.
3	Code & Test	i. Coding the functions and simulations of the project using compatible software.
4	Release	i. Release the VR and implement the simulator to the client's environment.
5	Feedback	i. Get feedback from clients and perform maintenance if there's a bug.

2.7 Gantt Chart

PROJECT NAME	HAJJ SIMULATOUR	START DATE	19/06/2023	END DATE	06/08/23	OVERALL PROGRESS	In Progress	MEMBERS : SYAZA ADLINA BINTI SHARI
PROJECT MANAGER	NADIAH HUSNA BINTI HASIM							MEMBERS : WAN NUR FARAH IZZAH BINTI WAN MOHD RAZUKI

NO	SPRINT	PHASES/ACTIVITIES	START	FINISH	DURATION in days	COMMENTS
1	SPRINT 1		19/06/2023	17/07/2023	21	
2		MEET & PLAN	19/06/2023	21/06/2023	3	Brainstorm for project ideas.
3		First Meeting	19/06/2023	19/06/2023	1	Pitch ideas to Ts. Khalid, Ts. approved the idea.
4		Second Meeting	20/06/2023	20/06/2023	1	Decided to meet client (SMK Bandar Rinchng)
5		Third Meeting	21/06/2023	21/06/2023	1	First meeting with client (SMK Bandar Rinchng) for requirement gathering
6		DESIGN	22/06/2023	07/07/2023	13	Data Flow Diagram, ERD, Interfaces, VR Space Design
7		Data Flow Diagram Design	22/06/2023	24/06/2023	3	Designing UML diagrams to understand the functions, system boundaries and the overall flow of the project
8		VR Space Design	25/06/2023	30/06/2023	6	Designing the architecture of the project
9		Interface Design	01/07/2023	07/07/2023	7	Start designing Intelli-Hajj using Unity Software based on client requirements.
10		CODE TEST	08/07/2023	13/07/2023	6	Coding, Embed
11		Coding project functionalities	08/07/2023	11/07/2023	4	Coding the Intelli-Hajj functionalities on usng Unity3D and Microsoft Visual Studio
12		Testing	12/07/2023	13/07/2023	2	Test the Unity Software
13		RELEASE	14/07/2023	14/07/2023	1	Releasing VR simulator
14		Release project	14/07/2023	14/07/2023	1	Release the VR from development environment to the production environment
15		FEEDBACK	15/07/2023	15/07/2023	2	Client Feedback
16		Fourth Meeting	15/07/2023	15/07/2023	1	Get a feedback from client and perform maintenance if there's any bug on the project.
17	SPRINT 2		17/07/2023	06/08/2023	20	
18		MEET & PLAN	17/07/2023	18/07/2023	2	Meeting
19		Fifth Meeting	17/07/2023	17/07/2023	1	Meeting with client (SMK Bandar Rinchng)for Gathering Requirement and get Feedback.
20		Sixth Meeting	18/07/2023	18/07/2023	1	Meeting with team members to discuss improvement of the project.
21		DESIGN	19/07/2023	31/07/2023	13	Audio, Interfaces, VR Space Design
22		Audio	19/07/2023	23/07/2023	5	Insert an audio
23		VR Space Design	24/07/2023	31/07/2023	8	Designing Intelli-Hajj using Unity Software based on client requirements
24		CODE TEST	01/08/2023	04/08/2023	4	Coding
25		Code & Testing	01/08/2023	04/08/2023	4	Coding the functions and simulations of the project using compatible softwares
26		RELEASE	05/08/2023	05/08/2023	1	Release the VR simulator
27		Release project	05/08/2023	05/08/2023	1	Release the project and implement the VR simulator to the client's environment
28		FEEDBACK	06/08/2023	06/08/2023	1	Client Feedback
29		Seventh Meeting	06/08/2023	06/08/2023	1	Get a feedback from client and perform maintenance if there's any bug on the project.

Figure 2.6.1 : Project's Gantt Chart of based on the chosen methodology

3.0 REQUIREMENT SPECIFICATION

3.1 Functional Requirement

The functional requirements of the project are as follows:

User Requirements

- i. Users can use the teleportation function to move around the simulator.
- ii. Users can view virtual interfaces that show information and guides from the virtual screen.
- iii. Users can use the joystick controller to move around the simulator.
- iv. Users can grab and release objects such as jamrat stone using controller.
- v. Users can view the learning video inside the learning room.
- vi. Users can flip a virtual book to the next and previous pages.
- vii. Users can listen to the learning audio materials while performing the Hajj simulation.
- viii. Users can navigate from one scene to another with a click of button.

System Requirements

- i. This application can teleport users to their desired location.
- ii. This application can provide users with Grab Interactions, which let them grab and release objects.
- iii. This application can display the learning materials inside each module.
- iv. This application provides user control of flipping the virtual book from left to right.
- v. This application provides voice interaction and information labelling to guide users while they're simulating hajj.
- vi. This application provides users with navigation control to let users navigate from one scene to another.

3.2 Non-Functional Requirement

The non-functional requirements of the project are as follows:

i. Usability

Minimal time should be taken for users to learn how to use this system and the steps taken to use this system must be simple to remember.

ii. Reliability

This system must consistently perform any specified functions without crashing and can run for a long period of time.

3.3 Hardware and Software Requirement

Table 3.3.1 Shows the hardware requirement.

NO	HARDWARE	SPECIFICATION	PRICE(RM)
1.	Oculus Quest (VR)	i. Field of view 360 ° ii. Wired and wireless iii. Wi-Fi/Bluetooth connected. iv. Dimensions (191.5 x 102 x 142.5mm) v. Weight: 503g vi. Material plastic vii. Power Supply: Battery	3899.00
2.	Laptop Acer Nitro 5	i. AMD Ryzen 7 5800H ii. NVIDIA GeForce RTX 3070 Ti (Laptop, 150W) iii. 15.6", QHD (2560 x 1440), 165 Hz, IPS	5199.00
3.	Laptop MSI GF63 Thin 10SC	i. Intel(R) Core (TM) i5-10500H CPU@ 2.50GHz ii. Intel i5 - 10500H	3599.00

Table 3.3.2 Shows the software requirement.

NO	SOFTWARE	SPECIFICATION	PRICE (RM)
1.	Unity	i. Support a wide range of platforms such as Windows, Mac, Linux, IOS, Android, Xbox, PlayStation. ii. Support programming languages like C#, JavaScript. iii. Support features such as 3D spatialization, audio mixing and real-time audio effects.	1854.55
2.	Visual Studio Community	i. Support programming languages like C#, C++, Visual Basic.NET, F#, Python. ii. Includes a powerful code editor with features such as syntax highlighting, code completion, refactoring and debugging.	209.16
3.	Adobe Illustrator	i. Allows users to create and edit shapes, paths, and curves using mathematical equations. ii. Has a wide range of tools and panels, such as the Selection tool, Pen tool, Type tool, and Layers panel.	59.35
4.	Sketchup Pro	i. The most intuitive way to design, document and communicate ideas in 3D. ii. Work through ideas in 3D space and quickly develop projects. SketchUp enables to design, define, and plan in all stages of the project.	553.11
			TOTAL: RM 15,373.17

3.4 System Configuration

a. Download SideQuest and Sign Up account.

- i. Users need to install the Side Quest on Windows, Linux, or Mac and sign up for an account in this link: <https://sidequestvr.com/download>

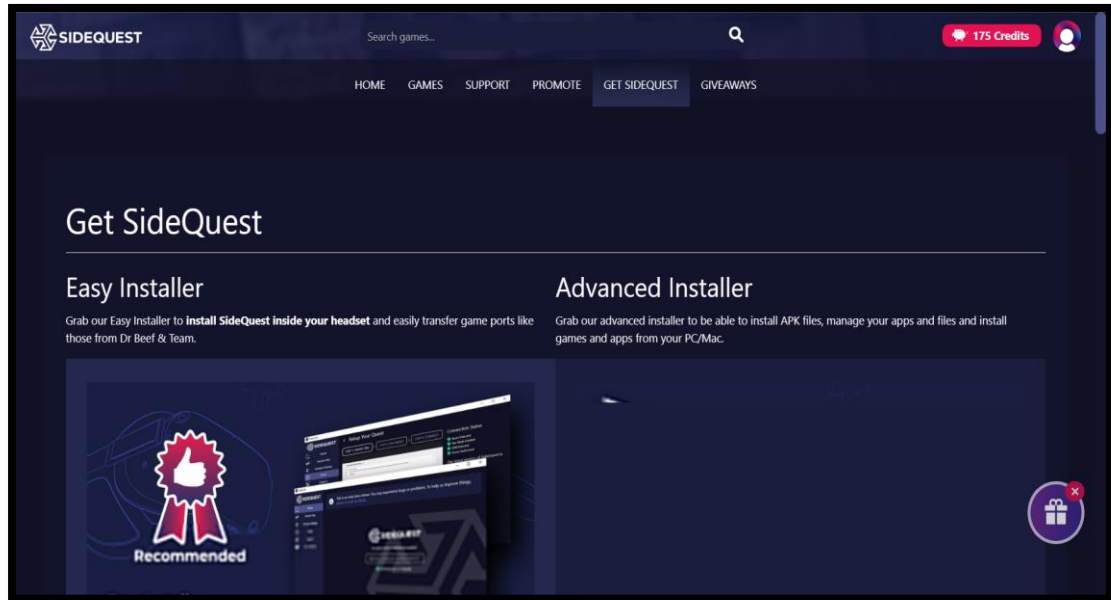


Figure 3.4.1 : SideQuest Configuration

- ii. Also, users need to sign up and login account into Meta Quest for show in vr when wear the vr headset.

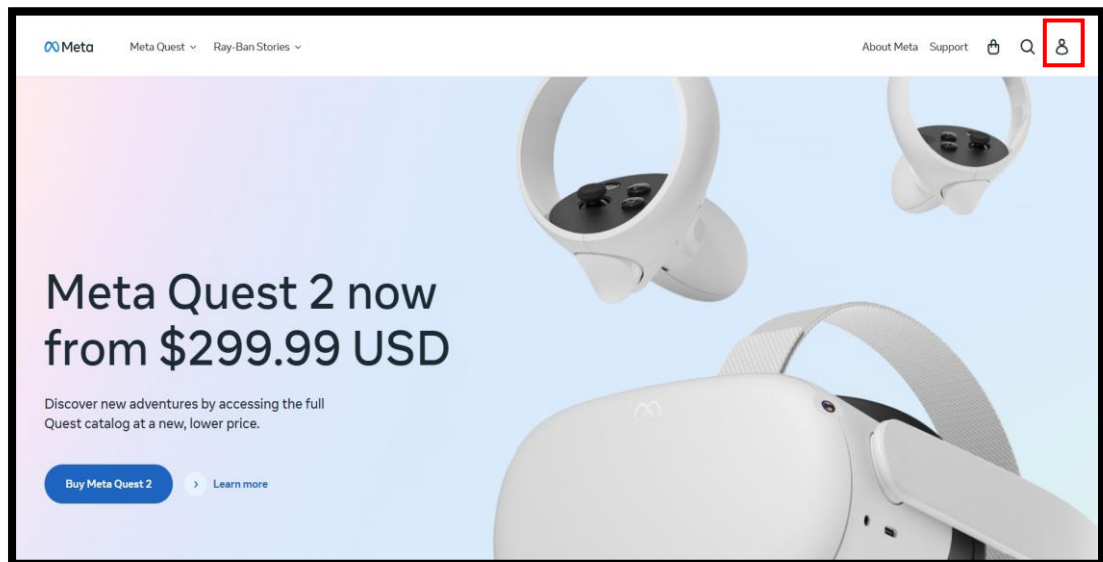


Figure 3.4.2 : Meta Quest software

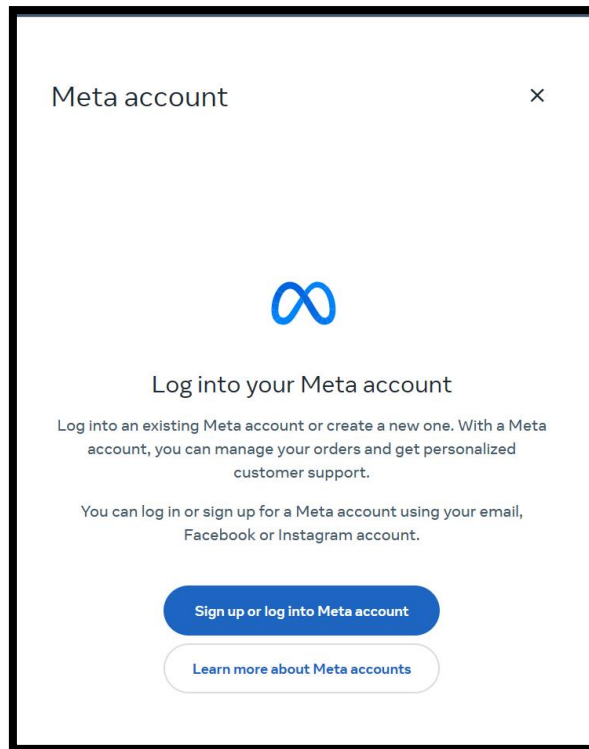


Figure 3.4.3 : Sign Up or login into Meta account

- iii. Oculus Quest connected in SideQuest when show the green color.

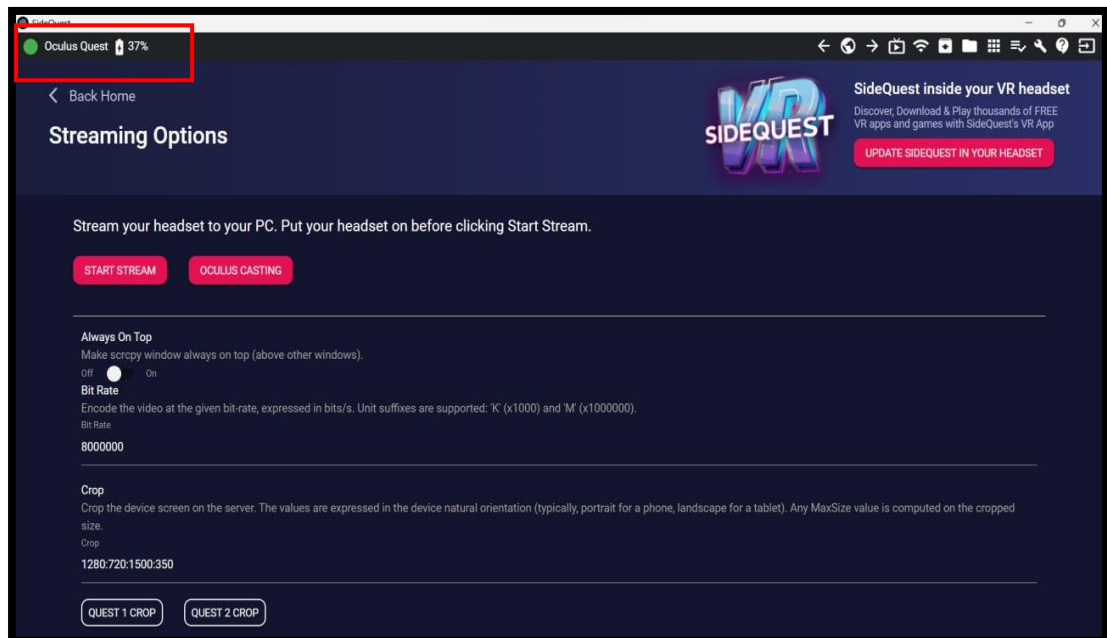


Figure 3.4.4 : Succesfully connected to SideQuest

- iv. Install the apk file Hajj Simulatour in SideQuest.
- v. The apk file will show in SideQuest.

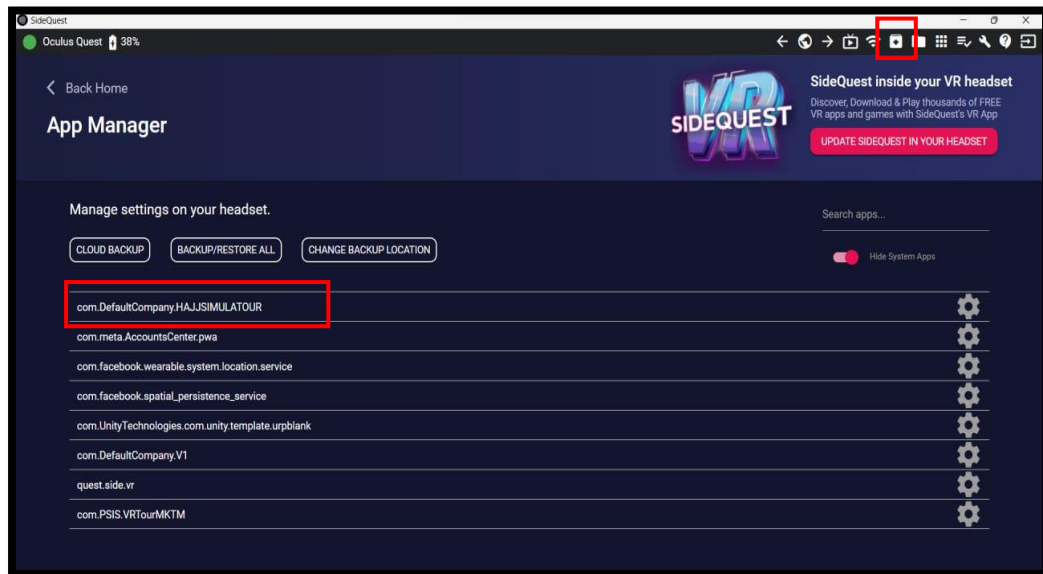


Figure 3.4.5 : APK installation

b. Launching Hajj Simulatour in Oculus

- i. Users need to wear the vr headset first.
- ii. Users click the “Unknown sources” to find the apk file Hajj Simulatour.

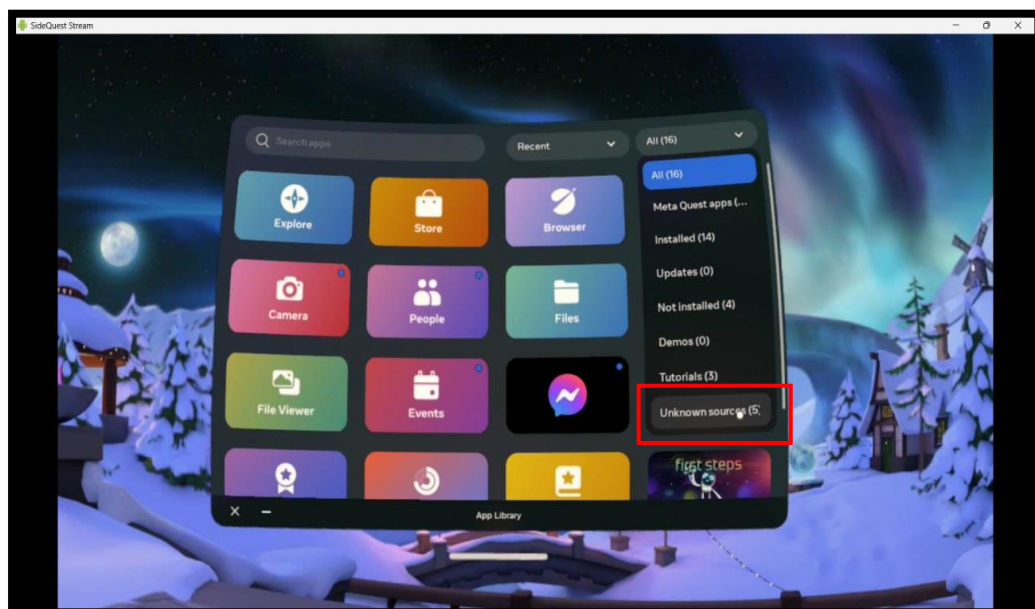


Figure 3.4.6 : Oculus headset Configuration

iii. And select the HAJJ SIMULATOUR.

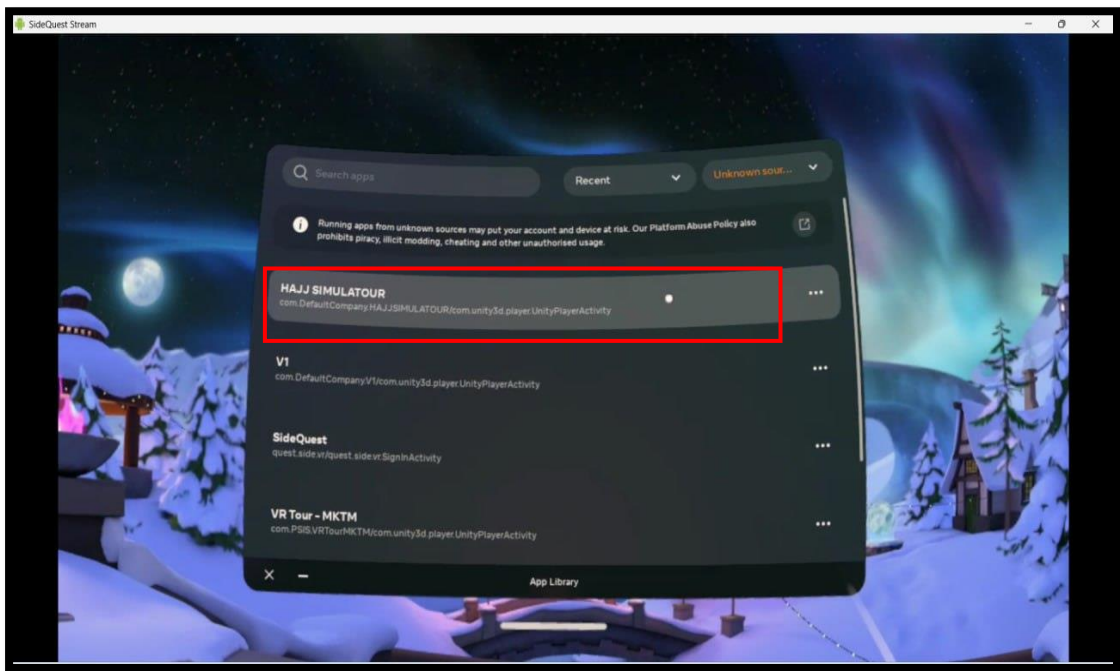


Figure 3.4.7 : Choose apk file

3.5 Security Requirement

Hajj Simulatour does not gather information or data from this application using databases. Therefore, this VR application does not require any security requirements.

4.0 FINAL DESIGN

4.1 Logical Design

I. Use Case Diagram

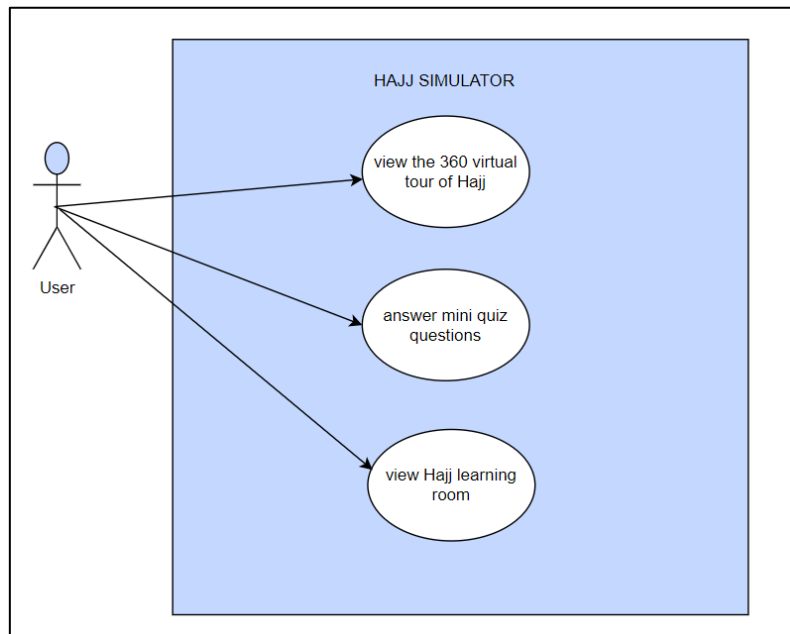


Figure 4.1.1 Hajj Simulatour Use Case Diagram

II. Functional Decomposition Diagram (FDD)

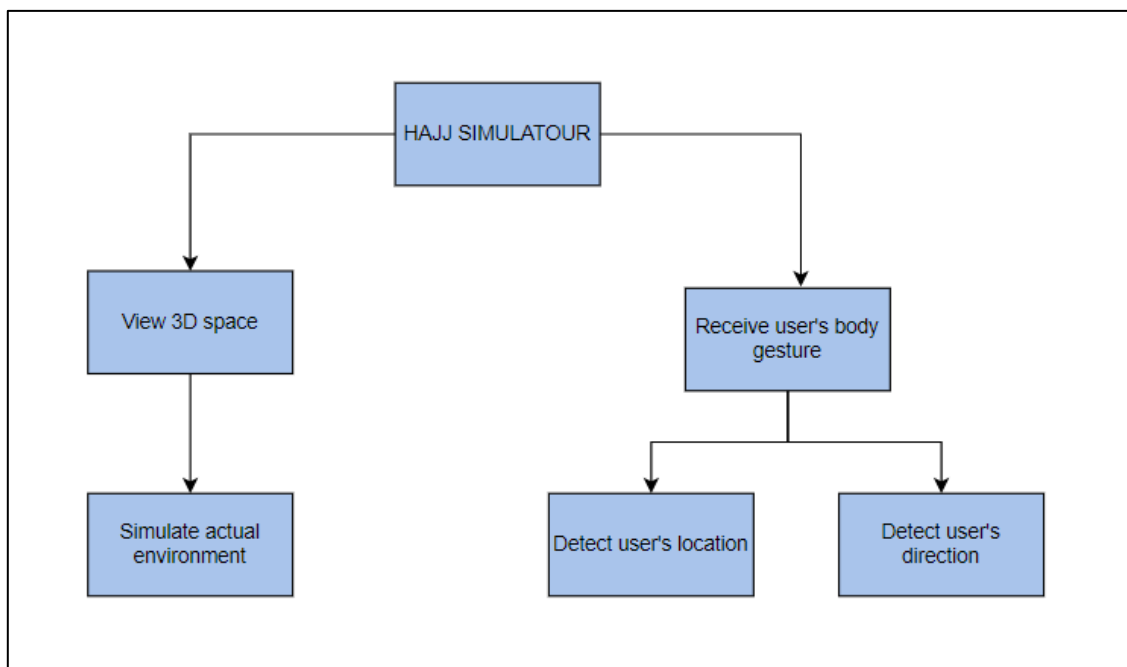


Figure 4.1.2 Hajj Simulatour FDD

III. Context diagram

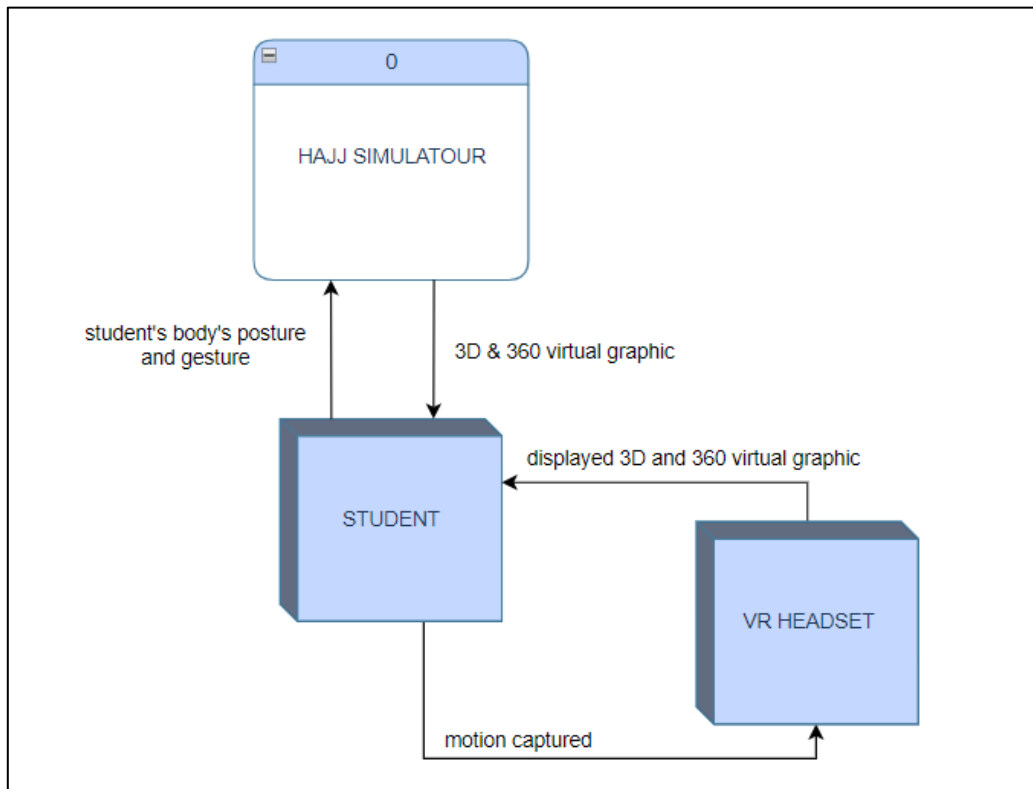


Figure 4.1.3 Hajj Simulatour Context Diagram

IV. Data Flow Diagram (DFD)

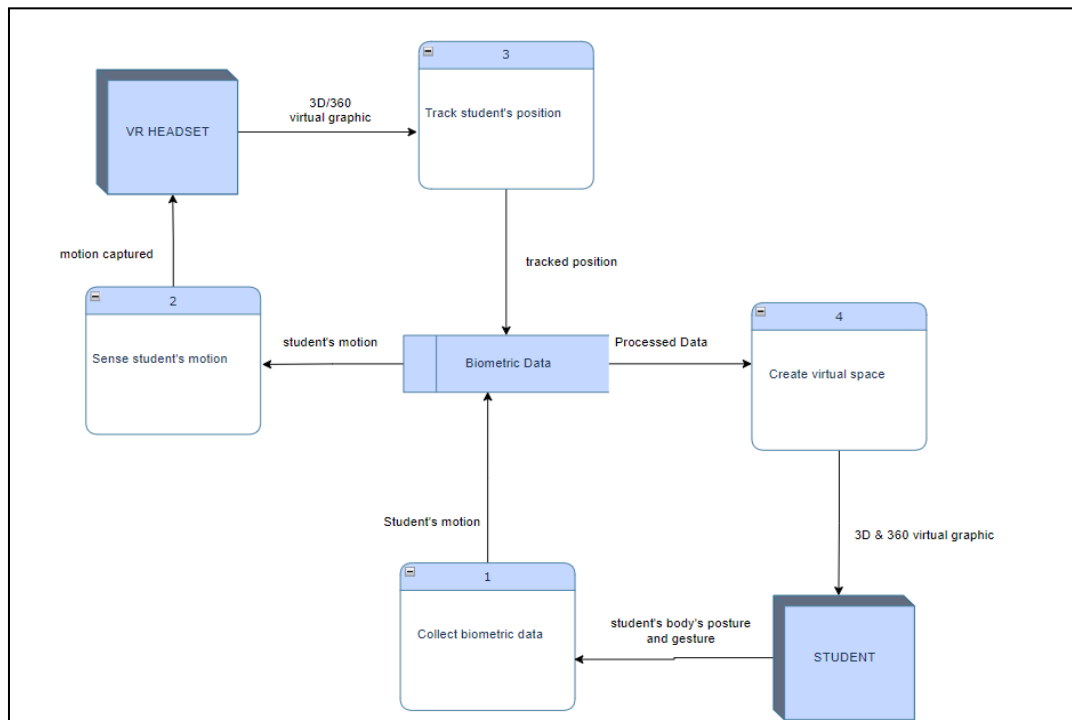


Figure 4.1.4 Hajj Simulatour DFD

4.2 Physical Design

I. Start Scene



Figure 4.2.1 : Start Menu Scene



Figure 4.2.2 : Start Menu Scene

II. Tour Scene



Figure 4.2.3 : Jeddah International Airport

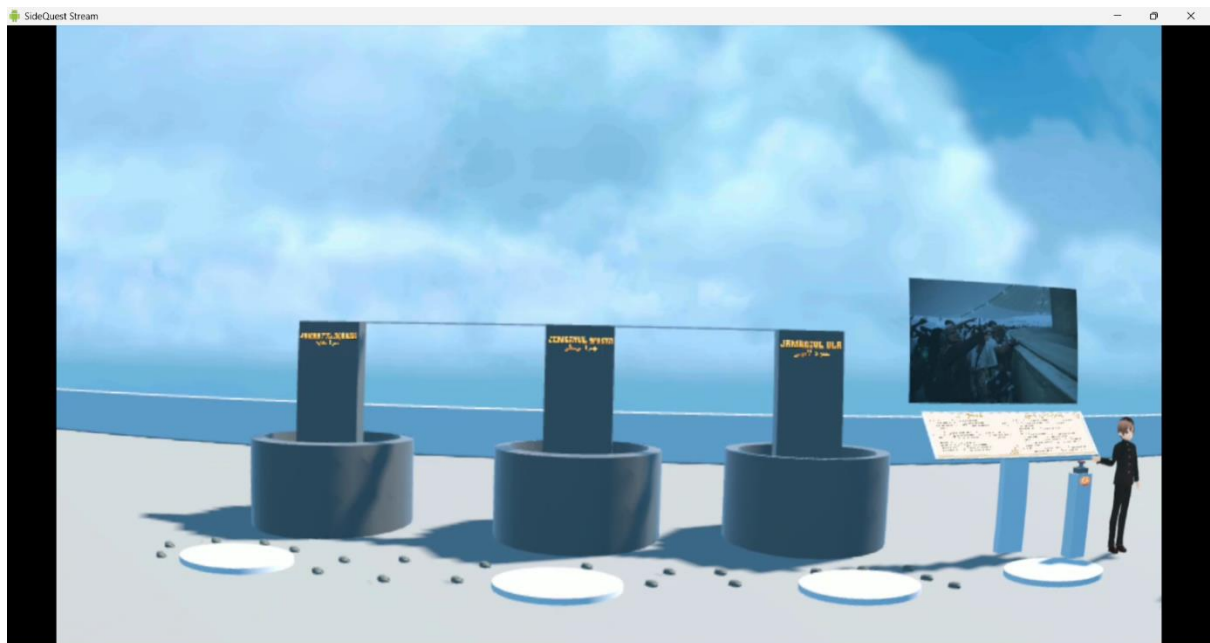


Figure 4.2.4 : Jamarat



Figure 4.2.5 : Grab Interaction



Figure 4.2.6 : Grab Interaction



Figure 4.2.7 : Information board



Figure 4.2.8 : Poke Interaction

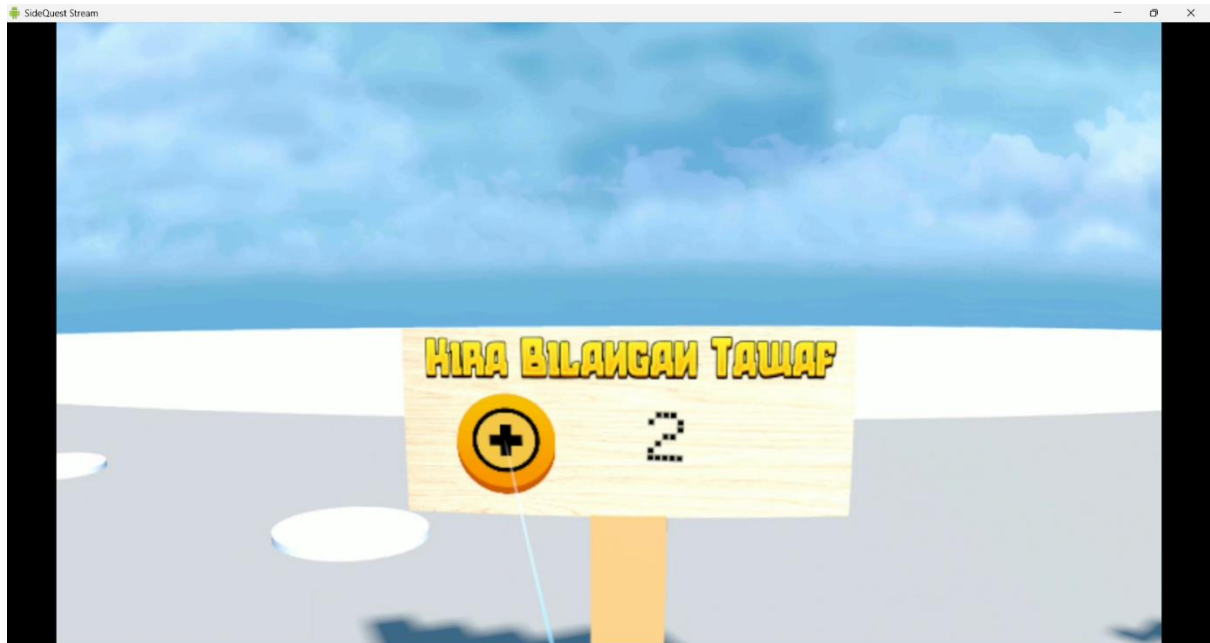


Figure 4.2.9 : Poke Interaction



Figure 4.2.10 : Saie

III. Quiz Scene



Figure 4.2.11 : Quiz Scene



Figure 4.2.12 : Quiz Scene

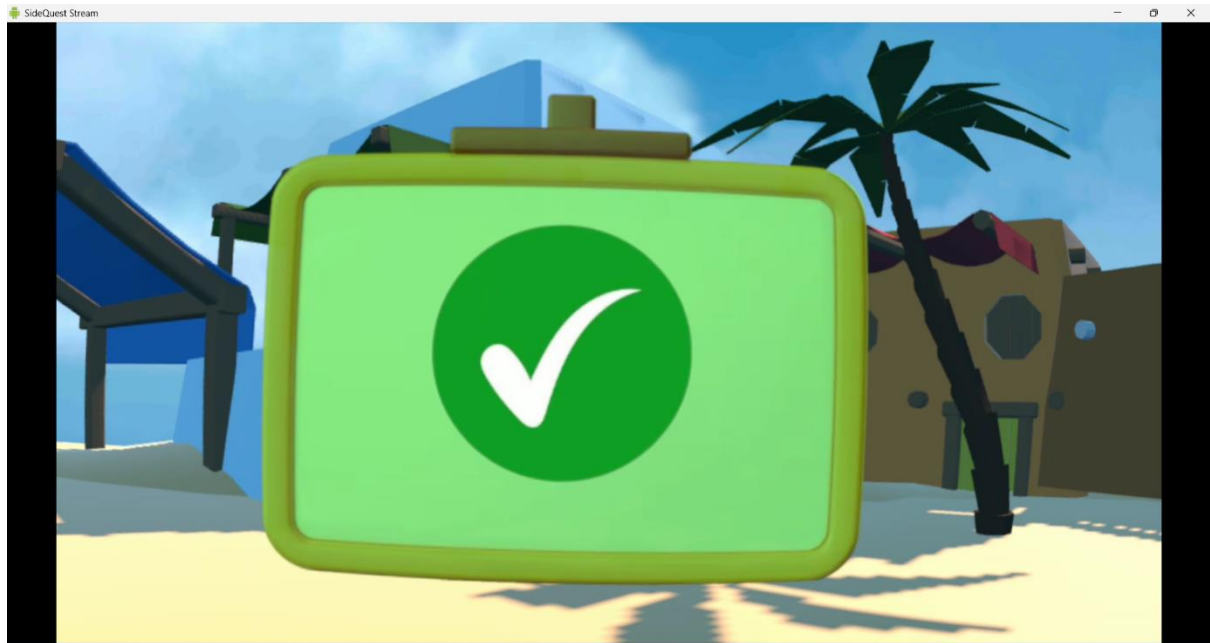


Figure 4.2.13 : Display the correct answer



Figure 4.2.14 : Display the wrong answer

IV. Learning Room Scene



Figure 4.2.15 : Learn Scene



Figure 4.2.16 : Learn Scene



Figure 4.2.17 : Learn Scene



Figure 4.2.18 : Learn Scene

5.0 TEST DESCRIPTION AND RESULTS

5.1 Unit Testing

Table 5.1.1 Module Start Unit Testing Plan

MODULE START						
No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result (Pass/Fail)
1	Start Button	Poke the button using controller	None	Change to Module Main Menu	Nadiah	Pass

Table 5.1.2 Module Main Menu Unit Testing Plan

MODULE MAIN MENU						
No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result (Pass/Fail)
1	'Mula Simulasi' Button	Poke the button using controller	None	Change to Hajj Simulation Scene	Syaza	Pass
2	'Jawab Quiz' Button	Poke the button using controller	None	Change to Quiz Scene	Syaza	Pass
3	'Belajar Haji' Button	Poke the button using controller	None	Change to Flipbook Scene	Syaza	Pass
4	About Us Button	Poke the button using controller	None	Audio of project introduction plays	Syaza	Pass

Table 5.1.3 Module Hajj Simulation Unit Testing Plan

MODULE HAJJ SIMULATION						
No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result (Pass/Fail)
1	Arafah Button	Poke the button using controller	None	Audio of Arafah information plays	Nadiah	Pass
2	Muzdalifah Button	Poke the button using controller	None	Audio of Muzdalifah information plays	Nadiah	Pass
3	Mina Button	Poke the button using controller	None	Audio of Mina information plays	Nadiah	Pass
4	Jamrah Button	Poke the button using controller	None	Audio of Jamrah information plays	Nadiah	Pass
5	Tawaf Button	Poke the button using controller	None	Audio of Tawaf information plays	Nadiah	Pass
6	Tawaf Standing Kiosk Button	Poke the button using controller	None	Audio of Talbiyah recitation plays	Nadiah	Pass
7	Tawaf Counter Button	Poke the button using controller	None	Counter increases each time the button is poked	Nadiah	Pass
8	Jamrah Stone Grab Test	Poke a stone using controller	None	Stone is grabbed and in ready position to be throwed	Nadiah	Pass
9	Numbering Direction – Icon Number 1	Stand near to the direction arrow	None	The Numbering Direction floats in loop	Nadiah	Pass

				from top to bottom		
10	Numbering Direction – Icon Number 2	Stand near to the direction arrow	None	The Numbering Direction and Arrow float in loop from left to right	Nadiah	Pass
11	Numbering Direction – Icon Number 3	Stand near to the direction arrow	None	The Numbering Direction floats in loop from top to bottom	Nadiah	Pass
12	Numbering Direction – Icon Number 4	Stand near to the direction arrow	None	The Numbering Direction and Arrow float in loop from left to right	Nadiah	Pass
13	Numbering Direction – Icon Number 5	Stand near to the direction arrow	None	The Numbering Direction floats in loop from top to bottom	Nadiah	Pass
14	Numbering Direction – Icon Number 6	Stand near to the direction arrow	None	The Numbering Direction floats in loop from top to bottom	Nadiah	Pass

Table 5.1.4 Module Mini Quiz Unit Testing Plan

MODULE MINI QUIZ						
No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result (Pass/Fail)
1	Question 1 – ‘Betul’ Button	Poke the button using controller	None	Correct icon appears and ‘Alhamdulillah’ sound plays	Syaza	Pass
2	Question 1 – ‘Salah’ Button	Poke the button using controller	None	Wrong icon appears and a beep sound plays	Syaza	Pass
3	Question 2 – Option 1 Button	Poke the button using controller	None	Wrong icon appears and a beep sound plays	Syaza	Pass
4	Question 2 – Option 2 Button	Poke the button using controller	None	Correct icon appears and ‘Alhamdulillah’ sound plays	Syaza	Pass
5	Question 2 – Option 3 Button	Poke the button using controller	None	Wrong icon appears and a beep sound plays	Syaza	Pass
6	Question 3 – ‘Betul’ Button	Poke the button using controller	None	Correct icon appears and ‘Alhamdulillah’ sound plays	Syaza	Pass
7	Question 3 – ‘Salah’ Button	Poke the button using controller	None	Wrong icon appears and a beep sound plays	Syaza	Pass
8	Question 4 – Option 1 Button	Poke the button using controller	None	Wrong icon appears and a beep sound plays	Syaza	Pass
9	Question 4 – Option 2 Button	Poke the button using controller	None	Wrong icon appears and a	Syaza	Pass

				beep sound plays		
10	Question 4 – Option 3 Button	Poke the button using controller	None	Correct icon appears and ‘Alhamdulillah’ sound plays	Syaza	Pass
11	Question 5 – ‘Betul’ Button	Poke the button using controller	None	Wrong icon appears and a beep sound plays	Syaza	Pass
12	Question 5 – ‘Salah’ Button	Poke the button using controller	None	Correct icon appears and ‘Alhamdulillah’ sound plays	Syaza	Pass
13	Question 6 – ‘Betul’ Button	Poke the button using controller	None	Correct icon appears and ‘Alhamdulillah’ sound plays	Syaza	Pass
14	Question 6 – ‘Salah’ Button	Poke the button using controller	None	Wrong icon appears and a beep sound plays	Syaza	Pass

Table 5.1.5 Module Learning Room Unit Testing Plan

MODULE LEARNING ROOM						
No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result (Pass/Fail)
1	Book 1 – Previous Button	Poke the button using controller	None	Book flips to the left page and flipping sound plays	Farah	Pass
2	Book 1 – Next Button	Poke the button using controller	None	Book flips to the right page and flipping sound plays	Farah	Pass
3	Book 2 – Previous Button	Poke the button using controller	None	Book flips to the left page and flipping sound plays	Farah	Pass
4	Book 2 – Next Button	Poke the button using controller	None	Book flips to the right page and flipping sound plays	Farah	Pass
5	Book 3 – Previous Button	Poke the button using controller	None	Book flips to the left page and flipping sound plays	Farah	Pass
6	Book 3 – Next Button	Poke the button using controller	None	Book flips to the right page and flipping sound plays	Farah	Pass
7	Jawi Deco Animation	Stand near to the wall decoration	None	The Jawi Animation floats in loop from left to right	Farah	Pass
8	Learning Video 1	Watch the learning video attached to the wall	None	The learning video automatically plays and loop	Farah	Pass

9	Learning Video 2	Watch the learning video attached to the wall	None	The learning video automatically plays and loop	Farah	Pass
10	Learning Video 3	Watch the learning video attached to the wall	None	The learning video automatically plays and loop	Farah	Fail Error Log : video doesn't play automatically and loading rate takes more time than usual

5.2 Integration Testing Plan

Table 5.2.1 Module Start Integration Testing Plan

MODULE START						
No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result (Pass/Fail)
1	Start Button	Poke the button	None	Change to Module Main Menu	Nadiah	Pass

Table 5.2.2 Module Main Menu Integration Testing Plan

MODULE MAIN MENU						
No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result (Pass/Fail)
1	'Mula Simulasi' Button	Poke the button using controller	None	Change to Hajj Simulation Scene	Nadiah	Pass
2	'Jawab Quiz' Button	Poke the button using controller	None	Change to Quiz Scene	Nadiah	Pass
3	'Belajar Haji' Button	Poke the button using controller	None	Change to Learning Room Scene	Nadiah	Pass

Table 5.2.3 Module Hajj Simulation Integration Testing Plan

MODULE HAJJ SIMULATION						
No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result (Pass/Fail)
1	'Jawab Quiz' Button	Poke the button using controller	None	Change to Mini Quiz Scene	Syaza	Pass
2	'Belajar Haji' Button	Poke the button using controller	None	Change to Flipbook Scene	Syaza	Pass
3	'Utama' Button	Poke the button using controller	None	Change to Main Menu Scene	Syaza	Pass

Table 5.2.4 Module Mini Quiz Integration Testing Plan

MODULE MINI QUIZ						
No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result (Pass/Fail)
1	'Belajar Haji' Button	Poke the button using controller	None	Change to Flipbook Scene	Syaza	Pass
2	'Utama' Button	Poke the button using controller	None	Change to Main Menu Scene	Syaza	Pass

Table 5.2.5 Module Learning Room Integration Testing Plan

MODULE LEARNING ROOM						
No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result (Pass/Fail)
1	'Mula Simulasi' Button	Poke the button using controller	None	Change to Hajj Simulation Scene	Farah	Pass
2	'Jawab Quiz' Button	Poke the button using controller	None	Change to Quiz Scene	Farah	Pass

5.3 User Acceptance Testing

Table 5.3.1 Module Start Unit Testing Plan

MODULE START						
No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result (Pass/Fail)
1	Start Button	Poke the button using controller	None	Change to Module Main Menu	Mrs. Suzaimi	Pass

Table 5.3.2 Module Main Menu Unit Testing Plan

MODULE MAIN MENU						
No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result (Pass/Fail)
1	'Mula Simulasi' Button	Poke the button using controller	None	Change to Hajj Simulation Scene	Mrs. Suzaimi	Pass
2	'Jawab Quiz' Button	Poke the button using controller	None	Change to Quiz Scene	Mrs. Suzaimi	Pass
3	'Belajar Haji' Button	Poke the button using controller	None	Change to Flipbook Scene	Mrs. Suzaimi	Pass
4	About Us Button	Poke the button using controller	None	Audio of project introduction plays	Mrs. Suzaimi	Pass

Table 5.3.3 Module Hajj Simulation Unit Testing Plan

MODULE HAJJ SIMULATION						
No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result (Pass/Fail)
1	Arafah Button	Poke the button using controller	None	Audio of Arafah information plays	Mrs. Suzaimi	Pass
2	Muzdalifah Button	Poke the button using controller	None	Audio of Muzdalifah information plays	Mrs. Suzaimi	Pass
3	Mina Button	Poke the button using controller	None	Audio of Mina information plays	Mrs. Suzaimi	Pass
4	Jamrah Button	Poke the button using controller	None	Audio of Jamrah information plays	Mrs. Suzaimi	Pass
5	Tawaf Button	Poke the button using controller	None	Audio of Tawaf information plays	Mrs. Suzaimi	Pass
6	Tawaf Standing Kiosk Button	Poke the button using controller	None	Audio of Talbiyah recitation plays	Mrs. Suzaimi	Pass
7	Tawaf Counter Button	Poke the button using controller	None	Counter increases each time the button is poked	Mrs. Suzaimi	Pass
8	Jamrah Stone Grab Test	Poke a stone using controller	None	Stone is grabbed and in ready position to be throwed	Mrs. Suzaimi	Pass
9	Numbering Direction – Icon Number 1	Stand near to the direction arrow	None	The Numbering Direction floats in loop	Mrs. Suzaimi	Pass

				from top to bottom		
10	Numbering Direction – Icon Number 2	Stand near to the direction arrow	None	The Numbering Direction and Arrow float in loop from left to right	Mrs. Suzaimi	Pass
11	Numbering Direction – Icon Number 3	Stand near to the direction arrow	None	The Numbering Direction floats in loop from top to bottom	Mrs. Suzaimi	Pass
12	Numbering Direction – Icon Number 4	Stand near to the direction arrow	None	The Numbering Direction and Arrow float in loop from left to right	Mrs. Suzaimi	Pass
13	Numbering Direction – Icon Number 5	Stand near to the direction arrow	None	The Numbering Direction floats in loop from top to bottom	Mrs. Suzaimi	Pass
14	Numbering Direction – Icon Number 6	Stand near to the direction arrow	None	The Numbering Direction floats in loop from top to bottom	Mrs. Suzaimi	Pass

Table 5.3.4 Module Mini Quiz Unit Testing Plan

MODULE MINI QUIZ						
No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result (Pass/Fail)
1	Question 1 – ‘Betul’ Button	Poke the button using controller	None	Correct icon appears and ‘Alhamdulillah’ sound plays	Mrs. Suzaimi	Pass
2	Question 1 – ‘Salah’ Button	Poke the button using controller	None	Wrong icon appears and a beep sound plays	Mrs. Suzaimi	Pass
3	Question 2 – Option 1 Button	Poke the button using controller	None	Wrong icon appears and a beep sound plays	Mrs. Suzaimi	Pass
4	Question 2 – Option 2 Button	Poke the button using controller	None	Correct icon appears and ‘Alhamdulillah’ sound plays	Mrs. Suzaimi	Pass
5	Question 2 – Option 3 Button	Poke the button using controller	None	Wrong icon appears and a beep sound plays	Mrs. Suzaimi	Pass
6	Question 3 – ‘Betul’ Button	Poke the button using controller	None	Correct icon appears and ‘Alhamdulillah’ sound plays	Mrs. Suzaimi	Pass
7	Question 3 – ‘Salah’ Button	Poke the button using controller	None	Wrong icon appears and a beep sound plays	Mrs. Suzaimi	Pass
8	Question 4 – Option 1 Button	Poke the button using controller	None	Wrong icon appears and a beep sound plays	Mrs. Suzaimi	Pass
9	Question 4 – Option 2 Button	Poke the button using controller	None	Wrong icon appears and a	Mrs. Suzaimi	Pass

				beep sound plays		
10	Question 4 – Option 3 Button	Poke the button using controller	None	Correct icon appears and ‘Alhamdulillah’ sound plays	Mrs. Suzaimi	Pass
11	Question 5 – ‘Betul’ Button	Poke the button using controller	None	Wrong icon appears and a beep sound plays	Mrs. Suzaimi	Pass
12	Question 5 – ‘Salah’ Button	Poke the button using controller	None	Correct icon appears and ‘Alhamdulillah’ sound plays	Mrs. Suzaimi	Pass
13	Question 6 – ‘Betul’ Button	Poke the button using controller	None	Correct icon appears and ‘Alhamdulillah’ sound plays	Mrs. Suzaimi	Pass
14	Question 6 – ‘Salah’ Button	Poke the button using controller	None	Wrong icon appears and a beep sound plays	Mrs. Suzaimi	Pass

Table 5.3.5 Module Learning Room Unit Testing Plan

MODULE LEARNING ROOM						
No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result (Pass/Fail)
1	Book 1 – Previous Button	Poke the button using controller	None	Book flips to the left page and flipping sound plays	Mrs. Suzaimi	Pass
2	Book 1 – Next Button	Poke the button using controller	None	Book flips to the right page and flipping sound plays	Mrs. Suzaimi	Pass
3	Book 2 – Previous Button	Poke the button using controller	None	Book flips to the left page and flipping sound plays	Mrs. Suzaimi	Pass
4	Book 2 – Next Button	Poke the button using controller	None	Book flips to the right page and flipping sound plays	Mrs. Suzaimi	Pass
5	Book 3 – Previous Button	Poke the button using controller	None	Book flips to the left page and flipping sound plays	Mrs. Suzaimi	Pass
6	Book 3 – Next Button	Poke the button using controller	None	Book flips to the right page and flipping sound plays	Mrs. Suzaimi	Pass
7	Jawi Deco Animation	Stand near to the wall decoration	None	The Jawi Animation floats in loop from left to right	Mrs. Suzaimi	Pass
8	Learning Video 1	Watch the learning video attached to the wall	None	The learning video automatically plays and loop	Mrs. Suzaimi	Pass

9	Learning Video 2	Watch the learning video attached to the wall	None	The learning video automatically plays and loop	Mrs. Suzaimi	Pass
10	Learning Video 3	Watch the learning video attached to the wall	None	The learning video automatically plays and loop	Mrs. Suzaimi	Pass

6.0 MAJOR FINDINGS AND DISCUSSION

6.1 Advantages of Project

- i. There is no need for an internet connection to use the application.
- ii. Because it only requires a joystick to move, movement is limited when using this application, hence less space can be used.
- iii. In this virtual reality environment, there are detailed instructions for performing the hajj.
- iv. Users can use the VR controller to interact with the application.

6.2 Disadvantages of Project

- i. VR headsets can be pricey and difficult to buy.
- ii. Long-term and frequent use of VR headsets can result in weariness, confusion, migraines, glare, nausea, and vomiting.
- iii. VR applications are substantially larger in size. Compared to other devices, it occupies a large amount of space and uses a lot of computer power.
- iv. VR experiences are less realistic and engaging because they can't replicate actual experiences and interactions.

7.0 RECOMMENDATION AND CONCLUSION

Project members found that Hajj Simulatour requires a lot of accretion in terms of hand gestures and others. Among them, making grabs on a stone using hand gestures to show a real result when throwing a stone. The Mecca design should also be looking more interesting and as real. In Addition, Hajj Simulatour can be designed with inclusiveness in mind, meeting the needs of individuals with diverse backgrounds, abilities and languages. This approach will enable a wider audience to gain knowledge of hajj and Islamic culture, fostering understanding and respect between cultures.

In conclusion, Hajj Simulatour has the potential to provide a unique and immersive experience for students who may not have the opportunity to physically attend the Hajj pilgrimage. Through the use of VR technology, students can engage in a simulated Hajj experience, allowing them to learn about the significance of the pilgrimage and the rituals involved. While a virtual Hajj experience cannot replace the spiritual and communal aspects of the physical pilgrimage, it can serve as a valuable educational tool for students to gain a deeper understanding of the Hajj and its significance in Islam.

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