

AUGMENTED REALITY ARABIC
APPLICATION FOR PRESCHOOL

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BACHELOR OF COMPUTER SCIENCE
(GRAPHIC & MULTIMEDIA TECHNOLOGY)
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AUGMENTED REALITY ARABIC APPLICATION FOR PRESCHOOL

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Thesis submitted in fulfillment of the requirements
for the award of the degree of
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ABSTRAK

AR ialah teknologi yang meletakkan imej yang dijana komputer pada perspektif pengguna tentang dunia sebenar, mencipta imej komposit. Pada masa ini, sebilangan besar ibu bapa menggunakan aplikasi ini untuk anak-anak mereka. Augmented Reality membuat perubahan dalam persekolahan. Aplikasi ini membolehkan pelajar memperoleh, mengurus dan mengingati maklumat dengan mudah, dan ia juga boleh menjadikan pembelajaran lebih menarik. Nama aplikasi ini ialah Aplikasi Arab AR untuk Prasekolah. Aplikasi ini boleh membantu ibu bapa dalam mengajar anak-anak mereka huruf dan nombor. Aplikasi ini telah memenuhi keperluan pengguna. Menggunakan pendidikan AR, kanak-kanak mungkin lebih berminat dengan model 3D ini. Aplikasi ini direka dengan pakej Unity dan EasyAR. Proses pembangunan aplikasi projek ini adalah berdasarkan model pembangunan RAD.

ABSTRACT

AR is a technology that places a computer-generated image on a user's perspective of the actual world, creating a composite image. Currently, a significant number of parents using this application for their children. Augmented Reality makes a difference in schooling. This application enables students to easily acquire, manage, and remember information, and it may also make studying more engaging. The name of this application is AR Arabic Application for Preschool. This application can assist parents in teaching their children the letters and numbers. This application has fulfilled the user requirement. Using AR education, kids may be more interested in this 3D model. The application is designed with Unity and the EasyAR package. This project's application development process is based on the RAD development model.

TABLE OF CONTENT

DECLARATION	
TITLE PAGE	
ACKNOWLEDGEMENTS	ii
ABSTRAK	iii
ABSTRACT	iv
TABLE OF CONTENT	v
LIST OF TABLES	ix
LIST OF FIGURES	x
LIST OF ABBREVIATIONS	xii
CHAPTER 1 INTRODUCTION	1
1.1 Background of Study	1
1.2 Problem Statement	2
1.3 Aim and Objectives	3
1.4 Scope	3
1.5 Thesis Organization	4
CHAPTER 2 LITERATURE REVIEW	5
2.1 Introduction	5
2.2 Existing Systems	5
2.2.1 Arabic Alphabet & Numbers Augmented Reality	5
2.2.2 Flashcards Arabic AR	7
2.2.1 AR for Kids Alphabet-Numbers	9
	v

2.3	Comparative analysis of Existing System	11
2.4	Summary	12
CHAPTER 3 METHODOLOGY		13
3.1	Introduction	13
3.2	Rapid Application Development (RAD)	13
3.2.1	Requirements Planning	14
3.2.2	User Design	14
3.2.3	Construction	15
3.2.4	Cutover	15
3.3	Project Requirement	16
3.3.1	Functional Requirement	16
3.3.2	Non Functional Requirement	16
3.3.3	Constraints and Limitations	17
3.3.4	User Requirements	17
3.4	Propose Design	19
3.4.1	Flowchart	19
3.4.2	Context Diagram	22
3.4.3	Use Case Diagram	22
3.4.4	Storyboard	23
3.5	Data Design	34
3.6	Testing Plan	37
3.7	Potential Used	41
3.8	Gantt Chart	41
3.9	Conclusion	41

CHAPTER 4 RESULT AND DISCUSSION	42
4.1 Introduction	42
4.2 Development Tools	42
4.3 Implementation	43
4.3.1 Build Application Project	43
4.3.2 Getting the EasyAR License Key	44
4.3.3 Set Up the 3D Model	47
4.3.4 Build and Run in Mobile Device	49
4.4 Interface	51
4.4.1 Main Menu Interface	51
4.4.2 AR Camera - Module interface	52
4.4.3 AR Camera - Alphabet module interface	53
4.4.4 AR Camera	53
4.4.5 AR Camera - Number module interface	54
4.4.6 AR Camera	56
4.4.7 Info interface	57
4.4.8 Info - Alphabet info interface	58
4.4.9 Info - Number info interface	58
4.4.10 Quiz interface	59
4.4.11 Exit popup	60
4.5 Coding	61
4.5.1 Code Use in Unity	61
4.6 Testing Result and Discussion	62
4.6.1 Result of User Acceptance Test (UAT)	62
4.7 Summary	90
CHAPTER 5 CONCLUSION	91
5.1 Introduction	91
5.2 Discussion on User Acceptance	91
5.3 Limitations and Constraints	91
5.4 Future Work	92

REFERENCES	93
APPENDIX A	94
APPENDIX B	95
APPENDIX C	98
APPENDIX D	101

LIST OF TABLES

Table 1.1	Problem Statement	2
Table 2.1	Comparison between each Existing System	11
Table 3.1	Module of Alphabets	35
Table 3.2	Module of Numbers	36
Table 3.3	Main Menu	37
Table 3.4	Module	37
Table 3.5	Module of Alphabet	38
Table 3.6	Module of Number	38
Table 3.7	AR Camera of Alphabet	38
Table 3.8	AR Camera of Number	39
Table 3.9	Info Module	39
Table 3.10	Alphabet info	39
Table 3.11	Number info	40
Table 3.12	Quiz	40
Table 3.13	Credit	40
Table 4.1	Development tools	42

LIST OF FIGURES

Figure 2.1	Arabic Alphabet & Numbers Augmented Reality	6
Figure 2.2	The application on Google Play Store	6
Figure 2.3	AR object appeared on flashcard	7
Figure 2.4	Flashcards Arabic AR	7
Figure 2.5	Available for purchase	8
Figure 2.6	Animals have incomplete faces and heads separated from its bodies	8
Figure 2.7	AR object appeared when camera directed to the flashcard	9
Figure 2.8	AR for Kids Alphabet-Numbers	9
Figure 2.9	The application on Google Play and App Store	10
Figure 2.10	3D models appear when the user points with the camera to any surface such as ground or walls	10
Figure 3.1	RAD model	13
Figure 3.2	Result of the survey	17
Figure 3.3	Flowchart of the application	20
Figure 3.4	Flowchart of the user	21
Figure 3.5	Context Diagram	22
Figure 3.6	Use Case Diagram	23
Figure 3.7	Storyboard of main menu	24
Figure 3.8	Storyboard of module	25
Figure 3.9	Storyboard of alphabet module	26
Figure 3.10	Storyboard of display 3D object	27
Figure 3.11	Storyboard of numbers	28
Figure 3.12	Storyboard of display 3D object	29
Figure 3.13	Storyboard of info module	30
Figure 3.14	Storyboard of alphabet module	31
Figure 3.15	Storyboard of number info	32
Figure 3.16	Storyboard of quiz	33
Figure 3.17	Storyboard of score	34

Figure 4.1	Create New Project in Unity3D	43
Figure 4.2	Unity already open	43
Figure 4.3	Unity Plugin	44
Figure 4.4	Import the package	44
Figure 4.5	Login using registered account	45
Figure 4.6	Sense Authorization interface	45
Figure 4.7	New Sense License Key interface	46
Figure 4.8	List of Name License Key	46
Figure 4.9	License Key	46
Figure 4.10	Insert License Ket to Unity	47
Figure 4.11	Adjusting 3D models into the camera	47
Figure 4.12	Set the audio after user press button in alphabet interface	48
Figure 4.13	Set the audio of model name	48
Figure 4.14	Set the audio sound effect of 3D models after the user press the button	49
Figure 4.15	How to Build Settings	49
Figure 4.16	Build Project int APK File	50
Figure 4.17	Install the apk to mobile device	50
Figure 4.18	The application already in mobile device	51
Figure 4.19	Main menu	52
Figure 4.20	AR Camera Module	52
Figure 4.21	Alphabet module	53
Figure 4.22	Camera AR shows the 3D models	54
Figure 4.23	Info popup	54
Figure 4.24	The image capture save in DCIM file	55
Figure 4.25	Numbers module	55
Figure 4.26	Camera AR shows the 3D model	56
Figure 4.27	Info popup	57
Figure 4.28	Info module interface	57
Figure 4.29	Alphabet info	58
Figure 4.30	Number info	59
Figure 4.31	Quiz	59
Figure 4.32	Answer of Quiz	60
Figure 4.33	Score	60

LIST OF ABBREVIATIONS

UMP	Universiti Malaysia Pahang
FK	Faculty of Computing
AR	Augmented Reality
UAT	User Acceptance Test
3D	Three-Dimensional

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Augmented Reality (AR) is a computer system that combines real world data with data created by a computer. Virtual objects are blended into real footage in real time (Daud, R., Abd Raman, N., & Ab. Jalil, Z. 2020). In this case, this technology in education sector is important. AR technology has significantly improved those earlier education. Early education is strongly encouraged to use AR in teaching and learning.

When students can imagine well, this can help encourage them to think. It is because the feature of AR is to encourage students' cognitive processes in visualization. AR also can change the perception of students of the subject and provide an interesting experience for teachers and students. Today's children are quite technologically smart in utilizing tablets, computers, and smartphones to access the internet, play games, and consume media.

With AR, there is no longer needed to use the traditional way to teach children. AR also makes learning more engaging and enjoyable. It is also not confined to a particular age group or level of education but may be utilized as successfully in all stages of learning, from kindergarten through pre-school education and even at work.

In Malaysia's education system, preschool allows children from aged four to six years to get early learning experiences before starting primary school (Dahari, Z.B. & Ya, M.S. 2011). Muslim parents need to introduce religion and spirituality to their children at a young age. Parents choose Islamic pre-schools for their children. One of the subjects taught at Islamic preschools is Arabic.

In Malaysia education system, Arabic is a foreign language, and it is hard to be understand by students. But with AR system means being able to empower children to learn Arabic better. Nowadays, children are very interested in entertainment or something fun. It will

make them appreciate and enjoy learning Arabic. Therefore, it is important to start learning Arabic at an early age. In fact, many parents are concerned about giving their children the best chance for future success by teaching them a second language.

1.2 Problem Statement

Nowadays, children are currently too much open with the technology so they don't have any interest in reading books. In addition, they easy to get bored. By developing AR mobile application, children will have more interesting in Arabic education.

Due to the quick development of technology, it is essential to try to assist parents and teachers in giving their children the best education possible, particularly when it comes to studying Arabic. So that after the children use this application in their life, they at least can learn something new in their life. The problem statements of this project are summarized in Table.1.1.

Table 1.1

No.	Problem	Description	Effect
1.	Traditional methods are ineffective	The methods used do not correspond to the acceptance of the student	Students will feel bored if kept doing learning sessions only with books
2.	Lack of interest	Many children are not interested in learning Arabic because it is a foreign language	Students may have difficulty communicating.

1.3 Aim and Objectives

The aim of the project is to develop a fun and interactive AR for preschool to learn Arabic. To achieve the project aim, there are several objectives must be satisfied. The objectives of the project are shown below.

- i. To study the method of preschool students to learn and understand Arabic.
- ii. To implement AR in education teaching surfaces more intelligent to develop AR system.
- iii. To test the proposed application for preschool.

1.4 Scope

The scopes of this project are listed as follows:

User Scope:

- i. The preschool is the main user for AR system application

System Scope:

- i. This system provides AR technology integrated in mobile applications for smartphone.
- ii. This system featuring 3D model characters and object

Development Scope:

- i. This system is developed by using Unity.
- ii. The system used the EasyAR mobile device that enables the creation of AR applications

1.5 Thesis Organization

The report consists of five chapters in all. The first chapter will briefly describe the background of study, problem statement, objective, and scope of study.

Chapter 2 conducts the literature review. It discusses three existing AR systems compared with the solution of the project's outcome.

Chapter 3 gives the details of the methodology used to develop the project. This project implements a Rapid Application Development (RAD) methodology. This chapter also contains all the information about the application such as project requirements, flowchart, context diagram, use case diagram, storyboard, and testing plan.

Chapter 4 contains the results of the project. Testing methods and other information are included in the appendix. The results of the project are in line with the purpose of the intended application. This chapter also provides a detailed description of each interface in this application.

Chapter 5 concludes and summarises the project. In this chapter, the limitations and future work are discussed in detail.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter cover on the review of available application of AR in the field of Arabic. These three existing AR applications in Arabic was choose and comparison on language are platform, language, marker use, user, updated and cost were made. The literature review will go through the existing applications as well as evaluate the advantages and disadvantages of each application. The objective of literature review is to combine all the elements effectively to develop new application that perform better than the existing application.

2.2 Existing Systems

This section compares the existing application to make sure the proposed application is better than the existing application. The existing mobile applications are Arabic Alphabet & Numbers Augmented Reality, Flashcards Arabic AR and AR for Kids Alphabet – Numbers. Each application that is reviewed was compared to find their advantages and disadvantages and also several elements to find the gap between each application. Next is the detail explanations of these applications.

2.2.1 Arabic Alphabet & Numbers Augmented Reality

Figure 2.1 shows Arabic Alphabet & Numbers Augmented Reality logo application. This application was developed by Mohamed Khairy Salem. The android application is available for free download from Google Play Store as shown in Figure 2.2. The application is specializing in the design of AR exhibits Arabic letters, words, and numbers. This application was developed to facilitate the educational process at an early stage and attract user interest.



Figure 2.1 Arabic Alphabet & Numbers Augmented Reality

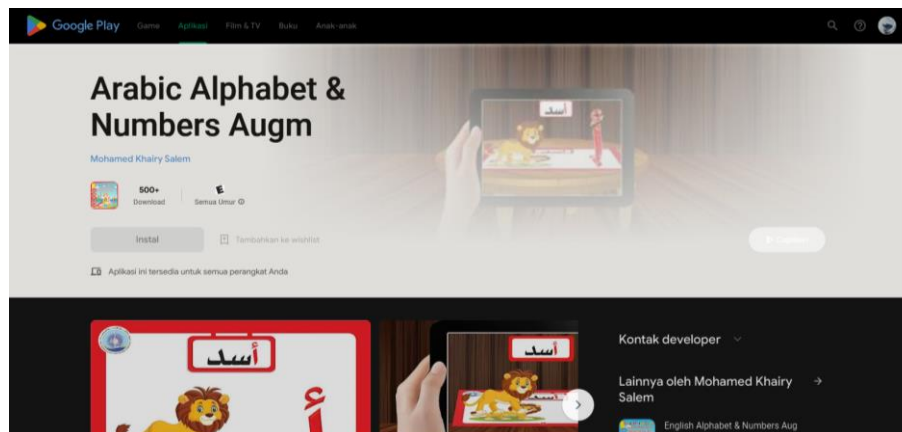


Figure 2.2 The application on Google Play Store

This application features are provided way for integrating in with the environment and makes learning enjoyable in a real way. The smart interactive teaching card for Arabic letters, words, and numbers is included in a unique edition of their publications that keeps up with the most recent advancements in technology.

Figure 2.3 shows AR object appeared on flashcard. Moreover, this flash card allows learning Arabic letters, words, and numbers with a distinctive way of writing and erasing, using delightful stereoscopic technology, and developing listening skills and differentiating letters, words, and numbers, as well as pronunciation skills and letters out, join an engaging experience that will remain in memory for years. As a result, it can enhance Arabic calligraphy writing technique and enhance visual and muscular skills. Self-teaching skills can help improve memory and focus.



Figure 2.3 AR object appeared on flashcard

The components that provide in Arabic Alphabet & Numbers Augmented Reality are 28 educational letters that improve skills and knowledge using augmented reality application. The application also teaching and counting numbers in Arabic from one to twenty. The application is designed and creatively developed to fit the requirements of the modern educational environment.

2.2.2 Flashcards Arabic AR

Figure 2.4 shows Flashcards Arabic AR logo application. The application was developed by Widhi Muttaqien. Figure 2.5 shows that available for purchase via Amazon and local offline or online stores. This application developed because want to children play while learning with these AR flashcards. There are several types of AR flashcards used in this application. Among them are flash cards for animals and cards for the Arabic alphabet. There are a total of 38 cards in the flashcard set, including 10 Arabic numerals and 28 Arabic alphabet cards. The 3D animals will emerge when the card is viewed on a mobile device. This makes children excited in using this application. The application is specializing in the design of AR exhibits Arabic letters, animals name in Arabic language and Arabic numbers.



Figure 2.4 Flashcards Arabic AR



Figure 2.5 Available for purchase

This application has a variety of flashcard features. This application is full sharia compliance is where it don't have illustrations of living beings. Figure 2.6 shows all animals have incompletely separated heads and faces from their bodies on flashcard. Moreover, each card also has a distinctive design. Each card has a special design that engages the right brain while encouraging the left brain to recall the information. It also can lessen the possibility of damage. The risk of paper cuts and other injuries is reduced by the card's rounded corners. The extra-large flashcards measure 10.2 by 14.6 cm, more than twice the size of regular playing cards. Without using any trickery, the cards are printed front and back in full color.



Figure 2.6 Animals have incomplete faces and heads separated from its bodies

There are several features in this application. Among them are AR activities that can be fun and educational for children to explore the cards in a free game mode. Children can learn independently using this learning system, which features a practice mode with carefully designed step-by-step challenges. To use this application, the user needs to point the camera at the flash card to bring up the AR object as shown in Figure 2.7.



Figure 2.7 AR object appeared when camera directed to the flashcard

2.2.3 AR for Kids Alphabet – Numbers

Figure 2.8 shows the logo of the AR for Kids Alphabet – Numbers application. This application was developed by Ibrahim Amer. This application is available and free to downloaded from Google Play and App Store. This application does not use internet connection to be used as shown in Figure 2.9. This application provides alphabets and numbers in three languages for children. Among the three language sections are Arabic, English and French. AR for Kids Alphabet – Numbers is one of AR application that will make the kids loved when doing this application.



Figure 2.8 AR for Kids Alphabet – Numbers

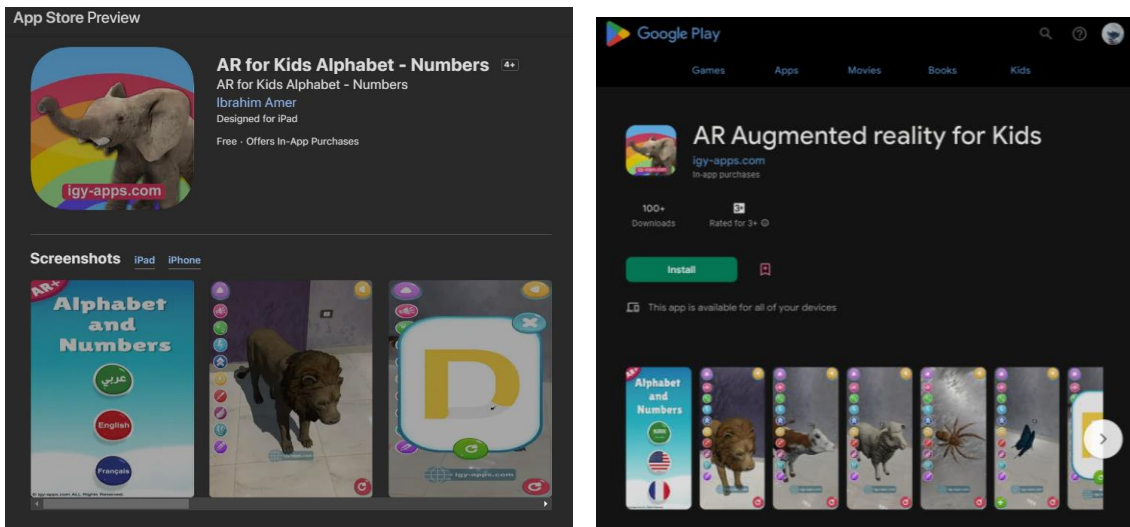


Figure 2.9 The application on Google Play and App Store

The reason why children like this application is because of the variety of models and can be used anywhere without carrying materials either books or cards. Then, it has some interesting features. Based on Figure 2.10, the 3D model appears when the user points the camera at any surface such as the ground or floor. The children can control the 3D models. For example, the user wants to choose the character of lion for letter L. So, the user can control of the character run or jump.

Each of the letters there is a 3D object that can be fully controlled by the children. According to the 3D object displayed, the application also hears sound effects and pronounces the character's name and letters.



Figure 2.10 3D models appear when the user points with the camera to any surface such as ground or walls.

2.3 Comparative analysis of Existing System

Each existing system is compared with platform, language, marker used, user, updated and cost for each application. The comparisons made will be created to improve the new system that is being developed. Table 2.1 shows the comparison between each existing system.

Table 2.1 Comparison between each existing system

Criteria	Arabic Alphabet & Numbers Augmented Reality	Flashcards Arabic AR	AR for Kids Alphabet – Numbers
Platform	Android	Android, iOS, Amazon apps and Windows	Android, iOS
Language	English & Arabic	English & Indonesia	Arabic, English & France
Marker Use	Flashcard	Flashcard	No marker
User	Made for ages 3 - 7	Not specify the age of user	Made for ages 6 - 8
Updated	6 September 2021	9 November 2018	20 August 2021
Cost	Free application (Purchase of material)	Free application (Purchase of material)	Free (In app purchase)

Arabic Alphabet & Numbers Augmented Reality, Flashcards Arabic AR and AR for Kids Alphabet – Numbers each have their advantages and disadvantages. First, the advantage found in the Arabic Alphabet & Numbers Augmented Reality application is that this application contains an introduction about the alphabet to animals or fruits. It can also write the alphabet. The disadvantages of the application are that the AR model that appears is 2D

and in a static state. For the second application, the advantages are that the application is interactive and easy to understand by users who use it. The AR model that appears in this application is 3D. The disadvantage of the application is that the user cannot write the alphabet. Finally, the advantages of the AR for Kids Alphabet - Numbers application are being able to change the 3D model to another model and the 3D model can be zoom in or out. The disadvantages of this application are buttons only work for some objects the target is just the flat surfaces only.

2.4 Summary

This whole chapter, there are comparison among the discussed existing systems. In terms of discussing on the existing systems, it shows that each of the existing systems has its advantages and disadvantages. Considered on the features for the discussed existing system, most probably some of these features will be used to implement for developing the proposed application.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter will go through the methodology that was used in this project from beginning to end. The project flow discussed briefly to provide a better understanding of the concept and development of this application. An analysis of the methods or process of enquiring in a certain topic is called methodology, which is described as a set of procedures used in a particular field of study (Oxford University Press, 2018). There are many types of methodology development process that can be used to develop the system or application. For example, ADDIE Model Spiral Method, Rapid Application Model (RAD), Waterfall Model and Agile Model. Hence, choosing a reasonable technique will ease the engineer by following the step or forms that will lead to the ultimate item.

3.2 Rapid Application Development (RAD)

The methodology that has been chosen for this project was RAD model. This model has four phases: requirement planning, user design, construction, and cutover. Figure 3.1 shows the phases in RAD model. Next is the discussion of each phase in RAD.

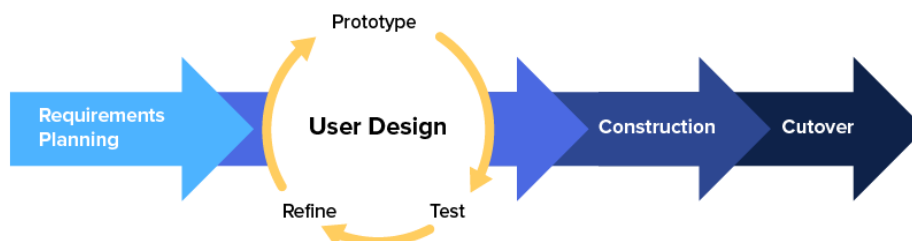


Figure 3.1 RAD model

3.2.1 Requirements Planning

The first phase is the requirements planning phase. This phase will begin with an analytical study to determine the project requirements. To guarantee that the project can accomplish its goals as intended, the analysis research must be properly described. In order for the project to succeed and achieve its goals as intended, the analysis research must be clearly described.

Since the research topic for this project is supported by AR technology, all relevant information such as detailed background data on the AR study was also gathered. The market's existing systems were reviewed as a starting point for the project and for future improvement. The outcome of this review activity is real-time interactions between the digital and physical worlds, accurate 3D object recognition of virtual and real objects.

In the process of developing an application, the requirement phase is important. Data is gathered to better understand the demands of the user at this phase. The goal of this phase is to understand the needs of the users and how they would like to interact with the application. Google Form is one tool that may be used to gather this data. A Google Form is a tool that allows users to create a survey. Organising and interpreting the data is simple as the responses can be collected and analysed in a spreadsheet. There is just one component of this survey, which consists of five questions. The survey is in **APPENDIX B**.

3.2.2 User Design

The second phase is User Design Phase. A visual representation of the application may be made by the developer with the use of prototyping and storyboard design. The full prototype is subsequently delivered to the potential end user for evaluation, comments, and product enhancement suggestions. The goal of this phase is to create a user-friendly and effective AR Arabic application. The prototyping process was iterated process until a completed prototype is generated that completely satisfies all end user requirements. All improvements will be acknowledged. The initial design was based on the storyboard, which was particularly designed. The phase also includes the flowchart, context diagram, use case diagram to design of the application.

In the user design phase is to create a user interface (UI) design. The UI design is the visual representation of the application. It includes the layout of the screens, the colors, and the fonts. The flowchart shows the AR application process and user flow in using this application. In the context diagram is intended to show the flow of preschool or parents between AR Arabic application. In the use case diagram, the users or actor can perform actions such as are choose module, choose object, view 3D object, view image, choose answer, view score, and hear audio.

3.2.3 Construction

The third phase is Construction Phase. The AR application was developed in its true form, together with any associated course materials, when the developer has planned out the entire basic interface, functions, and others. The goal of this phase is to create a working AR Arabic application. This application was developed using Unity, which is connected with EasyAR, with C# language. The AR Arabic application is planned to be operate in Android device only.

This requires coding the displays, controls, and other UI components. This step aims to create a user interface that adheres to the design established in the user design phase. After the implementation of the user interface, the application must be validated. This includes checking the application's functionality and ensuring it meets user requirements. Before the AR Arabic application is released, the purpose of this phase is to identify and resolve any defects or issues with the application.

3.2.4 Cutover

The cutover phase of the RAD methodology for Arabic AR application is the last phase in the development process. Arabic AR applications will undergo usability testing to ensure performance and the functionality of the application meets the standards and is aligned with the goals and scope. This project can be implemented by the process of moving the project from its development to its production status. To launch its production is to convert the Arabic AR application project to apk. Users can install Arabic AR applications using Android devices. Usability testing will be conducted once the Arabic AR application is successfully developed and launched.

3.3 Project Requirement

Project requirements are conditions that must be achieved in order for a project to succeed. It is important to consider both functional and non-functional requirements when developing a system. Functional requirements specify how the system must function, where non-functional requirements specify how the system should function. Ensuring that both functional and non-functional requirements are correct can assist in ensuring that a new system can be developed as planned. The application should be designed to be user-friendly and accessible to users of preschool students. It is important to carefully consider all of these requirements when developing an AR Arabic application.

3.3.1 Functional Requirement

Functional requirements are product features or functions that developers must implement to allow users to complete their tasks. Below is the summary of the functional requirements:

- i. The application shall allow user for permission to access their camera smartphone.
- ii. The application shall allow user to control the size and rotation of the object.
- iii. The application shall allow user to change the object.
- iv. User should point the camera at the environment.
- v. Users should look in the DCIM file after clicking the camera button.

3.3.2 Non-Functional Requirement

Non-functional requirements are characteristics or attributes of the system that can judge its operation. Below is the point of non-functional requirements:

- i. Performance requirement
 - The application work very fast and no buffering

ii. Portability requirement

- The application should be able to run on any Android.

iii. Environment requirement

- The application has realistic 3D objects.

iv. Security

- There are no specific requirements.

3.3.3 Constraints and Limitations

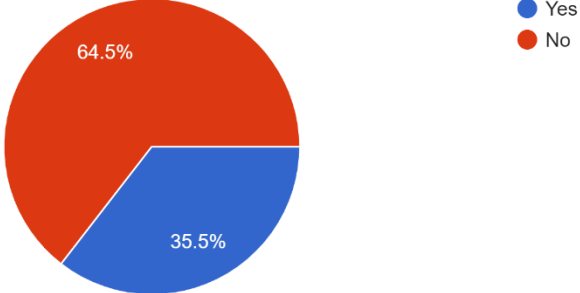
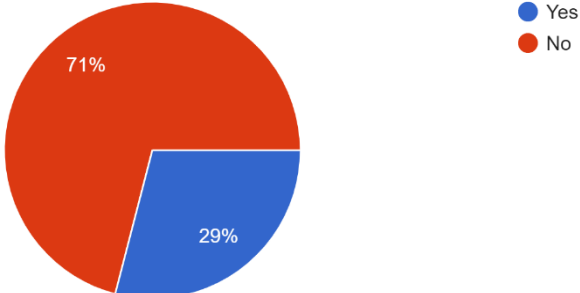
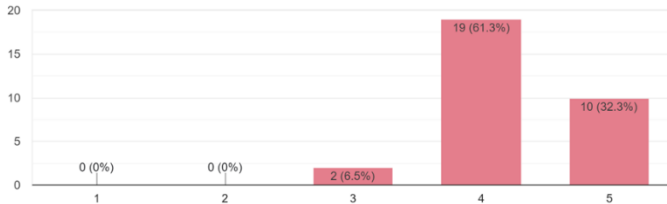
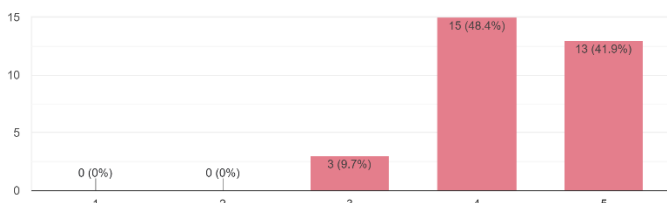
The following are several of the project constraints and limitations:

- i. The developer may have limited AR skills.
- ii. Software and skill limitation.
- iii. Android based devices only.
- iv. Only android smartphone users can access this application.
- v. To use an application, the user needs a smartphone with a camera.

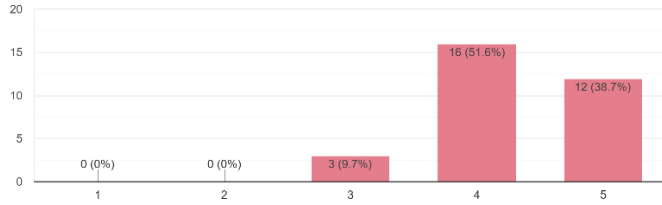
3.3.4 User Requirements

The user requirements phase is concerned with identifying the user's objectives and requirements such that technology may easily fulfill those requirements. There was a total of 31 responders to surveys made using Google Forms. This survey's objective is to collect user concerns and requirements. Results of the survey are as described as show in Figure 3.2.

Survey	Description
Have you ever used any mobile application for early Arabic learning?	64.5% of those polled have never used any mobile application for early Arabic learning and 35.5% have used it.

 <p>A pie chart with a legend. The legend shows a blue circle for 'Yes' and a red circle for 'No'. The chart shows 35.5% in blue and 64.5% in red.</p>	
<p>Have you experience using any Augmented Reality application before?</p>  <p>A pie chart with a legend. The legend shows a blue circle for 'Yes' and a red circle for 'No'. The chart shows 29% in blue and 71% in red.</p>	<p>71% of those surveyed had no experience using any augmented reality application and 29% had previous experience.</p>
<p>On a scale of 1 to 5, does the application suitable enough for preschool?</p>  <p>A bar chart with a y-axis from 0 to 20 and an x-axis from 1 to 5. The bars are pink. The data points are: 1: 0 (0%), 2: 0 (0%), 3: 2 (6.5%), 4: 19 (61.3%), 5: 10 (32.3%).</p>	<p>19 respondents believe that AR application are suitable for pre-schoolers.</p>
<p>On a scale of 1 to 5, does the Augmented Reality help to increase the interactivity of the application?</p>  <p>A bar chart with a y-axis from 0 to 15 and an x-axis from 1 to 5. The bars are pink. The data points are: 1: 0 (0%), 2: 0 (0%), 3: 3 (9.7%), 4: 15 (48.4%), 5: 13 (41.9%).</p>	<p>15 respondents supported AR applications can help to improve interactivity learning</p>

On a scale of 1 to 5, does the 3D models in the application can help teacher to gain full attention from preschool to learn Arabic?



15 respondents said that the 3D model application can help teachers get the attention of preschool students

Figure 3.2 Result of the survey

3.4 Propose Design

The proposed design is a document used to make decisions that describes the design from the perspective of the user. The proposal needs to be written in terms of the project's requirements.

3.4.1 Flowchart

A flowchart is a visual representation of the decisions and processes that must be followed in order to complete a process. Figure 3.3 shows the flowchart for AR application. After the user clicks the "alphabet or number" button of module in AR Camera section the object starts tracking the environment. To get the position of the object in the correct state, the user needs to update the position and rotation to the object. After that, the object will be displayed correctly.

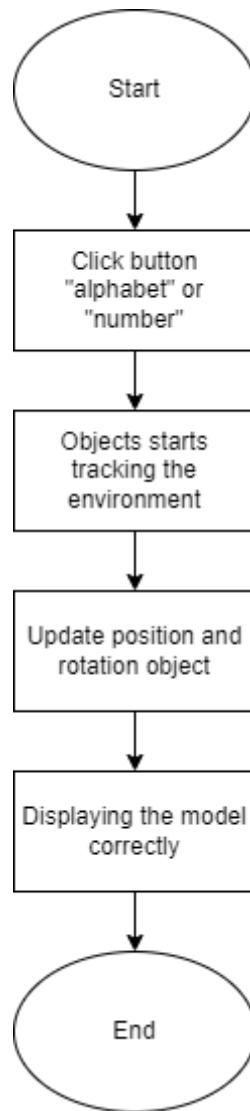


Figure 3.3 Flowchart of the application

Figure 3.4 shows the flowchart for user. The flowchart how the overall process happens in application. This will help user to identify the flow of the system clearly. The application will start by displaying the main menu interface. The main menu interface will be providing four buttons selection which are AR Camera button, info button, quiz button, and exit button. If the user selects the ar camera button, the modules in the application will be displayed. The application have two modules which are alphabet and number in Arabic. That module can will be display 3D object. If user select info button, then will be display info module interface. Then, after user select info module, it will display the information of alphabet or number. If user select quiz button, then will be display the quiz with four answers. The quiz have ten questions, each correct answer will get ten marks. After finish answering the quiz, it will

display the total score that the user has answered. If user select the exit button, then the application will be exit.

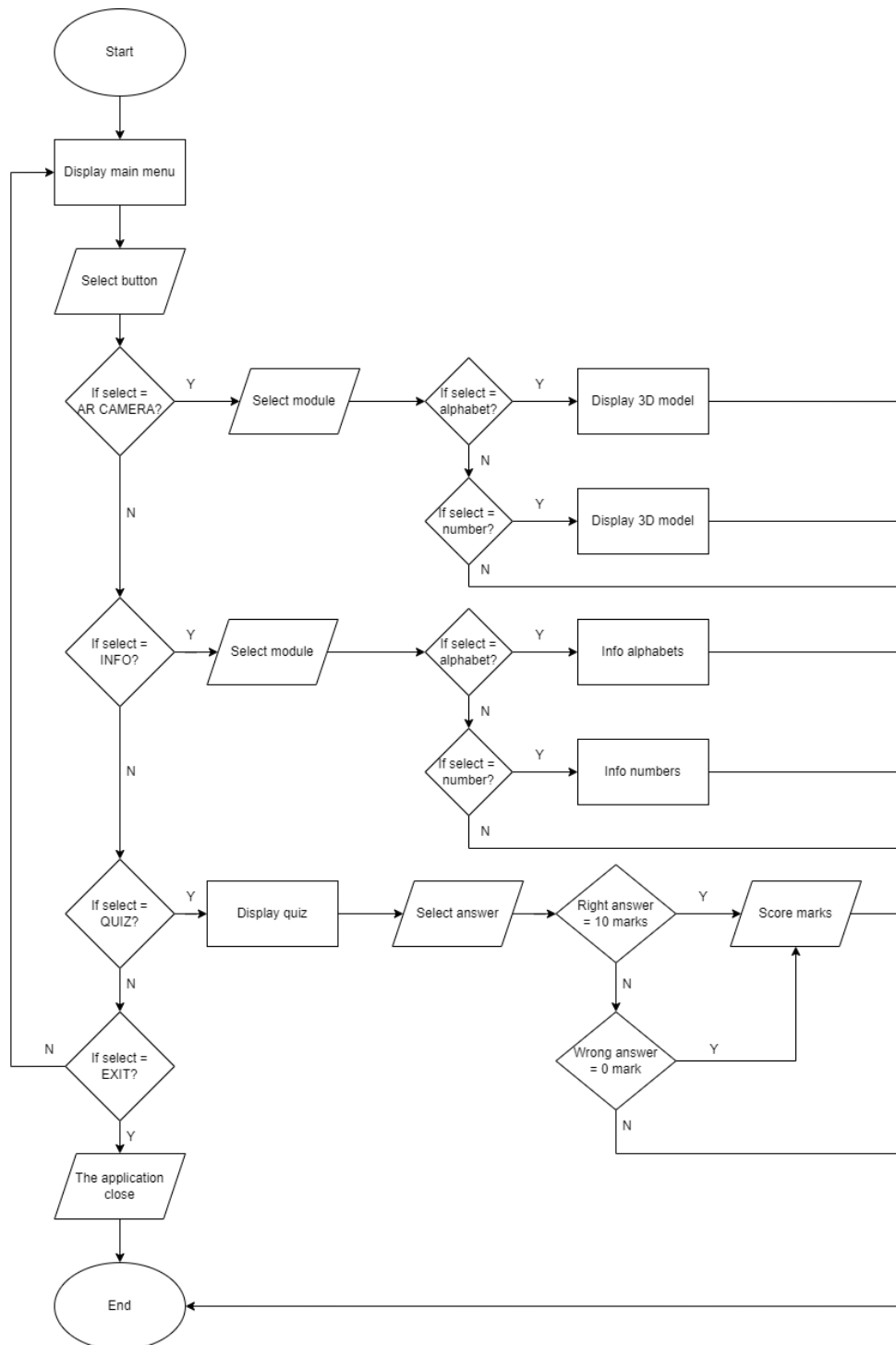


Figure 3.4 Flowchart of the user

3.4.2 Context Diagram

A diagram that shows the flow of data through the system is called a context diagram. Figure 3.5 shows the context diagram for AR Arabic application. This application will connect with users by exchanging data. The application will receive select alphabet, select number, view 3D object, select answer of quiz and take photo as input, then it will forward display image, display score mark, display 3D object and hear audio to the preschool or parent.

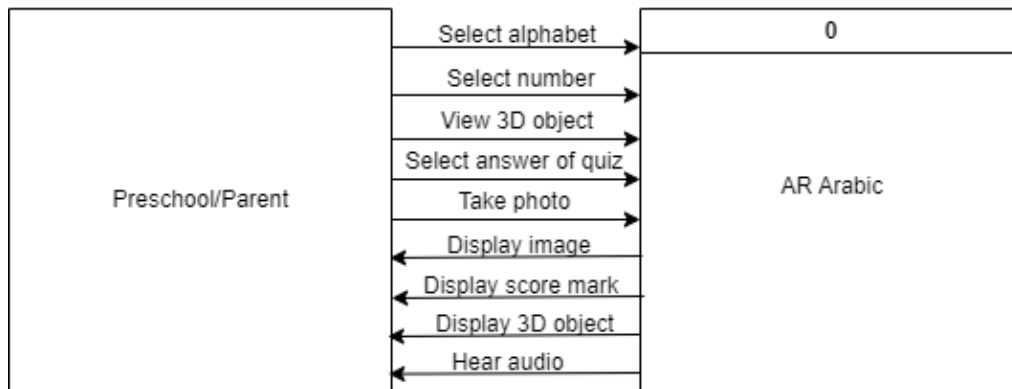


Figure 3.5 Context Diagram

3.4.3 Use Case Diagram

The use case diagram is a diagram that shows the use to visualize the functional requirements of a system. One actor for this application is the preschool or parent. The functionalities in the application are choose module, choose object, view 3D object, view image, choose answer, view score, and hear audio. Figure 3.6 shows the Use Case Diagram for this application.

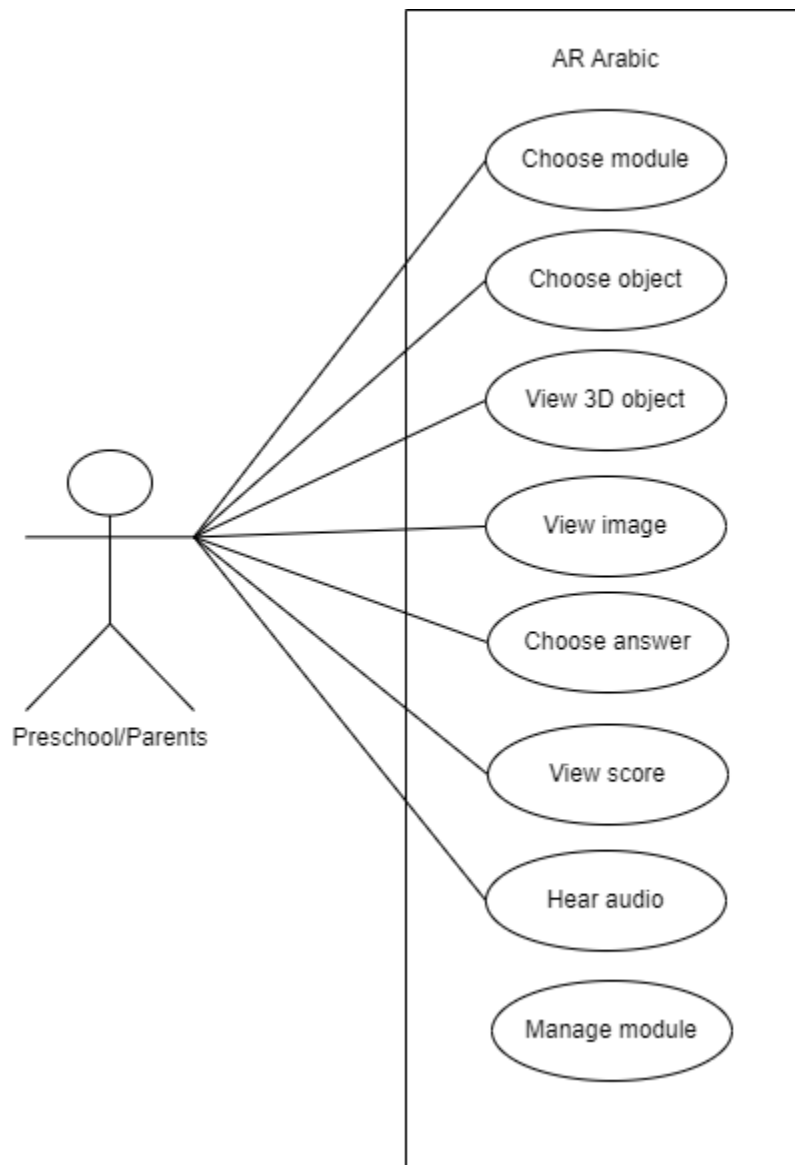


Figure 3.6 Use Case Diagram

3.4.4 Storyboard

Storyboards are used to show the through interface for the AR application that will be developed in the project. Figure 3.7 show the interface for the main menu. There are five buttons in main menu which are “AR Camera”, Info”, “Quiz”, “Credit By” and “Exit” button. “AR Camera” button will direct user to another page which is shown in Figure 3.8, “Info” button to another page which is shown in Figure 3.13, “Quiz” button to quiz interface and “Credit” button to know the developer of the application. User can close the application by press on the “Exit” button.

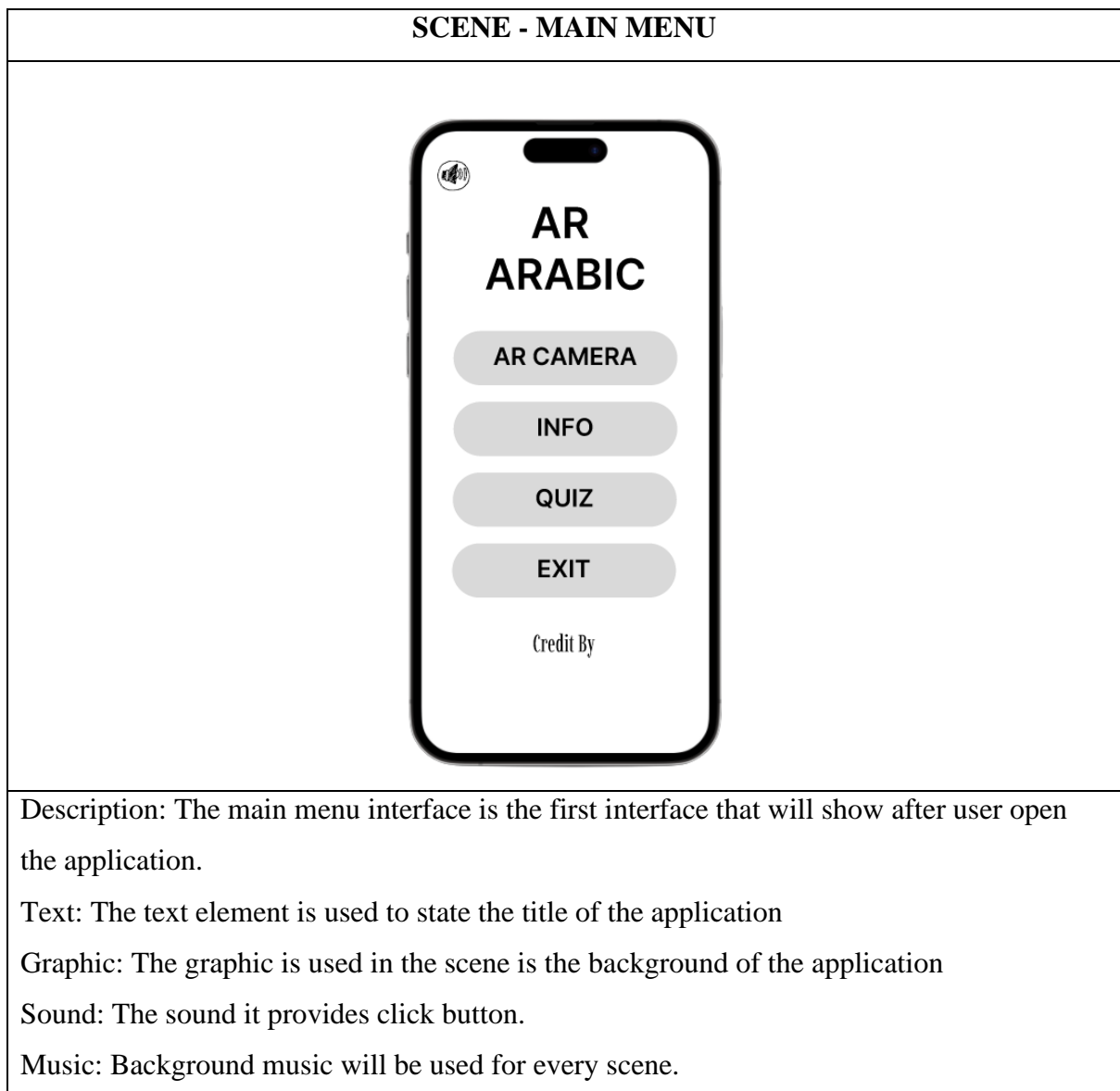


Figure 3.7 Storyboard of main menu

Figure 3.8 shows the two buttons in the interface module which are first button “Alphabet” button, and second button is “Numbers” button. The “Back” button is for back to the main menu interface.

SCENE - MODULE

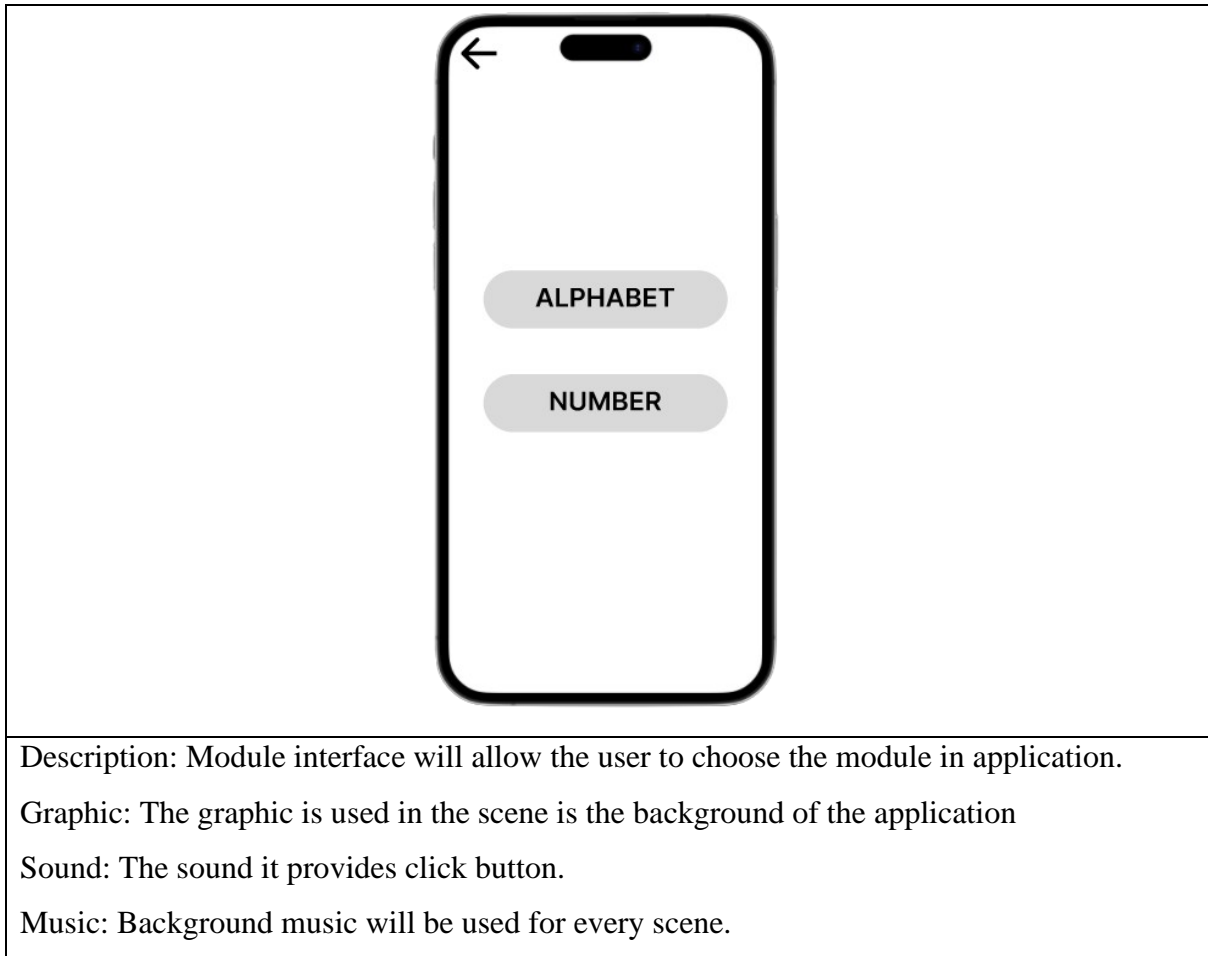


Figure 3.8 Storyboard of module

This interface displays all alphabets of Arabic as show in Figure 3.9. The buttons of alphabet are twenty-eight. Users need to choose any alphabet to learn. The “Back” button is for back to the module interface and “Home” button to direct the main menu interface.

SCENE – ALPHABET MODULE

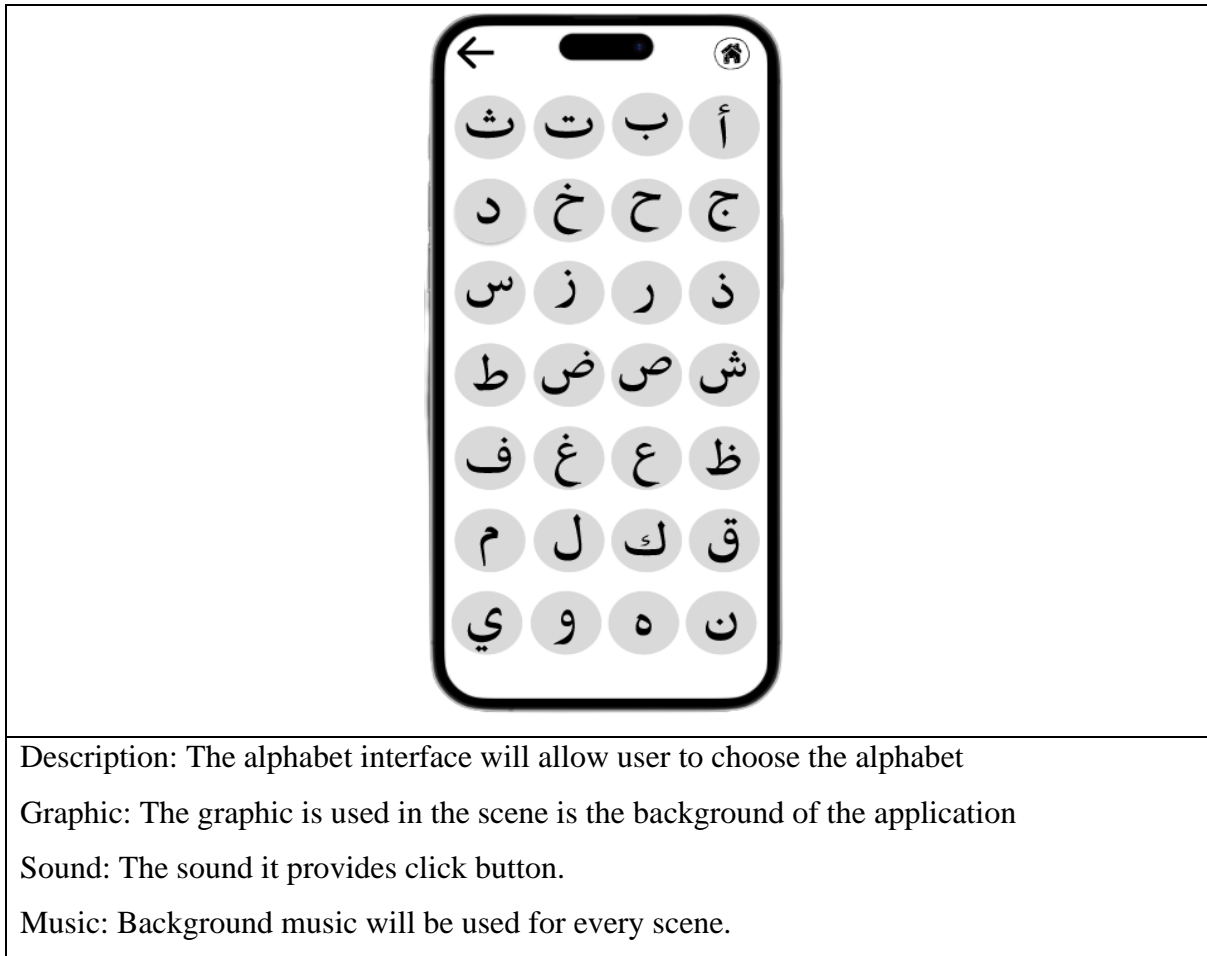


Figure 3.9 Storyboard of alphabet module

Figure 3.10 shows the interface of display object. The interface provides six buttons which are “Back” button to back the number interface, “Home” button to the main menu interface, The “Audio” button is the sound effect button, the “Play” button is the sound of model name, the “Information” button is the model information and the “Camera” button to snap a picture with object.

SCENE - DISPLAY OBJECT

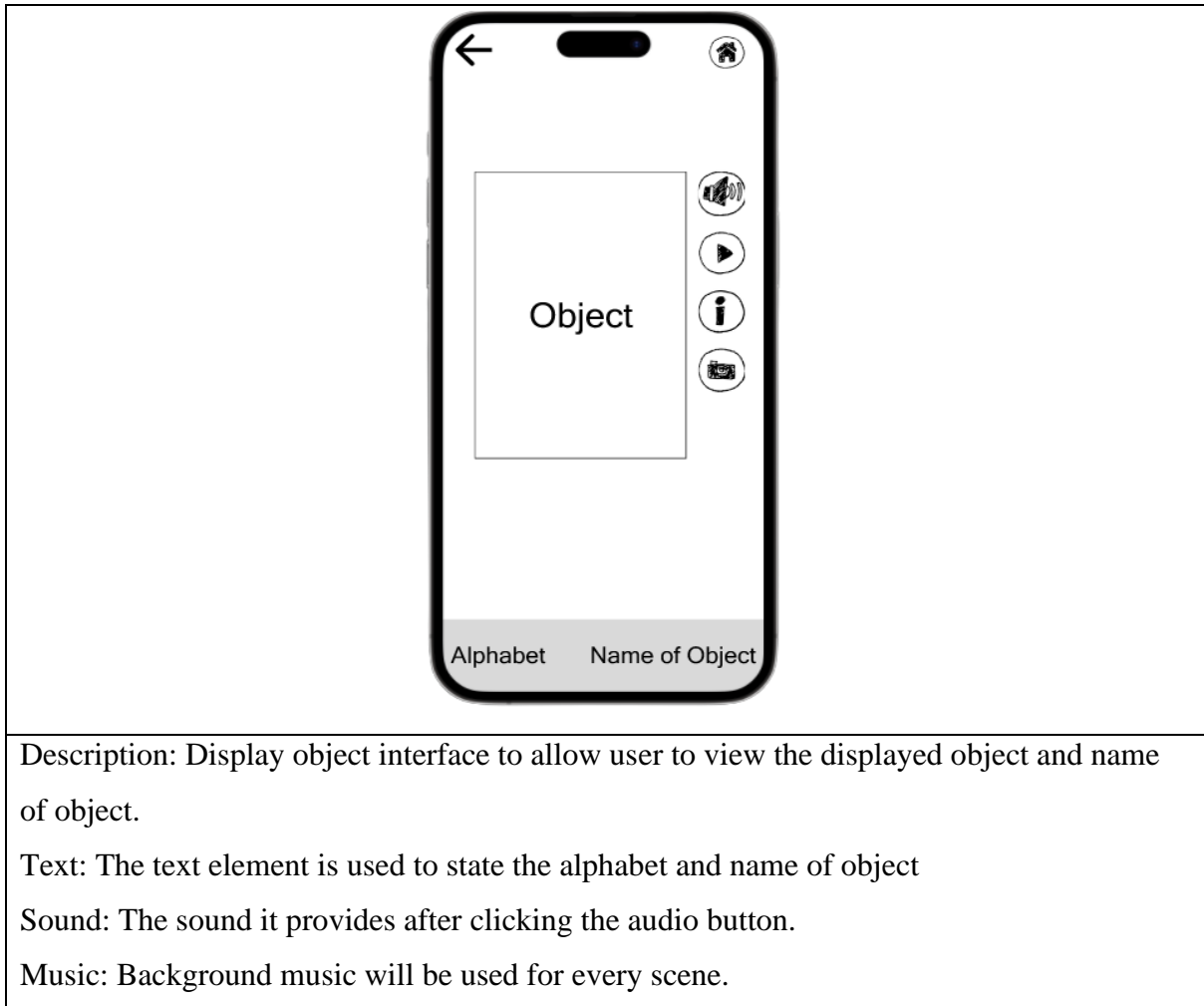


Figure 3.10 Storyboard of display 3D object

This interface displays all numbers of Arabic as show in Figure 3.11. The total of numbers are ten. Users need to choose any number to learn.

SCENE - NUMBER



Description: The number interface will allow user to choose the number 1 to 10.

Graphic: The graphic is used in the scene is the background of the application

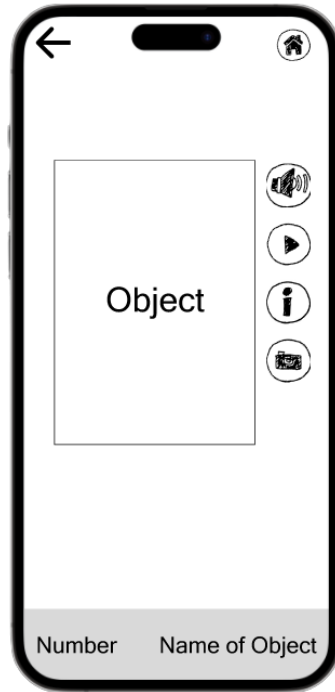
Sound: The sound it provides click button.

Music: Background music will be used for every scene.

Figure 3.11 Storyboard of numbers

Figure 3.12 shows the interface of display object. The interface provides six buttons which are “Back” button to back the number interface, “Home” button to the main menu interface, The “Audio” button is the sound effect button, the “Play” button is the sound of model name, the “Information” button is the model information and the “Camera” button to snap a picture with object.

SCENE – DISPLAY OBJECT



Description: Display object interface to allow user to view the displayed object, and number of objects.

Text: The text element is used to state the alphabet and name of object

Sound: The sound it provides after clicking the audio button.

Music: Background music will be used for every scene.

Figure 3.12 Storyboard of display 3D object

Figure 3.13 shows the two buttons in the interface module which are first button “Alphabet” button, and second button is “Numbers” button. The “Back” button is for back to the main menu interface.

SCENE - INFO

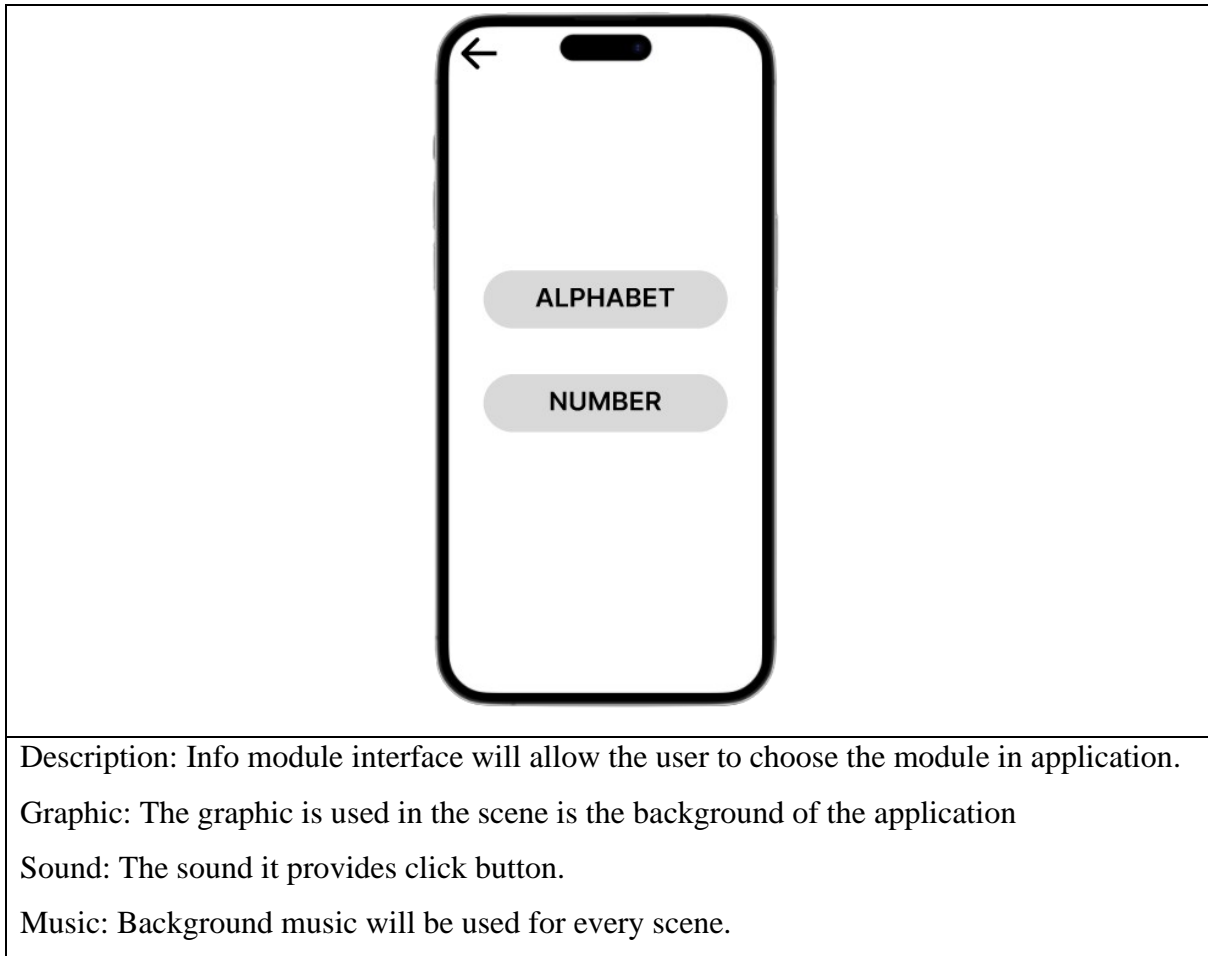


Figure 3.13 Storyboard of info module

Figure 3.14 shows the eight buttons in alphabet information interface. There is a "Back" button to the previous interface, a "Home" button for the main menu interface, a "Previous" button to slide the previous alphabet, a "Next" button to slide the next alphabet, an "Alphabet Card" button to make alphabet sounds, and three different alphabet pronunciation buttons.

SCENE – ALPHABET INFO



Description: Alphabet info interface will allow the user to choose the alphabet in application.

Graphic: The graphic is used in the scene is the background of the application

Sound: The sound it provides click button.

Music: Background music will be used for every scene.

Figure 3.14 Storyboard of alphabet info

Figure 3.15 shows the five buttons in the number info interface. There are a "Back" button to the previous interface, a "Home" button for the main menu interface, a "Previous" button to slide the previous number, a "Next" button to slide the next number and "Number Card" button to make number sounds.

SCENE – NUMBER INFO



Description: Number info interface will allow the user to choose the number in application.

Graphic: The graphic is used in the scene is the background of the application

Sound: The sound it provides click button.

Music: Background music will be used for every scene.

Figure 3.15 Storyboard of number info

Figure 3.16 shows the quiz interface. The interface have provided five button which are “Close” button to back the previous interface and four button to answer the question

SCENE - QUIZ

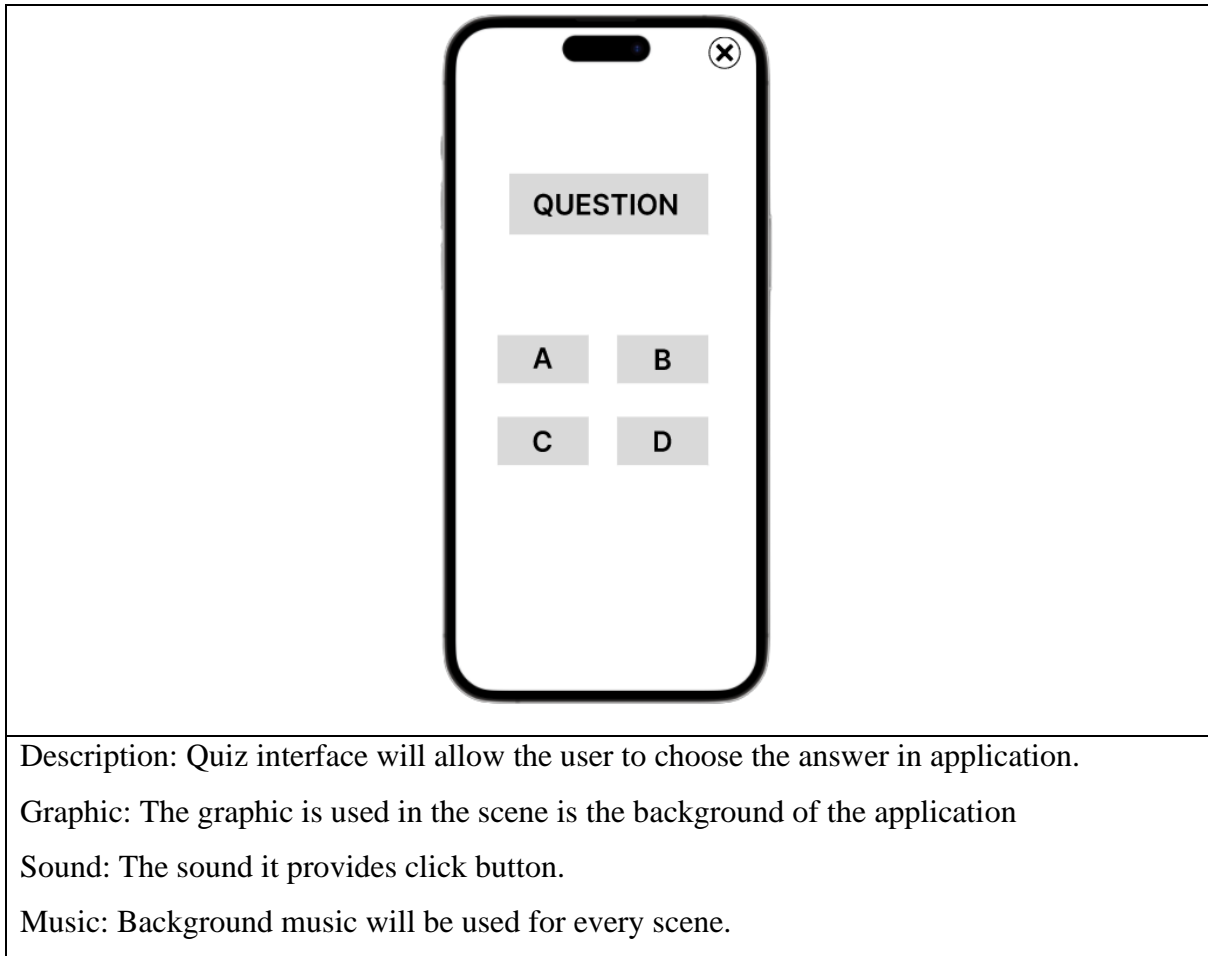


Figure 3.16 Storyboard of quiz

Figure 3.17 shows the score interface. The score will display once the user has done answering all question.

SCENE - QUIZ

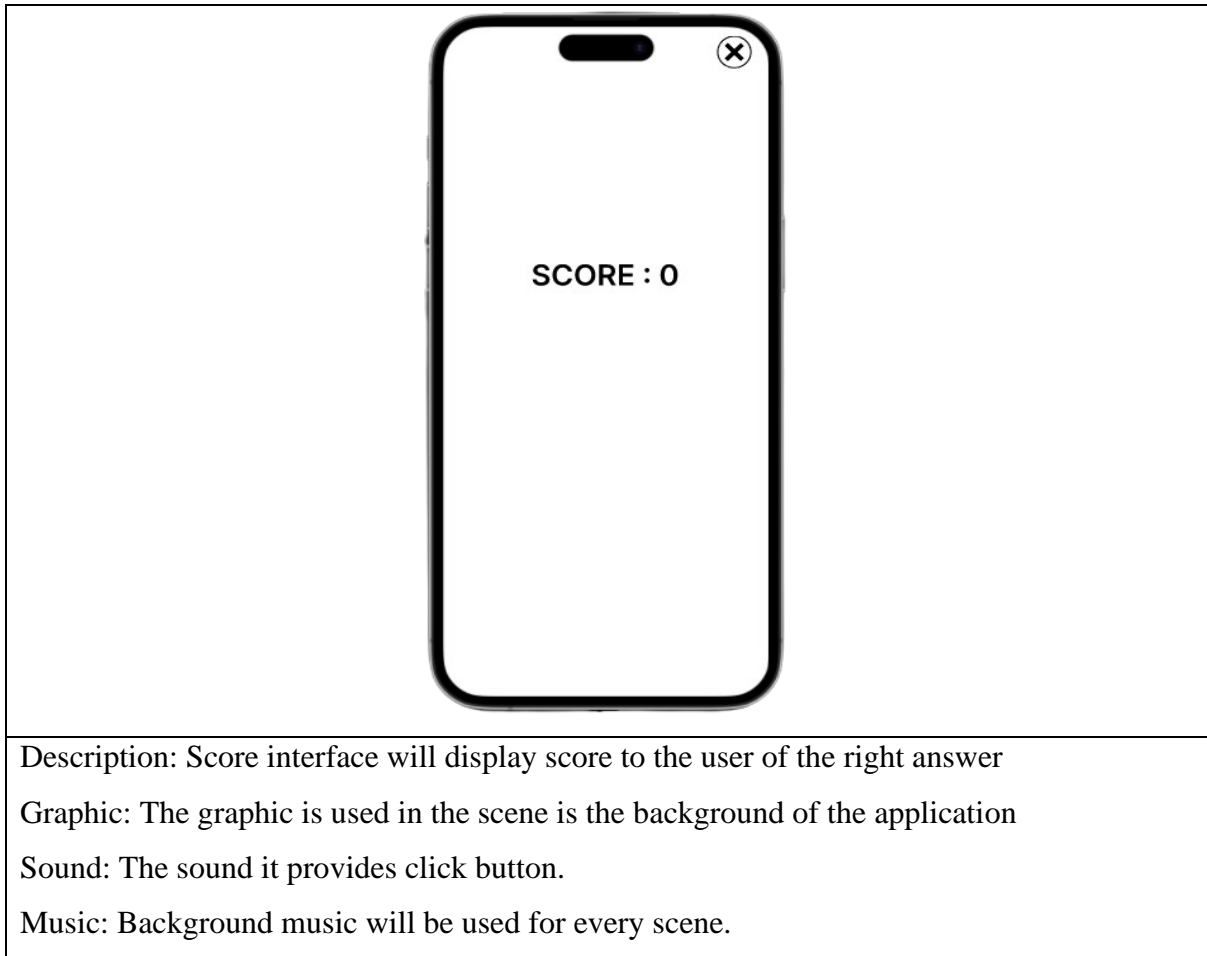


Figure 3.17 Storyboard of score

3.5 Data Design

Several 3D objects will be displayed through augmented reality in this Arabic AR application's data design in order to enhance the user's enjoyment of this application. This 3D object will be displayed in two modules which are alphabet and number as shown in Table 3.1 and Table 3.2. The 3D objects used are:

Table 3.1 Module of alphabets

Module - Alphabet		
ALPHABET	3D OBJECT	NAME OF OBJECT
ا	3D rabbit	أرنب
ب	3D duck	بطة
ت	3D crocodile	تمساح
ث	3D fox	ثعلب
ج	3D camel	جمل
ح	3D horse	حصان
خ	3D sheep	خروف
د	3D bear	دب
ذ	3D wolf	ذئب
ر	3D racoon	راكون
ز	3D flower	زهرة
س	3D squirrel	سنجاب
ش	3D fork	شوكة
ص	3D hawk	صقر
ض	3D frog	ضفدع
ط	3D bird	طائر
ظ	3D antelope	ظبي
ع	3D spider	عنكبوت
غ	3D crow	غراب
ف	3D elephant	فيل
ق	3D monkey	قرد
ك	3D dog	كلب
ل	3D lioness	لبؤة

م	3D table	مَكْتَب
ن	3D tiger	نمر
هـ	3D cat	هرة
و	3D bat	وطواط
ي	3D dragonfly	يعسوب

Table 3.2 Module of Numbers

Module - Number		
NUMBER	3D OBJECT	NUMBER OF OBJECTS
١	3D pineapple	واحد
٢	3D cooking oil	اثنين
٣	3D bottle	ثلاثة
٤	3D apple	أربعة
٥	3D carrot	خمسة
٦	3D strawberry	ستة
٧	3D donut	سبعة
٨	3D ball	ثمانية
٩	3D pencil	تسعة
١٠	3D pen	عشرة

3.6 Testing

The objective of software testing is to ensure that the actual software product satisfies the defined criteria and is free of problems. The name "software testing" refers to the verification of the software being tested (AUT). When a system is tested, errors, gaps, or missing requirements that were not specified in the original requirements are requested out.

Table 3.3 Main Menu

Test Case 1: Main Menu				
No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the “AR CAMERA” button	Navigate to Module interface	Show the Module interface	
2	User click on the “INFO” button	Navigate to Info Module interface	Show the Info Module interface	
3	User click on the “QUIZ” button	Navigate to Quiz interface	Show the Quiz interface	
4	User click on the “EXIT” button	Navigate to popup	Show the popup	
5	User click on the “Yes” button	Exit the application	Application close	
6	User click on the “No” button	Navigate to Main Menu interface	Show the Main Menu interface	
7	User click on the “Credit By” button	Navigate to Credit interface	Show the Credit interface	

Table 3.4 Module

Test Case 2: Module				
No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the “Alphabet” button	Navigate to Alphabet interface	Show the Alphabet interface	
2	User click on the “Number” button	Navigate to Number interface	Show the Number interface	

3	User click on the “Back” button	Navigate to Main Menu interface	Show the Main Menu interface
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Table 3.5 Module of Alphabet

Test Case 3: Module of Alphabet				
No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the “Alphabet module” button	Navigate to Alphabet interface	Show the Alphabet interface	
29	User click on the “Back” button	Navigate to Module interface	Show the Module interface	
30	User click on the “Home” button	Navigate to Main Menu interface	Show the Main Menu interface	

Table 3.6 Module of Number

Test Case 4: Module of Number				
No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the “Number module” button	Navigate to One interface	Show the One interface	
2	User click on the “Back” button	Navigate to Module interface	Show the Module interface	
3	User click on the “Home” button	Navigate to Main Menu interface	Show the Main Menu interface	

Table 3.7 AR Camera of Alphabet

Test Case 5: AR Camera of Alphabet				
No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the “Sound Effect” button	The button will voice out	The button will voice out	
2	User click on the “Audio” button	The button will voice out	The button will voice out	
3	User click on the “Info” button	Display popup	Display popup	
4	User click on the “Camera” button	Save the image to the file	Save the image to the file	
5	User click on the “Back” button	Navigate to Alphabet interface	Show the Module interface	

6	User click on the “Home” button	Navigate to Alphabet interface	Show the Main Menu interface
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Table 3.8 AR Camera of Number

Test Case 6: AR Camera of Number				
No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the “Audio” button	The button will voice out	The button will voice out	
2	User click on the “Info” button	Display popup	Display popup	
3	User click on the “Camera” button	Save the image to the file	Save the image to the file	
4	User click on the “Back” button	Navigate to Alphabet interface	Show the Module interface	
5	User click on the “Home” button	Navigate to Alphabet interface	Show the Main Menu interface	

Table 3.9 Info Module

Test Case 7: Info Module				
No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the “Alphabet” button	Navigate to Alphabet interface	Show the Alphabet interface	
2	User click on the “Number” button	Navigate to Number interface	Show the Number interface	
3	User click on the “Back” button	Navigate to Main Menu interface	Show the Main Menu interface	

Table 3.10 Alphabet info

Test Case 8: Alphabet info				
No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the “Alphabet Card” button	The button will voice out	The button will voice out	
2	User click on the “Alphabet Pronunciation 1” button	The button will voice out	The button will voice out	
3	User click on the “Alphabet Pronunciation 2” button	The button will voice out	The button will voice out	

4	User click on the “Alphabet Pronunciation 3” button	The button will voice out	The button will voice out
5	User click on the “Back” button	Navigate to Info Module interface	Show the Info Module interface
6	User click on the “Home” button	Navigate to Main Menu interface	Show the Main Menu interface

Table 3.11 Number info

Test Case 9: Number info				
No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the “Number Card” button	The button will voice out	The button will voice out	
2	User click on the “Back” button	Navigate to Info Module interface	Show the Info Module interface	
3	User click on the “Home” button	Navigate to Main Menu interface	Show the Main Menu interface	

Table 3.12 Quiz

Test Case 10: Quiz				
No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the “Wrong” button	Display Wrong answer	Display Wrong answer	
2	User click on the “True” button	Display True answer	Display True answer	
4	User complete answer the question	Show the score interface	Show the score interface	
3	User click on the “Close” button	Navigate to Main Menu interface	Show the Main Menu interface	

Table 3.13 Credit

Test Case 11: Credit				
No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the “Close” button	Navigate to Main Menu interface	Show the Main Menu interface	

3.7 Potential used

The application of this project is to develop AR that can help in learning Arabic effectively for preschoolers in Malaysia. The application does not require a trigger image with AR without markers because the technology only scans the area. It will make it easier for users to use anywhere. This application only requires a flat surface such as a table or floor. This application will help students think about things in a 3D model and give them fun ways to learn. It can also teach students how to use AR apps and make teaching and learning more interactive.

3.8 Gantt Chart

The Gantt Chart is a bar chart that shows the timetable of the project by breaking up the tasks that must be completed for it into several lines of bar with a certain amount of time. The Gantt Chart, which is based on the RAD model methodology's steps, has been established to guarantee that the proposed project application is developed and completed on time. The figure of Gantt Chart has shown at **APPENDIX A**.

3.9 Conclusion

In conclusion of Chapter 3 has discussed on the methodology that will be implemented in this project. In the development of a system, methodology is important. As the system develops effectively from phase to phase, it helps to ensure that. The RAD model was used in this developed the application. Additionally, it ensures that all the goals may be accomplished.

CHAPTER 4

RESULT AND DISCUSSION




4.1 Introduction

This chapter discuss on the development, implementation and testing of AR Arabic application. There are important components that were used to develop the application such as interface, 3D model, and tools used in the application development. This application is implemented for preschool students. The testing application was performed to identify the possible error and fixed it immediately.

4.2 Development Tools

To develop the AR Arabic application, there are few applications and tools needed to be installed. Table 4.1 shows the tools that are used to develop the project.

Table 4.1 Development tools

Software	Description
	Unity engine is the engine that used to develop the application. The version used is 2021.3.21f1
	Microsoft Visual Studio is the application used during the scripting phase of application development.
	EasyAR is a tool that makes apps that bring digital objects to the real world through phones and other devices.

4.3 Implementation

In this section, the topic that will be discussed is implementation. The development steps will be recorded among the application development progress.

4.3.1 Build Application Project

Firstly, open Unity 3D. Figure 4.1 shows create a new project with fill up the project name, location to save and choose the editor version. After completing the filling, click the “Create project” button.

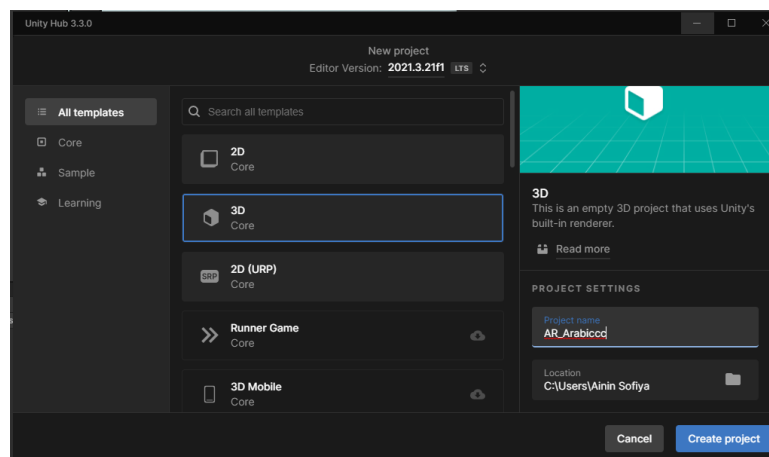


Figure 4.1 Create New Project in Unity 3D

Figure 4.2 shows that Unity already open to build the application.

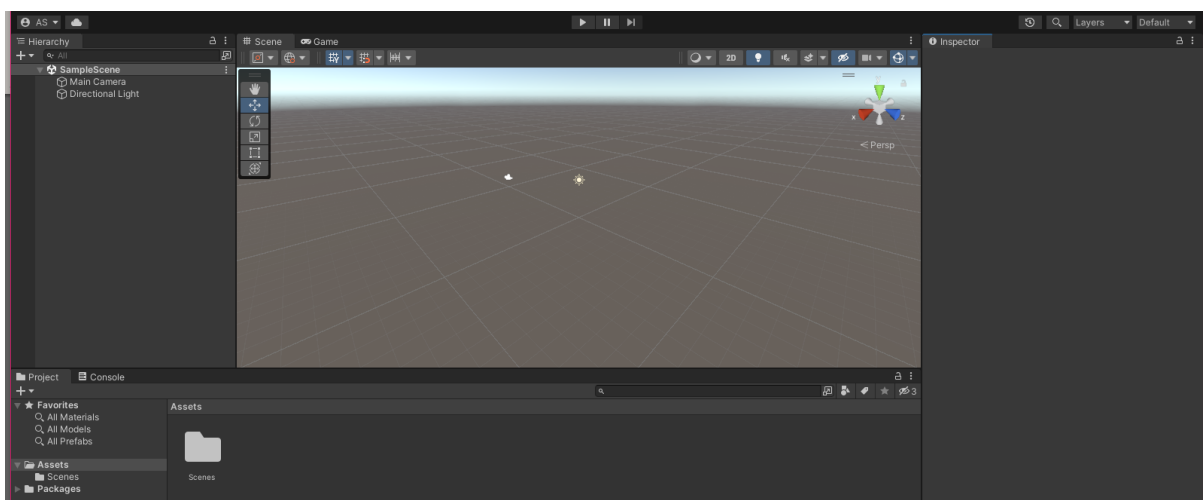


Figure 4.2 Unity already open

4.3.2 Getting the EasyAR License Key

To create AR applications on mobile devices, an AR software development kit (SDK) such as EasyAR is required. Figure 4.3 shows download of the package EasyAR. The package can get using this link <https://www.easyar.com/view/download.html>. Find the EasyAR Sense section, then click button download.

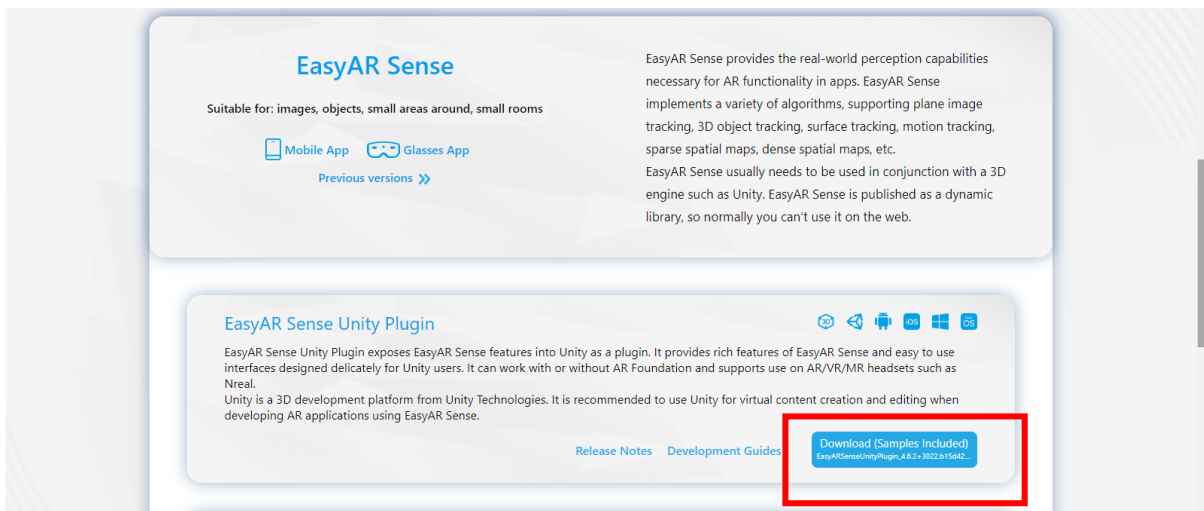


Figure 4.3 Unity Plugin

After complete downloaded, import the package in Unity as shown in Figure 4.4. Then click import button to importing the package.

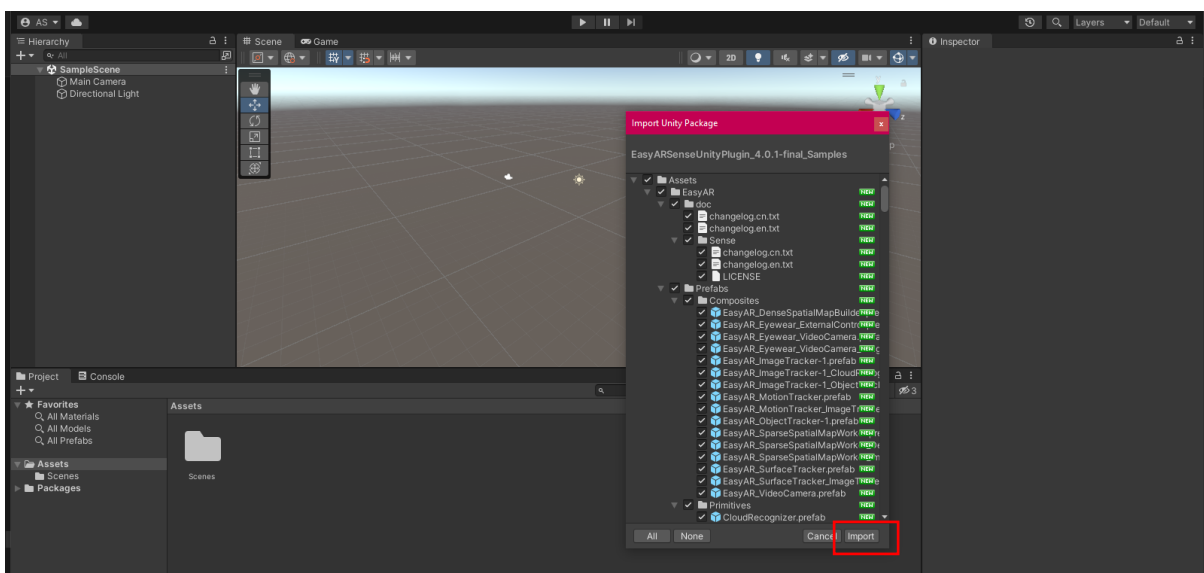


Figure 4.4 Import the package

Click on the EasyAR tool using this link <https://www.easyar.com/view/login.html>. Figure 4.5 shows login using registered account to get the license key.

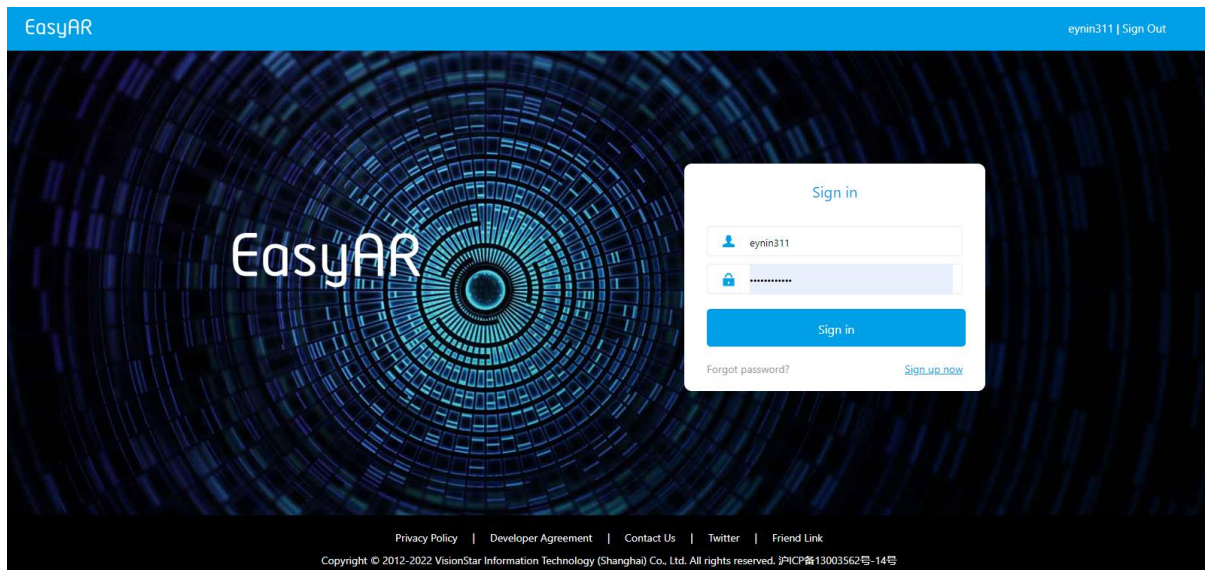


Figure 4.5 Login using registered account

After login, it will display the Sense Authorization interface as shown Figure 4.6. On the Sense Authorization interface, there is a "Sense License Key" button. This indicates that the button will get a license key. Click that button to get a license key.

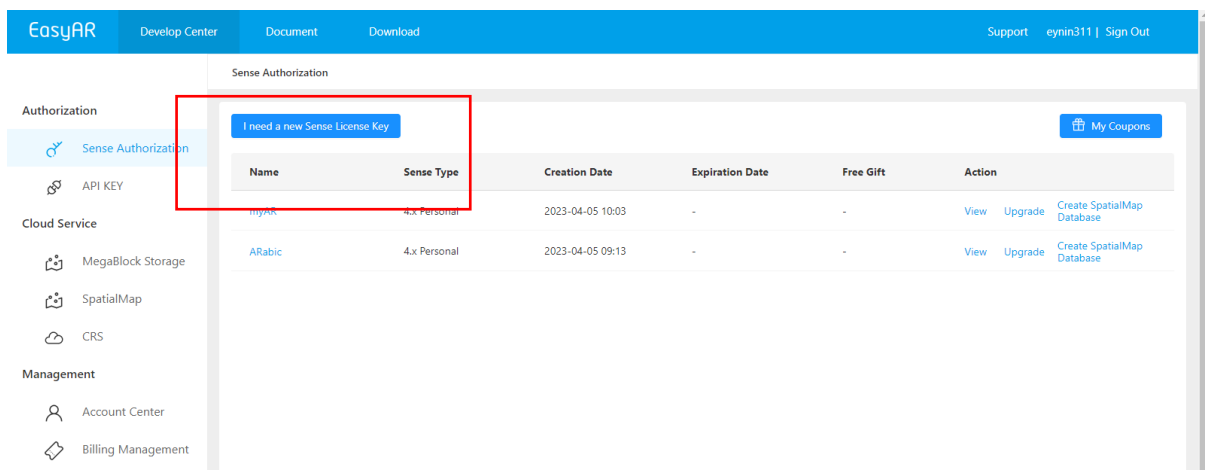


Figure 4.6 Sense Authorization interface

Figure 4.7 shows after clicking the button, the new sense license key interface will be displayed. Fill up the form and click the "Confirm" button.

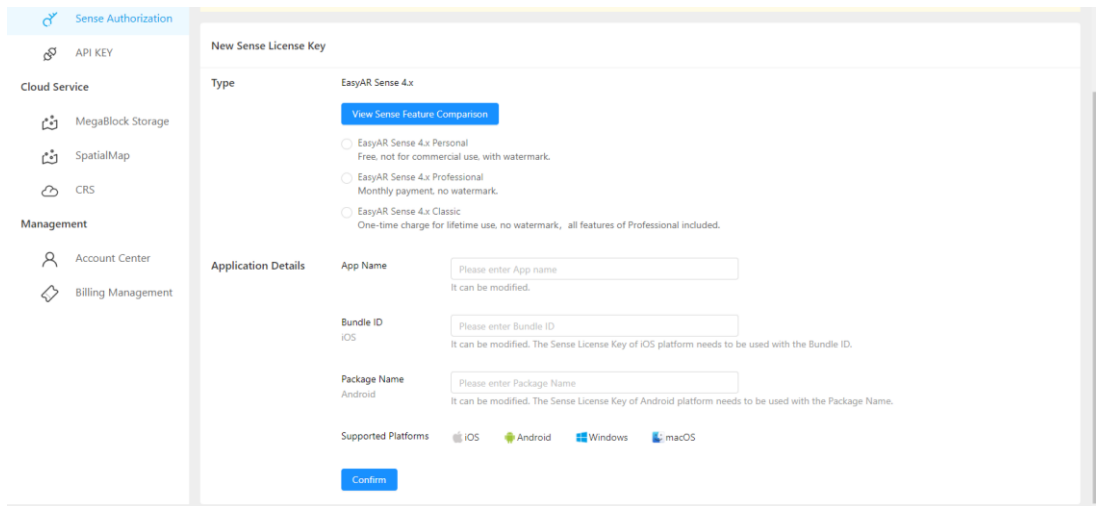


Figure 4.7 New Sense License Key interface

Figure 4.8 shows a display list of name license key. Click the name create before that to show the license key.

Name	Sense Type	Creation Date	Expiration Date	Free Gift	Action
myAR	4x Personal	2023-04-05 10:03	-	-	View Upgrade Create SpatialMap Database
ARabic	4x Personal	2023-04-05 09:13	-	-	View Upgrade Create SpatialMap Database

Figure 4.8 List of Name License Key

This application uses the mobile device's camera. Figure 4.9 shows to develop Arabic AR, it is necessary to build a license key from EasyAR to be included in Unity. Copy the license key and paste to unity as shown Figure 4.10.

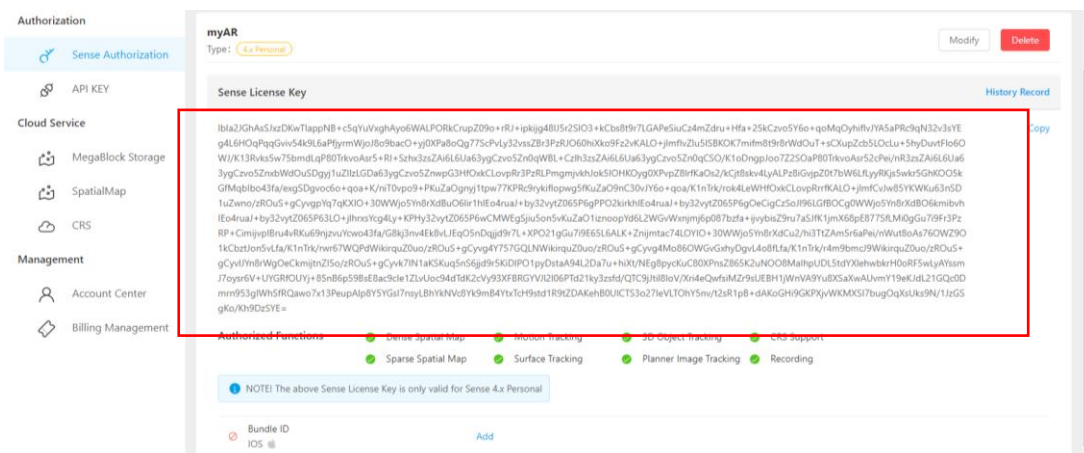


Figure 4.9 License Key

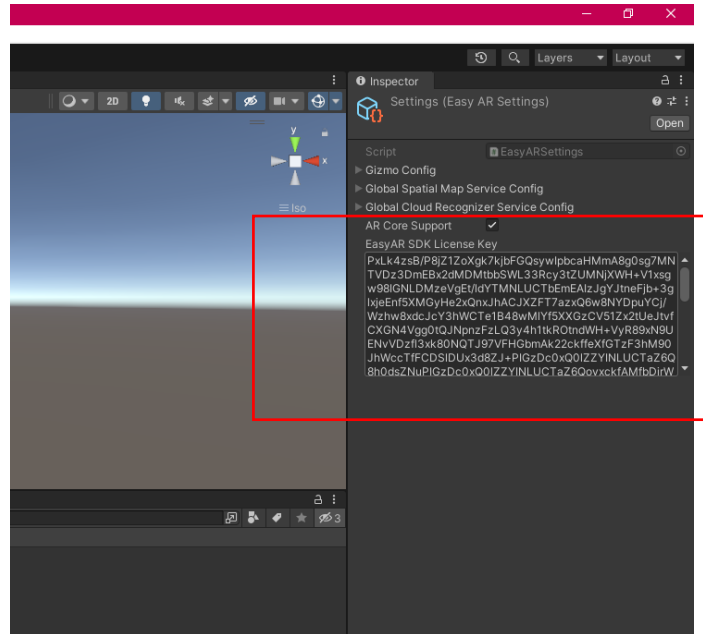


Figure 4.10 Insert License Key to Unity

4.3.3 Set Up the 3D Model

Insert the 3D model in Unity and resize it using rotate, move, scale and rect tools to fit in the camera as shown in Figure 4.11

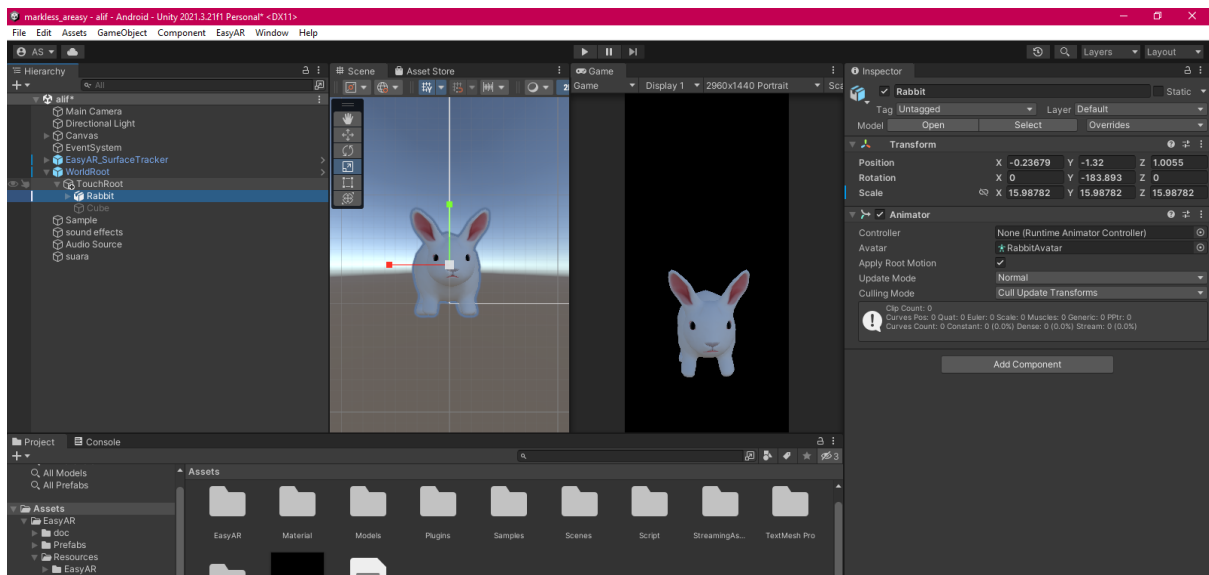


Figure 4.11 Adjusting 3D models into the camera

After pressing the button on the previous interface, the audio in this interface will sound because this interface has been setup "Play On Awake". The trick is to create a Game Object

and enter the audio to be inserted into the audio source and select "Play On Awake" shown in Figure 4.12.

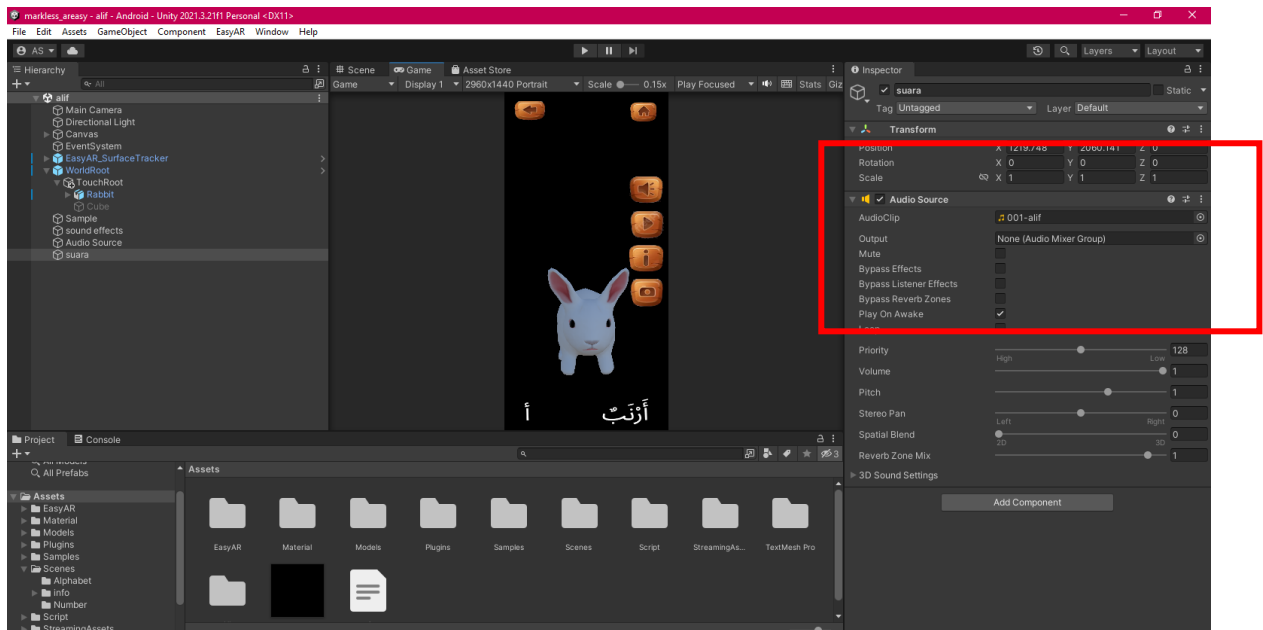


Figure 4.12 Set the audio after user press button in alphabet interface

Figure 4.13 shows way of setting the button when pressed will output the audio sound that has been entered. This button is used as the audio for the model name.

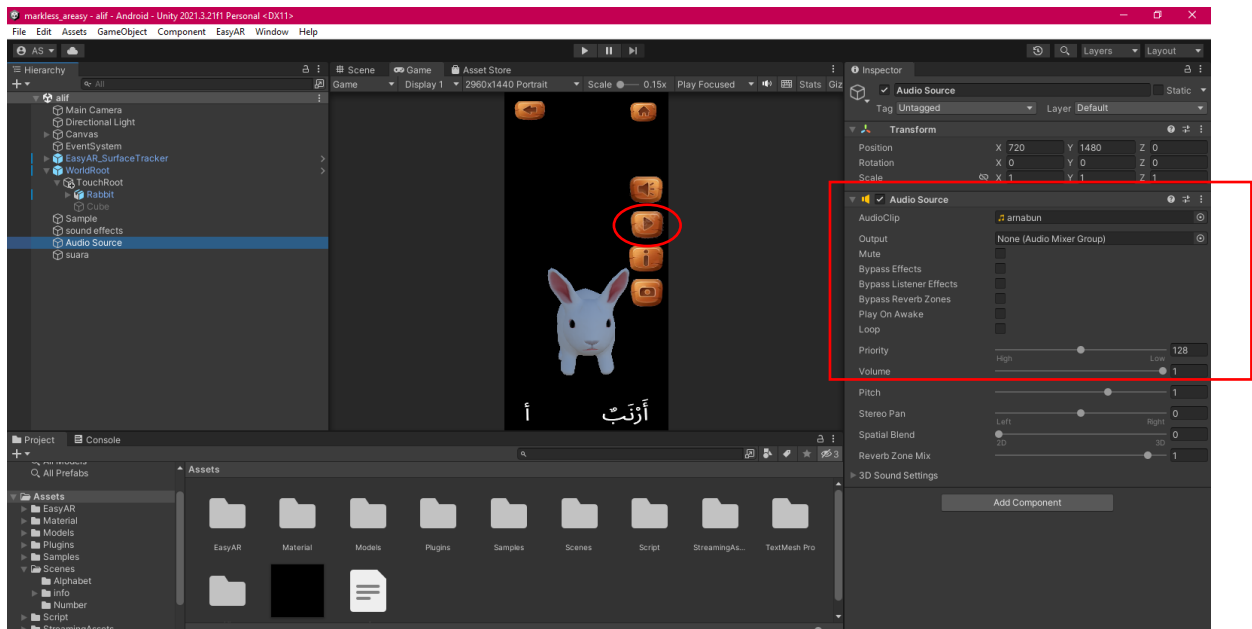


Figure 4.13 Set the audio of model name

Create a model sound effect as shown in Figure 4.14. This is the same as creating an audio button for the model name.

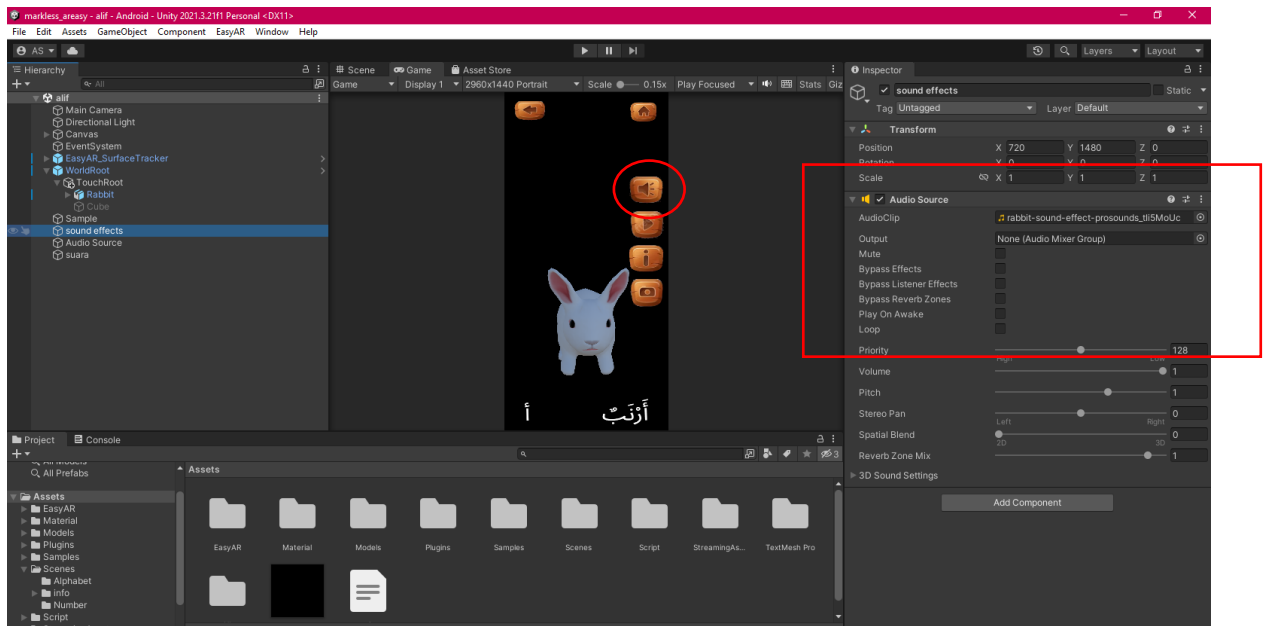


Figure 4.14 Set the audio sound effect of 3D models after the user press the button

4.3.4 Build and Run in Mobile Device

After finishing developing this application, the user needs to install the Arabic AR application into the mobile device. To create all of the player settings, open the Build Setting window by selecting File > Build Setting as shown Figure 4.15. To make the apk file, click the build button as shown in Figure 4.16.

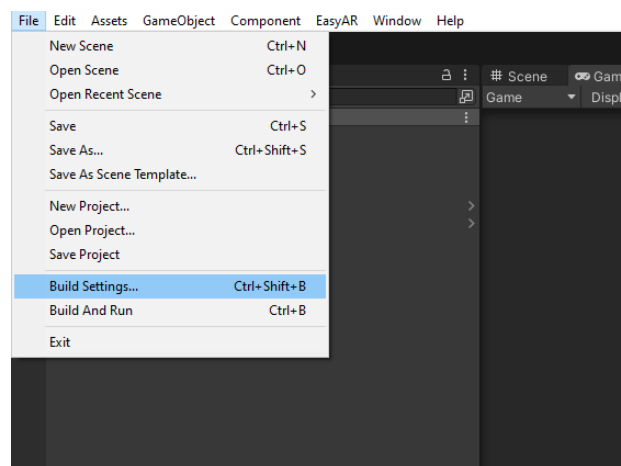


Figure 4.15 How to Build Settings

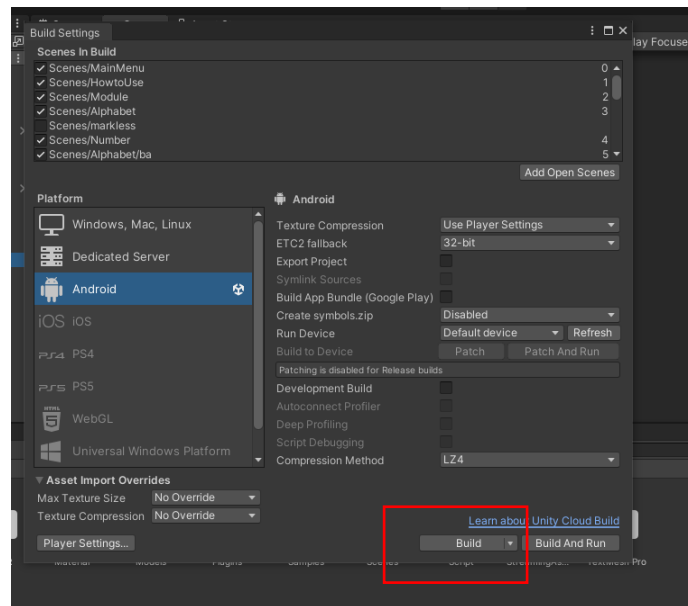


Figure 4.16 Build Project into APK File

Figure 4.17 shows the application ready to be installed. After completing the installation, the application will appear on the screen. Figure 4.18 shows the application in the mobile device.



Figure 4.17 Install the apk to mobile device



Figure 4.18 The application already in mobile device

4.4 Interfaces

4.4.1 Main Menu Interface

Figure 4.19 shows the main menu interface of the application. In this interface, there are five buttons which are “AR CAMERA” button, “INFO” button, “QUIZ” button, “EXIT” button and “CREDIT” button. “AR CAMERA” button will direct user to module interface of alphabet and numbers. The second button is “INFO” button. The button will direct user to the info interface of alphabet and numbers. The third button is “QUIZ” button to quiz interface. To close the application, user can click the “EXIT” button. Last button is “CREDIT” button to know the developer of the application.



Figure 4.19 Main menu

4.4.2 AR Camera - Module interface

Figure 4.20 shows the module interface. This interface will display after the user clicks the “AR CAMERA” button. The module interface has three buttons which are the alphabet button, number button and back button to back the previous interface.



Figure 4.20 AR Camera Module

4.4.3 AR Camera - Alphabet module interface

Figure 4.21 show the interface where it displays the alphabet module interface. The interface will display twenty-eight alphabet buttons. Users need to choose the alphabet to learn and recognize. In this interface there is also a back button to return to the previous interface.



Figure 4.21 Alphabet module

4.4.4 AR Camera

The AR camera interface is to show the 3D model selected by the user. For example, the user presses the "أ" button and the 3D model displayed is a rabbit as shown in Figure 4.22. The AR camera interface has 6 buttons such as "Back" button to return to the previous interface, "Home" button to the main menu interface. On the right side of the interface provides 4 buttons. The first button is the sound effect button, the second is the model name, the third is the model information and the last button is the camera button to capture images. The first and second buttons are the buttons that make sounds. Figure 4.23 is the third button, it will display the name in English, Arabic, and pronunciation in Arabic in a popup.



Figure 4.22 Camera AR shows the 3D models of “أَرْزَبْ”



Figure 4.23 Info popup

For the last button is the camera button. When the user presses the button, the picture taken will be automatically inserted into the DCIM file located in the internal storage of the user's mobile device as shown in Figure 4.24

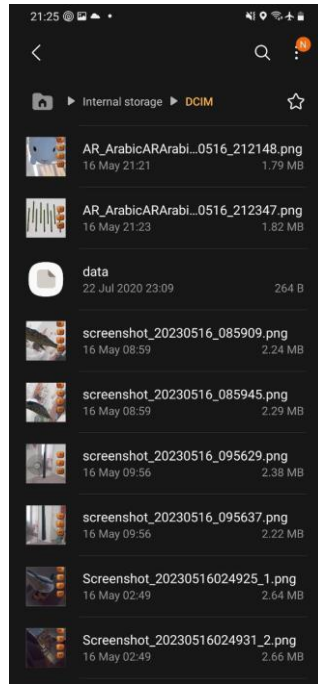


Figure 4.24 The image capture save in DCIM file

4.4.5 AR Camera - Number module interface

Figure 4.25 show the interface where it displays the number module interface. The interface will display ten number buttons. Users need to choose the number to learn and recognize. In this interface there is also a back button to return to the previous interface.



Figure 4.25 Numbers module

4.4.6 AR Camera

The AR camera interface is to show the 3D model selected by the user. For example, the user presses the “٩” button and the 3D model displayed is nine models as shown in Figure 4.26. The AR camera interface has five buttons such as "Back" button to return to the previous interface, "Home" button to the main menu interface. On the right side of the interface provides 3 buttons. The first button is the model name, the second is the model information and the third button is the camera button to capture images. The first and second buttons are the buttons that make sounds. Figure 4.27 is the third button, it will display the name in English, Arabic, and pronunciation in Arabic in a popup.

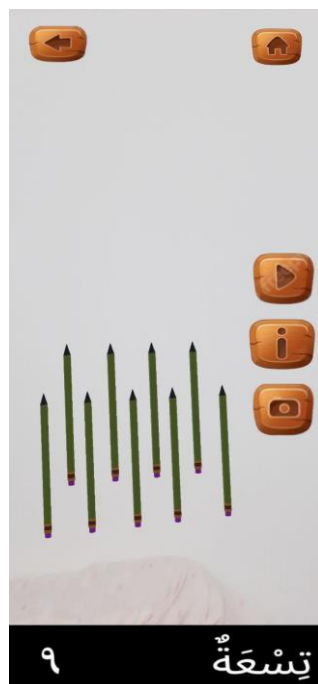


Figure 4.26 Camera AR shows the 3D models of “9”



Figure 4.27 Info popup

4.4.7 Info interface

Figure 4.28 shows the info module interface. This interface will display after the user clicks the “INFO” button. The module interface has three buttons which are the alphabet button, number button and back button to back the previous interface.



Figure 4.20 Info module interface

4.4.8 Info - Alphabet info interface

After pressing the alphabet button on the info module interface, it will display this interface which is the information interface as shown in Figure 4.29. The alphabet information interface provides eight buttons. There is a "Back" button to the previous interface, a "Home" button for the main menu interface, a "Previous" button to slide the previous alphabet, a "Next" button to slide the next alphabet, an "Alphabet Card" button to make alphabet sounds, and three different alphabet pronunciation buttons.



Figure 4.29 Alphabet info

4.4.9 Info - Number info interface

After pressing the number button on the info module interface, it will display this interface which is the information interface as shown in Figure 4.30. The number information interface provides five buttons. There is a "Back" button to the previous interface, a "Home" button for the main menu interface, a "Previous" button to slide the previous number, a "Next" button to slide the next number and "Number Card" button to make number sounds.



Figure 4.30 Number info

4.4.10 Quiz interface

After clicking the “QUIZ” button on the main menu interface, the quiz interface will be display as shown in Figure 4.31. The interface have provided five button which are “Close” button to back the previous interface and four button to answer the question Figure 4.32 show the result of the question will appear in the screen after the user choose the answer.



Figure 4.31 Quiz

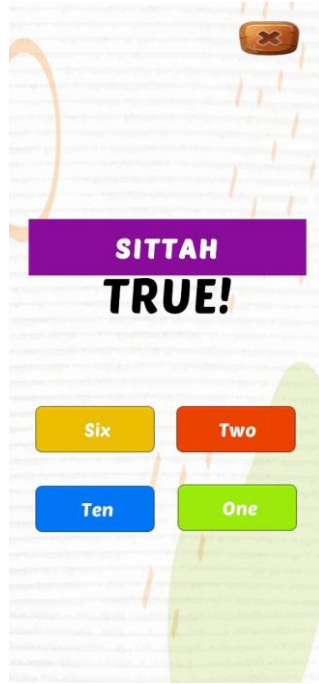


Figure 4.32 Answer of Quiz

The right overall score will be provided once the user has done answering all of the questions as shown in Figure 4.33.

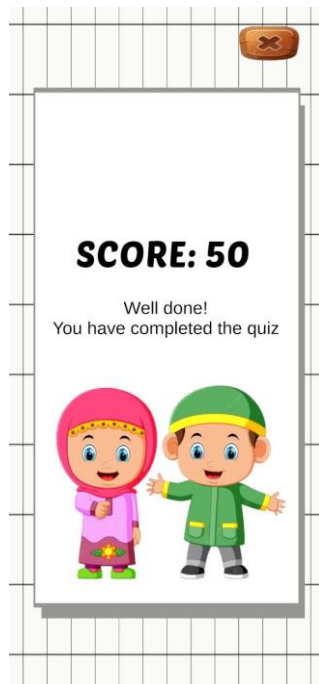


Figure 4.33 Score

4.4.11 Exit popup

To exit this application, users need to press the "EXIT" button on the main menu interface as shown in Figure 4.34. After that, a popup query will appear to confirm the user to exit. If the user does not want to exit, click the "No" button. If the user wants to exit click the "Yes" button.



Figure 4.34 Exit popup

4.5 Coding

In application development there is an important component scripting. The scripting in development has been done with the programming language C# in Unity. The script in Microsoft Visual Studio.

4.5.1 Code Use in Unity

Main Menu Script

```
using System.Collections;  
using System.Collections.Generic;  
using UnityEngine;  
using UnityEngine.SceneManagement;
```

```

public class mainmenu : MonoBehaviour
{
    public void play(string play){
        SceneManager.LoadScene("Module");
    }

    public void Instruction(string Instruction){
        SceneManager.LoadScene("HowtoUse");
    }

    public void quiz(string quiz){
        SceneManager.LoadScene("quiz");
    }

    public void info(string info){
        SceneManager.LoadScene("info");
    }

    public void credit(string credit){
        SceneManager.LoadScene("credit");
    }

    public void Exit(){
        Application.Quit();
    }
}

```

Background Music Script

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class backgroundmusic : MonoBehaviour
{
    private static backgroundmusic backgroundMusic;

    void Awake()
    {
        if(backgroundMusic == null)
        {
            backgroundMusic = this;
            DontDestroyOnLoad(backgroundMusic);
        }
    }
}

```

```

        else
        {
            Destroy(gameObject);
        }
    }
}

```

Button Sound Effect Script

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;

public class btnFX : MonoBehaviour {

    public AudioSource myFx;
    public AudioClip clickFx;

    public void ClickSound()
    {
        myFx.PlayOneShot (clickFx);
    }
}

```

Button Back Script

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;

public class Buttonback : MonoBehaviour
{
    public void back(string back){
        SceneManager.LoadScene("alphabet");
    }

    public void home(string home){
        SceneManager.LoadScene("MainMenu");
    }

    public void backk(string backk){

```



```
        SceneManager.LoadScene("number");
    }
}
```

Module Script

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;

public class module : MonoBehaviour
{
    public void alphabet(string alphabet){
        SceneManager.LoadScene("Alphabet");
    }

    public void number(string number){
        SceneManager.LoadScene("Number");
    }

    public void back(string back){
        SceneManager.LoadScene("MainMenu");
    }
}
```

Alphabet Script

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;

public class alphabet : MonoBehaviour
{
    public void back(string back){
        SceneManager.LoadScene("module");
    }

    public void home(string home){
        SceneManager.LoadScene("MainMenu");
    }

    public void ain(string ain){
        SceneManager.LoadScene("ain");
    }
}
```

```
}

public void alif(string alif){
    SceneManager.LoadScene("alif");
}

public void ba(string ba){
    SceneManager.LoadScene("ba");
}

public void dal(string dal){
    SceneManager.LoadScene("dal");
}

public void dhod(string dhod){
    SceneManager.LoadScene("dhod");
}

public void dzal(string dzal){
    SceneManager.LoadScene("dzal");
}

public void dzo(string dzo){
    SceneManager.LoadScene("dzo");
}

public void fa(string fa){
    SceneManager.LoadScene("fa");
}

public void ghain(string ghain){
    SceneManager.LoadScene("rin");
}

public void hah(string hah){
    SceneManager.LoadScene("ha'");
}

public void ha(string ha){
    SceneManager.LoadScene("ha");
}

public void jim(string jim){
    SceneManager.LoadScene("jim");
}

public void kaf(string kaf){
    SceneManager.LoadScene("kaf");
}
```

```
}

public void kha(string kha){
    SceneManager.LoadScene("kha");
}

public void lam(string lam){
    SceneManager.LoadScene("lam");
}

public void mim(string mim){
    SceneManager.LoadScene("mim");
}

public void nun(string nun){
    SceneManager.LoadScene("nun");
}

public void qof(string qof){
    SceneManager.LoadScene("qof");
}

public void ra(string ra){
    SceneManager.LoadScene("ra");
}

public void sa(string sa){
    SceneManager.LoadScene("sa");
}

public void shin(string shin){
    SceneManager.LoadScene("shin");
}

public void sin(string sin){
    SceneManager.LoadScene("sin");
}

public void sod(string sod){
    SceneManager.LoadScene("sod");
}

public void ta(string ta){
    SceneManager.LoadScene("ta");
}

public void tho(string tho){
    SceneManager.LoadScene("tho");
}
```

```

    }

    public void tsa(string tsa){
        SceneManager.LoadScene("tsa");
    }

    public void wau(string wau){
        SceneManager.LoadScene("wau");
    }

    public void ya(string ya){
        SceneManager.LoadScene("ya");
    }

    public void zai(string zai){
        SceneManager.LoadScene("zai");
    }
}

```

Number Script

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;

public class number : MonoBehaviour
{
    public void back(string back){
        SceneManager.LoadScene("module");
    }

    public void home(string home){
        SceneManager.LoadScene("MainMenu");
    }

    public void satu(string satu){
        SceneManager.LoadScene("1");
    }

    public void dua(string dua){
        SceneManager.LoadScene("2");
    }

    public void tiga(string tiga){
        SceneManager.LoadScene("3");
    }
}

```

```

    public void empat(string empat){
        SceneManager.LoadScene("4");
    }

    public void lima(string lima){
        SceneManager.LoadScene("5");
    }

    public void enam(string enam){
        SceneManager.LoadScene("6");
    }

    public void tujuh(string tujuh){
        SceneManager.LoadScene("7");
    }

    public void lapan(string lapan){
        SceneManager.LoadScene("8");
    }

    public void sembilan(string sembilan){
        SceneManager.LoadScene("9");
    }

    public void sepuluh(string sepuluh){
        SceneManager.LoadScene("10");
    }
}

```

Camera Screenshot Script

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using System.IO;
using System;

public class ss : MonoBehaviour
{
    private string screenshotFilename;

    // Fungsi untuk mengambil tangkapan layar
    public void TakeScreenshot()
    {
        StartCoroutine(CaptureScreenshot());
    }
}

```

```

private IEnumerator CaptureScreenshot()
{
    // Tunggu satu frame untuk memastikan semua rendering selesai
    yield return new WaitForEndOfFrame();

    // Buat texture baru dengan ukuran layar saat ini
    Texture2D screenshotTexture = new Texture2D(Screen.width,
Screen.height, TextureFormat.RGB24, false);

    // Baca data piksel dari layar dan terapkan pada texture
    screenshotTexture.ReadPixels(new Rect(0, 0, Screen.width,
Screen.height), 0, 0);
    screenshotTexture.Apply();

    // Simpan gambar ke galeri DCIM pada perangkat Android
    screenshotFilename = "/sdcard/DCIM/AR_Arabic" + "ARArabic_" +
System.DateTime.Now.ToString("yyyyMMdd_HH:mm:ss") + ".png";
    System.IO.File.WriteAllBytes(screenshotFilename,
screenshotTexture.EncodeToPNG());

    // Refresh galeri agar gambar dapat langsung terlihat
    AndroidJavaClass mediaScanner = new
AndroidJavaClass("android.media.MediaScannerConnection");
    mediaScanner.CallStatic("scanFile", new object[] {
screenshotFilename, "image/png" }, null, null);

    // Hapus texture setelah selesai
    Destroy(screenshotTexture);

    Debug.Log("Screenshot saved to: " + screenshotFilename);
}
}

```

Info Script

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;

public class info : MonoBehaviour
{
    public void back(string back){
        SceneManager.LoadScene("info");
    }
}

```

```

    public void mainmenu(string mainmenu){
        SceneManager.LoadScene("mainmenu");
    }

    public void huruf(string huruf){
        SceneManager.LoadScene("huruf");
    }

    public void nombor(string nombor){
        SceneManager.LoadScene("nombor");
    }
}

```

Swipe Control Script

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;

public class swipecontrol : MonoBehaviour
{
    public GameObject scrollbar;

    float scroll_pos = 0;
    float [] pos;
    int posisi = 0;
    // Start is called before the first frame update
    void Start()
    {

    }

    public void next(){
        if (posisi < pos.Length - 1){
            posisi += 1;
            scroll_pos = pos [posisi];
        }
    }

    public void prev(){
        if (posisi > 0){
            posisi -= 1;
            scroll_pos = pos [posisi];
        }
    }
}

```

```

// Update is called once per frame
void Update()
{
    pos = new float[transform.childCount];
    float distance = 1f / (pos.Length-1f);
    for (int i = 0; i < pos.Length; i++) {
        pos [i] = distance * i;
    }

    if (Input.GetMouseButton(0)){
        scroll_pos = scrollbar.GetComponent<Scrollbar> ().value;
    } else {
        for (int i = 0; i < pos.Length; i++) {
            if (scroll_pos < pos [i] + (distance / 2) && scroll_pos > pos
[i] - (distance / 2)){
                scrollbar.GetComponent<Scrollbar> ().value = Mathf.Lerp
(scrollbar.GetComponent<Scrollbar> ().value, pos [i], 0.15f);
                posisi = i;
            }
        }
    }
}
}

```

Question Script

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;
using TMPro;

public class soalan : MonoBehaviour
{
    public TextAsset assetSoal;

    private string[] soal;

    private string[,] soalBag;

    int indexSoal;
    int maxSoal;
    bool ambilSoal; // Change the data type to bool
    char kunciJ;

    bool[] soalanSelesai;
}

```



```

public TextMeshProUGUI txtSoal, txtJwpA, txtJwpB, txtJwpC, txtJwpD;

bool isHasil;
private float durasi;
public float durasiPenilaian;

int jwpBetul, jwpSalah;
float nilai;

public GameObject panel;
public GameObject Nilai, Hasil;
public TextMeshProUGUI txtHasil;

// Start is called before the first frame update
void Start()
{
    durasi = durasiPenilaian;
    soal = assetSoal.ToString().Split('#');

    soalanSelesai = new bool[soal.Length];

    soalBag = new string[soal.Length, 6];
    maxSoal = soal.Length;
    Olahsoal();

    ambilSoal = true;
    TampilkanSoal();

    print(soalBag[1,3]);
}

private void Olahsoal()
{
    for(int i=0; i<soal.Length; i++)
    {
        string[] tempSoal = soal[i].Split('+');
        for(int j=0; j<tempSoal.Length; j++)
        {
            soalBag[i, j] = tempSoal[j];
            continue;
        }
        continue;
    }
}

private void TampilkanSoal()
{
    if (indexSoal < maxSoal)

```

```

    {
        if (ambilSoal)
        {

            for (int i=0; i < soal.Length; i++)
            {
                int randomIndexSoal = Random.Range(0, soal.Length);
                print("random: "+randomIndexSoal);
                if (!soalanSelesai[randomIndexSoal])
                {
                    txtSoal.text = soalBag[randomIndexSoal, 0];
                    txtJwpA.text = soalBag[randomIndexSoal, 1];
                    txtJwpB.text = soalBag[randomIndexSoal, 2];
                    txtJwpC.text = soalBag[randomIndexSoal, 3];
                    txtJwpD.text = soalBag[randomIndexSoal, 4];
                    kunciJ = soalBag[randomIndexSoal, 5][0];

                    soalanSelesai[randomIndexSoal]= true;

                    ambilSoal = false;
                    break;
                }
                else
                {
                    continue;
                }
            }
        }
    }

    public void Opsi(string opsiHuruf)
    {
        CheckJawapan(opsiHuruf[0]);

        if (indexSoal == maxSoal -1)
        {
            isHasil = true;
        }
        else
        {
            indexSoal++;
            ambilSoal = true;
        }
    }

```

```

        panel.SetActive(true);
    }

    private float HitungNilai()
    {
        //return nilai = (float)jwpBetul / maxSoal * 100;
        return nilai = (float)jwpBetul *10;
    }

    public TextMeshProUGUI txtPenilaian;

    public void CheckJawapan(char huruf)
    {
        string penilaian;

        if (huruf.Equals(kunciJ))
        {
            penilaian = "TRUE!";
            jwpBetul++;
        }
        else
        {
            penilaian = "WRONG!";
            jwpSalah++;
        }

        txtPenilaian.text = penilaian;
    }

    // Update is called once per frame
    void Update()
    {
        if(panel.activeSelf)
        {
            durasiPenilaian -= Time.deltaTime;

            if (isHasil)
            {
                Nilai.SetActive(true);
                Hasil.SetActive(false);

                if(durasiPenilaian <= 0)
                {
                    //txtHasil.text = "Markah Betul: " + jwpBetul;
                    txtHasil.text = "SCORE: " + HitungNilai();
                }
            }
        }
    }

```

```

//txtHasil.text = "Markah Betul: " + jwpBetul +
"\nMarkah Salah: " + jwpSalah + "\n\nMarkah Keseluruhan: " + HitungNilai();

    Nilai.SetActive(false);
    Hasil.SetActive(true);

    durasiPenilaian = 0;

}

}
else
{
    Nilai.SetActive(true);
    Hasil.SetActive(false);

    if (durasiPenilaian <= 0)
    {
        panel.SetActive(false);
        durasiPenilaian = durasi;

        TampilkanSoal();
    }
}
}
}
}
}

```

Camera Image Renderer Script

```

using System;
using UnityEngine;
using UnityEngine.Rendering;

namespace easyar
{
    [RequireComponent(typeof(RenderCameraController))]
    public class CameraImageRenderer : MonoBehaviour
    {
        private RenderCameraController controller;
        private CommandBuffer commandBuffer;
        private CameraImageMaterial arMaterial;
        private Material material;
        private CameraParameters cameraParameters;
        private bool renderImageHFlip;
        private UserRequest request;
    }
}

```

```

public event Action<Material, Vector2> OnFrameRenderUpdate;
private event Action<Camera, RenderTexture> TargetTextureChange;

protected virtual void Awake()
{
    controller = GetComponent<RenderCameraController>();
    arMaterial = new CameraImageMaterial();
}

protected virtual void OnEnable()
{
    UpdateCommandBuffer(controller ? controller.TargetCamera : null,
material);
}

protected virtual void OnDisable()
{
    RemoveCommandBuffer(controller ? controller.TargetCamera :
null);
}

protected virtual void OnDestroy()
{
    arMaterial.Dispose();
    if (request != null) { request.Dispose(); }
    if (cameraParameters != null) { cameraParameters.Dispose(); }
}

public void RequestTargetTexture(Action<Camera, RenderTexture>
targetTextureEventHandler)
{
    if (request == null)
    {
        request = new UserRequest();
    }
    TargetTextureChange += targetTextureEventHandler;
    RenderTexture texture;
    request.UpdateTexture(controller ? controller.TargetCamera :
null, material, out texture);
    if (TargetTextureChange != null && texture)
    {
        TargetTextureChange(controller.TargetCamera, texture);
    }
}

public void DropTargetTexture(Action<Camera, RenderTexture>
targetTextureEventHandler)
{

```

```

        if (controller)
        {
            targetTextureEventHandler(controller.TargetCamera, null);
        }
        TargetTextureChange -= targetTextureEventHandler;
        if (TargetTextureChange == null && request != null)
        {
            request.RemoveCommandBuffer(controller ?
controller.TargetCamera : null);
            request.Dispose();
            request = null;
        }
    }

    public void OnAssemble(ARSession session)
    {
        session.FrameChange += OnFrameChange;
        session.FrameUpdate += OnFrameUpdate;
    }

    public void SetHFlip(bool hFlip)
    {
        renderImageHFlip = hFlip;
    }

    private void OnFrameChange(OutputFrame outputFrame, Matrix4x4
displayCompensation)
    {
        if (outputFrame == null)
        {
            material = null;
            UpdateCommandBuffer(controller ? controller.TargetCamera :
null, material);
            if (request != null)
            {
                request.UpdateCommandBuffer(controller ?
controller.TargetCamera : null, material);
                RenderTexture texture;
                if (TargetTextureChange != null &&
request.UpdateTexture(controller.TargetCamera, material, out texture))
                {
                    TargetTextureChange(controller.TargetCamera,
texture);
                }
            }
            return;
        }
        if (!enabled && request == null && OnFrameRenderUpdate == null)

```

```

    {
        return;
    }
    using (var frame = outputFrame.inputFrame())
    {
        using (var image = frame.image())
        {
            var materialUpdated = arMaterial.UpdateByImage(image);
            if (material != materialUpdated)
            {
                material = materialUpdated;
                UpdateCommandBuffer(controller ?
controller.TargetCamera : null, material);
                if (request != null) {
request.UpdateCommandBuffer(controller ? controller.TargetCamera : null,
material); }
            }
        }
        if (cameraParameters != null)
        {
            cameraParameters.Dispose();
        }
        cameraParameters = frame.cameraParameters();
    }
}

private void OnFrameUpdate(OutputFrame outputFrame)
{
    if (!controller || (!enabled && request == null &&
OnFrameRenderUpdate == null))
    {
        return;
    }

    if (request != null)
    {
        RenderTexture texture;
        if (TargetTextureChange != null &&
request.UpdateTexture(controller.TargetCamera, material, out texture))
        {
            TargetTextureChange(controller.TargetCamera, texture);
        }
    }

    if (!material)
    {
        return;
    }
}

```

```

        bool cameraFront = cameraParameters.cameraDeviceType() ==
CameraDeviceType.Front ? true : false;
        var imageProjection =
cameraParameters.imageProjection(controller.TargetCamera.aspect,
EasyARController.Instance.Display.Rotation, false, cameraFront?
!renderImageHFlip : renderImageHFlip).ToUnityMatrix();
        if (renderImageHFlip)
        {
            var translateMatrix = Matrix4x4.identity;
            translateMatrix.m00 = -1;
            imageProjection = translateMatrix * imageProjection;
        }
        material.SetMatrix("_TextureRotation", imageProjection);
        if (OnFrameRenderUpdate != null)
        {
            OnFrameRenderUpdate(material, new Vector2(Screen.width *
controller.TargetCamera.rect.width, Screen.height *
controller.TargetCamera.rect.height));
        }
    }

    private void UpdateCommandBuffer(Camera cam, Material material)
    {
        RemoveCommandBuffer(cam);
        if (!cam || !material)
        {
            return;
        }
        if (enabled)
        {
            commandBuffer = new CommandBuffer();
            commandBuffer.Blit(null,
BuiltinRenderTextureType.CameraTarget, material);
            cam.AddCommandBuffer(CameraEvent.BeforeForwardOpaque,
commandBuffer);
        }
    }

    private void RemoveCommandBuffer(Camera cam)
    {
        if (commandBuffer != null)
        {
            if (cam)
            {
                cam.RemoveCommandBuffer(CameraEvent.BeforeForwardOpaque,
commandBuffer);
            }
        }
    }

```



```

        commandBuffer.Dispose();
        commandBuffer = null;
    }
}

private class UserRequest : IDisposable
{
    private RenderTexture texture;
    private CommandBuffer commandBuffer;

    ~UserRequest()
    {
        if (commandBuffer != null) { commandBuffer.Dispose(); }
        if (texture) { Destroy(texture); }
    }

    public void Dispose()
    {
        if (commandBuffer != null) { commandBuffer.Dispose(); }
        if (texture) { Destroy(texture); }
        GC.SuppressFinalize(this);
    }

    public bool UpdateTexture(Camera cam, Material material, out
RenderTexture tex)
    {
        tex = texture;
        if (!cam || !material)
        {
            if (texture)
            {
                Destroy(texture);
                tex = texture = null;
                return true;
            }
            return false;
        }
        int w = (int)(Screen.width * cam.rect.width);
        int h = (int)(Screen.height * cam.rect.height);
        if (texture && (texture.width != w || texture.height != h))
        {
            Destroy(texture);
        }

        if (texture)
        {
            return false;
        }
    }
}

```

```

        else
        {
            texture = new RenderTexture(w, h, 0);
            UpdateCommandBuffer(cam, material);
            tex = texture;
            return true;
        }
    }

    public void UpdateCommandBuffer(Camera cam, Material material)
    {
        RemoveCommandBuffer(cam);
        if (!cam || !material)
        {
            return;
        }
        if (texture)
        {
            commandBuffer = new CommandBuffer();
            commandBuffer.Blit(null, texture, material);
            cam.AddCommandBuffer(CameraEvent.BeforeForwardOpaque,
commandBuffer);
        }
    }

    public void RemoveCommandBuffer(Camera cam)
    {
        if (commandBuffer != null)
        {
            if (cam)
            {
                cam.RemoveCommandBuffer(CameraEvent.BeforeForwardOpa
que, commandBuffer);
            }
            commandBuffer.Dispose();
            commandBuffer = null;
        }
    }
}
}
}
}
}
}
}
}

```

Touch Controller Script

```
using System.Collections;
```

```

using System.Collections.Generic;
using UnityEngine;

namespace Common
{
    public class TouchController : MonoBehaviour
    {
        private const float rotateSpeed = 270;
        private const float gestureEnableDistanceThreshold = 10;

        private Transform controlTarget;
        private Camera cameraTarget;
        private bool isOneFingerDraggable;
        private bool isTwoFingerDraggable;
        private bool isTwoFingerScalable;
        private bool isTwoFingerRotatable;
        private Dictionary<int, Vector2> originalPosition = new
Dictionary<int, Vector2>();
        private GestureControl curGesture;
        private float targetCamDistance;

        private enum GestureControl
        {
            NoTouch,
            OneMove,
            TwoWait,
            TwoMove,
            TwoRotate,
            TwoScale,
            OutOfControl,
        }

        private void Update()
        {
            if (!controlTarget) { return; }
            foreach (var touch in Input.touches)
            {
                if (touch.phase == TouchPhase.Began)
                {
                    originalPosition[touch.fingerId] = touch.position;
                }
                else if (touch.phase == TouchPhase.Ended)
                {
                    originalPosition.Remove(touch.fingerId);
                }
            }

            if (curGesture == GestureControl.OutOfControl)

```

```

{
    if (Input.touchCount == 0)
    {
        StopAllCoroutines();
        curGesture = GestureControl.NoTouch;
    }
}
else if (curGesture == GestureControl.TwoMove || curGesture ==
GestureControl.TwoRotate || curGesture == GestureControl.TwoScale)
{
    if (Input.touchCount != 2)
    {
        StopAllCoroutines();
        curGesture = GestureControl.OutOfControl;
    }
}
else if (curGesture == GestureControl.TwoWait)
{
    if (Input.touchCount != 2)
    {
        StopAllCoroutines();
        curGesture = GestureControl.OutOfControl;
    }
    else
    {
        Vector2 touch1Delta = Input.GetTouch(0).position -
originalPosition[Input.GetTouch(0).fingerId];
        Vector2 touch2Delta = Input.GetTouch(1).position -
originalPosition[Input.GetTouch(1).fingerId];
        if (touch1Delta.magnitude >
gestureEnableDistanceThreshold && touch2Delta.magnitude >
gestureEnableDistanceThreshold)
        {
            StopAllCoroutines();
            if (Vector2.Dot(touch1Delta, touch2Delta) > 0)
            {
                Vector3 xMov;
                Vector3 yMov;
                GetRelativeTouch(touch1Delta + touch2Delta, out
xMov, out yMov);

                if (xMov.sqrMagnitude > yMov.sqrMagnitude)
                {
                    curGesture = GestureControl.TwoRotate;
                    if (isTwoFingerRotatable)
                    {
                        StartCoroutine(OnTwoRotate());
                    }
                }
            }
        }
    }
}

```

```

        else
        {
            curGesture = GestureControl.TwoMove;
            if (isTwoFingerDraggable)
            {
                StartCoroutine(OnTwoMove());
            }
        }
    }
    else
    {
        curGesture = GestureControl.TwoScale;
        if (isTwoFingerScalable)
        {
            StartCoroutine(OnTwoScale());
        }
    }
}
}
else if (curGesture == GestureControl.OneMove)
{
    if (Input.touchCount == 2)
    {
        StopAllCoroutines();
        curGesture = GestureControl.TwoWait;
    }
    else if (Input.touchCount != 1)
    {
        StopAllCoroutines();
        curGesture = GestureControl.OutOfControl;
    }
}
else if (curGesture == GestureControl.NoTouch)
{
    if (Input.touchCount == 1)
    {
        curGesture = GestureControl.OneMove;
        if (isOneFingerDraggable)
        {
            StopAllCoroutines();
            StartCoroutine(OnOneMove());
        }
    }
    else if (Input.touchCount == 2)
    {
        curGesture = GestureControl.TwoWait;
        StopAllCoroutines();
    }
}

```

```

        }
    }
    if (controlTarget != null)
    {
        targetCamDistance = (cameraTarget.transform.position -
controlTarget.position).magnitude;
    }
}

public void TurnOn(Transform target, Camera cam, bool
isOneFingerDraggable, bool isTwoFingerDraggable, bool isTwoFingerScalable,
bool isTwoFingerRotatable)
{
    StopAllCoroutines();
    controlTarget = target;
    cameraTarget = cam;
    this.isOneFingerDraggable = isOneFingerDraggable;
    this.isTwoFingerDraggable = isTwoFingerDraggable;
    this.isTwoFingerScalable = isTwoFingerScalable;
    this.isTwoFingerRotatable = isTwoFingerRotatable;
    curGesture = GestureControl.NoTouch;
}

public void TurnOff()
{
    StopAllCoroutines();
    controlTarget = null;
    cameraTarget = null;
    curGesture = GestureControl.NoTouch;
}

private IEnumerator OnOneMove()
{
    yield return new WaitForSeconds(0.1f);
    foreach (var touch in Input.touches)
    {
        originalPosition[touch.fingerId] = touch.position;
    }

    while (Input.touchCount == 1 &&
originalPosition.ContainsKey(Input.GetTouch(0).fingerId))
    {
        if (!controlTarget) { yield break; }
        var touchV3 = new Vector3(Input.GetTouch(0).deltaPosition.x
/ Screen.width, Input.GetTouch(0).deltaPosition.y / Screen.height, 0);
        var addV3 =
cameraTarget.transform.localToWorldMatrix.MultiplyVector(touchV3);

```

```

        var newPos = controlTarget.position + addV3 *
targetCamDistance;
        controlTarget.position = newPos;
        yield return 0;
    }
}

private IEnumerator OnTwoMove()
{
    Vector3 xMovement;
    Vector3 yMovement;
    var rawTargetPos = controlTarget.position;

    foreach (var touch in Input.touches)
    {
        originalPosition[touch.fingerId] = touch.position;
    }

    while (Input.touchCount == 2 &&
&&
        originalPosition.ContainsKey(Input.GetTouch(0).fingerId)
&&
        originalPosition.ContainsKey(Input.GetTouch(1).fingerId)
)
    {
        if (!controlTarget) { yield break; }
        Vector2 fixedDelta = (Input.GetTouch(0).position +
Input.GetTouch(1).position - originalPosition[Input.GetTouch(0).fingerId] -
originalPosition[Input.GetTouch(1).fingerId]);
        GetRelativeTouch(fixedDelta, out xMovement, out yMovement);
        if (yMovement != Vector3.zero)
        {
            var Cam_Forward = cameraTarget.transform.forward;
            var Cam_Forward_XZ = Vector3.ProjectOnPlane(Cam_Forward,
Vector3.up);

            var newPos = rawTargetPos + (Vector3.Dot(yMovement,
Cam_Forward) > 0 ? Cam_Forward_XZ : -Cam_Forward_XZ) * yMovement.magnitude *
targetCamDistance * 2 / 1000;
            controlTarget.position = newPos;
        }
        yield return 0;
    }
}

private IEnumerator OnTwoRotate()
{
    Vector3 xMovement;
    Vector3 yMovement;

```

```

Quaternion rawRotation = controlTarget.rotation;
foreach (var touch in Input.touches)
{
    originalPosition[touch.fingerId] = touch.position;
}

while (Input.touchCount == 2 &&
    originalPosition.ContainsKey(Input.GetTouch(0).fingerId)
&&
    originalPosition.ContainsKey(Input.GetTouch(1).fingerId)
)
{
    if (!controlTarget) { yield break; }
    Vector2 fixedDelta = (Input.GetTouch(0).position +
Input.GetTouch(1).position - originalPosition[Input.GetTouch(0).fingerId] -
originalPosition[Input.GetTouch(1).fingerId]) * 0.5f / Screen.width *
rotateSpeed;
    GetRelativeTouch(fixedDelta, out xMovement, out yMovement);
    if (xMovement != Vector3.zero)
    {
        if (Vector3.Dot(Vector3.Cross(xMovement.normalized,
Vector3.up), Camera.main.transform.forward) < 0f)
        {
            controlTarget.rotation = rawRotation *
Quaternion.Euler(0f, xMovement.sqrMagnitude / Mathf.PI, 0f);
        }
        else
        {
            controlTarget.rotation = rawRotation *
Quaternion.Euler(0f, -xMovement.sqrMagnitude / Mathf.PI, 0f);
        }
    }
    yield return 0;
}
}

private IEnumerator OnTwoScale()
{
    Vector3 rawScale = controlTarget.localScale;
    foreach (var touch in Input.touches)
    {
        originalPosition[touch.fingerId] = touch.position;
    }

    float rawFingersDistance =
Vector2.Distance(originalPosition[Input.GetTouch(0).fingerId],
originalPosition[Input.GetTouch(1).fingerId]);

```



```

        while (Input.touchCount == 2 &&
            originalPosition.ContainsKey(Input.GetTouch(0).fingerId)
&&
            originalPosition.ContainsKey(Input.GetTouch(1).fingerId)
)
    {
        if (!controlTarget) { yield break; }
        float scaleFactor = rawFingersDistance /
Vector2.Distance(Input.GetTouch(0).position, Input.GetTouch(1).position);
        controlTarget.localScale = rawScale / scaleFactor;
        yield return 0;
    }
}

private void GetRelativeTouch(Vector2 delta, out Vector3 xMovement,
out Vector3 yMovement)
{
    if (delta != Vector2.zero)
    {
        Vector3 startPoint = Camera.main.ScreenToWorldPoint(new
Vector3(0f, 0f, 300f));
        Vector3 endPoint = Camera.main.ScreenToWorldPoint(new
Vector3(delta.x, delta.y, 300f));
        Vector3 moveDirection = endPoint - startPoint;
        Vector3 relaForward =
Vector3.ProjectOnPlane(Camera.main.transform.forward,
Vector3.up).normalized;
        if (relaForward == Vector3.zero)
        {
            xMovement = moveDirection;
            yMovement = Vector3.zero;
        }
        else
        {
            Vector3 relaRight = Vector3.Cross(Vector3.up,
relaForward);
            xMovement = Vector3.Project(moveDirection, relaRight);
            Vector3 temp = moveDirection - xMovement;
            if (temp != Vector3.zero)
            {
                if (Vector3.Dot(Vector3.up, temp.normalized) == 0)
                {
                    yMovement = temp.magnitude *
((Vector3.Dot(relaForward, temp.normalized) > 0 ? relaForward : -
relaForward));
                }
                else
                {

```


4.7 Summary

In this chapter, the functionality of each component that has been utilised has been discussed in greater depth than in previous chapters. In addition, the method that was involved in order to produce this project has been detailed.

CHAPTER 5

CONCLUSION

5.1 Introduction

The purpose of this chapter is to discuss the summary of the development Augmented Reality Arabic Application for Preschool that has been made. It will include an explanation of the application achievement of objectives, the application limitations and constraints during development, and suggestions for future work to improve the application.

5.2 Discussion on User Acceptance

In order to test the application's functionality and usability, the implementation and evaluation procedures are carried out after the development phase has concluded. User Acceptance Testing (UAT) is used to ensure that all features of the system function as expected. The UAT results are provided in **APPENDIX C**. The results show that the application can utilize all of its available features as anticipated.

5.3 Limitations and Constraints

The limitations and constraints during the development of the application are:

- i. **Skills**

To develop AR Markerless, developer use various AR tools to get good results. This makes developers try and error, until get the right tools according to the criteria of this application. Developing the application also will need coding. Sometimes an error occurs on script. If there are errors, the application will be unable to be tested or executed.

ii. Scope

As the development process progresses, certain aspects of the scope and requirements end up being altered. As a result, adjustments are required to accommodate these revisions. Because of this reason, extra time was invested on some stages, and as a result, the project went beyond the allotted amount of time for certain phases.

iii. Time

Learning how to use AR Markless is a new skill that requires practice before it can be considered proficient. Additionally, procuring a model might be a time-consuming process due to the fact that the necessary model is not currently accessible.

5.4 Future Work

There are several enhancements that can be carried out for future improvement of AR Arabic Application:

- i. Adding more interactive modules, such as shape, color, and body parts, to make learning Arabic more engaging for children.
- ii. Create more features such as writing and calculating. It can provide children with feedback on their writing and math skills it could also provide them with interactive exercises to help them practice their skills.
- iii. The application can make more activities and simple puzzles such as drag and drop, word scrambled and jigsaw to make the application more challenging.
- iv. The IOS users will also be able to use the application.
- v. More language options to make it easier for users from all over the world to use the application.
- vi. The captured images will be uploaded to the gallery, making them more accessible to users.

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APPENDIX B
USER REQUIREMENTS FORM

AR ARABIC

This survey is conducted to collect responses on the requirements of the Augmented Reality Arabic for preschool.

[Sign in to Google](#) to save your progress. [Learn more](#)

Have you ever used any mobile application for early Arabic learning?

Yes

No

Have you experience using any Augmented Reality application before?

Yes

No

Does the application suitable enough for preschool?

1

2

3

4

5

Does the Augmented Reality help to increase the interactivity of the application?

1 2 3 4 5

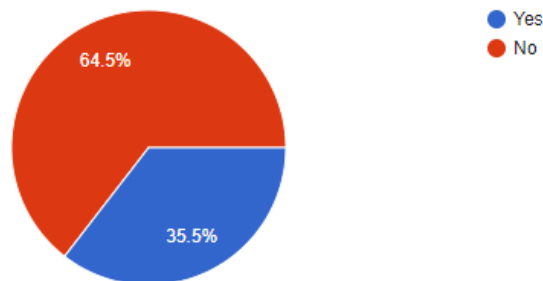
Does the 3D models in the application can help teacher to gain full attention from preschool to learn Arabic?

1 2 3 4 5

Have you ever used any mobile application for early Arabic learning?

 Salin

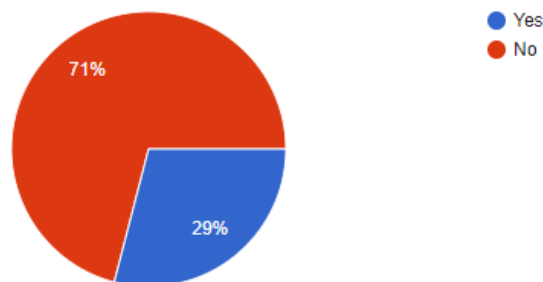
31 jawapan



Have you experience using any Augmented Reality application before?

 Salin

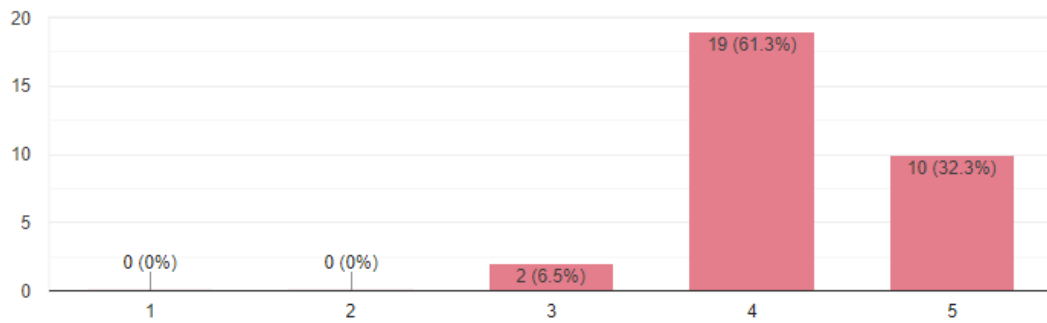
31 jawapan



Does the application suitable enough for preschool?

Salin

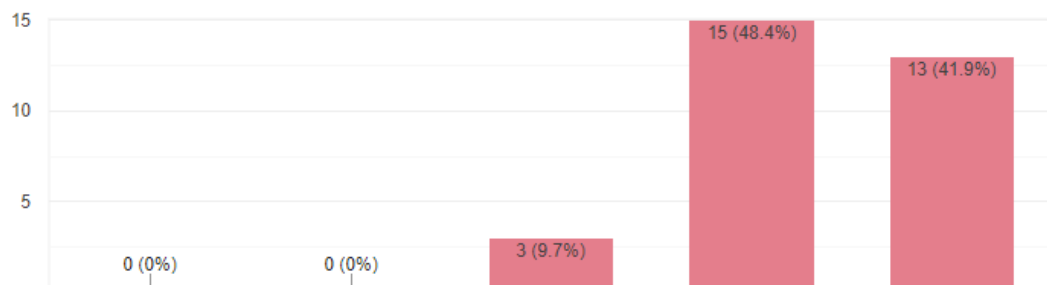
31 jawapan



Does the Augmented Reality help to increase the interactivity of the application?

Salin

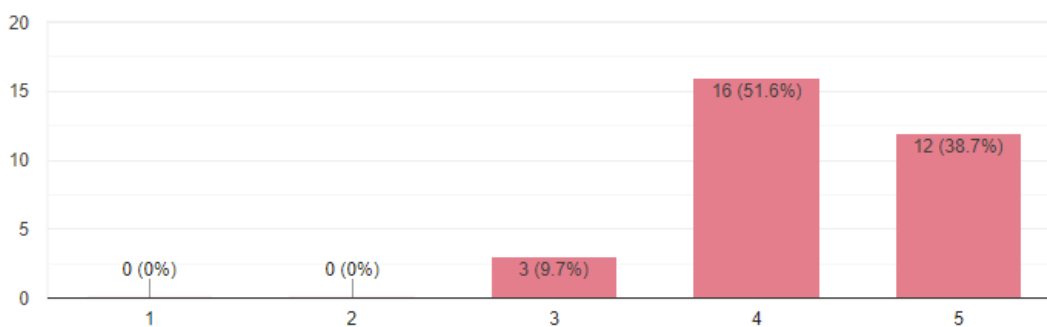
31 jawapan



Does the 3D models in the application can help teacher to gain full attention from preschool to learn Arabic?

Salin

31 jawapan



APPENDIX C

USER ACCEPTANCE TESTING FORM

Test Case 1: Main Menu				
No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the "AR CAMERA" button	Navigate to Module interface	Show the Module interface	/
2	User click on the "INFO" button	Navigate to Info Module interface	Show the Info Module interface	/
3	User click on the "QUIZ" button	Navigate to Quiz interface	Show the Quiz interface	/
4	User click on the "EXIT" button	Navigate to popup	Show the popup	/
5	User click on the "Yes" button	Exit the application	Application close	/
6	User click on the "No" button	Navigate to Main Menu interface	Show the Main Menu interface	/
7	User click on the "Credit By" button	Navigate to Credit interface	Show the Credit interface	/

Test Case 2: Module				
No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the "Alphabet" button	Navigate to Alphabet interface	Show the Alphabet interface	/
2	User click on the "Number" button	Navigate to Number interface	Show the Number interface	/
3	User click on the "Back" button	Navigate to Main Menu interface	Show the Main Menu interface	/

Test Case 3: Module of Alphabet				
No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the "Alphabet module" button	Navigate to Alphabet interface	Show the Alphabet interface	/

29	User click on the "Back" button	Navigate to Module interface	Show the Module interface	/
30	User click on the "Home" button	Navigate to Main Menu interface	Show the Main Menu interface	/

Test Case 4: Module of Number

No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the "Number module" button	Navigate to One interface	Show the One interface	/
2	User click on the "Back" button	Navigate to Module interface	Show the Module interface	/
3	User click on the "Home" button	Navigate to Main Menu interface	Show the Main Menu interface	/

Test Case 5: AR Camera of Alphabet

No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the "Sound Effect" button	The button will voice out	The button will voice out	/
2	User click on the "Audio" button	The button will voice out	The button will voice out	/
3	User click on the "Info" button	Display popup	Display popup	/
4	User click on the "Camera" button	Save the image to the file	Save the image to the file	/
5	User click on the "Back" button	Navigate to Alphabet interface	Show the Module interface	/
6	User click on the "Home" button	Navigate to Alphabet interface	Show the Main Menu interface	/

5	User click on the "Back" button	Navigate to Info Module interface	Show the Info Module interface	/
6	User click on the "Home" button	Navigate to Main Menu interface	Show the Main Menu interface	/

Test Case 9: Number info				
No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the "Number Card" button	The button will voice out	The button will voice out	/
2	User click on the "Back" button	Navigate to Info Module interface	Show the Info Module interface	/
3	User click on the "Home" button	Navigate to Main Menu interface	Show the Main Menu interface	/

Test Case 10: Quiz				
No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the "Wrong" button	Display Wrong answer	Display Wrong answer	/
2	User click on the "True" button	Display True answer	Display True answer	/
4	User complete answer the question	Show the score interface	Show the score interface	/
3	User click on the "Close" button	Navigate to Main Menu interface	Show the Main Menu interface	/

Test Case 11: Credit				
No.	Task/Requirement	Expected Result	Actual Result	Pass/Fail
1	User click on the "Close" button	Navigate to Main Menu interface	Show the Main Menu interface	/

Tested by:

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Jalal.

APPENDIX D
PASTI AL-QAMARIAH

