APPLICATION OF AUGMENTED REALITY IN MOBILE-BASED HIJAIYAH LETTER RECOGNITION APPLICATIONS USING MULTIMEDIA DEVELOPMENT METHODS LIFE CYCLE

Fitria Lizati [1] , Sondy C. Kumajas [2] , Ferdinan I. Sangkop [3]
Informatics Engineering Study Program, Manado State University
e-mail: * [1] fitria.xmm@gmail.com , [2] sondykumajas@unima.ac.id , [3] ivan.sangkop@unima.ac.id

Abstract
Islamic religious education is an important aspect of Muslim life, and learning Arabic and Hijaiyah letters is an integral part of Islamic education. The use of augmented reality (AR) technology in educational setting is rapidly increasing. This study aims to apply the AR concepts to the creation of mobile Hijaiyah letters using Multimedia Development Life Cycle (MDLC) methodology. The application of AR in this application allows users to interactively learn each hijaiyah letter. Through a mobile device camera, users can see hijaiyah letters that appear virtually on the device screen. The development of this application is based on the needs of users in understanding hijaiyah letters in a more attractive and interactive way. Thus, this application is expected to facilitate users, especially children, to learn hijaiyah letters more effectively.

Keywords: Augmented Reality, Hijaiyah Letters, MDLC, Mobile Applications.

INTRODUCTION

The Koran is the main guideline in the Islamic religion. The Koran is not only a guideline regarding the relationship between humans and their God, but also between humans and the natural surroundings. There is one surah in the Koran that instructs Muslims to study, namely surah Al-Alaq. Islamic religious education is an important aspect of Muslim life, and learning Arabic and hijaiyah letters is an essential part of Islamic education (Islamic, 2022). Basically, hijaiyah letters are used to read the Al-Quran at an early stage. If they have difficulty reading the Al-Quran then their worship as Muslims will of course not be optimal. So, to be able to read the Koran, every Muslim must learn and know the hijaiyah letters.

The introduction of hijaiyah letters is usually done manually using an Iqra' book which contains hijaiyah letters in it. Since this introduction is done by reading the letters and their pronounciations, The introduction process is not yet very interesting and interactive, especially who are children who are just beginning to memorize the Quran and get to know the hijaiyah letters. At this age it is easier for children to understand and record things in their brain or memory, compared to old age or adulthood. Introducing hijaiyah letters to children requires effective and fun learning methods, so that children do not feel bored (Jada Wa, 2022).

Learning hijaiyah letters for children is not easy. So we need a learning facility that can maximize children's comprehension skills to help children learn by seeing, hearing and doing (Hidayah et al., 2021). This needs to be paid attention to not only by the teachers or educators but parents also play a very important role in learning using electronic media (mobile smartphones). Learning system technology must have a good strategy, appropriate learning media are necessary and have good advantages. In line with the opinion Haris et al. 2023, smartphones are one of the means of playing and using visualization and audio methods in the form of educational games based on android to support language learning for students as a form of technology utilization one learning system technology that can help in the current learning process is augmented reality (Ahdan et al., 2020). Augmented Reality (AR) is a technology that can depict and combine the real world with the virtual world projected via electronic devices, and can be used not only on desktop platforms, it can even be used within

platforms. mobile (Rizaludin et al., 2022). Augmented Reality is currently used in the Pokemon go application. Technology, This very possibility is used to support media learning. Based on these problems, the authors developed the Hijaiyah Letter Recognition Application Using Mobile-Based Augmented Reality Technology Using the Multimedia Development Life Cycle (MDLC) Method which aims to make it easier to learn Hijaiyah letters by using animated letters and their pronunciation sounds.

RESEARCH METHODS

2.1 Software Development Methods

The method used in designing this system is the Luther version of multimedia software development method. This method was developed by Luther (1994) according to Luther (Maulana et al., 2020)
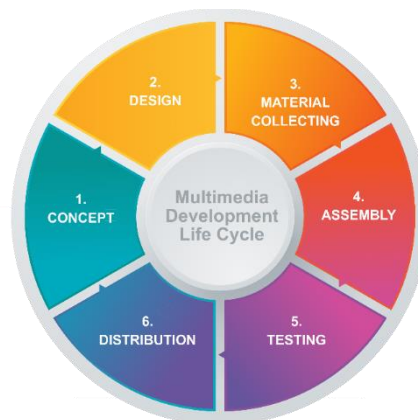
Figure 1. Multimedia Development Life Cycle Method

The stages in the Multimedia Development Life Cycle are first concept: at this stage the researcher begins to create a concept for the Augmented Reality application that will be created and analyzes the requirements for the system to be built. Second, design: this stage is where researchers design the appearance of the application, menus and buttons in the application. Third, material collecting: at this stage the researcher will collect the requirements that will be needed in making this application, such as images and 3-dimensional objects that will be included in the application. Fourth assembly: The next stage, the researcher will create an application according to the design that was designed at the concept stage. Five testing: in this stage, the researcher tested the application by checking the objects and features in the application. And six distribution: the final stage is where the application has been completed in testing and is declared good according to the purpose of creation, and is ready to be distributed.

2.2 System Development

According to Akbar & Irawan, (2021) "Augmented Reality is a technology that can be applied to Android mobile device applications because the augmented reality system analyzes in real-time the objects captured in the camera". The concept of augmented reality is to combine the real and virtual worlds, is interactive in real time, and is 3D animation. In augmented reality there are two methods used, namely: marker based tracking and markerless. Meanwhile, according to Muhammad et al., (2019) "Augmented reality is a technology that allows users to see the real world with virtual objects combined with the real world in real time, be it 2D or 3D objects so that it will look as if the object is virtual and these real objects coexist in the same place and time."

Next, according to Aktafi et al., (2020) "Letters are the smallest units in the composition of a pronoun or word. In order to produce a meaning, a letter must be combined with other letters and form a variety of vocabulary. The term hijaiyah letters itself is taken from the Arabic term **الهجائية**, it has its roots in **هجاء - هجا- يهجو**which means spelling or spelling. Apart from meaning the spelling in Arabic, the hijaiyah letters are the smallest part of the Arabic language, the hijaiyah letters are of course the initial requirement for someone to be able to read the holy Koran. Even knowing the letters is the first lesson taught when first learning about the Islamic religion. There are three different calculation references related to the number of hijaiyah letters, namely 28,29 and 30. However, these three are actually only based on counting certain letters as independent letters or including them in other letters. If you take the most letters, the total number is 30 letters, with the table details as follows:

Table 1. Number of Hijaiyah Letters

No	Hijaiyah letters	Name Letter	Latin transliteration
1	ا	Alif	Not symbolized
2	ب	Bha'	B
3	ت	Ta'	Q
4	ث	TT'	Ts
5	ج	Jim	J
6	ح	Ha'	H
7	خ	Kho'	KH
8	د	Dal	D
9	ذ	Dzal	DZ
10	ر	Ro'	R
11	ز	Za'	Z
12	س	Sin'	S
13	ش	Shin'	SY
14	ص	Shad	SH
15	ض	Dho'	DH
16	ط	Tho'	TH
17	ظ	Zho'	ZH
18	ع	'Ain	'(quotation marks followed by letters vowels like 'A'I-'U if the letter has a vowel
19	غ	Ghoin	GH
20	ف	Fa'	F
21	ق	Qaf	Q
22	ك	Kaf	K
23	ل	Lam	L
24	م	Meme	M
25	ن	Nun	N
26	و	Wow	W
27	ه	Ha'	H
28	لا	Lam alif	La (with a rather long sound)
29	ء	Hamza	A, I, U In accordance with the harakat, after Added a casket(')
30	ي	Yes'	Yes-Yi-Yu

Then, the next development system is in the form of unity as game an engine that is easy to use by creating objects and then giving them functions to create games of variable quality that must be understood and understood. Below are parts of the 3D unit: Assets, a unity storage that can store sound, images, video and textures. Scene a place that contains elements for creating a game, such as creating a level, creating a game interface, and much more. Game objects, which contain items in assets that are moved into scenes, which control the size and rotation of objects. Components, a new reaction to objects such as collisions giving rise to particles, and so on. Script, a command that can be used in unity. There are languages that can be used in unity, javascript, and C#. Prefabs, a place to store one type of game objects, so it will be easy to reproduce. The development of Unity 3D runs on Microsoft Windows and Mac OS X, games created by unity can run on Windows, Mac, Xbox 360, Playstation 3, iPad, iPhone, and not behind on Android platforms. (Doni et al., 2022).

Next, development system is Vuforia SDK as software for augmented reality developed by Qualcomm, which uses consistent sources regarding computer vision, which focuses on images. Recognition Vuforia has many features and capabilities, which can help developers realize their thoughts and ideas without any technical limitations. Vuforia supports developers to create applications that can be used on almost all types of smartphones and tablets. Targets in Vuforia are objects in the real world that can be detected by the camera, to display virtual objects (Agustina et al., 2020). The last step in the development system is Android an an operating system for Linux- based mobile devices that includes an operating system, middleware and applications. Android provides an open platform for developers to create their own applications (Rahmadhan A, 2021). Initially, Google Inc. bought Android Inc. which is a newcomer that makes software for cell phones or smartphones. Then, to develop Android, the Open Handset Alliance was formed , a consortium of 34 hardware, software and telecommunications companies, including Google, HTC, Intel, Motorola, Qualcomm, T-Mobile and Nvidia(Ichsan, 2023) .

RESULTS AND DISCUSSION

3.1 Concept

Concept is the stage where you determine the purpose of the application to be created, and who will use it, as well as the needs of the system to be built.
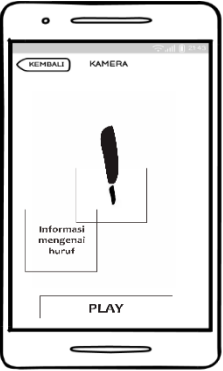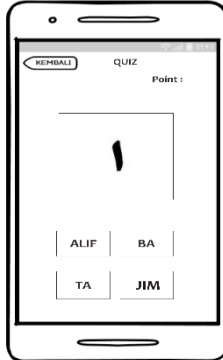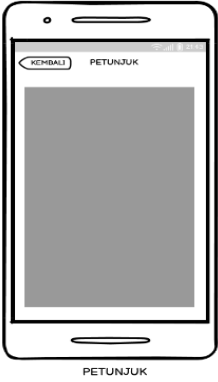
Table 2. Concept Description

Concept Category	Concept Description
Title	Application of Augmented Reality in the Mobile -Based Hijaiyah Letter Recognition Application Using the Multimedia Development Life Cycle Method.
Application Name	Let's Get to Know the Hijaiyah Letters
Multimedia Type	Information media for the Introduction to Hijaiyah Letters is based on interactive multimedia in the form of an application that uses AR.
Objective	Create and implement Augmented Reality technology in the Hijaiyah letter recognition application. It is hoped that this application can increase children's interest in recognizing Hijaiyah letters and can increase awareness of the importance of learning Hijaiyah letters.
Target	Beginners or children aged 3 – 6 years with parental guidance.
Picture	Using 3D images
Audio	Backsound and audio effects , with audio format (*. wav and *. mp3)

3.2 Design

After the completing the consept stage, the next stage is the application design stage. At this stage the researcher will start designing the application in the form of a flowchart, storyboard and navigation structure design in the form of a menu hierarchy. The following is a design form for the Augmented Reality application for recognizing Hijaiyah letters Hijaiyah letters:

Table 3 . Storyboarding

No	Appearance	Description
1.		Main page design This display is the main page of the application, there is an application logo and 5 buttons. Picture — Application logo, icon for each button, background Voice — - Text — - Animation — - Information : - Start AR is used to go to the camera's AR feature page. - Quiz is used to go to the quiz page. - Instructions for use go to page regarding instructions for use. - About use goes to the page about the application and application developer. - - The 'x' icon is used to display the options page to close the application or not.
2.		View of the camera's AR features This display is an AR camera display where the marker has been detected, a 3D object, an info board and 2 buttons will appear. Picture — Board, 3d object letters, icons for each button Voice — Letter sounds, letter explanation sounds Text — Explanation of information about letters Animation — Hijaiyah letters 3d object Information : - The play icon is used to play the sound of the hijaiyah letters that appear. - Icons again used to display the main page.
3.		Display of game features This display is a game feature display where there is an image of the question and 4 choice buttons answer. Among the 4 answer choice buttons there is 1 correct answer button. Picture — Background, thumbs up, thumbs down , questions, answers and back button Voice — background , sound correct effect , sound wrong effect Text — Points Animation — Thumbs up, thumbs down

4.

PETUNJUK
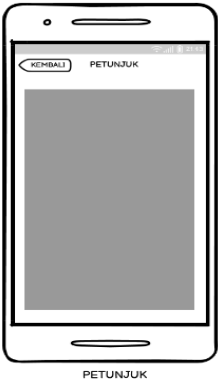
Display instructions page

This display is an instructions page which contains the function of the application buttons and how to use the features in the application.

Picture	Application logo, icon for each button, background
Voice	-
Text	Explanation of application use
Animation	-

Information :
- The icon is used again to display the main page.

5.

PETUNJUK

About page view

This view is a display that contains information about the application and application developer.

Picture	Application logo, back icon , background
Voice	-
Text	Explanation of application information and application developers
Animation	-

Information :
- The icon is used again to display the main page

6.

KELUAR APLIKASI

Exit page display

This display will appear when pressing the 'x' icon button on the main page. In this display there is text, are you sure you want to exit this application? And there is a 'Yes' button to exit the application and 'No' to cancel exiting the application.
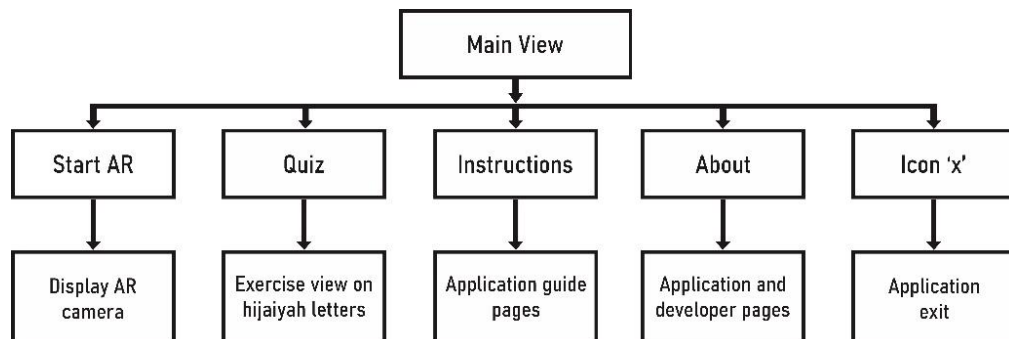
Figure 2. Hierarchy Menu
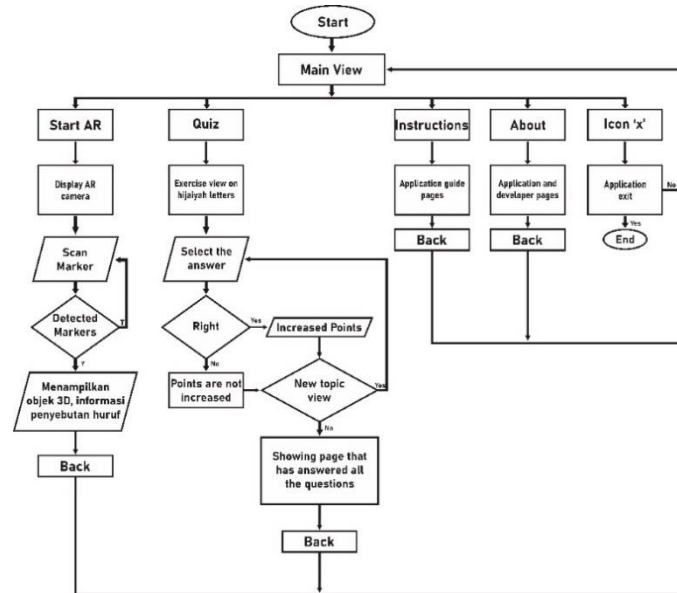
Figure 3. Flowchart

3.3 Material Collecting

At this stage the researcher will collect the requirements that will be needed in making this application, such as images, text, audio, 3D objects, etc. To collect some of the materials used in this application, they were taken from the internet and other materials were made using CorelDraw software for making interfaces and markers for the Vuforia application, Google Sketchup for making 3D objects in .fbx or .obj format, and Unity as software for making AR applications.

3.4 Assembly (Preparation and Manufacturing).

At this stage, all the materials that have been collected are developed into an application based on the design process that was created in the previous stage in the form of a storyboard and navigation structure. To combine all the components that have been collected previously, several steps must be taken, namely: 3D Object Creation, 3D letter objects were created using the Sketchup application using the .fbx format
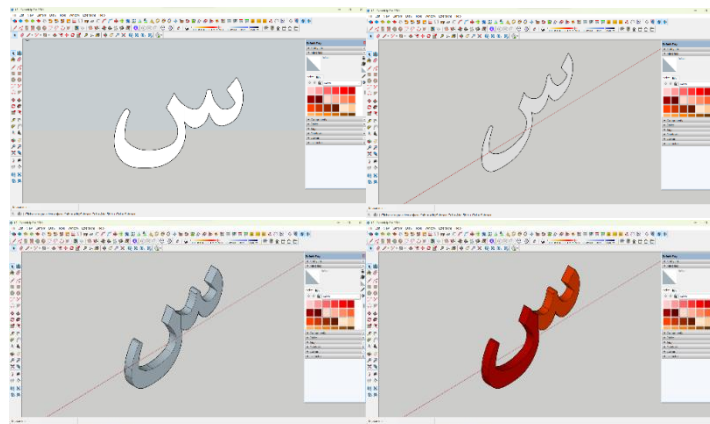
Figure 4. Creation of 3D hijaiyah letter objects

Next, making markers are very important in making augmented reality because they have the function of displaying objects that will later be created. These markers are downloaded at https://shawnlehner.github.io/ .
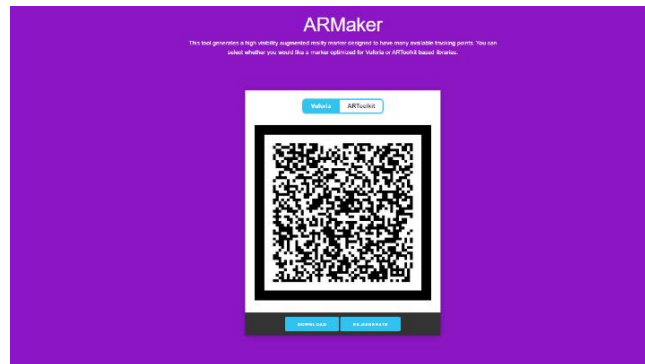
Figure 1. Marker Design
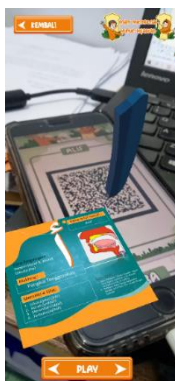
Futhermore, augmented reality application creation, after going through the stages of creating objects, the next step is the process of creating an augmented reality application using the Unity application. The following is the process of creating an augmented reality application.

Figure 6. Creating a user interface for an augmented reality application

Next, application display results to implementation After going through a series of stages in creating an augmented reality application, the following are the displays of the application that has been developed.

Table 4. Application Display

Appearance		
Main Page Display	AR Start View	Quiz Page View

| Instructions Page View | About Page Views | App Exit Page Display |

3.5 Testing (Trial)

After completing the assembly stage, the next stage is testing by running the application/program, and at this stage you can see if there are any errors in the application. At this stage, black box testing is used for testing. This blackbox method is based on program testing of program functions. During application development, testing is done by several users who are tested by profesional users and in this case, aplication testing focuses on the functionalities present in the application and markers used in the application. Application testing is also performed on several devices, a table of the testing results is provided below.

Table 5. Smartphone Testing Table

Device and Specifications	Results
Realme C2 Operating System: Android 9 Screen: 6.1 inches Resolution: 720 x 1560 pixels Ratio 19.5:9 13 + 2MP camera	The application runs on this smartphone and the features of the application can run as designed, and the application display adapts to the resolution of this smartphone.
Realme C55 Operating System: Android 13 Screen: 6.72 inches Resolution: 1080 x 2400 pixels Ratio 20:9 64 + 2MP camera	The application runs on this smartphone and the features of the application can run as designed, and the application display adapts to the resolution of this smartphone.
Realme C53 Operating System: Android 13 Screen: 6.74 inches Resolution: 1080 x 2400 pixels Ratio 20:9 50MP camera	The application runs on this smartphone and the features of the application can run as designed, and the application display adapts to the resolution of this smartphone.
Realme 6 pro Operating System: Android 11 Screen: 6.6 inches Resolution: 1080 x 2400 pixels Ratio 20:9 64MP camera	The application runs on this smartphone and the features of the application can run as designed, and the application display adapts to the resolution of this smartphone.

The conclusion from this test is that the application on several devices runs smoothly according to the features and the application display adapts to the resolution of each

smartphone, the AR camera runs smoothly. In the testing stage, testers only test applications starting from the Android 8 operating system and above, therefore this application will run smoothly if used on Android 8 smartphones and above.

3.6 Distribution (Disseminating)

The distribution stage is the stage of disseminating the application. The method used is by distributing leaflets in the form of marker pamphlets, where the markers already have a Qrcode to be scanned and will be directed to a download link from Google Drive which includes an application along with a hijaiyah letter marker pocket book.

Figure 7 . Marker Application Let's Get to Know the Hijaiyah Letters

CONCLUSION

Based on research that has been carried out starting from the concept, design, material collecting, assembly, testing to distribution, the conclusions obtained are the application of augmented reality has been successfully implemented in the mobile-based hijaiyah letter recognition application using the multimedia development life cycle method.

SUGGESTION

The application of Augmented Reality in the Mobile -Based Hijaiyah Letter Recognition Application Using the Multimedia Development Life Cycle Method certainly still has shortcomings , for this reason the researcher has suggestions that can be developed in further research:
1. This Hijaiyah Letter Recognition application can be developed again so that it is compatible with the IOS operating system.
2. Design 3D objects that are more detailed and realistic and display the UI to make it more attractive to users.
3. Added menu for hijaiyah letters material such as how to combine hijaiyah letters and how to give character.

BIBLIOGRAPHY

Agustina, D., Mardianti, A., & Aziz, R. F. F. (2020). Perancangan Aplikasi Augmented Reality Pengenalan Jenis-Jenis Tanaman Herbal Berbasis Android. IKRA-ITH Informatika: Jurnal Komputer dan Informatika, 4(3), 89-94. https://journals.upi-yai.ac.id/index.php/ikraith-informatika/article/view/863.

Ahdan, S., Thyo Priandika, A., Andhika, F., & Shely Amalia, F. (2020). Perancangan Media Pembelajaran Teknik Dasar Bola Voli Mengunakan Teknologi Augmented Reality Berbasis Android Learning Media for Basic Techniques of Volleyball Using Android-Based Augmented Reality Technology. *Education*, *8*(3), 1–16. http://journalbalitbangdalampung.org

Akbar, F. K., & Irawan, R. H. (2021). Markerless Augmented Reality Dalam Pengenalan Huruf Hijaiyah Untuk Siswa TK Pertiwi Baron. Prosiding SEMNAS INOTEK (Seminar Nasional Inovasi Teknologi), 5(2), 277–281. https://proceeding.unpkediri.ac.id/index.php/inotek/article/view/1145

Aktafi, B., Wibowo, SA, & Wahid, A. (2020). Implementation of Augmented Reality for Android-Based Recognition of Al-Quran Hijaiyah Letters. JATI (Informatics Engineering Student Journal) , 4 (1), 42–48. https://doi.org/10.36040/jati.v4i1.2383

Doni, M., Sm, F., & Azizah, NL (2022). Hijaiyah Learning Media Using Augmentend Reality TK Masyitoh 12 Hijaiyah Letter Learning Media Using Augmentend Reality TK Masyitoh 12 . 2 (2).

Haris, F., Ichsan, M., Qamaruzzaman, M. H., & Yana, P. (2023). Rancang Bangun E-Learning Pelajaran Pilihan Pada SMAN 3 Palangkaraya Berbasis Web (Studi Kasus Pelajaran Bahasa Jerman): Web-Based Design And Design Of E-Learning Optional Lessons At SMAN 3 Palangkaraya (German Language Lesson Case Study). *Jurnal Sains Komputer dan TeknologiInformasi*, *6*(1),9-17. https://journal.umpr.ac.id/index.php/jsakti/article/view/5880.

Hidayah, A. K., Prihantoro, C., & Fernandez, S. (2021). Implementasi Metode Linear Congruent Method Pada Game Edukasi Pembelajaran Huruf Hijaiyah Berbasis Android. *Pseudocode*, *8*(1), 38–48. https://doi.org/10.33369/pseudocode.8.1.38-48

Ichsan, M., Tinggi, S., Informatika, M., Palangka, S., No, J. G. O., & Indonesia, P. R. (n.d.). *INDEKS AL-485 ¶$1 BERBASIS WEB MOBILE Mochammad Ichsan Program Studi Manajemen Informatika Sekolah Tinggi Manajemen Informatika dan Komputer (STMIK) Palangka Raya*. *114*, 13–25.

Islamic, C. (2022). 561-2760-1-Pb .

Jada Wa, et al. (2022). Jada, W., & Salwiah, S. (2020). Menstimulasi perkembangan motori halus anak melalui kegiatan puzzle stik pada anak usia 5-6 tahun di desa burangasi rumbia kecamatan lapandewa. *Jurnal Lentera Anak*, *1*(2), 63-77. http://www.jurnal-umbuton.ac.id/index.php/JLA/article/view/924. https://doi.org/10.35326/jla.v1i2.924

Nuryani, E., Darpi, and A. Muhtapid (2019). Android-based Arabic language learning application using Android Studio. Iftech, 1(2), 117–130.

Maulana, A., Rosalina, V., & Safaah, E. (2020). Implementasi Teknologi Virtual Tour Perpustakaan Menggunakan Metode Pengembangan Multimedia Development Life Cycle (Mdlc). *JSiI (Jurnal Sistem Informasi)*, *7*(1), 1. https://doi.org/10.30656/jsii.v7i1.1875

Muhammad, A. R., Wardhono, W. S., & Afirianto, T. (2019). *Pengembangan Aplikasi Mobile Augmented Reality Sebagai Media Belajar Pengenalan Dasar Huruf Hijaiyah*. *3*(1), 1062–1069.

Rahmadhan A, P. A. S. A. (2021). Aplikasi Pengenalan Perangkat Keras Komputer Berbasis Android Menggunakanaugmented Reality (Ar). *Jurnal Teknologi Dan Sistem Informasi (JTSI)*, *2*(2), 24–31.

Rizaludin, M., Fikriah, F. K., & Hidayat, H. (2022). Pengenalan Augmented Reality (AR) Sebagai Media Pembelajaran Di SMK NU Kesesi. *Jurnal Pengabdian Masyarakat TEKNO*, *3*(2), 77–83. http://jurnal.iaii.or.id/index.php/JAMTEKNO

Agustina, D., Mardianti, A., Fahmi, R., & Aziz, F. (2020). *Perancangan Aplikasi Augmented Reality Pengenalan Jenis - Jenis Tanaman Herbal Berbasis Android*. *4*(3), 89–94.