

Android-Based Augmented Reality: An Alternative in Mastering Tajweed for Student Learning

Zulfani Sesmiarni^{1*}, Gusnita Darmawati², Yulifda Elin Yuspita³, Saiful Yeri⁴
and Ilian Ikhsan⁵

^{1*}Faculty of Tarbiyah and Teacher Training, Universitas Islam Negeri Sjech M. Djamil Djambek Bukittinggi, Indonesia. zulfanisesmiarni@iainbukittinggi.ac.id,
Orcid: <https://orcid.org/0000-0001-5209-318X>

²Faculty of Tarbiyah and Teacher Training, Universitas Islam Negeri Sjech M. Djamil Djambek Bukittinggi, Indonesia. gusnitadarmawati@iainbukittinggi.ac.id
Orcid: <https://orcid.org/my-orcid?orcid=0009-0008-8001-618X>

³Faculty of Tarbiyah and Teacher Training, Universitas Islam Negeri Sjech M. Djamil Djambek Bukittinggi, Indonesia. yulifdaelin@iainbukittinggi.ac.id
Orcid: <https://orcid.org/my-orcid?orcid=0009-0003-7901-2505>

⁴Faculty of Tarbiyah and Teacher Training, Universitas Islam Negeri Sjech M. Djamil Djambek Bukittinggi, Indonesia. Saifulyeri1987@gmail.com
Orcid: <https://orcid.org/my-orcid?orcid=0009-0007-7254-118X>

⁵Faculty of Tarbiyah and Teacher Training, Universitas Islam Negeri Sjech M. Djamil Djambek Bukittinggi, Indonesia. ihsansw13@gmail.com,
Orcid: <https://orcid.org/0009-0002-3851-4413>

Received: February 08, 2023; Accepted: March 26, 2023; Published: May 30, 2023

Abstract

Nowadays, the knowledge of recitation (Tajweed) is only seen as classical knowledge; it only needs to be memorized and practiced without needing to be understood. The purpose of this study is to design learning media in the science of recitation using Android-based augmented reality. The method used is Research and Development in application-based augmented reality technology which is applied in tajwid learning. The research design that was carried out was to create and develop an Android-based application by displaying various laws in the science of recitation used in reading the Qur'an., where the marker identified with the camera would produce a display of the Qur'anic verse and completed with the law of Tajweed and also equipped with an audio play menu. It can be concluded that this research found that the developed media can only provide knowledge about basic Tajweed, which can only be accessed through one platform, namely Android, so this learning media still needs additions and developments in the system. It can be in the form of additions in the discussion of the Tajweed and the development of the application system so that this application can be accessed not only using Android. Still, it can also be accessed using a laptop or computer.

Keywords: Android, Augmented Reality, Tajweed.

Journal of Internet Services and Information Security (JISIS), volume: 13, number: 2 (May), pp. 30-47.

DOI: [10.58346/JISIS.2023.12.002](https://doi.org/10.58346/JISIS.2023.12.002)

*Corresponding author: Faculty of Tarbiyah and Teacher Training, Universitas Islam Negeri Sjech M. Djamil Djambek Bukittinggi, Indonesia.

1 Introduction

The function of the Koran as a foundation and guidance in the life of Muslims, as Allah explicitly explains it in (Q.S. Al-Baqarah verse 2). Therefore, if humans want a good, prosperous and successful life in this world and the hereafter, they should use Qur'an as a guide in everyday life. Making the Qur'an a friend in everyday life can be done by getting used to interacting with it as often as possible. By continuing to read and understand the Qur'an, the interaction will continue so that the function of guidance and direction in life will continue to occur. At the beginning of the revelation of the Koran, the Prophet emphasized to friends to read and memorize the text that was revealed. So that the spread of the Koran was carried out from one friend to another orally. (Akkila and Abu-Naser, 2018).

The routine of continuing to read the Qur'an is a worship and a must for Muslims. Someone who reads the Qur'an must be able to give the rights of each letter because the Arabic language is very risky with changes in meaning. Thus, if one letter or one punctuation mark changes, it may cause a difference in the meaning of a word or sentence. For example, in Ibn Kathir's interpretation, it is stated that if someone reads the fifth verse of Surah Al-Fatiha without using *tasydid* on the letter *ya*, then Ibn Kathir's interpreted that it can change its meaning from what it should mean as "Only to You we worship and only You. It is to You that we ask for help," turned to "the sun we worshiped and asked for help (Abdul Ghofar and Al-Atsari, 2019).

Therefore, maintaining the reading of the Qur'an from errors and changes and maintaining the oral (mouth) from reading errors has become a must. Maintaining the recitation of the Qur'an from any mistakes is the goal of the Tajweed. Tajweed is a scientific discipline that teaches readers to understand how to read the Qur'an properly and correctly. However, in the eyes of most Muslims, such a mindset is poorly understood, so the Tajweed is only considered classical knowledge, which is enough to be memorized and applied without the need to understand (Nasution, 2014).

Studying Tajweed is *fardhu kifayah* (a society obligation) while reading the Qur'an properly (according to the Tajweed) is *fardhu Ain* (an individual obligation) (Sudiarjo, Mariana and Nurhidayat, 2015). There are many sentences in the Qur'an and *hadith* that require the practice of recitation Qur'an by using correct Tajweed in every reading of the Qur'an. The Qur'an is studied to understand the meaning or message behind the text. Thus, to get the meaning following the Qur'an, it is necessary to understand *qiraat* and how to read the Qur'an properly and correctly. How to read the Qur'an properly and correctly can be learned with Tajweed (Haryanto and Rohimin, 2020). However, this is not in line with what is happening in the field, especially in education. As reported by Tribunnews.com, the Director of Islamic Religious Education at the Ministry of Affairs, Rohmat Mulyana Sapdi, stating that the low ability to read the Qur'an should be a common concern. He conveyed this statement based on data from the Ministry of Affairs, which showed that many students still could not read the Qur'an. He argued that this is caused by several factors, including the lack of student interest and teacher competence (Fahlevi, 2021).

Therefore, to build students' interest in learning the Qur'an and Tajweed, it is necessary to develop a teaching method that is fun and not boring for students so that it can encourage students' interest in learning the Qur'an and the Tajweed. In terms of technological development, many media have been created and developed. However, many existing media still need improvements so that the developed media can provide more effective or enjoyable learning in reading Qur'an. The urgency of this study needs to be considered because the tracing has been done digitally. The research done by Jumarlis (2018) explains AR-based smart *hijaiyyah* learning. The AR technology in this study is only intended to project images of letters and sounds from these letters. Another research related to Tajweed has been previously

done entitled Digital Applications of Tajweed Minutes in Improving the Ability to Read the Qur'an. This research requires several tools such as laptops and LCDs to display the knowledge of recitation, which then students are asked to read, listen to, and ask for ununderstood material (Khairul and Haramain, 2018).

The A.R. technology has been used in many fields, such as education, medicine, military, industry, and entertainment. In the education field, usually, this kind of technology is used as an educational medium for learning; in the military, it is usually used for training or war simulation; in industry, it is usually used for promoting any products; while in entertainment, it is usually used for the game (Hanif, 2018). The current maturity of augmented reality (A.R.) and virtual reality (V.R.) (Akbari, Ha and Kok, 2022). The developments of virtual reality (V.R.) and augmented reality (A.R.) research in hospitality and tourism (Wei, 2019)

The implementation of learning, especially tajwid, can be interesting when combined with the use of learning technology, namely Augmented Reality. The use of AR technology presents information and displays objects in digital-based learning. AR learning is able to provide a view in the real world with some use of equipment such as webcams, computers, cellphones, or special glasses. Because use in the real world is not able to identify virtual objects by naked eye. So that the use of computers and cameras is needed as a medium that has the ability to represent objects in the virtual world into the real world. This technology has been commonly used in education as a medium of learning. However, this technology has not been widely used in formal education, especially in learning Qur'an and Tajweed. This technology is only widely used in the manufacture of educational games and other games so that children or students are more familiar with games because this technology is rarely used for other purposes, for example, making applications about designing learning media for Tajweed so that it can help someone in reading the Qur'an with good and correct Tajweed. Therefore, one way that is considered effective and efficient to increase students' interest in learning Tajweed is by designing a learning medium by implementing an application in it (Rodliyah, Sani and Arif, 2020).

There have been many researchers who have done research related to the use of A.R. technology. It includes research conducted by (Fatdha and Putra, 2020) which says that learning applications that utilize A.R. technology are alternative media in studying Tajweed. The application was made as a learning media for Tajweed for students by applying Augmented Reality technology so that the learning process looks real. It can be said that based on this research, markers with detailed patterns are easy to detect by the camera of Android devices. Furthermore, research conducted by (Septana, Putra and Safei, 2020) sLearning development results are strongly supported by the results of the use of learning media. Augmented Reality is one of the learning media that has a significant influence on improving learning outcomes. Besides, the research conducted by (Hamid and Jamil, 2019) found that one form of learning media that can be used to motivate students to explore and control from a different perspective is A.R. Furthermore, a research conducted by (Akkila and Abu-Naser, 2018) found that an intelligent ITS (intelligent tutoring system) system was developed to teach Reading Qur'an "Tajweed" with Riwaya which aims to overcome problems in terms of reading the Qur'an; Hafis from 'Aasem the way the Shatebiyyah (the most popular narration in many countries) is presented. This system provides personalized training and direct feedback to students who want to become teachers.

Previous research has developed AR media as alternative media in various materials. However, the AR media that has been developed does not contain the emphasis on sound and the concept of recitation which is actually in accordance with the law of recitation. Then this study aims to design learning media for recitation of recitation by using Augmented Reality technology based on android. This application is designed not only for students. However, the application was also created to make it easier for lecturers

to teach the Tajweed to their students. The display of the Tajweed law in this application will be accompanied by colors and an explanation of the Tajweed law. At the same time, this application will also be equipped with an audio play. Hence, by using this application, educators and students will be able to read the Qur'an more quickly and apply the Tajweed properly and correctly, following the rules contained in the Tajweed.

2 Review of Related Literature

2.1. Learning Media

Media is essentially a component of the learning system. As a component, the media should be integral and must follow the overall learning process (Nurrita, 2018). Learning activities must be more effective if an educator can provide related devices and support these learning activities (Winaya, Dibia and Rati, 2020). For example, in learning *fiqih* about the ablution chapter. This material is considered easy to understand if a teacher can demonstrate the procedure for ablution by using a video display in front of the class. This means that using technology as a medium in learning must be done, as is learning through Learning Applications (Noor et al., 2021). An application is a program with command processing activities to carry out user requests with a specific purpose. Applications can be used for learning purposes by considering that there should be interactions between learning components in a learning process. One of the possible learning approaches between these learning components is interactive learning. Interactive learning is the opposite of traditional learning, namely elements structured to increase students' understanding of concepts interactively through thinking and working activities that generate feedback through discussions with or without instructions from educators (teachers) (Supriyanto, 2018). In general, educational media has the following uses: (a) Learning will attract more students' attention so that it can foster learning motivation; (b) Teaching materials will have a clearer meaning so that students can better understand them; (c) Teaching methods will be more varied; (d) Students will do a lot of learning activities because they do not only listen to teacher descriptions, but also other activities such as observing, doing, demonstrating and others (Darmawati, Elin and Monia, 2021). Thus, learning media has the potential to create a learner-centered learning environment by empowering students to become creators and producers of knowledge and providing opportunities to interact and collaborate (An, 2021; Lindasari and Farida, 2021).

2.2. Tajweed

The etymological meaning of tajwid is "to increase". However, from an epistemological perspective, this means removing the pronunciation of the hijaiyah letters from their proper place of exit with proper and proportional rights. As for the original nature of letters, they are always attached and are called letter rights, such as Al Jahr, Isti'la', istifal, and so on. Meanwhile, letters mustahak characterize letters issued from time to time, such as tafkhim, tarqiq, ikhfa', and so on. (Ismail and Wardani, 2019). Another opinion also states that linguistically Tajweed is a refinement, while the terminology is reciting each letter of the Qur'an from the point of articulation and giving privileges, is a way of keeping the tongue from making mistakes in reading the Qur'an (Akkila and Abu-Naser, 2018). The main discussion or what is studied in Tajweed is the 29 letters, in various harakah (lines) and relationships (Ashadiqhi, Erlansari and Coastera, 2020). Tajweed is a knowledge that studies the rules or procedures for reading the Qur'an as well as possible (Rashed and Tamuri, 2021). The knowledge of recitation is part of the knowledge of the Ulumul Qur'an that needs to be studied (Habibulloh and Arifin, 2019).

2.3. Augmented Reality

Augmented Reality, or in Indonesian translated into additional reality, is a technique that combines two-dimensional and three-dimensional virtual objects into a real three-dimensional sphere and then projects these virtual objects in real-time (Pamudji et al., 2017). Augmented reality (A.R.) is a technology that combines two-dimensional or three-dimensional virtual objects into a real three-dimensional environment and then projects these virtual objects in a real environment (Fatdha and Putra, 2020). This Augmented Reality (A.R.) technology allows users to view and interact in real-time with virtual images projected seamlessly in the real world. A.R. systems can be used to create unique collaborative experiences. For example, users in the same location can view shared 3D virtual objects with which they interact, or users can annotate video views, enabling them to collaborate remotely (Lukosch et al., 2015). This augmented reality technology can add certain information into the virtual world and display that information in the real world with the help of equipment such as webcams, computers, Android smartphones, or special glasses. Users in the real world cannot see virtual objects directly, so to identify objects, intermediaries are needed in the form of computers and cameras, which will later add virtual objects into the real world (Mauludin, Sukanto and Muhandi, 2017). Augmented Reality (A.R.): In physical reality, participants also see virtual elements (Arena et al., 2022). A.R. is created to help users enjoy searching, selecting, and purchasing products or services freer (Abed, 2021). Augmented Reality strives to overlay additional layers of useful (Massis, 2015).

2.4. Android

Android is an operating system for Linux-based mobile devices that includes an operating system, middleware, and applications (Kuswanto and Radiansah, 2018; Ummah et al., 2021). Android provides an open platform for developers to create applications freely for Android smartphone users (Sari and Okra, 2020). Android is the most widely deployed end-user-focused operating system (Astuti, Sumarni and Saraswati, 2017). Through its growing set of use cases encompassing communication, navigation, media consumption, entertainment, finance, health, and access to sensors, actuators, cameras, or microphones, its underlying security model needs to address a host of practical threats in a wide variety of scenarios while being useful to non-security experts (Mayrhofer et al., 2021). In essence, Mayrhofer and his friends revealed that Android is an operating system that focuses on its users, where the use of Android includes communication systems, information, social media, and so on (Park, M., 2019).

3 Research Methodology

3.1. Types of Research

This research was conducted using Research and Development (R&D) by developing an application for learning Tajweed using android-based augmented reality. During the research, there was a development for the application to learn to read Qur'an and Tajweed by using Unified Modeling Language. Here are the steps used in the research as stated in Figure 1:

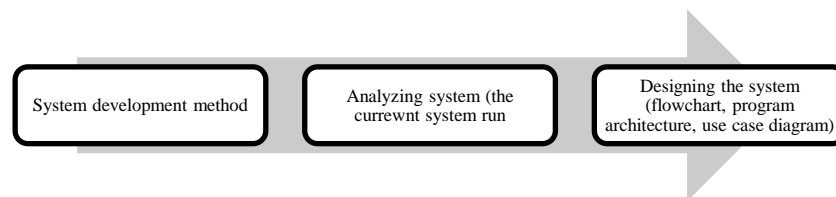


Figure 1: The Procedures of the Research

3.2. System Design Method

The system design method for developing this learning media uses the Unified Modeling Language (UML) model. UML is one of the visual modeling methods used in designing and manufacturing object-oriented software (Prihandoyo, 2018). UML becomes a writing standard or a kind of blueprint which includes a business process and writing classes in a specific language. Several UML diagrams are often used in the development of a system, namely: Flowchart: A flowchart of activities in the running system, Program architecture: Describes the interaction between objects in and around the system in the form of messages depicted against time, Use Case diagram: Is a description of the expected functionality of a system, and represents an interaction between actors and the system. In the use case diagram, there is an actor, a picture of an entity from a human or a system that works on the system (Booch, 2005).

3.3. Running System

The current teaching and learning system still tend to use manual methods in the learning process, where most teachers rely on books as the main media; as a result, students get bored quickly because they mostly listen when studying (Jumarlis, 2018).



Figure 2: Running System

From the current system, it can be seen: When in the learning process, a teacher writes about the rules and laws of recitation on the blackboard, then students pay attention to what the teacher has written. The same thing happens when a teacher says or gives an example of how to read one of the laws of recitation, then students repeat and practice it. So, based on this, the author proposes to design a media in the Tajweed learning process using Augmented Reality (A.R.) technology based on Android so that students are more interested and active in learning the Qur'an.

3.4. System Design

System design is carried out to describe the work of the application internally and the interaction of the system with application users. The design of this system is described in the form of flowcharts, program architecture, and use diagrams as follows:

3.4.1. Flowchart

The flowchart in designing the system on the running application describes the procedures and steps of this application, which starts from the start menu and ends with the finish menu, as stated in the following figure 3.

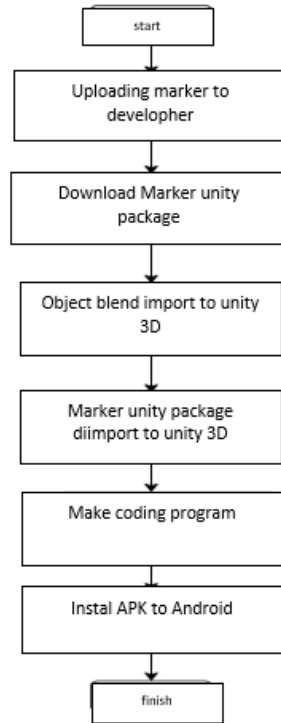


Figure 3: Flowchart of Program Design

3.4.2. Program Architecture

The architecture of this program describes the interaction between the user and the running system. This section describes the method being designed for Tajweed's learning process, which consists of several steps. These steps include: The user puts a marker that has been previously registered. If the marker is valid, it will proceed to the next process. If it is not valid, then the user will repeat the marker identification process. The marker that has been valid and identified will display the play button or paragraph button. After you touch the verse button, the system will automatically display the law of recitation via an android smartphone. For more details, the steps above can be seen in the following figure 4:

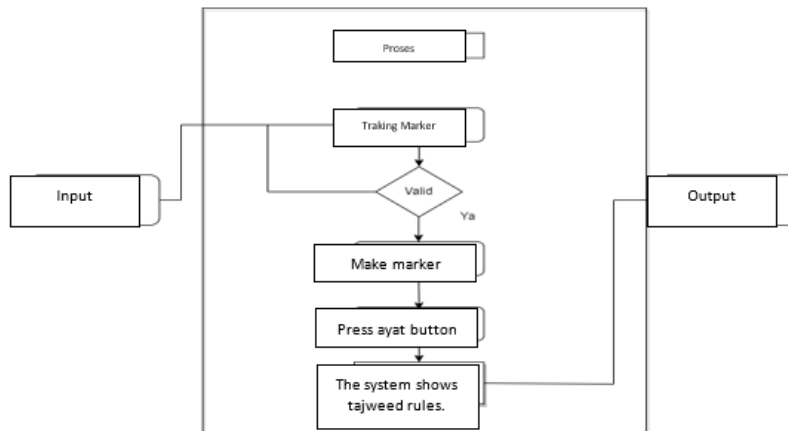


Figure 4: Program Architecture

3.4.3. Use Case Diagrams

Use case diagrams describe the system from the user's point of view so that the description of use case diagrams focuses on the system's functionality. It is aimed to understand the system's needs easily. Besides, the description of the application design which has been developed is in the case diagram. The description of the application system through the case diagram can be seen in figure 5 as follow:

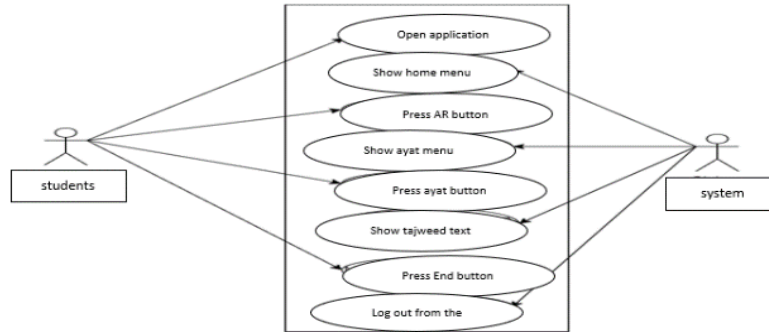


Figure 5: Use Case Diagram

4 Results and Discussion

4.1. Program Implementation

After carrying out the previous stages in developing Tajweed learning media using Android-based AR technology, the next step is to implement the system that has been designed. At this stage, the program design results will be displayed starting from the main menu display on the screen.

4.1.1. Face-to-Face Main Menu

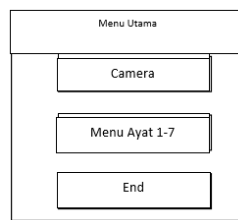


Figure 6: Initial Display of the Program

The initial view in the main menu will display three menus, namely the camera menu, paragraph menu, and end menu. If the user presses the camera menu, the results will appear as follows.

4.1.2. Face-to-Face 3D Camera

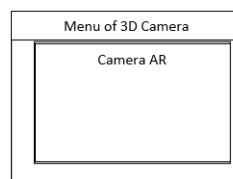


Figure 7: 3D Camera View

The figure 7 above is a 3D camera menu view. If the menu selected by the user is the 3D camera menu, then the display will look like the figure 7 above, where the A.R. camera will appear.

4.1.3. Face-to-Face A.R. Menu

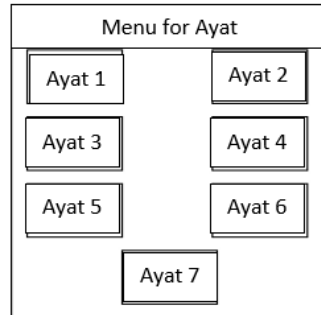


Figure 8: Display of the Verse Menu

If the user selects the verse menu on the media, the later display is like the figure 8 above, where a selection of verses from the selected surah will appear.

4.2. Comparison to Previous Findings

At this point, the researcher compared the application which is developed to the previous findings which were done by (Fatdha and Putra, 2020) entitled Implementation of Augmented Reality with Marker Based Tracking Method as Learning Media for Tajweed on the Android Platform. The previous finding more focused on introducing the kinds of Tajweed law as stated in figure 9:

Tatap muka menu belajar berisi tentang penjelasan tajwid nun sukun/tanwin. Pada tatap muka ini ada 5 sub menu pilihan diantaranya ikhfa, izhar, idgam, iqlab dan kembali.



Figure 9: Learning Menu Display on Previous Findings

Meanwhile, on the developed application, it presents the theory and practice together while also explaining the kinds of Tajweed law and how to read it. Besides, this application also helps the users to identify Tajweed law which appears in one verse. It can be seen in figure 10 up to figure 19.

4.3. Media Test Results

4.3.1. Media Initial View

The figure 10 below is an initial view of the application before entering the next view.



Figure 10: Media Preview

4.3.2. Intro View



Figure 11: Intro Display

The figure 11 above is an overview of the application before entering the main menu.

4.3.3. Main Menu Display

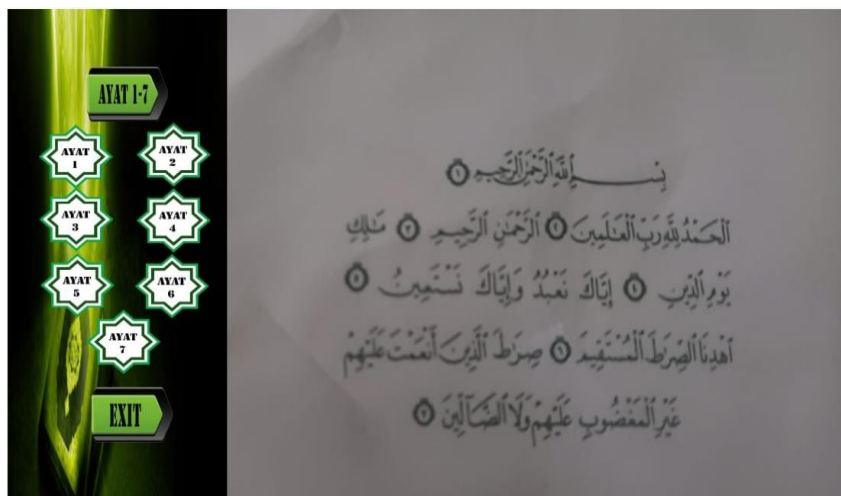


Figure 12: Main Menu Display

In the figure 12 above is the main menu display of the application that displays Surah al-Fatihah from the first verse to the last verse. Then on the left side of the display on the screen, under the paragraph section, there is an exit menu. This menu is useful if the user wants to exit the main menu display.

4.3.4. First Verse Display

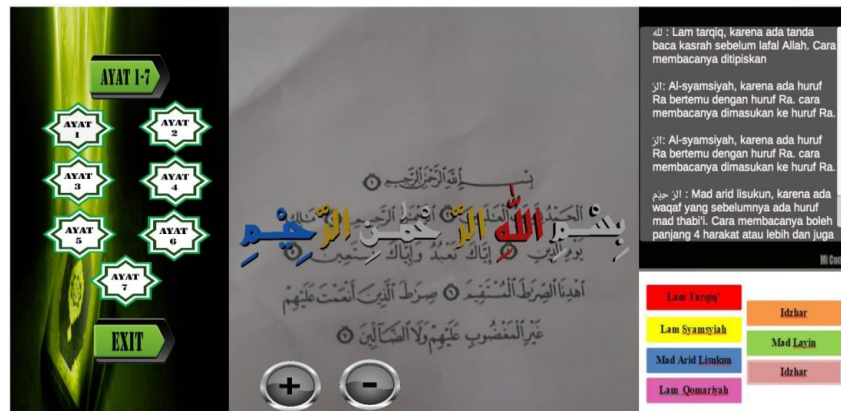


Figure 13: Display of Surah al-Fatihah Verse 1

It can be seen in the figure 13 above that there is a new display in the upper right part or column on the screen that contains an explanation of the reading law contained in the first verse in Surah al-Fatihah. Then, the column below contains the names of the laws of recitation, where each law of recitation has a different color so that it becomes easier when you want to identify one of the laws of recitation.

4.3.5. Second Verse Display

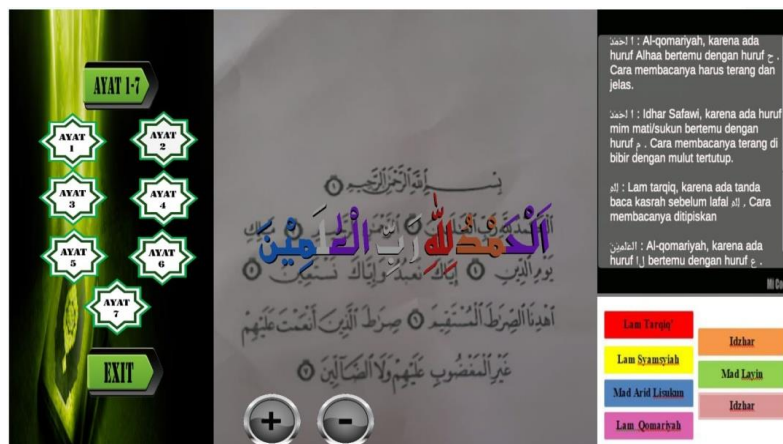


Figure 14: Display of Surah Al-Fatihah Verse 2

The figure 14 above explains the law of reading in the second verse in Surah al-Fatihah. Each Tajweed law in the verse has its own color, making it easier for users to identify what Tajweed laws are in the verse.

4.3.6. Third Verse Display

The figure 15 below explains the reading laws in the third verse in Surah al-Fatihah. Then there is an audio play display at the top center of the screen.

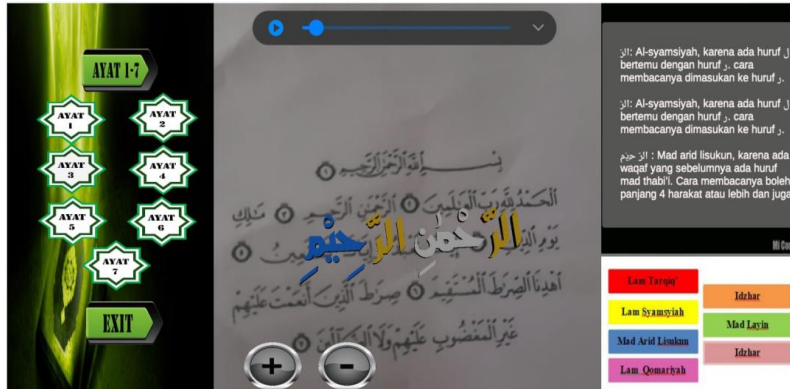


Figure 15: Display of Surah Al-Fatihah Verse 3

4.3.7. Fourth Verse Display

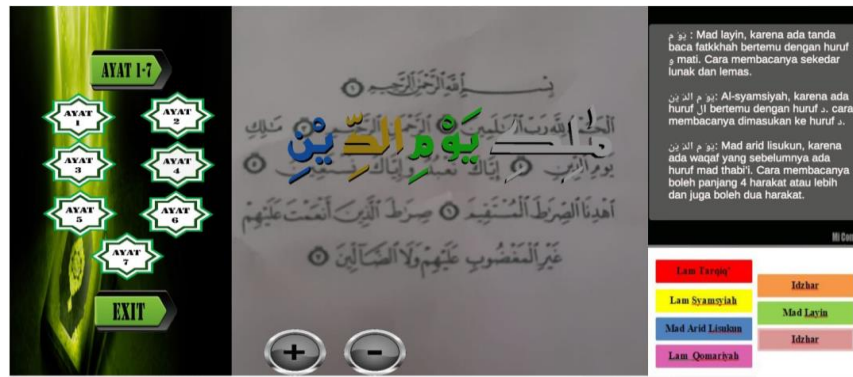


Figure 16: Display of Surah al-Fatihah Verse 4

The figure 16 above explains the law of reading in the fourth verse in Surah al-Fatihah. In addition, the 3D effect of the displayed verse is a function of A.R. technology in this learning media, which sees virtual objects in 3D.

4.3.8. Fifth Verse Display

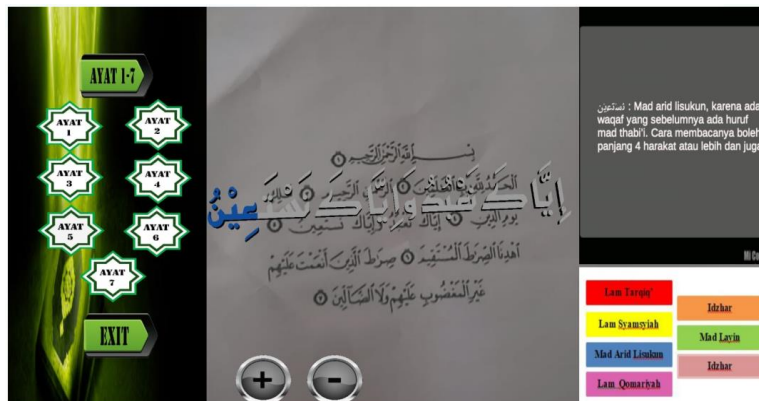


Figure 17: Display of Surah Al-Fatihah Verse 5

The figure 17 above explains the reading laws in the fifth verse in Surah al-Fatihah.

4.3.9. Sixth Verse Display

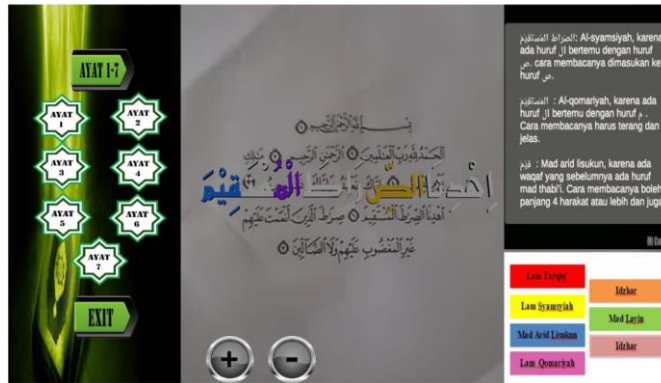


Figure 18: Display of Surah Al-Fatihah Verse 6

The figure 18 above explains the law of reading in the sixth verse in Surah al-Fatihah.

4.3.10. Seventh Verse Display



Figure 19: Display of Surah Al-Fatihah Verse 7

The figure 19 above explains the law of reading in the seventh verse of Surah al-Fatihah. Media can help clarify and convey messages according to the purpose of the message. The figure display in 19 is a demonstration process of the Tajweed learning media currently being developed. It starts by demonstrating the initial display of the media in the program, which is then followed by the intro menu display, and then only after that enters the main menu display. A.R. technology in this learning media makes objects visible in 3D so that the verses appear to appear, which makes them more visible. The developing Quranic verse recitation recognition with tajweed checking rules function (Ibrahim et al., 2013). Implementing new technologies to meet curricular demands and reach instructional outcomes is often difficult, requiring a lot of trial and error (Lege and Bonner, 2020).

Learning media using A.R. is useful in clarifying and helping visualize abstract concepts to understand an object model's structure. A.R. is widely used in gaming, medicine, and image processing, while it is still rarely used in education. In this sense, A.R. may offer unique advantages and benefits to creating inclusive AR-based educational settings (Bacca et al., 2014). The advantage of this developed media is that the display of verses containing the law of Tajweed is equipped with colors to make it easier for users to identify them. Besides, this media is also equipped with an explanation of the law of Tajweed and how to read it. Finally, this media is also equipped with an audio play, so it is also friendly to students who are blind.

5 Conclusion

Based on the results of the research and discussion described above, it can be concluded that the developed media is intended for educators, both teachers, and lecturers, to make it easier to teach Tajweed to their students, and vice versa, both students and students, can easier to learn the Tajweed. The developed media also aims to attract students (students and students) to be more interested and enjoy studying Tajweed. This learning media uses the software development life cycle (SDLC) model in the system design process. This learning media displays the verses of the Qur'an accompanied by an explanation of what reading laws are contained in each of these verses. This application works by utilizing Augmented Reality (A.R.) technology. The suggestions that can be conveyed are that this application is still limited to an introduction to the most basic laws of enjoyment, so the study is not in-depth. Therefore, it is expected that, in the future, further research can provide additional material in the form of deepening the knowledge of recitation; about the types of Tajweed laws that exist in the Qur'an, for example, the various laws of reading *ikhfa* and so on. Furthermore, this application only runs on Android. It is recommended for other researchers to be able to complete the shortcomings in this study.

References

- [1] Abed, S.S. (2021). Examining augmented reality adoption by consumers with highlights on gender and educational-level differences. *Review of International Business and Strategy*, 31(3), 397-415.
- [2] Abdul Ghofar, M.E.M. & Al-Atsari, A.I., (2019). *Tafsir Ibnu Katsir: Terjemahan Kitab Lubabut Tafsir Min Ibni Katsir*. Jakarta: Yayasan Mitra Netra.
- [3] Akbari, M., Ha, N., & Kok, S. (2022). A systematic review of AR/VR in operations and supply chain management: maturity, current trends and future directions. *Journal of Global Operations and Strategic Sourcing*, 15(4), 534-565.
- [4] Akkila, A.N., & Abu-Naser, S.S. (2018). Rules of Tajweed the Holy Quran Intelligent Tutoring System. *International Journal of Academic Pedagogical Research*, 2(3), 7–20.
- [5] An, Y. (2021). A History of Instructional Media, Instructional Design, and Theories. *International Journal of Technology in Education*, 4(1), 1-21.
- [6] Arena, F., Collotta, M., Pau, G., & Termine, F. (2022). An overview of augmented reality. *Computers*, 11(2), 1-15.
- [7] Ashadiqhi, M.H, Erlansari, A., & Coastera, F.F (2020). Android-Based Tajweed Science Learning Application. *Recursive: Journal of Informatics*, 8 (1), 59-70.
- [8] Astuti, I.A.D., Sumarni, R.A., & Saraswati, D.L. (2017). Development of Android-based mobile learning physics learning media. *Jurnal Penelitian & Pengembangan Pendidikan Fisika*, 3(1), 57-62.
- [9] Bacca Acosta, J.L., Baldiris Navarro, S.M., Fabregat Gesa, R., & Graf, S. (2014). Augmented reality trends in education: a systematic review of research and applications. *Journal of Educational Technology and Society*, 17(4), 133-149.
- [10] Booch, G., (2005). *The unified modeling language user guide*. Pearson Education India.
- [11] Darmawati, G., Elin, Y., & Monia, F.A (2021). Effect of Learning Media Design with Adobe Flash CS 6 Program for Learning to Count. *Journal of Practice Learning and Educational Development*, 1 (3), 94-100.
- [12] Fahlevi, F., 2021. The Ministry of Religion is concerned that many students cannot read the Koran. <https://www.tribunnews.com/nasional/2021/05/05/kemenag-prihatin-banyak-siswa-tidak-bisa-baca-alquran>
- [13] Fatdha, T.S.E., & Putra, R.D.R. (2020). Informasi Implementasi Augmented Reality Dengan Metode Marker Based Tracking Sebagai Media Pembelajaran Ilmu Tajwid Pada Platform

- Android. *SATIN–Sains Dan Teknologi Informasi*, 6(1), 45-52.
- [14] Habibulloh, M. & Arifin, A., (2019). The effectiveness of the stad cooperative learning model using teaching aids of the Koran to improve tajwid mastery. *Jurnal Pendidikan Agama Islam*, 16(2), 189-202.
- [15] Hamid, H. & Jamil, M., (2019). Designing an interactive book based on augmented reality on the introduction and learning of the history of Maitara Island. *Jurnal Informatika Dan Rekayasa Perangkat Lunak*, 1(2), 147-152.
- [16] Handoko, B.L., Lindawati, A.S.L., & Budiarto, A.Y. (2020). Using Mixed Reality to Provide Experience for Internship Students in the Field of Auditing Studies during Covid 19. *In 2nd International Conference on E-Business and E-commerce Engineering*, 17-22.
- [17] Hanif, M., (2018). Getting more advanced, here is the application of augmented reality technology in 5 different fields. <https://dafunda.com/teknopenerapan-teknologi-augmented-reality/>
- [18] Haryanto, K.W. & Rohimin, M., (2020). Development of a learning application for tajweed Al-Qur'an based on augmented reality case study at Madrasah Miftahul Ulum 22 Karang Nongko. *Spirit: STMIK Yadika Journal of Computing and Cybernetic System*, 12(2), 60-66.
- [19] Ibrahim, N.J., Idris, M.Y.I., Razak, Z. & Rahman, N.N.A., (2013). Automated tajweed checking rules engine for Quranic learning', *Multicultural Education and Technology Journal*, 7(4), 275–287.
- [20] Ismail, A. & Wardani, A., (2019). Android based tajweed learning application. *Prosiding Semantik*, 2(1), 56–65.
- [21] Jumarlis, M., (2018). Smart hijaiyyah learning application based on augmented reality. *ILKOM Jurnal Ilmiah*, 10(1), 52–58.
- [22] Khairul, K. & Haramain, M., (2018). A digital application of the treatise on tajweed science in improving the ability to read the Koran. *KURIOSITAS: Media Komunikasi Sosial dan Keagamaan*, 11(2), 145–157.
- [23] Kuswanto, J. & Radiansah, F., (2018). Android-based learning media on Class XI network operating system subjects. *Jurnal Media Infotama*, 14(1), 15-20.
- [24] Lege, R. & Bonner, E., (2020). Virtual reality in education: The promise, progress, and challenge. *Forum*, 16(3), 167-180.
- [25] Lindasari, L.M. & Farida, F., (2021). Interactive learning media with realistic mathematics approach: Facilitating distance learning on linear program materials. *Online Learning in Educational Research*, 1(1), 37-48.
- [26] Lukosch, S., Billingham, M., Alem, L. & Kiyokawa, K., (2015). Collaboration in Augmented Reality. *Computer Supported Cooperative Work: CSCW: An International Journal*, 24(6), 515-525.
- [27] Massis, B., (2015). Using virtual and augmented reality in the library. *New Library World*, 116(11–12), 796–799.
- [28] Mauludin, R., Sukamto, A.S. & Muhandi, H., (2017). Augmented reality is applied as a medium for learning the digestive system in humans in biology subjects. *Jurnal Edukasi Dan Penelitian Informatika (JEPIN)*, 3(2), 117-123.
- [29] Mayrhofer, R., Stoep, J.V., Brubaker, C. & Kravovich, N., (2021). The android platform security model. *ACM Transactions on Privacy and Security*, 24(3), 1-35.
- [30] Nasution, A.S.A., (2014). Utilizing phonetic studies for the development of learning tajweed science. *ARABIYAT: Jurnal Pendidikan Bahasa Arab dan Kebahasaan*, 1(2), 209-222.
- [31] Noor, R.N.F., Zainuddin, Z., Misbah, M., Hartini, S. & Dewantara, D., (2021). Blended learning with schoology in impulse and momentum materials: The development of physics teaching materials. *Online Learning in Educational Research*, 1(2), 63-73.
- [32] Nurrita, T., (2018). Development of learning media to improve student learning outcomes. *MISYKAT: Jurnal Ilmu-Ilmu Al-Quran, Hadist, Syari'ah Dan Tarbiyah*, 3(1), 171-187.
- [33] Park, M., You, G., Cho, S.J., Park, M., & Han, S. (2019). A Framework for Identifying

- Obfuscation Techniques applied to Android Apps using Machine Learning. *Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications*, 10(4), 22-30.
- [34] Pamudji, A.K., Setiyowati, Maryuni & Sanjaya., (2017). Easily Create Augmented Reality (AR) and Virtual Reality (VR) Games with Unity 3D. In *PT Elex Media Komputindo: Jakarta*.
- [35] Prihandoyo, M.T., (2018). Unified Modeling Language (UML) a model for the development of web-based academic information systems. *Jurnal Informatika: Jurnal Pengembangan IT*, 3(1), 126–129.
- [36] Rashed, Z.N. & Tamuri, A.H. (2021) ‘Integrated and Holistic Education System as Fundamental Approach Toward Quranic Generation Outcome’, *JURNAL EDUCATIVE: Journal of Educational Studies*, 6(1), 72–83.
- [37] Rodliyah, A., Sani, D.A. & Arif, M.F., (2020). Designing a mobile-based tajweed science learning application. *J I M P - Jurnal Informatika Merdeka Pasuruan*, 5(1), 32-37.
- [38] Sari, W.P. & Okra, R., (2020). Android-based verse deposit mobile application design for comprehensive students at IAIN Bukittinggi. *Jurnal Ilmiah Informatika*, 5(2), 157-167.
- [39] Septana, R.D., Putra, M.Y. & Safei, A., (2020). Learning media for introducing computer hardware components using Android-based augmented reality. *Information Management For Educators And Professionals: Journal of Information Management*, 5(1), 65-74.
- [40] Sudiarjo, A., Mariana, A.R. & Nurhidayat, W., (2015). Application for learning the science of tajweed, waqaf and makharijul letters based on android. *Jurnal Sisfotek Global*, 5(2), 54-60.
- [41] Suheri, C.K. Hendrikus dkk. (2018). *Goresan Pena Psikologi Pembelajaran Dari Teori Ke Aplikasi*, 2.
- [42] Supriyanto, D., (2018). Effect of using e-learning based learning media. *MODELING: Jurnal Program Studi PGMI*, 5(1), 112-129.
- [43] Ummah, N.F.K., Windayani, N., Irwansyah, F.S. & Sulaeman, D., (2021). Android-based digital book oriented to multiple chemical representations on terpenoid materials. *Online Learning in Educational Research*, 1(1), 1-15.
- [44] Wahyudi, D., & Suheri, S. (2020). Implementation and Evaluation of Digital Literacy: Strategies to Increase Reading Interest Basic level students. *International Journal of High Education Scientists (IJHES)*, 1(1), 1-15.
- [45] Wei, W., (2019). Research progress on virtual reality (V.R.) and augmented reality (A.R.) in tourism and hospitality: A critical review of publications from 2000 to 2018. *Journal of Hospitality and Tourism Technology*, 10(4), 539–570.
- [46] Winaya, G.S.M.D., Dibia, I.K. & Rati, N.W., (2020). Development of mathematics learning tools for data processing materials based on the PMRI approach. *Jurnal Ilmiah Pendidikan Profesi Guru*, 3(3), 468–476.

Author's Biography



**Dr. Zulfani Sesmiarni,
M. Pd**

Born in Koto Panjang on September 23, 1981 from parents named Hakimi and Darmis. Education begins at SD 09 Koto Panjang then continues to SLTP 02 Tanjung Ampalu and senior high school at SMU 1 Sijunjung. Graduated from PMDK in the FIP UNP Educational Technology Study Program and continued to Masters level in the same Study Program at the Postgraduate Program at Padang State University, a Doctoral degree was obtained through a Diktis Scholarship at the Postgraduate Educational Technology Study Program, Jakarta State University. Some of the books that have been published are Learning Program Evaluation Models, Brain-Friendly Learning Models in the 2013 Curriculum Implementation Curriculum, Skilled in Learning Theories and Models, Educational Aspects in the Qur'an, Educational Philosophy, and the Role of Islamic Education in Welcoming the Golden Generation. While scientific articles that have been published in several journals include Analysis of the Ability of Islamic Education Teacher in Comprehending the Procedure to Make Learning Evaluation, Students' Learning Motivation To The Implementation Of Online Learning During Covid 19 Pandemic In IAIN Bukittinggi, The Effectiveness of Online Learning During Covid-19: Challenges and Opportunities, The Correlation of Students' Perception About Online Learning and Students' Grade Point at IAIN Bukittinggi, The Assessment of Online Learning in IAIN, Bukittinggi, During the COVID-19 Pandemic.



**Gusnita Darmawati,
S. Pd, M. Kom**

The author was born in Pintu Rimbo on May 12, 1988. She completed a bachelor's degree in the Educational Technology, Informatics, and Computer Science Department at STAIN Sjech M. Djamil Djambek Bukittinggi. Later, she completed her Master's degree in the Computer Science Department at Universitas Putra Indonesia "YPTK" Padang. She is a Permanent Lecturer in the Educational Technology, Informatics, and Computer Science Department at Faculty of Tarbiyah and Teacher Training, UIN Sjech M. Djamil Djambek Bukittinggi. She actively conducted research related to computer science, including research titled; "*Design of Integrated Recording and Reporting of Public Health Centres Based on E-Report to Improve Community Health (2018)*", "*Use of CIPP Model in Evaluating Qur'an Tahfiz Implementation in Islamic Boarding Schools (2020)*", "*Quality of Service EIGRP Routing Protocol on Campus Area Network (2021)*", "*Application for Calculation of Islamic Sharia Inheritance Based on Android for Mawaris Fiqh Courses (2021)*", "*The iInfluence of Learning Media Design with Adobe Flash CS 6 Program for Learning Mathematics (2021)*" "*Expert System for Recommending Healthy Food Menus for Patients with Diseases Using Forward Chaining Method (2023)*".



**Yulifda Elin Yuspita,
M. Kom**

The author was born in Gumarang on December 22, 1991. She completed her undergraduate studies in the Information Systems Department at Universitas Putra Indonesia "YPTK" Padang. Later, she completed her Master's degree in the Computer Science Department at Universitas Putra Indonesia "YPTK" Padang. She is a Permanent Lecturer in the Educational Technology, Informatics, and Computer Science Department at Faculty of Tarbiyah and Teacher Training, UIN Sjech M. Djamil Djambek Bukittinggi. She actively conducted research related to computer science, including research titled "*Pengaruh Desain Media Pembelajaran dengan Program Adobe Flash CS 6 untuk Belajar Berhitung (2021)*", "*Selection Of Internet Provider To Improve Quality Of Service And Learning Using Decision Support System (2022)*", "*Decision-Making System for KIP IAIN Bukittinggi Scholarship Recipients Using the SAW and TOPSIS Methods (2022)*", "*Sistem Informasi Pusat Pengaduan Pelayanan Masyarakat Menggunakan Work System Framework (2022)*", "*Sistem Informasi Consultation Online Menggunakan Bahasa Pemograman PHP dan Database MySQL (2023)*".



Saiful Yeri, M. Pd

The author was born in Pintu Rimbo on December 31, 1987. He completed a bachelor's degree in the Educational Technology, Informatics, and Computer Science Department at STAIN Sjech M. Djamil Djambek Bukittinggi. Later, he completed his Master's degree in Islamic Education at Faculty of Tarbiyah and Teacher Training, IAIN Bukittinggi. He is a lecturer in the Islamic Education Department at the Faculty of Tarbiyah and Teacher Training, UIN Sjech M. Djamil Djambek Bukittinggi.



**Ilhan Ikhsan S.Hum,
M.Pd**

The writer is the second of four children from the couple Muhammad Abrar and Masna. At that time, Ikhsan, his nickname, completed his primary education in 2011 at SD 9 Limo Koto, then he continued his education at the Madrasah Tsanawiyah Kauman Padang Panjang until 2014, after that he continued his education for the upper secondary level at SMA Negeri 7 Sijunjung until 2017, then after After graduating from high school, he took the joint selection exam to enter college in 2017 and successfully graduated at Padjadjaran University in the Arabic Literature study program until he was able to complete his studies on June 14, 2021, and is currently pursuing a bachelor's degree or postgraduate education at the Islamic Institute of Religion Bukittinggi.