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Development of The "Kisah Si Jojo" Android Application Based on Augmented Reality with Unity 3D

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A B S T R A C T

Oriented towards the PISA analysis report, the results of the literacy and numeracy abilities of Indonesian students are low and very concerning. Apart from that, there are other problems regarding the ability and interest in reading of Indonesian students which are still below average. The purpose of this research is to motivate and increase students' interest in reading. Therefore, we need a learning media that can encourage students' interest and reading skills with the help of technology, namely through the development and creation of an android literacy application "Kisah Si Jojo" based on Augmented Reality Unity 3D. This android literacy application "Kisah Si Jojo" talks about the importance of tolerance between friends. The research model used in this study is ADDIE with six stages including starting from analysis, design, development, implementation, and evaluation. Based on the research results it is known that the android literacy application "Kisah Si Jojo" is developing well and can be used according to its function

1. INTRODUCTION

The literacy skills of students in Indonesia still requires significant attention. According to the results of the Programme for International Student Assessment (PISA) survey in 2019, the quality of education in Indonesia ranked sixth lowest out of 76 countries worldwide (Kurniawati, 2022). This indicates that literacy skills and awareness in Indonesia are also low. This situation can be attributed to the lack of understanding among the public regarding the benefits of literacy. In fact, there are those who are unfamiliar with the meaning of literacy itself. This is followed by a low interest in reading among the Indonesian population (Ati and Widiyarto, 2020). The issue of reading interest among elementary school students is an important problem that needs to be addressed. This is because the problem of reading interest is closely related to students' reading and writing skills (Jannah and Oktaviani, 2022). If students have an interest in reading, they will read wholeheartedly (Marshal et al., 2021). Consequently, this will greatly impact their academic achievements. Reading ability stimulates reading interest, and reading interest itself will cultivate reading habits or a reading culture among students (Rohim and Rahmawati, 2020).

In order to motivate and encourage students' reading interest, teachers should provide engaging media in their classroom design to enhance their reading interest and literacy skills (Hasanah, 2020). Therefore, instructional media that can support or attract students' interest are needed, utilising the current state where almost everything relies on technology. Based on this situation, the researcher aims to offer and present engaging activities that stimulate students' reading interest, particularly through an application, to improve their reading abilities.

The "Kisah Si Jojo" application is an Android-based application that facilitates the improvement of reading interest among modern children. It is practical and can be accessed anywhere and anytime. The "Kisah Si Jojo" application can enhance students' reading abilities and interests. Android-based instructional media can have a significant influence on increasing students' reading motivation (Ahmad et al., 2022) by utilizing Android-based instructional media.

The "Kisah Si Jojo" application can train students' digital literacy skills and utilize their gadgets effectively. With SAC features, learning can become more engaging. When students feel happy and engaged, the learning process becomes easier to absorb. This application presents visually appealing illustrated stories with AR features that make the characters appear lifelike.

2. METHOD

The research method used is the ADDIE (Analysis, Design, Development, Implementation, Evaluation) research and development model, which represents a systematic working process and systemic aimed at achieving desired results (Almelhi, 2021). The main purpose of this development model is to design and develop an effective and efficient product.

The research and development procedure utilises a model developed by Robert Maribe Branch, based on the philosophical foundation of education (Lee, 2012) that the implementation of ADDIE should be student-centred, innovative, authentic, and inspiring. The steps in the ADDIE model are interconnected, requiring a gradual and comprehensive approach to ensure the creation of effective learning products.

In this development process, it will be carried out according to the procedures developed by Robert Maribe Branch, which consist of five steps. These five steps are: analysis, design,

development, implementation, and evaluation (Putra et al., 18). Since there is no implementation and evaluation yet, the explanation will consist of analysis, design, and development steps. Based on these steps, a more detailed explanation can be provided for easier understanding, as follows:

1. Analysis

The analysis step consists of two phases: performance analysis and needs analysis. The first phase, performance analysis, is conducted to identify and classify the problems faced by students regarding their low literacy skills. Then, solutions are sought by improving or developing instructional media through Unity software in creating a Virtual-Based Literacy Application. The second phase is needs analysis, which involves determining the elements or variations in instructional media required by students to enhance the quality of learning and students' academic achievements.

2. Design

The second step is designing the interface. UI/UX design is highly beneficial in enhancing the user experience and overall user satisfaction in the application. In this learning media, the design of the media is considered in terms of visual design, content design, and language design. Afterward, the next step involves the development of the learning environment.

3. Development

The third step involves developing the instructional media based on the initial media design. The steps involved in developing the Virtual-Based Literacy Application, "Kisah Si Jojo," using Unity software are as follows: 1) Creating and sourcing assets such as materials, images, backgrounds, music, character designs, and UI/UX designs through platforms like YouTube, Google, and Canva. 2)Integrating all these assets into the Unity software. 3)Combining the code processing process that utilises programming languages from Visual Studio Code software into Unity software. 4)Conducting application testing by extracting it from the final project into APK format (Android application). This stage helps identify any bugs or shortcomings so that we can be evaluated and improved upon.

4. Implementation

The fourth step is the implementation of "Kisah Si Jojo" to the readers. At this stage, we have not yet implemented the "Kisah Si Jojo" application to the subjects involved.

5. Evaluation

The fifth step is the evaluation of the "Kisah Si Jojo" application. However, since there has been no implementation with the subjects, there is no evaluation available for this application.

3. RESULT
3.1. Analysis stage

In this stage, an analysis is conducted regarding educational needs and the existing curriculum. In the 21st century, it is recognized that literacy skills, especially reading, are essential and necessary for Indonesian society. However, the current situation contradicts this recognition, as the interest in reading and literacy skills among Indonesian society, particularly students who are the future generation of the nation, are still weak and concerning. Based on the PISA analysis, it is known that the literacy achievement of

Indonesian students is currently at a low level, with an overall score of 32% across various aspects, consisting of 29% for content, 34% for processes, and 32% for contexts (Silalahi et al., 2022). Furthermore, according to the PISA survey conducted in 2019, the quality of education in Indonesia ranks sixth lowest out of 76 countries worldwide (Kurniawati, 2022). This indicates the low level of literacy skills and awareness in the country. Based on research and the findings of the PISA survey, it is evident that efforts are needed to address and improve students' literacy skills and reading interests.

One of the efforts that can be done to address the issue and improve students' literacy skills and reading interests is through the development of an Android-based literacy application titled "Kisah Si Jojo". The creation of an Android-based literacy application or digital literacy leverages digital media and networks to present information in reading, evaluate, discover, and utilise understanding and skills to enhance students' reading interests (Nasrullah et al., 2017). The Android-based literacy application that will be designed is structured and equipped with audiovisual elements to create a sense of enjoyment and prevent boredom, as it includes various appealing visuals. It is expected that this application will significantly increase students' interest and desire to read. Therefore, we have designed the development of the "Kisah Si Jojo" application as a digital literacy tool accessible and usable by elementary school students to enhance their current reading interests and literacy skills.

3.1. Designing stage

Creating an Augmented Reality-based application requires various preparations, such as designing the application and identifying what is needed in the app development process, including images, storyboards, concepts, and so on (Nincarean et al., 2013). The following are the stages involved in designing the development of the Kisah Si Jojo application.

a. Conceptualization

This stage is the earliest phase in creating the "Kisah Si Jojo" application. In this stage, the concept is determined based on the background discovered. The issue related to literacy serves as the foundation for developing the concept of the "Kisah Si Jojo" application, which highlights the importance of literacy, particularly in elementary schools. Therefore, a concept is created for a picture literacy application that can enhance elementary student's reading interests and literacy skills.

b. Storyboard creation

After determining the concept, the developers need to create a storyboard that outlines the narrative flow to be incorporated into the application. The story should not be abstract and should possess moral values, aiming not only to increase reading interests and literacy skills but also to instil positive moral values in students. The storyboard is designed to be as simple as possible yet captivating through visually appealing illustrations that can be easily understood by elementary school students.

c. Gathering necessary images and components

The main characters and supporting characters in the story are created by the developer using the ibisPaint X application, ensuring originality in their design. For the background design, menu display, and buttons within the application, the developer uses the Canva application to combine various elements provided by Canva. In Unity, a 3D object in the form of an orange and white cat image is obtained from the Unity Assets Store, while the marker

image utilizes Jojo's character by adding a database in the target manager. The database is then assigned the image as the target with a 5-star rating.

d.   Program development

The program development stage utilises Unity 2021 with a project file of the 3D Object type. Additionally, Vuforia is required to execute the Augmented Reality scan using the target image, which in this case is the Jojo character.

e.   Program evaluation

After completing the application, the next step is the evaluation stage. The evaluation is only done by the developer by installing the application on their respective devices and identifying any errors encountered during the initial development phase. It was discovered that there were several errors that occurred after building and running the application on an Android device, necessitating further improvements.

f.   Final stage and android application testing

After the evaluation, the application is refined based on the identified errors encountered by the developer during the build and installation process on their devices. Each error is addressed and resolved, and the application is retested. In this final stage, the application is considered complete and ready for use, as the errors from the previous stages have been rectified.

3.1. Development phase

Before creating each scene in Unity, in the Build Settings, ensure that the selected platform is Android. Then, import images for buttons, icons, and canvases, add background music, and import the necessary scripts for creating the application in Unity. This can be done by selecting "Import New Asset." Each scene that will be displayed in the application is created by right-clicking on the Assets folder, selecting "Create" from the menu, and choosing "Scene."

To create each screen according to the designed layout in the application, the created scenes are then added with a Canvas. Next, drag and drop the images that will be used as the display for each screen from the Assets folder onto the Canvas. The size of the images is adjusted using Transform to fit the Canvas size.

In the creation of the first scene, which is the cover with the title "Kisah Si Jojo," there are menus such as start, credit, setting, audio, and exit. In the creation of the second and third scenes, which are the credit and setting screens, there is a back menu indicated by an arrow. In the creation of the story scenes from the first to the ninth page, there are back and previous menus indicated by arrows. In the creation of the scene for augmented reality, there is an instruction image for usage and a home menu.

To create each of these menus, Button Text Mesh Pro from the UI is used. To make each button functional, scripts are created that can move from one scene to the next or previous scene, play background music, turn on and off the background music, and exit the application. To create augmented reality, Vuforia is used as an intermediary, and 3D models are searched for through the Unity Assets Store.
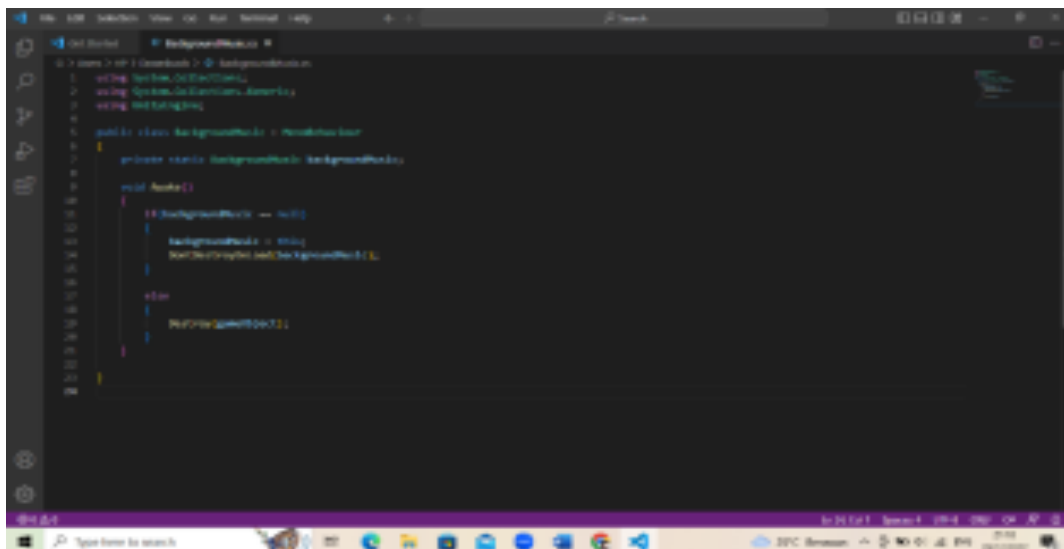
The method used to create functional buttons for scene transitions is by creating an Empty object then rename it to Change Scene and adding a script that enables the scene to change within the component.
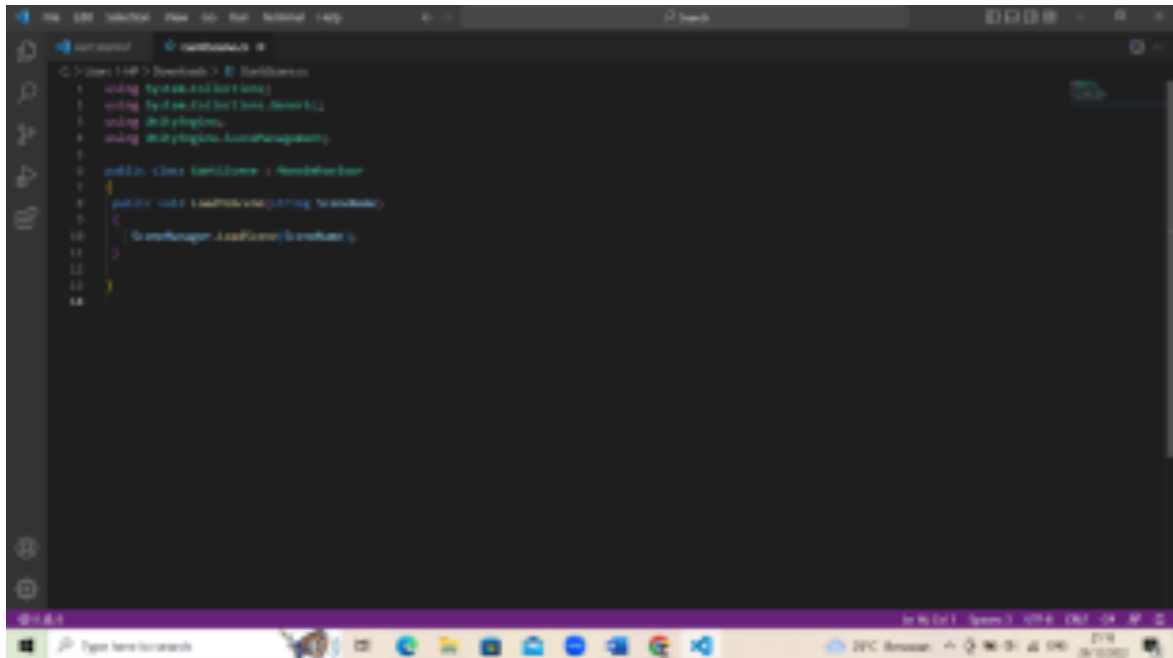
Picture 1. *Scene Transition Script*

Next, create buttons for the Start, Credit, Setting, Back, and Previous menus on the Canvas. Once the buttons are created, go to the Inspector and add an On Click event to each button by dragging an Empty object named 'Change Scene' that contains the script into the On Click section. Then, select the LoadToScene option in the Button menu and write the name of the scene you want to navigate to in the box at the bottom of LoadToScene. Change the image on each button by selecting an image and assigning it to the Source Image section in the Inspector. Adjust the size and position of each button using the Transform section in the Inspector.
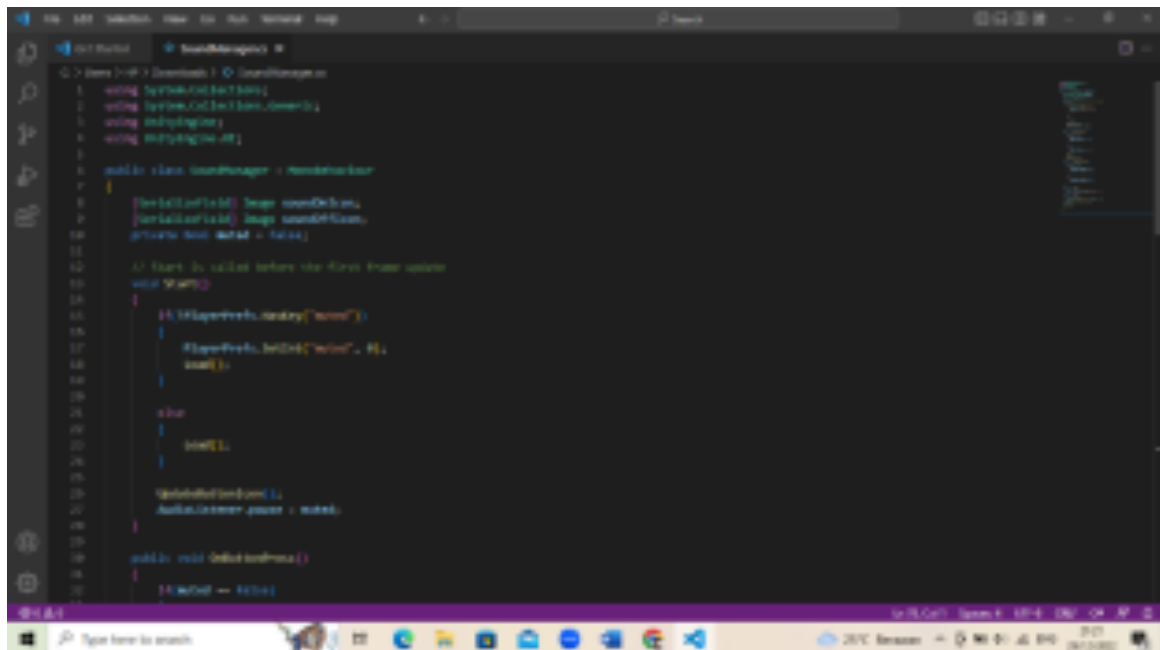
To add background music, create an Empty object named 'Background Music' and then add a script that plays the background music throughout the scenes. In the Component section, add the music you want to use to the AudioClip within the Audio Source.

Picture 2. Script background music

The method used to create a button that functions to turn on and off the background music is to create an Empty object and rename it to Sound Manager. Then, add a script to the Sound

Manager that allows the audio button to toggle the background music on and off, as well as change the button image to indicate whether it is on or off in the Component section.
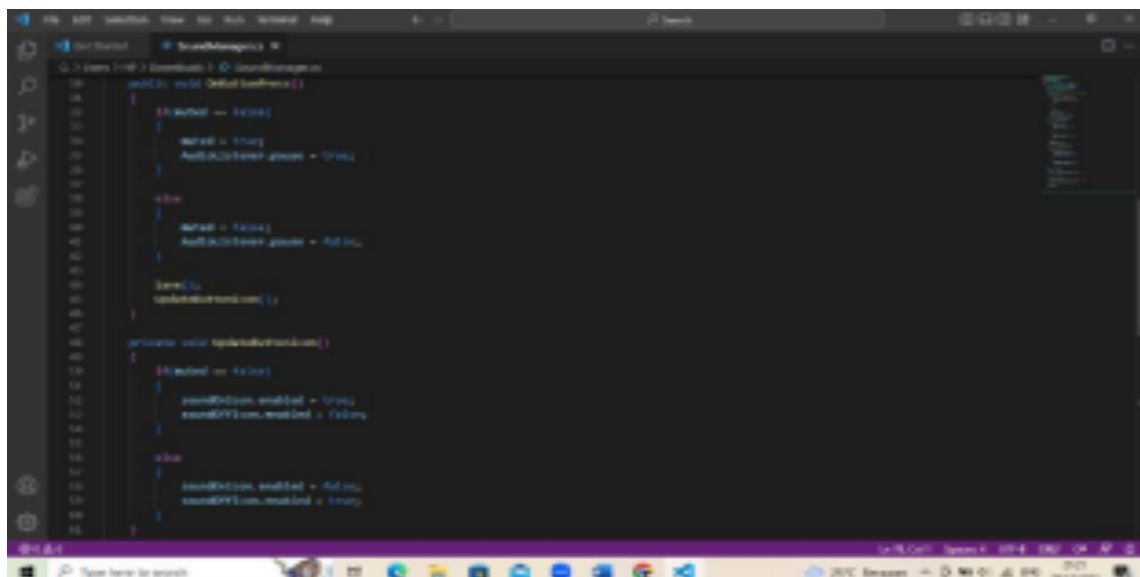
Picture 3. Sound manager script 1

Picture 4. Sound manager script 2
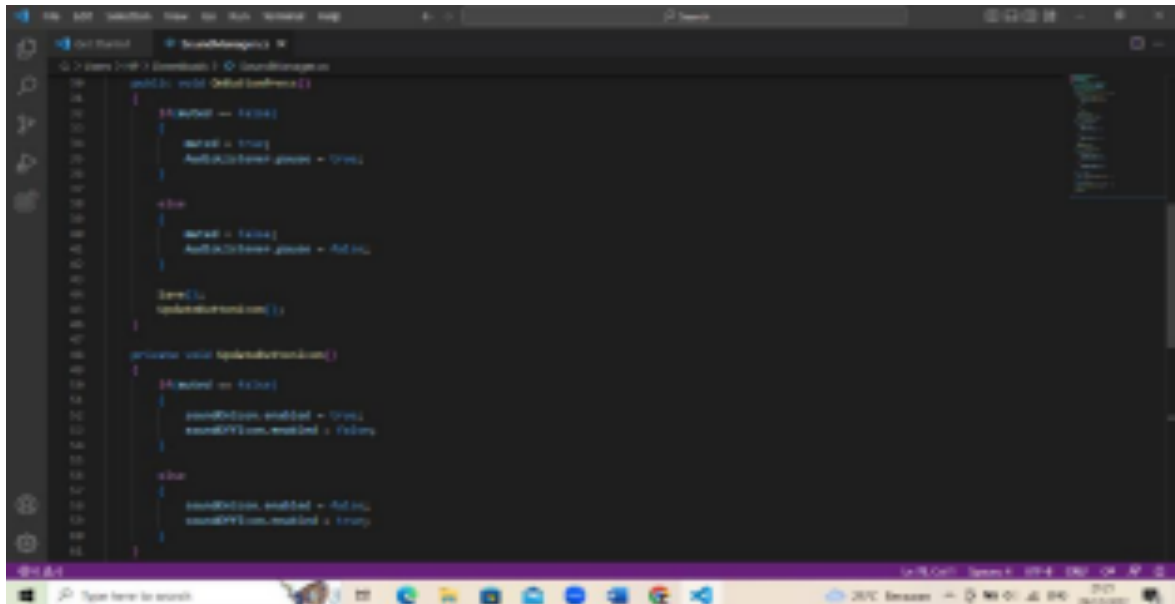
Picture 5. Sound manager script 3

Next, create a button named Sound Button on the Canvas. In the button, add two images through the UI, named Sound on Icon and Sound Off Icon, and assign the images for the on and off states of the background music to the Source Image section in the Inspector. Then, go back to the Sound Manager Empty object. There are two empty fields named Sound on Icon and Sound Off Icon. Drag the Sound on Icon and Sound Off Icon images from the Sound Button onto the respective empty fields in the Sound Manager, matching their names.

On the Sound Button, in the Inspector, there is an On Click event. Add the 'Sound Manager' Empty object containing the script to the On Click event. Next, select the OnButtonPress option in the Sound Manager.

On the Sound Button there is an On Click in the inspector added by dragging an Empty object named Sound Manager containing a script into On Click. Next choose the OnButtonPress menu in the Sound Manager section.

To create a button that functions to exit the application, create an Empty object named 'Exit Game Manager' and add a script that allows the button to be clicked to exit the application in the Component section.
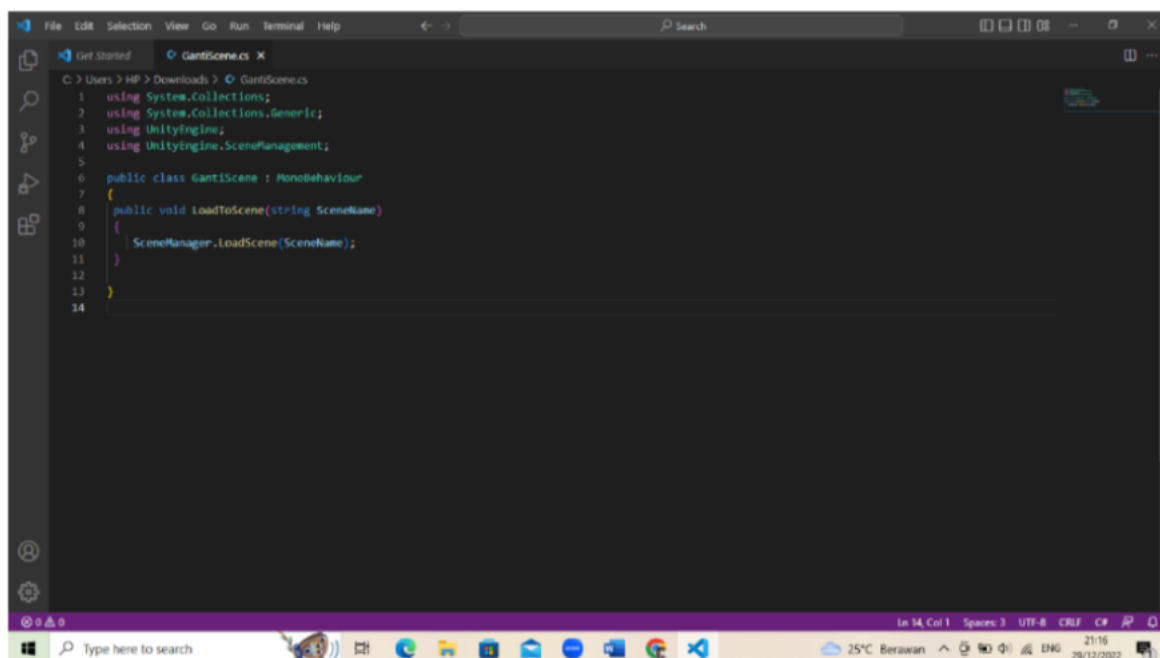
Picture 6. Exit game manager script

Then, in the Canvas section, a button named Exit is created. To change the image on the button, you can insert an image in the Image Source section in the Inspector. The size and position of the button can be adjusted by modifying the Transform. An empty object named exit game manager with a script is dragged into the On Click in the Inspector section. The next step is to select the Quit Game option in the Exit menu.

To create an AR Camera, right-click in the Hierarchy section and select the Vuforia Engine menu. In the Vuforia Engine menu, click on AR Camera. Next, the image used as a marker is added to the scene by right-clicking on the AR Camera and selecting the Image Target option in the Vuforia Engine menu. In the Inspector, the Image Target section contains the Image Target Behaviour component, where the Database and Image Target are adjusted according to the ones to be used for Augmented Reality.

After everything is set up, the project is saved, and then the Build Settings menu is clicked in the file. All scenes are added to Scenes in Build in the order they appear in the application. The icon and name of the application are changed by selecting the Player Settings menu. In that section, the Company Name is changed to the group name, Group 1 Class 5A', the Product Name is changed to "Kisah Si Jojo", and the Default Icon is changed to the application image for 'Kisah Si Jojo'. Once done, the Unity project is built.

An issue that was encountered is that after building and testing the application on a mobile phone, all button positions became disorganised. This was tested on different types of phones, and the results were the same, with the buttons being disorganised. The solution to address this issue is to change the UI Scale Mode in the Canvas Scaler section in the Inspector for each scene to Scale with Screen Size. By doing so, the buttons that have been positioned correctly will retain their positions on each phone type because the canvas will adjust its size according to the user's phone screen layer (Yin et al., 2022)

Another issue encountered was that the application icon image did not appear when installed on a mobile phone, even though an image was inserted into the Default Icon. The solution to address this issue is to configure Adaptive and Legacy Icons. By doing so, the icon display can appear on all Android versions on the phone when installed.

Another problem that required starting the project from scratch was selecting Unity 2D at the beginning. This mistake was realised when starting to work on augmented reality. The Vuforia Engine menu was not found in that project. When the project was created with Unity 3D, the Vuforia Engine menu was available. This is why the Kisah Si Jojo application had to be created from scratch in a Unity 3D project in order to incorporate augmented reality.

One of the common obstacles faced during the completion of this project was encountering several errors in the Unity application. These errors included missing downloaded components and tools that didn't function as expected. As a new Unity user, these errors posed the biggest challenge as they were difficult to understand and resolve. The solution adopted was to search for solutions or answers to the errors faced by others with similar issues through Google and the Unity community forums.

4. CONCLUSION

The Kisah Si Jojo application is an Android-based literacy application aimed at enhancing the reading interest of students, created using the Unity application. Before developing the application, there are several preparations that need to be made, such as concept development, planning, storyboarding, image components, backgrounds, and more. During the development of this application, there were certainly various challenges encountered, ranging from the devices used to the developer's understanding of creating applications using Unity. However, all difficulties and challenges that arose during this process were successfully overcome.

5. AUTHOR'S NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirm that this paper is free from plagiarism.

6. REFERENCES

Ahmad, I., Samsugi, S., and Irawan, Y. (2022). Penerapan augmented reality pada anatomi tubuh manusia untuk mendukung pembelajaran titik titik bekam pengobatan alternatif. *Jurnal Teknoinfo*, *16*(1), 46-53.

Almelhi, A. M. (2021). Effectiveness of the ADDIE model within an e-learning environment in developing creative writing in EFL students. *English Language Teaching*, *14*(2), 20-36.

Ati, A. P., and Widiyarto, S. (2020). Literasi bahasa dalam meningkatkan minat baca dan menulis pada siswa smp kota bekasi. *Basastra*, *9*(1), 105-113.

Fami, A., and Hikmat, A. M. (2022). Teknologi augmented reality untuk memorabilia pameran:"OURCHETYPE". *Jurnal Sains Terapan: Wahana Informasi dan Alih Teknologi Pertanian*, *12*(2), 60-76

Firmansyahputra, B., and Cherid, A. (2020). Aplikasi multimedia pengenalan huruf alfabet, buah dan hewan menggunakan teknologi augmented reality. *J. Telekomun. dan Komput*, *9*(3), 173-185.

Hasanah, N. (2020). Media komik dalam meningkatkan keterampilan membaca siswa di gubuk baca sekolah pagesangan wintaos gunungkidul (Studi Fenomenologi). *Jurnal Transformatif (Islamic Studies)*, *4*(1), 49-62.

Hürst, W., and Van Wezel, C. (2013). Gesture-based interaction via finger tracking for mobile augmented reality. *Multimedia Tools and Applications*, *62*, 233-258.

Jannah, R., and Oktaviani, R. N. (2022). Pengaruh penggunaan media augmented reality terhadap kemampuan literasi numerasi digital pada pembelajaran matematika materi penyajian data kelas v mi at-taufiq. *Jurnal Ibriez: Jurnal Kependidikan Dasar Islam Berbasis Sains*, *7*(2), 123-138.

Kurniawati, F. N. A. (2022). Meninjau permasalahan rendahnya kualitas pendidikan di indonesia dan solusi. *AoEJ: Academy of Education*, *13*(1), 1–13.

Lee, K. (2012). Augmented reality in education and training. *TechTrends*, *56*(2), 13-21

Marshall, T., Keville, S., Cain, A., and Adler, J. R. (2021). On being open-minded, wholehearted, and responsible: A review and synthesis exploring factors enabling practitioner development in reflective practice. *Reflective Practice*, *22*(6), 860-876.

Nincarean, D., Alia, M. B., Halim, N. D. A., and Rahman, M. H. A. (2013). Mobile augmented reality: The potential for education. *Procedia-social and behavioural sciences*, *103*, 657-664.

Nirwana, E. S. (2021). Pengembangan media pembelajaran berbasis game android untuk anak usia 5-6 tahun. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, *6*(3), 1811-1818.

Silalahi, D. E., Herman, H., Sihombing, P. S. R., Damanik, A. S., and Purba, L. (2022). An Analysis of students' achievement in reading comprehension through higher order thinking skills (HOTS). *Al-Ishlah: Jurnal Pendidikan*, *14*(2), 1853-1868.

Putra, M. T. M., Sari, A. K., and Risnasari, M. (2018). Pengembangan game educative berbasis android pada materi bangun ruang untuk siswa sekolah dasar. *Jurnal Ilmiah Edutic: Pendidikan dan Informatika*, *5*(1), 39-47.

Ramadhan, A. F., Putra, A. D., and Surahman, A. (2021). Aplikasi pengenalan perangkat keras komputer berbasis android menggunakan augmented reality. *Jurnal Teknologi Dan Sistem Informasi*, *2*(2), 24-31.

Ramadhanty, E., Tolle, H., and Brata, K. C. (2019). Pengembangan aplikasi navigasi menggunakan teknologi augmented reality pada perangkat smartphone berbasis android (Studi Kasus: Jawa Timur Park 1 Malang). *Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer e-ISSN*, *2548*, 964X. *3*(8), 7594-7602

Rohim, D. C., and Rahmawati, S. (2020). Peran literasi dalam meningkatkan minat baca siswa di sekolah dasar. *Jurnal review pendidikan dasar: Jurnal kajian pendidikan dan hasil penelitian*, *6*(3), 230–237.

Suharyanto, E. (2021). Pengembangan aplikasi augmented reality berbasis android untuk pengenalan hewan endemik. *Jurnal Ilmu Komputer*, *4*(2), 33-37.

Yin, K., Hsiang, E. L., Zou, J., Li, Y., Yang, Z., Yang, Q., and Wu, S. T. (2022). Advanced liquid crystal devices for augmented reality and virtual reality displays: principles and applications. *Light: Science and Applications*, *11*(1), 161 - 183.