Development of 3D Educational Game with Pancasila Theme based on Android

Anthon Arie Kimbal
Dept. of Informatic Engineering
Manado State Polytechnic
Manado 95252 North Sulawesi
Indonesia

Olga Engelien Melo
Dept. of Informatic Engineering
Manado State Polytechnic
Manado 95252 North Sulawesi
Indonesia

Robby Tangkudung
Dept. of Informatic Engineering
Manado State Polytechnic
Manado 95252 North Sulawesi
Indonesia

Harson Kapoh
Dept. of Informatic Engineering Manado State
Polytechnic Manado 95252 North Sulawesi
Indonesia

Roby Lumbu
Dept. of Informatic Engineering Manado State
Polytechnic Manado 95252 North Sulawesi
Indonesia

ABSTRACT

Pancasila is the ideology of the Indonesian nation which was born from the culture and history of Indonesian society which existed long before the Indonesian nation became independent. The founding fathers of the nation succeeded in exploring noble values and then formulating them into a guideline or ideology, namely Pancasila. The culture and attitudes of the Indonesian people are reflected in the values and symbols of Pancasila. The aim of the research is to find games that can provide educational knowledge of Pancasila values that can be played by children and adults and as a learning medium in the form of mobile games. The Game Based Learning (GBL) method used is learning using games as a learning medium and data collection methods using observation, interviews and literature studies. This game application is on the Android platform and uses the Unty 3D application as a medium for designing educational games. Unity 3D, Blender, Visual Studio, and C# programs, are used to create Android-based games. The results of the research obtained are that the functionality of this game application is suitable for use, which is the result of trials using the blackbox method.

General Terms

Game Development.

Keywords

Educational Games, Pancasila, 3D, Android Platform

1. INTRODUCTION

Pancasila is the foundation of the Indonesian state which contains the values of the Indonesian nation that have existed for a long time which serve as guidelines for national and state life.

There are many ways to introduce and teach Pancasila so that it remains sustainable in national and state life. The current young generation, known as the millennial generation, is very vulnerable to moral degradation which is not in accordance with the foundations of Indonesia, namely Pancasila.

Practicing and preserving the values of Pancasila so that they will not be forgotten by utilizing Android or mobile based games and implemented on current existing smartphone technology.

This game was created using the Unity 3D application, Blender, Visual Studio, and the C Sharp program, so that this game could be created with interesting characteristics. The aim of making this educational game about Pancasila is not just a game, but can educate players and increase interest in learning.

This research was conducted to answer how to design and implement an educational game about Pancasila using Unity 3D, Blender, Visual Studio and the C Sharp Program?

So as to produce a game that can educate players about the history and values of Pancasila, creating a game that is easy and interesting to play.

2. RESEARCH METHODE

2.1 Research Planning

Game Based Learning

According to Annie Pho (2015) Game Grounded Literacy (GGL) to increase the knowledge of students or users for the learning process, they can use or utilize the principles of the game, namely game grounded literacy (GBL). GBL has elements of psychology, motivation, student involvement, allowing students to get an enjoyable experience from the educational material taught and through dynamic processes, besides that the design of learning activities is carried out in stages in introducing concepts as well as guiding users or students towards the final goal. There are 5 stages of GBL

These five stages are as follows:

2.1.1 Application design stage, this stage is the stage of collecting data and researching the needs that will be used in the form of studying literature and consulting with supervisors as ideas providers, as well as playing games that have a concept that is almost the same as the concept of the game that will be created.

2.1.2 Application design, at this stage, planning is carried out for the game design that will be made according to the data collection that has been carried out, including planning what game engine will be used, what application will be used to design the characters in the game, and what programming language will we use in the game .

2.1.3 Application creation, at this stage, is made, namely, a game engine using Unity 3D software, the Blender application as a character design application, and the C Sharp program as the programming language that will be used in the game.

2.1.4 Testing stage, at this stage testing will be carried out with the aim of finding out whether the game runs smoothly or whether there are problems in the game, an example of a problem in the game is the occurrence of bugs, where the application system experiences several errors that make the

game look strange. If a problem occurs then the process will return to the application creation stage, if the problem has been fixed then the application is ready to be used.

Application System Ok, the final stage is to produce a game that is in accordance with the concept that has been planned.

Stages or research procedures carried out using several methods such as Waterfall
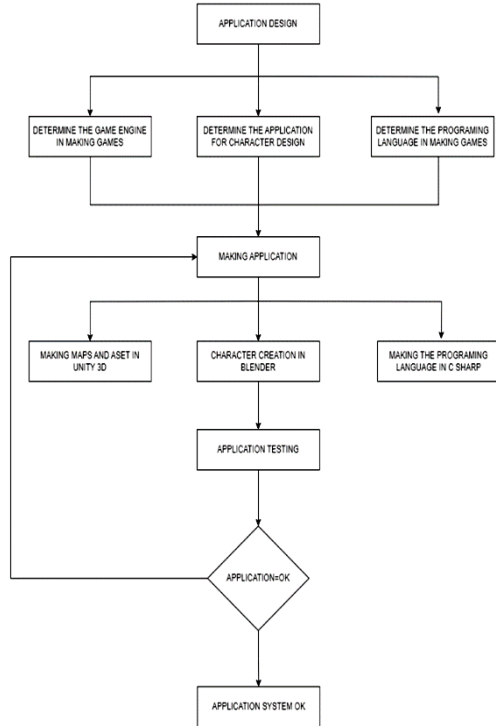

Figure 1.

2.2 Problem Analysis

Due to the basic results of observations, interviews, literature studies, and Google searching that the author did, the author evaluated and found that there were still many deficiencies in society regarding knowledge of the history of Pancasila and values. The media for learning related to the history of Pancasila and Pancasila values are mostly less interesting and there are still few games with educational themes about the history of Pancasila.

The following is an explanation of the framework for making games. This framework will be divided into steps, then accompanied by explanations..

First step: Designing the story
The game will be easier if the creator has designed the concepts in the game. Actually, not all games have to have a storyline, but in this research, the author included the storyline contained in the game.

Second step: Gameplay design
Before making a game, the creator must know what the gameplay is like. Will the game be an action game, racing game, and so on. Gameplay is the way a game runs or how the game is played.

Third step: Designing and creating characters.
If you have got the story and gameplay, you can continue with designing and creating characters according to the creator's wishes. The character created is a player character that is run by the player. After that, the character is made according to the design into a 3D model using the Blender application.

Fourth step: Create additional models.
Once a character is created, the character cannot do anything, therefore there must be objects or an environment around him. After the character of the model has been determined, the next step is to create models such as ground, trees, rocks, checkpoints, and so on.

Fifth step: Design and create face to face.
The interface itself has a role as a medium of interaction between players and the game. The next step is to design the interface such as the buttons needed, the images needed, the location of the media and so on. Then these media are created using supporting programs, for example creating game titles in the main menu using the Photoshop application.

Sixth step: Asset preparation.
Completed characters, models, interfaces and other supporting objects that will be used in the game are called assets. The completed assets will be imported into the game project within Unity itself and arranged neatly in such a way.

Seventh step: writing the script.
Assets that have been imported cannot do anything if there are no instructions in them. These commands are given with a script. These scripts are created and embedded into the appropriate assets so that the game can be run and run.

Eighth step: Test and improve.
The game that has been created then enters the testing process by playing it on the intended media. For this game the author uses Android media. These trials will produce errors in the game, including errors in scripts, models, characters and animations. The errors were then corrected and tested again. This process is repeated until the game is correct and there are no more errors.

Ninth step: Evaluation.
While making the game, the author gained experience. From this experience, lessons can be learned that can be applied to the next game that will be made with professional qualities.

2.3 Outline of the Game Created

The game created is an adventure game with human characters. The reason the author chose an adventure game is because this adventure game is common in society and is interesting to play and the animated human characters used in the game attract the attention of players. This game was created with two applications, namely Blender to create 3D animated characters and Unity 3D to compose this game. The point of view taken in this game is a third person perspective where the camera is behind the animated character being played and the graphics chosen are 3D graphics. The way to play is to move the joystick in the game interface. This game is made specifically for the Android platform.

2.4 System Design, namely Using Flow Diagrams, Use Cases, and Activity Diagrams.

The data flow section is a concept that describes the sequence of program activities from the beginning to the end. Aims to illustrate and describe a reasonable sequence that will be used or applied when writing programs for computers to run.

2.4.1 Educational Game Application Data Flow Diagram
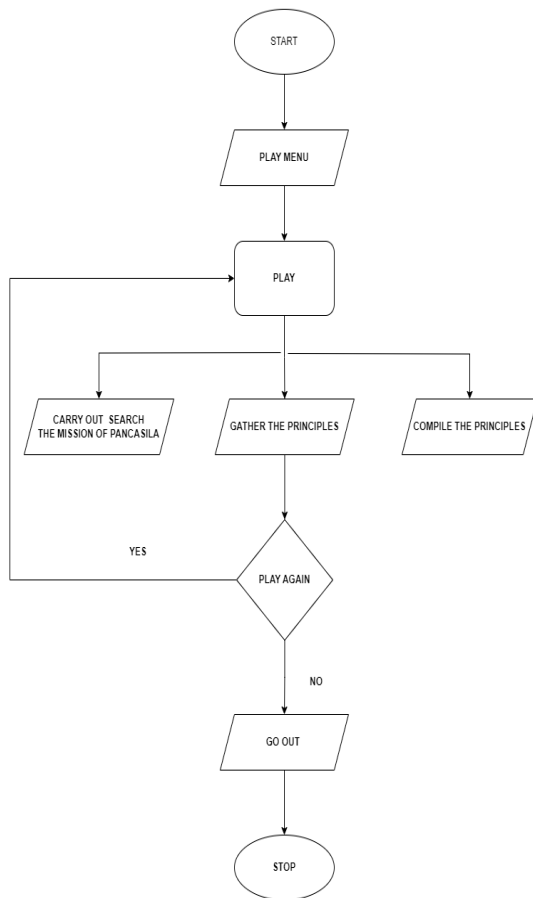
Fig 2: Data Flow Diagram of Educational Game Application

Start: To enter the game

Main Menu: To enter the game menu

Play: Menu to start playing

Carrying out missions: While playing, players will carry out missions

Collecting Precepts: When carrying out a mission, the mission is to collect 5 precepts.

Compiling Precepts: Players will compose precepts, which are useful for knowing the history and values of each mission.

Play Again: If the player has finished carrying out the mission, the player will be asked to play again or exit the game.

Exit: Exit the game.

2.4.2 Playing Section Data Flow Diagram
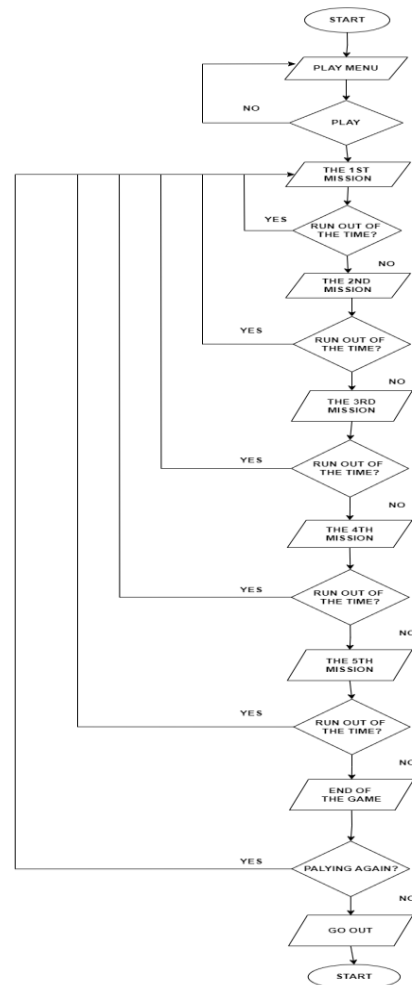
Fig3: Data Flow Diagram of the Playing Section Bermain

Start: To enter the game

Main Menu: First display when entering the game

Mission 1: The first challenge is to find the first precept so that the second mission can occur

Mission 2: The second challenge is to find the second precept so that the third mission can occur

Mission 3: The third challenge is to find the third precept so that the fourth mission can occur

Mission 4: The fourth challenge is to find the fourth precept so that the fifth mission can occur

Mission 5: Fifth challenge to find the fifth precept so that the mission can be completed

Running Out of Time: If the player takes too long to search for the checkpoint while carrying out the mission, the player will run out of time

Play Again: If the mission has been completed, the player will be asked whether to play again or exit the game.

Exit: The player will exit the game.

2.4.3   Use Case Diagram
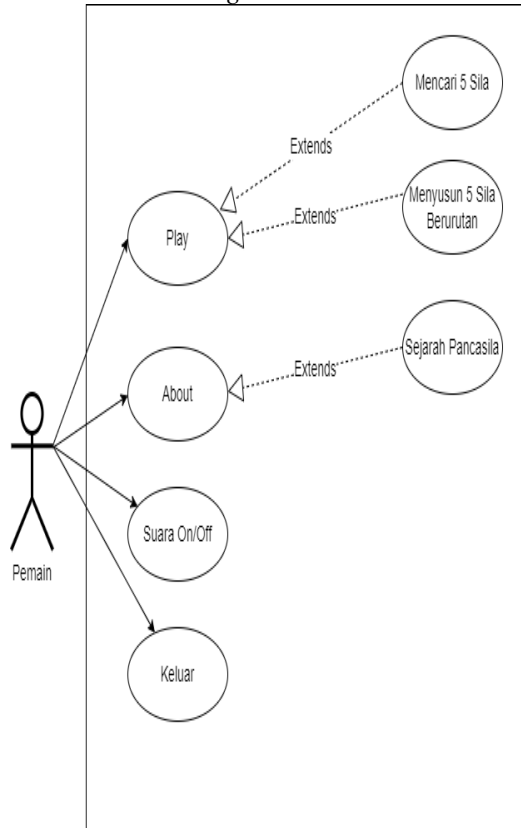

Fig 4: Use Case Diagram

The use case diagram in this educational game was created to illustrate the interaction between users and the educational game. This game has 3 main menus, namely the game start menu, about and exit.

When the user opens the game, the player will immediately go to the main menu. When the player selects the play menu, the player will search for 5 precepts, when searching for the mission there will be 5 checkpoints, each checkpoint will contain the history and philosophy of Pancasila.

If the player selects the "about" menu, the player will see a brief history of Pancasila and in "about" you will see biodata about the game creator.

If the player selects the "exit" menu, the player will be exited from the game.

2.4.4   Activity Diagram Game Edukasi
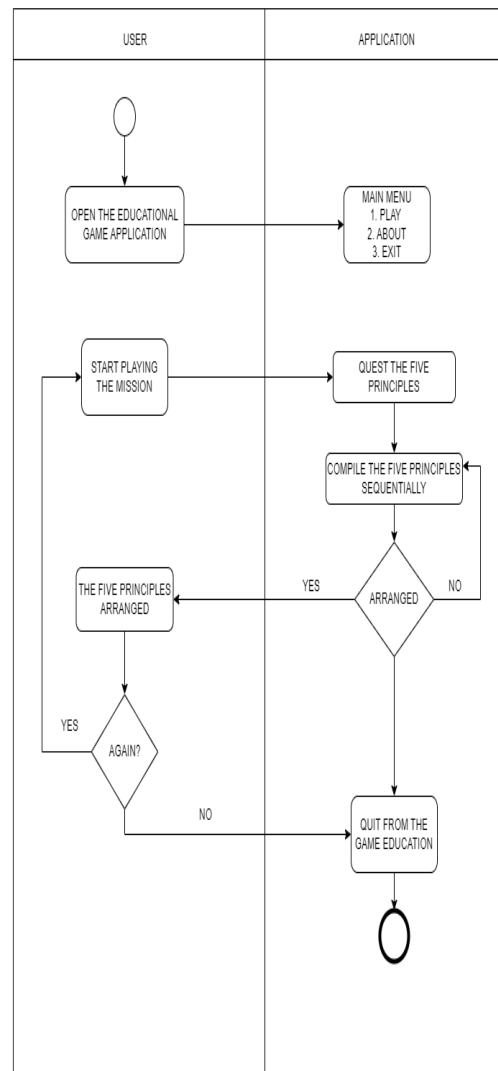
Fig 5: Activity Diagram Play Menu

Opening an Educational Game Application: The user opens the game.
Main Menu: Next, the application displays the Main menu.
Start Playing Carrying Out a Mission: On the menu, the user presses "Play" to start carrying out a game mission.
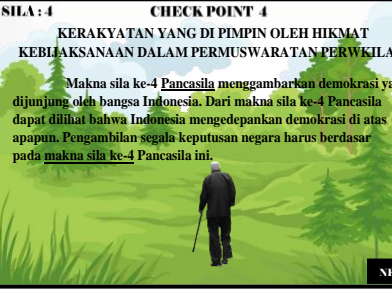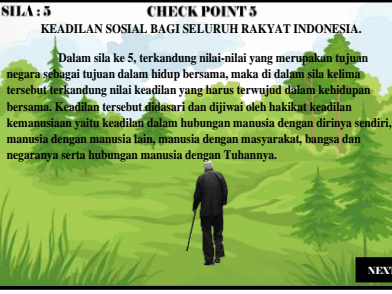Looking for the 5 Precepts: In searching for a mission, the mission is to look for the 5 precepts.
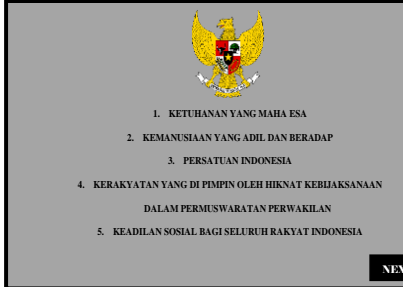Arrange 5 Precepts in Sequence: Players will arrange 5 precepts in sequence to complete the mission. If you run out of time searching for a mission, the application will ask the player to restart the game or not. Otherwise the player will leave the game.

2.5 Storyboard Game

A storyboard is a series of photos or drawings that show the outline of the story of a game, film, etc. In this storyboard, it shows the storyline of an educational game on the internalization of Pancasila.

	Scene 1 : The main menu section to start the Pancasila adventure game
	Scene 2 : begins with a preface about the briefly meaning of Pancasila
	Scene 3 : Before the adventure begins there will be guidance about what mission has to do by the player in this game..
	Scene 4 : In this scene, the player has received the first mission, that is finding the first principle : "Ketuhanan Yang Maha Esa" (Belief in the one and only God). A mission where everyone has the right to have freedom in determining the religion to follow
	Scene 5 : The adventure will keep going, now entering the second mission. That is the second principle : "Kemanusiaan Yang Adil Dan Beradab" (a just and

	civilized humanity). A mission of all human beings are equal before the law without exception."
	Scene 6 : The third mission is "Persatuan Indonesia" (The unity of Indonesia). A mission where the unity is important and be needed in the country of Indonesia, so Indonesia will be strong and can work together
	Scene 7 : The fourth mission quest" kerakyatan yang di pimpin oleh hikmat kebijaksanaan dalam permusyawaratan perwakilan" (Democracy guided by the inner wisdom in the unanimity arising out of deliberations among representatives). It is a mission where democracy is chosen in an Indonesia state order
	Scene 8 : The last mission quest is the fifth principle, "Keadilan sosial Bagi Seluruh Rakyat Indonesia" (Social justice for the whole of the people of Indonesia). One of the no less important mission in Indonesia, that

	is justice. Justice must be upheld and do not discriminate against each other.
	Scene 9 : If the five mission has been obtained, the adventure ends and the mission will be arranged in the completeness of Pancasila as the state ideology of Republic Indonesia.
	Scene 10 : The last part where's the adventure safely ended.

Fig 6: Storyboard Game

At the analysis stage the system requires data so it is necessary to collect qualitative data, namely primary data. Research stages include, among other things, carrying out activities or activities to study each data source from books and other sources of information related to research activities and needs. The data collection and retrieval techniques used are:

2.5.1   Observation
Observation is an activity carried out by observing the object being studied. This activity is carried out either directly or indirectly in order to obtain data from research.

2.5.2   Interview
Interviews were conducted to obtain data and information related to the problem being studied. In this research, interviews were conducted with parties in the electrical engineering department to obtain data and information.

2.5.3   Literature Study
Theoretical references are needed for literature related to the research being conducted.

2.6 Interface Design
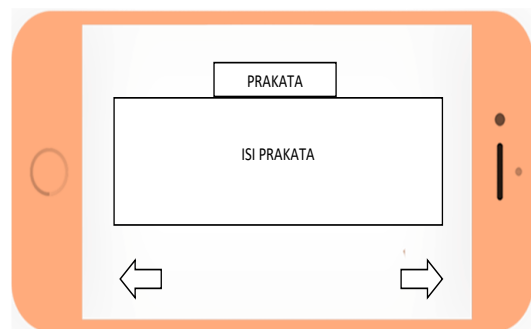The following is the educational game application interface design:

Main Menu Display

Fig 7: Main Menu Display

The main menu display is a design for the main menu display in educational games.
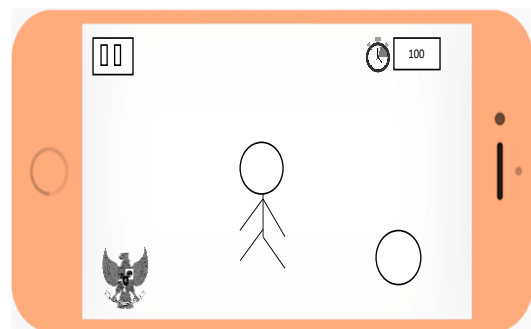
2.6.1   Preface Display

Fig 8: Preface Display

The foreword display is a display that briefly explains the state ideology and explains the mission that will be played in this educational game.

2.6.2   Gameplay Display

Fig 9: Gameplay Display

The gameplay display is a design to create an appearance when the game is played. For example, designs for joystick placement, the Pancasila logo, time images, and game pause images.
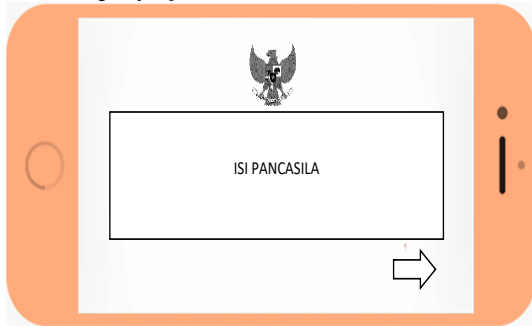
2.6.3 Display of Pancasila Contents

Fig 10: View of Pancasila Contents

The Pancasila content display is a display design for each checkpoint of the mission being carried out.
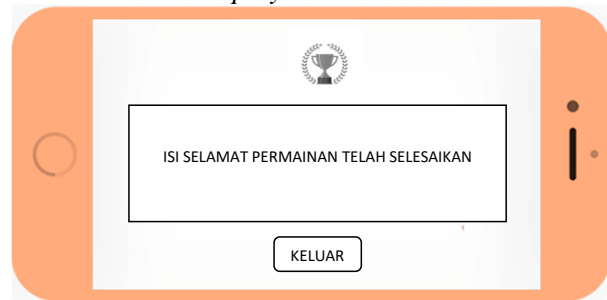
2.6.4 End Game Display

Fig 11: End Game View

The final display of the game is the display design for the end of the game where after the mission has been completed, this is the final display of the game.

2.7 Aplication Display

When the game App has been created, then the game is tested and implemented by trialling first, the aim is to find out whether the game is running smoothly or has problems while playing. In the testing stage, this application is run or played by the user. The following are the results of the implementation and testing of the interface contained in this Pancasila History educational game.

2.7.1 Main page

Fig 12: Halaman Utama

This main page is the initial menu of this application game which functions to connect to other pages, including "Play" to start the game, "About" to display the purpose of creating the game and biodata of the game creator, "Quit" functions to exit the game.

2.7.2 Play Yard

Fig 13: Page of Play

Once the user presses the "Play" button, the player will go to the play page. The initial display is the foreword, the content in the foreword is the ideology of Pancasila and the meaning of Pancasila.

2.7.3 Game Display Page

Fig 14: Game Display Page

After the foreword has been read and next, it will go to the game page display.

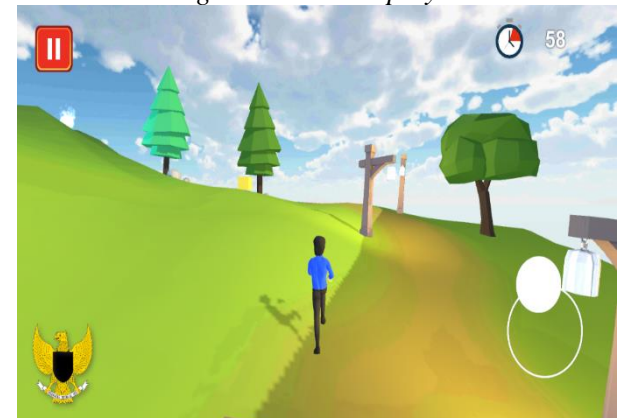### *2.7.4 Running Character Display*

Fig 15: Running Character Display

While playing, the player moves the character by pointing at the joystick on the screen.
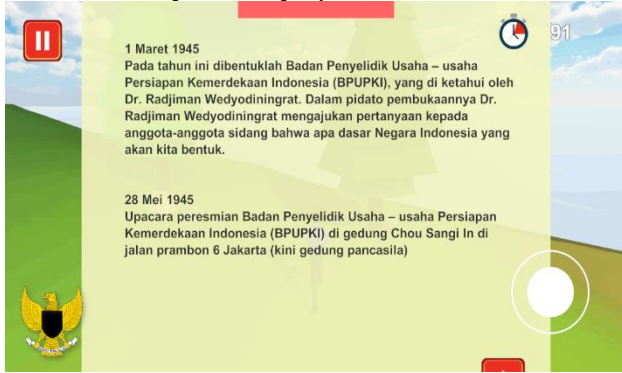
2.7.5   Checkpoint Display

Fig 16: Checkpoint Display

If when searching for points, you will get a display about the history of Pancasila, the history of Pancasila will be complete gradually as the points you are looking for are found..

2.7.6   End Time Display

Fig 17: End Time Display

If the player is slow when searching for a mission and runs out of time, the "Restart" display will appear to restart the mission or "Quit" to exit the game and go to the menu page or main page.

2.7.7   Last Mission Display

Fig 18: Last Mission Display

If the points have been collected and are successful, Pancasila along with the five precepts will be displayed.

2.7.8   End Game View

Fig 19: End Game Display

When the last mission has been obtained, the player has succeeded in carrying out the mission in this game. Namely the congratulations display, and "Quit" to exit the game.

3.   TEST

3.1 Black Box Test

In testing the Pancasila History educational game application using the Black Box method. The function of testing the Pancasila History educational application game is to find out whether the features in the game work as expected or not. Testing the feedback from each function operated on the Pancasila History educational game application.

Table 1. Black Box Test

No.	Features Tested	Expected	Conclusion
1.	Homepage	Enter the application	[√] [ ]
2.	Play Page	Users can go to the play page	[√] [ ]
3.	Foreword display page	Users can see the game introduction	[√] [ ]
4.	Page Point 1	Users can see the display point 1	[√] [ ]
5.	Point 2 page	Users can see display point 2	[√] [ ]
6.	Point 3 page	Users can see display point 3	[√] [ ]
7.	Page Point 4	Users can see display point 4	[√] [ ]
8.	Point 5 page	Users can see the display point 5	[√] [ ]
9.	Page Out of Time	Users can see the timeout display	[√] [ ]
10.	Final Mission Page	Users can see the composition of Pancasila	[√] [ ]
11.	End of game address	Users can see the final display of the game and mission completion.	[√] [ ]

| 12. | Page Return to Main Page | Users can go to the main menu page or the main page | [√] [ ] | |

3.2 Test Software

Testing of this software was carried out on hardware: Samsung A22 4G cellphone, MediaTek Helio G80 processor, 6 GB RAM, 128 GB ROM with Android 11 version.

3.2.1.1 Home Menu Page

Tabel 2. Test Of Software

No.	Testing	Inputs	Output	Conclusion
1.	Enter Application	Touch the Educational Game Application icon on the Android cellphone screen	Displays the main menu page for educational games on Android phones	Succeed
2.	Play Button	Touching the play button on the main menu page of the educational game	Displays educational game play pages	Succeed
3.	Exit Button	Touching the exit button on the main menu page of the educational game.	Displays the exit page of the educational game.	Succeed
4.	Pause button	Touching the Pause button during gameplay	Displays the menu, whether you want to stop or continue the game	Succeed

3.2.1.2 Menu Page of Play

Table 3. Menu Page of Paly

No.	Testing	Inputs	Output	Conclusion
1.	Next button	Touching the next button	Displays Next Page	Succeed
2.	Back Button	Touching the Back Button	Displays Previous Page	Succeed

| 3. | Restart button | Touching the Restart Button | Displays a page to restart the game when you lose or run out of time | Succeed |
| 4. | Exit Button | Touching the Exit Button | Displays the page for exiting and returning to the main page | Succeed |

4. CONCLUSION

In making an Android-based Pancasila Educational Game Application, it can be concluded that Unity 3D, Blender, Visual Studio, and the C# program can be used to create an Android-based game and the game can be used and played. Learning using the Android platform can attract everyone's interest because it has a display that can be moved so as to increase motivation to learn about the history and values of Pancasila and apply it in everyday life.

5. ACKNOWLEDGMENT

6. REFERENCES

[1] Admin. (2021, Desember 23). Understanding Games, Types and Benefits of Games. Retrieved from lambeturah: https://lambeturah.id/pengertian-game/

[2] Asfihan. (2022, Juni 11). Understanding Android. Retrieved from ruangpengetahuan.co.id/: https://ruangpengetahuan.co.id/pengertian-android/

[3] Azqiya, D. (2021, September 7). Get to know the Blender Application. Retrieved from Leskompi: https://www.leskompi.com/mengenal-aplikasi-blender/

[4] Bintara, W. S. (2022, Juni 9). Understanding Blender – History, Features, Advantages, Disadvantages. Retrieved from dianisa: https://dianisa.com/pengertian-blender/

[5] Filus, T. (2017, Januari 18). Introduction to the C# Programming Language. Retrieved from CODEPOLITAN: https://codepolitan.com/blog/pengenalan-bahasa-pemrograman-c-587effa1cb95b

[6] Hernawan, R. (2022, Juni 10). Understanding Android along with its history, advantages and disadvantages. Retrieved from nesabamedia.com: https://www.nesabamedia.com/pengertian-android-beserta-kelebihan-dan-kekurangannya/

[7] Lawrence, A. (2022, April 23). What is Visual Studio Code? Definition, advantages and how to install it. Retrieved from makinrajin.com: https://makinrajin.com/blog/visual-studio-code-adalah/

[8] Muhardian, A. (2020, Agustus 20). Learning C#: Getting to Know the C# Programming Language (untuk Pemula). Retrieved from petanikode: https://www.petanikode.com/cs-untuk-pemula/

[9] Parandaru, I. (2021, Mei 31). History of Pancasila. History of Pancasila as the Foundation of the State. Retrieved from

https://kompaspedia.kompas.id/baca/infografik/kronologi/sejarah-pancasila-sebagai-dasar-negara

[10] Rafarendra , A. H. (2020, juli 16). Get Acquainted With Unity 3D Features. Retrieved from Gamelab Indonesia: https://www.gamelab.id/news/211-berkenalan-dengan-fitur-fitur-unity-3d

[11] Restu, D. J. (2021THE URGENCY OF PANCASILA IN THE STUDY OF NATION'S HISTORY. Jakarta: OSF PREPRINTS. Retrieved from https://osf.io/dwu2q/

[12] Setiawan, M.Kom, D. (2022, Februari 15). Get to know the Visual Studio Code Editor. Retrieved from UNIVERSITAS STEKOM: http://teknik-komputer-d3.stekom.ac.id/informasi/baca/Mengenal-Editor-Visual-Studio-Code/a812f5ddfdd241c29f9645ea09e14dedbdae2f1b

[13] Student, I. (2022, Februari 10). 4 Understanding Educational Games According to Experts and Examples.Retrieved from IndonesiaStudent: https://www.indonesiastudents.com/pengertian-game-edukasi-menurut-para-ahli-dan-contohnya-lengkap/

[14] Syarif, S. (2020, 12 16). WHAT IS UNITY 3D GAME ENGINE AND ITS ADVANTAGES AND DISADVANTAGES. Retrieved from kaskus.co.id: https://www.kaskus.co.id/thread/5fd996ad2637721bec5008b2/apa-itu-unit