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Learn History Using the Rupiah Currency Utilizing Augmented Reality Technology

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Abstract: Studying history may be very boring for students. This is what makes history learning less effective. Education is an effort aimed at developing personality and abilities for life. In education, students are individuals who are different from other people in a class. This explanation can be seen in terms of ability. Every country must have a national identityTraditional dances in Indonesia are very diverse and have their characteristics. This is because the ethnic groups in Indonesia are very numerous and diverse. With advances in technology, it can be used as an alternative learning solution that is more creative and efficient. Therefore, it is the basis for expanding the application of learning about the history of heroes and dances on rupiah banknotes using the Augmented Reality Marker Training method. It is important to have a useful means of displaying and introducing each national hero featured on a particular currency By utilizing these technological Advances we can visualize images more realistically and in real-time, this is what will attract the interest of users, especially students, to use this application as a medium for learning the history of heroes and introducing regional dances found on the rupiah currency

Keywords: Augmented reality; Learn; Technology

Introduction

Everyone nowadays uses smartphones, tablets, and the like for daily purposes. There are many reasons to use them, one of which is practicality. With the rapid development of technology, it is very helpful, especially in the field of education (Garzón, 2021). We can use technology for more efficient learning media (Hidayat et al., 2021). Education is an effort aimed at developing personality and abilities for life. In education, students are individuals who are different from other people in a class. This explanation can be seen in terms of ability. Every country must have a national identity. Indonesia itself has a national identity, namely in the form of dance (Tjandra et al., 2023). There are around 1500 traditional Indonesian dances. Traditional dances in Indonesia are very diverse and have their characteristics. This is because the ethnic groups in Indonesia are very numerous and diverse (Yudhistira & Fatmawati, 2020). Therefore, many students still have difficulty recognizing every characteristic of traditional dance in Indonesia. National Hero is a title given to state awards for their struggle against colonialism so they died defending the nation and state of Indonesia (Brata et al., 2021). Thanks to his struggle, Indonesia was able to achieve independence. So to this day, to immortalize this struggle, their images are found on currency. Even though it has been immortalized in the rupiah currency (Fogg, 2019), there are still many Indonesian people, especially students, who only know a few of the names of national heroes. Therefore, it is important to have a useful means of displaying and introducing each national hero featured on a particular currency.

Previous research was carried out by Juniawan et al. (2022) with the title Using Augmented Reality Technology to Recognize Indonesian Heroes with Indonesian Banknote Markers. In this research, he created an application to recognize national heroes using the rupiah currency as a marker. Then there is research from Pradana et al. (2021), entitled Making Augmented Reality as a Learning Media about National Heroes. This research only included heroes, not regional dances, and then the researcher made cards as markers. Apart from that, there is also research from (Wulandari et al., 2022),

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entitled Traditional Cable Dance of the Bolaang Mongondow Region in Augmented Reality Cards. In this research, it was only for one type of dance and he made cards as markers (Nurrisma et al., 2021).

Meanwhile, this research builds an application by utilizing Augmented Reality technology with the 2022 emission rupiah currency, which is different from other researchers who still use the old emission currency. The reason researchers have a 2022 emission currency is that later users can easily find markers without needing to be afraid that the markers are no longer in circulation. Apart from that, other studies only include heroes or dances. This is different from the designed application where in this application the user can see the 3D form of the hero and the dance by pointing the smartphone camera at the 2022 emission rupiah currency which is used as a marker.

This research is structured into several parts. Section 2 presents the research method consisting of systems analysis. Section 3 explains the results and analysis consisting of System Design Results, Application Overview, Application System Flow, System Model Architecture, System Flowchart, Program Implementation, and Software Testing. Section 4 presents the Conclusions.

Method

Research Datasets

This research uses a dataset which is a database with a large number of 3D image formats, including 3D object assets of national heroes and regional dances (Skublewska-Paszkowska et al., 2022). With a total of 7 for national heroes and 7 for regional dances. In the process of creating 3D objects, researchers use Blender software to design 3D objects. With stages which include the first stage, namely modeling, then the next stage is texturing, namely the stage of giving texture to the surface of the object so that it looks realistic. Then the final stage is the rendering stage which is the final process of the entire 3D object modeling process. Apart from using a dataset in image format, researchers also used a complete dataset of material starting from biographies of heroes and the history of regional dances in Indonesia. Researchers got some of the datasets from e-books about national heroes and regional dances.

Research Framework

Researchers developed this application because many students and the public do not know about national heroes or regional dances. The reason is that learning media still uses the old method, namely writing and conveying theory. In this problem, researchers developed learning applications by utilizing technological advances. So that learning is more interesting and students do not get bored with learning activities. There are several methods used to solve the problem mentioned above. The first process is Problem Identification which begins with observing the surrounding environment and then continues with a systematic literature review. Data collection by observation, interviews, and questionnaires is the method used to collect research data. The next stage is data analysis to find solutions to the problems obtained. After that, the researcher created a research framework as in Figure 1.

Figure 1. Research framework

This research requires several methods, including identifying the Problem and looking at several related studies, there are still many Indonesian people who do not know history or even recognize Indonesian national heroes and there are still many who do not know about traditional Indonesian culture, one of which is regional dance. It would be a shame if Indonesian people did not cultivate traditional dances, it is feared that regional traditional dances in Indonesia will fade away or even disappear. Technology Approach, researchers take advantage of technological advances, one of which is Augmented Reality with a marker-based training method and using the 2022 emission rupiah currency as a marker. In the process, the smartphone acts as an output device capable of presenting 3D animation.

In the application system that was built, the mobile application, which as an output device displays 3D animation, is connected to the admin website that the researcher created, an admin website whose function is to process data that will later be displayed on the mobile application. The application development or model architecture designed by researchers is by utilizing AR technology, admin, database, marker-based tracking, Unity 3D, and Vuforia SDK.

Based on Figure 2, the stages of the Model Architecture can be explained, namely that the Admin processes the database and website to process data in the form of information data in the application. Meanwhile, users use an application to recognize national heroes

and regional dances using Android, by utilizing Augmented Reality technology using the 2022 emission currency as Marker Based Tracking to display 3D objects. Users also need an Android that has several sensor specifications, namely Accelerometer, Grotroscope, GPS, and a smartphone that supports ARcore services. Apart from that, the user scans to display 3D objects.

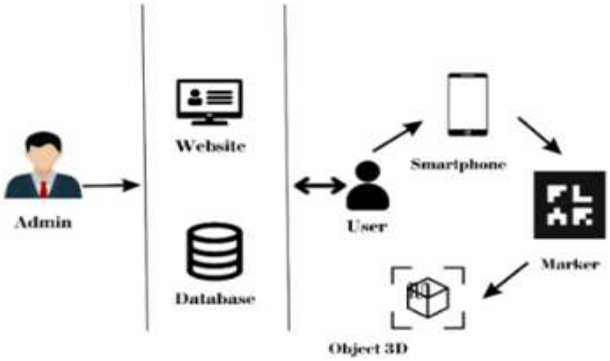

Figure 2. System model architecture

Design Analyst

Application Overview, in the application that the researcher designed, there are 5 buttons and there are also 4 menu options. A general overview of the application that the researchers designed can be seen in Figure 3.

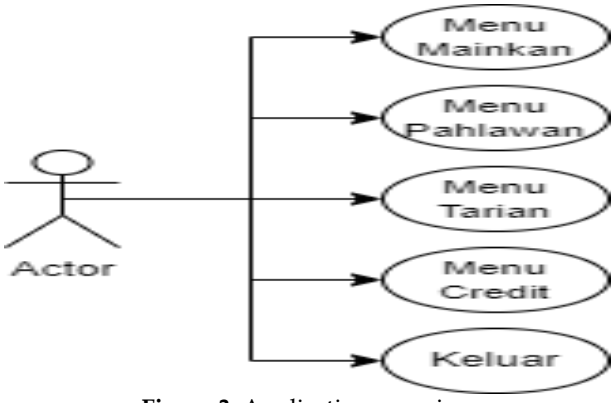

Figure 3. Application overview

Application System Flow, researchers designed this application using a flowchart. The flowchart itself is a useful chart for visualizing the flow of a system. The flowchart that researchers use can be seen in Figure 4.

A System Flowchart is a flow diagram design carried out to be developed by researchers. So that application creation can be done sequentially and connect the flows using arrows. The following design flow diagram for this application can be seen in Figure 5.

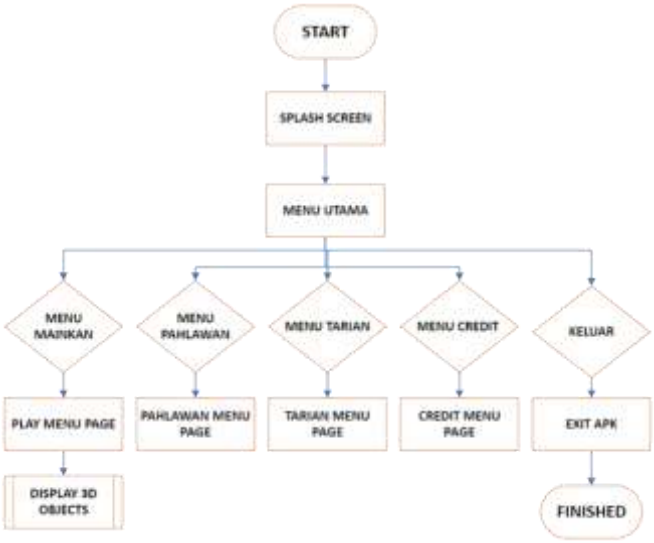

Figure 4. Application system flow

Flowchart User

Based on Figure 5 it can be explained about the Flowchart System that was created, namely as follows: The first step the user can run the application. Then the user selects the material menu and the camera detects the marker image. Once the marker is detected, a 3D object will appear, but if it is not detected, the 3D object will not appear.

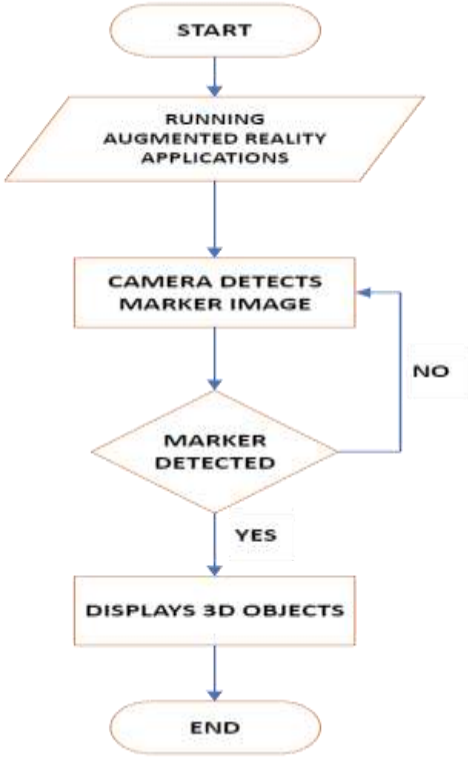

Figure 5. Flowchart user

Flowchart Admin

Based on Figure 6, it is explained that what the admin does is log in. If the admin enters the username or password incorrectly, an incorrect username or password warning will appear. If the username and password are valid, you will go to the home page. On the home page, there is a data display menu. In the data display the user can add data, change data, and delete data. In this activity the data entered is connected to the database. So the admin can display information data in the application.

Figure 6. Flowchart admin

Implementation

The implementation itself requires software and hardware to develop and run this system. Which consists of the following: The software that researchers use for application development includes: Microsoft Windows 10, Unity 2021.3.11f1, Blender 3.3, Monster Mash, and Inskape. The software that researchers use for application development includes Processor Intel® Core™ i7-7500U, Graphic Card Intel ® HD Graphics 620, and RAM 8GB. Apart from that, researchers need useful hardware to apply the system. The researcher himself used a Samsung Galaxy J4 Plus smartphone with the following specifications: Processor Qualcomm MSM8917 Snapdragon 425, GPU Quad-core 1.4 GHz, RAM 2 GB, Memory 16 GB, and Ratio 18: 5: 9.

Result and Discussion

Program Implementation

The following is the program implementation of the Augmented Reality Application as a Medium for Introducing Regional Dances and National Heroes on the 2022 Emission Rupiah Banknotes.

Application Program Implementation

Augmented Reality Application as a Media for Introducing Regional Dances and National Heroes on the 2022 Emission Rupiah Banknotes. Can be used on an Android OS of at least Android 8.0 Oreo. To use this application, a special marker is needed, namely 2022 emission rupiah banknotes. The following are the results of the application that the researchers designed. As seen in figures 7 - 12.

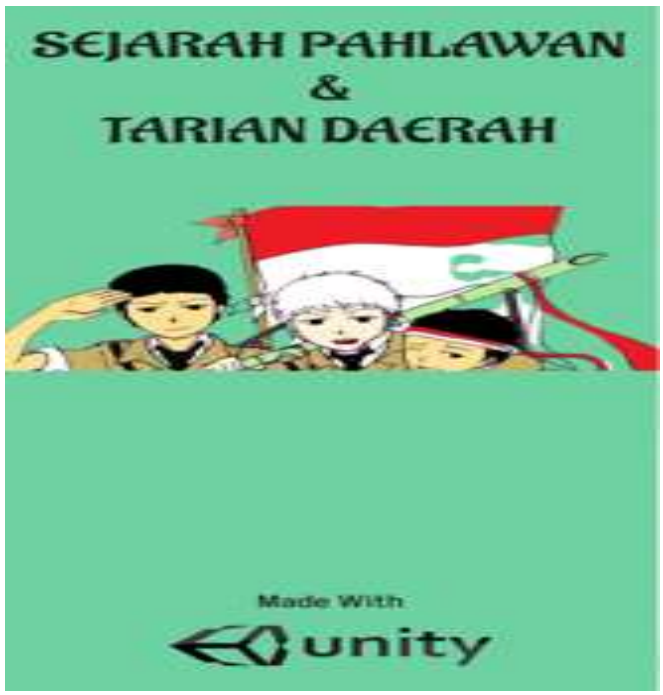

Figure 7. Splash screen display

Figure 8. Main menu display

Figure 9. Play menu display

Figure 10. Hero menu display

Figure 11. Dance menu display

Figure 12. Credit menu display

As can be seen in each of the pictures above. In this application, there are 6 displays with 5 buttons, each of which works according to its purpose. A system explanation of the application is explained below: The first time a user enters this application a splash screen will appear. After a few seconds, you will go to the main menu display. In this main menu, the user can choose what he wants to do with this application. If the user selects the menu for regional dances or national heroes, the user will focus on each menu which contains historical explanations. Then if the user selects the play menu, the user will be immediately directed to the camera where the user can then scan the 2022 emission rupiah currency to see the 3D animation of the object and study the history of the object. If the user selects the credit menu, the user will be directed to the credit menu which contains information about the application maker. When the user wants to exit the application, the user can press the exit button.

Implementation of the Website Database Admin Program

This application has the advantage that the application system is organized with the admin website as a database. The admin website has an important role in application development, as a form of information storage for the admin. Which is used to manage information data in the application later. This web admin has been integrated with the internet so that admins can easily manage information data in the application later. In designing this website, researchers applied the PHP and CSS programming languages. Login Form Web Page Display, before entering the website page, the admin first logs in to the account. As

in image 13. Meanwhile, if the admin enters the username incorrectly it will appear as in image 14.

Figure 13. Login form web page display

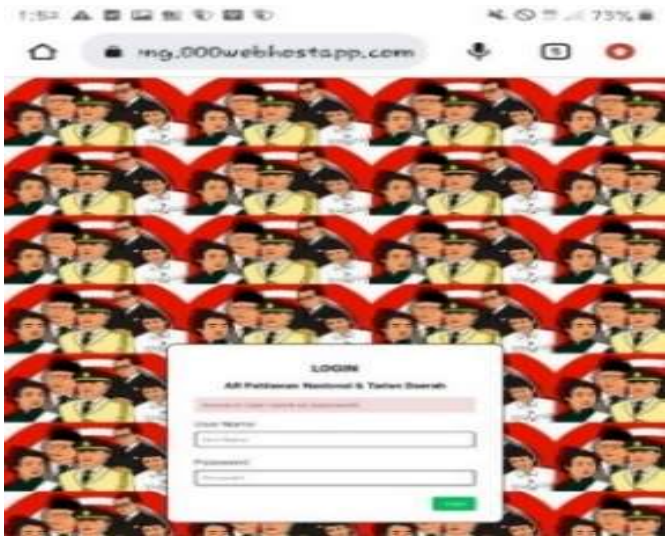

Figure 14. Login form web page display when entering the password

Home Web Page Display, after successfully logging in to the account, the admin will go to the home web page. As in Figure 15.

Figure 15. Home web page display

Hero Data Page View, in this hero menu, admins can view data, create data, edit data, and delete data. As in pictures 16 – 19.

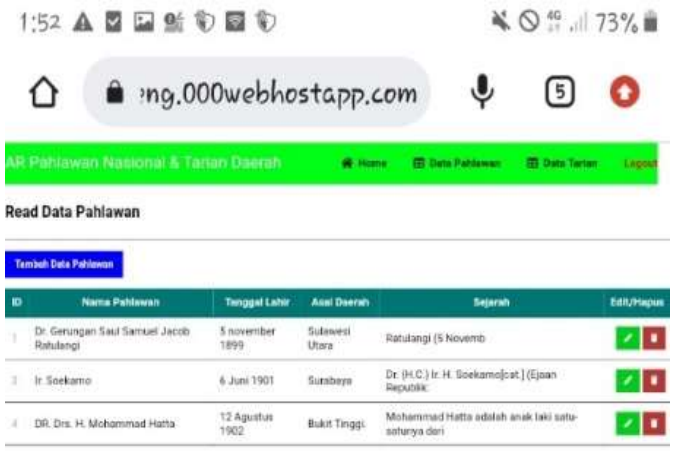

Figure 16. Hero data page view

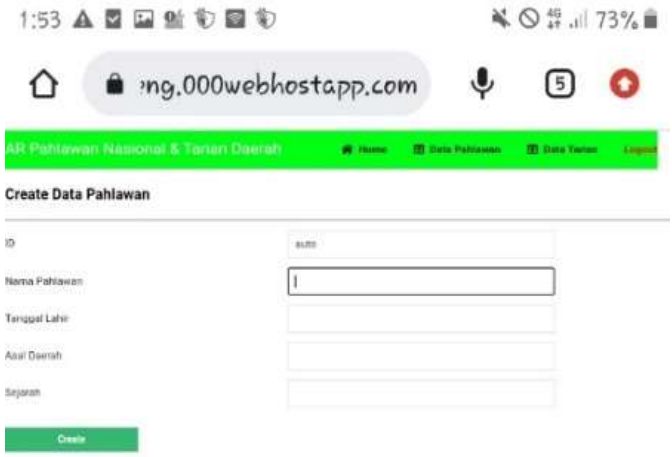

Figure 17. Hero create page view

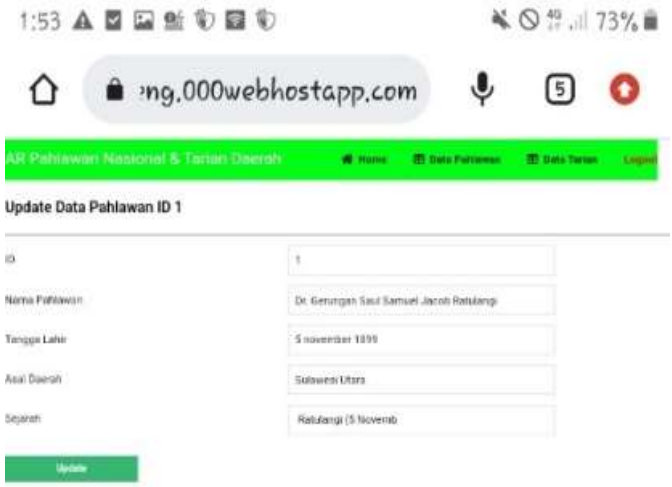

Figure 18. Hero update page view

Figure 19. Hero delete page view

Software Testing

User Acceptance Test

In this test, the first stage is conducting a respondent questionnaire using the application that has been designed. After the user has finished using the application, the author asks respondents to fill out the questionnaire that has been prepared. The respondents for this test consisted of 5 respondents. The list of respondents can be seen in Table 1.

Table 1. List of Respondents

Name	Age
Eri Irawati Agustien	25
Annisa Silmi Kaffah	15
Fredi Ardian Darsono Putra	16
Aurelia Risti	12
Rafi Muhammad I'smail	22

Table 2. Respondent Questionnaire Results

Statement	Verry Less 1	not enough 2	Enough 3	Good 4	Very good 5
The author's topic of introducing heroes and dance is quite interesting				3	2
The information provided is accurate			3	2	
This alternative learning media can increase learning motivation				2	3
Ease of use of the application					5
Application interface			1	3	1
The quality of the objects used in this application, namely 3D, is good				4	1

The data that the author obtains from the questionnaire will then be processed to obtain conclusions from respondents regarding the application that has been designed. To calculate the results of the questionnaire, use the formula (2.1). The validation test for respondents regarding this application can be seen in Table 3.

Table 3. Validity Test Results

Statement	Very Less 1	Not Enough 2	Enough 3	Good 4	Very Good 5	Result (s %)
The author's topic of introducing heroes and dance is quite interesting				3	2	85
The information provided is accurate			3	2		75
This alternative learning media can increase learning motivation				2	3	90
Ease of use of the application					5	100
Application interface			1	3	1	80
The quality of the objects used in this applicatioı namely 3D, is good				4	1	85

Based on the calculation results and percentages from the questionnaire results above, an analysis was carried out on the performance of the Augmented Reality application, learning media to recognize regional dances and national heroes on Android-based 2022 emission rupiah banknotes. The validity test analysis can be seen in Table 4.

Based on the results of tests carried out by 5 people as a sample of users who use this system application, this system application is running normally, where all the buttons on the application can function properly as designed. Users do not experience difficulties in using this application, users can understand the displays in this application well. Users can easily understand the material presented in this application, where in this application users get 2 discussions of the material in audio and visual ways.

Table 4. Validity Test Analysis

Statement	Result (%)	Information
The author's topic of introducing heroes and dance is quite interesting	85	In this aspect, it was concluded to be very good with a final score of 85% because the topics raised according to the respondents were interesting.
The information provided is accurate	75	This aspect was concluded to be good with a score of 75% because the information provided was accurate according to the respondents.
This alternative learning media can increase learning motivation	90	This aspect was concluded to be very good with a final score of 90% because AR technology made respondents enthusiastic and increased motivation.
Ease of use of the application	100	This aspect was concluded to be very good with a final score of 100% because the respondents did not experience the slightest difficulty in using this application.
Application interface	80	In this aspect, it was concluded as good with a final score of 80% because the application interface was clear and attractive.
The quality of the objects used in this application, namely 3D, is good	85	In this aspect, it was concluded that it was very good with a final score of 85% because according to the respondents, the 3D object was able to look like it was real.

Multi-Device Test

After carrying out Blackbox Testing, researchers also carried out Multi-device testing to find out whether the designed application can run well on various brands of smartphones (Hassija et al., 2023). The results of the research can be seen in Table 5.

Table 5. Multi-Device Test Results

Type of smartphone	Android OS type	Specification	App View
Samsung J4 Plus	Android 8.1 (Oreo)	Ram 2GB Emoryy 16GB CPU Qualcomm MSM 8917 Snapdragon 425 6-inch screen 720 x 1480 resolution	Buttons all work
Vivo Y22	Androis 12 (Funtouch)	CPU Octa-core Ram 4GB Memory 64GB 6. 55 Inch screen	Buttons all work

Analysis and Discussion

In building a system for recognizing heroes and also the history of this regional dance, supporting data was collected from several studies that are still related to this research. The basis of the research began with reading research conducted by (Oteng et al., 2023) Entitled Implementation of Learning Assessment in the 2013 Curriculum History Subject. In this research they found obstacles, namely as follows: Based on observations and interview results at SMA Negeri 2 Banjarmasin there were several obstacles in the assessment process.

First, the teacher paradigm is still traditional and still considers assessment only on learning outcomes, not on the learning process. The 2013 Curriculum assessment contains three assessments which contain aspects in them. Teachers' lack of understanding of the 2013 Curriculum assessment creates an assessment system less than optimal in its implementation. The second obstacle is the lack of teacher understanding about technology (Muhazir & Retnawati, 2020; Ertmer & Ottenbreit-Leftwich, 2013; Enochsson et al., 2022). Times have changed, teachers should make use of good facilities or infrastructure provided by the school and use it in the process of learning. So, teachers can be helped by technology, and students too, absorb the material presented more quickly.

After seeing and understanding the panel, the researcher found a solution so that the history learning process in the 2013 curriculum could run effectively. As researchers read in research conducted by Septianti et al. (2020), Nafi'ah et al. (2023), Farizi et al. (2021), Williamson, (2023), entitled "Development of It-Based History Learning Media". In this research, he found a solution from previous research. In which solution he applies technology to the history learning system. and the results are many benefits from using technology in the history learning system (Haleem et al., 2022; Teräs et al., 2020).

After seeing these two studies, the researcher tried to implement and build an application that could later help in the history learning process. This research utilizes technological advances, one of which is Augmented Reality. With Augmented Reality technology, users will be able to see and understand objects in real-time and in real-time. Seeing the progress of Augmented Reality helps the learning process become more effective and less boring for students (Hu et al., 2021; Wen et al., 2023). By using markers that are easy to obtain, namely the 2022 emission rupiah currency, students can easily carry out the history learning process. The initial stage in this research is the process of creating 3D objects of national heroes and regional dances. By using Blender software to design 3D

objects, the design stages include modeling, designing the 3D object model, texturing, the step of giving texture to the 3D object, then the final stage, namely rendering.

After the 3D object creation stage has been successfully created. Researchers started designing mobile applications. which is the application system that students will later use for the learning process (Jayatilleke et al., 2018; Oliveira et al., 2021; Hinze et al., 2023). The stages carried out are creating the application user interface, designing the application system, and then carrying out maintenance on the application system. Apart from the mobile application, researchers also built a website system as an admin database which will later function as a data processing route in the application. After the application is successfully built, there is an application testing process carried out by application testers. In this application testing, application testing is carried out at various age and professional levels. Among them: are a 25-year-old kindergarten teacher, a 22-year-old student, as well as elementary, middle, and high school students. With perfect results, the application can run according to its function. Students and teachers can easily understand the content of the learning material and understand this application system (Keiler, 2018; Seo et al., 2021; Almusaed et al., 2023).

Conclusion

This application for learning the history of national heroes and regional dances has been able to implement Marker Tracking in Augmented Reality to provide information about the history of national heroes and regional dances contained in the 2022 emission rupiah banknotes in the form of 3D animation which can produce a brief historical explanation of the 3D object. From the questionnaire distributed and tested by respondents, this application succeeded in helping respondents find out the history of national heroes and regional dances found on the 2022 emission rupiah banknotes so that it became an interesting and efficient alternative learning media. This research looks at the shortcomings of almost the same research that has been conducted previously. Previous research, only included material about national heroes or regional dances. Therefore, in this research, in one application users can learn the history of heroes and dances only by using 2022 emission rupiah banknotes. The reason researchers use emission rupiah banknotes in 2022 is because researchers have seen previous research that generally still uses the old rupiah currency. in this case, the money can no longer be circulated. Apart from money, other researchers also use cards as markers. It could be that if you use a card as a marker it will be difficult to get the marker. In this research, the application system is connected to the database website as admin. Where the admin can manage the data that will later be displayed in the application. This is something that may not be available in other research studies. Researchers who may be conducting similar research may be able to add more interesting features to the application which is expected to increase student interest so that it is more interesting and effective in the learning process.

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Author Contributions
Conceptualization, M. R. S., M. Z.; methodology, M. R. S.; validation, M. Z. and M. R. S.; formal analysis, M. Z.; investigation, M. R. S., and M. Z.; resources, M. R. S. and M. Z.; data curation, M. R. S.: writing—original draft preparation, M. Z. and M. R. S.; writing—review and editing, M. Z.: visualization, and M. R. S. and M. Z. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest
No conflicts of interest.

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