

Article

Introduction to Traditional Houses Using Augmented Reality Based on Unity 3D on Android Platform

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Abstract: Indonesian culture is rich with traditional houses spread across the archipelago, serving not only as physical structures but also as symbols of history and cultural identity. Each traditional house has unique characteristics that reflect local wisdom and traditional life. However, modernization and urbanization threaten the continuity of many traditional houses, compounded by the lack of public appreciation for traditional cultural values. An innovative approach is needed to address these challenges, one of which is leveraging augmented reality (AR) technology. AR allows users to interact with virtual objects in the real world through electronic devices such as smartphones. AR technology, using Surface Tracking and visual inertial odometry (VIO), can be used to introduce and preserve traditional houses. This study, titled "Introduction to Traditional Houses Based on Augmented Reality Using Unity 3D on the Android Platform," employs the Extreme Programming (XP) method. XP is suitable for small teams that require rapid adaptation to changes, aiming to create high-quality software and enhance productivity.

Keywords: Augmented Reality, Unity 3D, Android, Traditional Houses, Indonesian Culture, Cultural Preservation

1. Introduction

Indonesian culture is an invaluable treasure reflected in various aspects of life, one of which is through the diverse traditional houses scattered throughout the archipelago [1]. Traditional houses are not merely physical structures, but also symbols of history, culture, and the identity of a region or community [2]. Each type of traditional house has unique characteristics, reflecting local wisdom and the traditional way of life that has been passed down from generation to generation.

Although they hold significant value, many traditional houses in Indonesia face challenges in maintaining their sustainability. Globalization, urbanization, and modernization have caused many traditional houses to be neglected or even threatened with extinction. The lack of understanding and appreciation from the community towards traditional cultural values also poses a challenge in the efforts to preserve these traditional houses [3].

To address these challenges, an innovative and holistic approach is needed that can combine tradition with modern technology. One promising solution is to utilize augmented reality (AR) technology in the efforts to preserve and introduce traditional houses. AR is a technology that allows users to see and interact with virtual objects in the real world through electronic devices such as smartphones or special glasses [4]. Augmented reality technology also has the ability to integrate specific information into the digital world and present it in the physical world with the help of devices such as computer cameras, smartphones, or special glasses. The advantages of augmented reality technology have rapidly penetrated various sectors and have become a favorite among

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different segments of society. This augmented reality application uses Surface Tracking technology with visual inertial odometry (VIO) that can follow and understand the surfaces of objects in the real world [5].

Berdasarkan pada paparan di atas, judul yang diambil untuk skripsi ini adalah "Introduction to Traditional Houses Based on Augmented Reality Using Unity 3D on the Android Platform". The title reflects the focus of the research, which will discuss the use of augmented reality technology in introducing and preserving traditional Indonesian houses, using the Extreme Programming (XP) method. Extreme Programming, or XP, is one of the software engineering methods widely used by developers to meet the needs of software development that require rapid adaptation to changes. It is suitable for teams that are not too large and located in one place, with the aim of creating high-quality software, increasing productivity, and reducing costs that occur when changes happen [6].

2. Materials and Methods

This study applies extreme programming methodology to improve the efficiency and quality of software development, with an emphasis on intensive communication, short iterations, and continuous testing. This methodology consists of the following series of process steps:

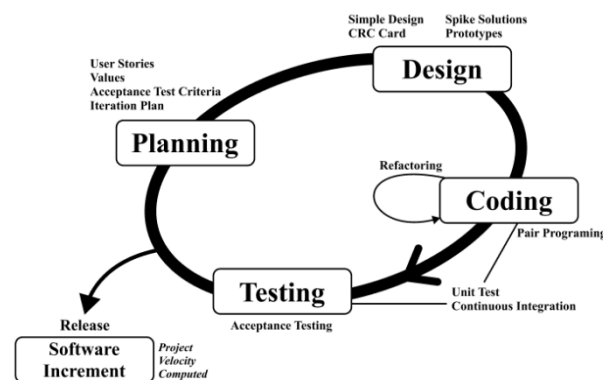


Figure 1. Process Diagram of Extreme Programming Method [7]

A Planning

The planning stage is the first step in the extreme programming method to analyze how to create a traditional house recognition application according to needs and the features needed.

B Design

The design part of software development refers to the process of planning the structure, function, and visual aspects of the software to be created. Good design helps ensure that the software can meet user needs effectively and efficiently, and allows for flexible changes and easy scaling in the future [8]. In this phase, the design stage is divided into 2 large parts, namely flowchart and user interface:

○ Flowchart

A flowchart is a visual representation of a sequence of steps or processes in a diagram [9]. It is used to describe the steps required to complete a task, procedure, or process systematically. The following is a flowchart design for a traditional house recognition application.

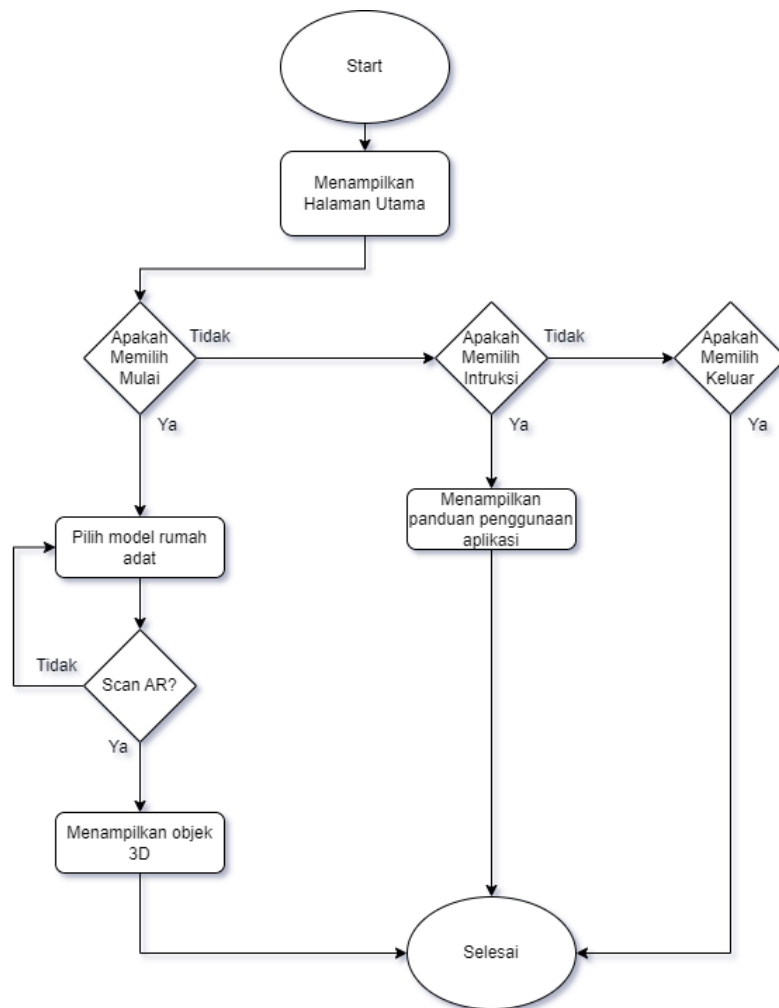


Figure 2. Flowchart Diagram

At the initial stage of use, when opening the application, users will be faced with the main page display or application menu that offers several options that can be explored. There are 'Start', 'Instructions', and 'Exit' buttons that direct users in exploring the application's features. In the 'Start' menu, users can choose from five interesting options that display traditional houses from Javanese, Batak, Toraja, Aceh, and Minangkabau cultures. In addition, there is an 'Info' button for a 2D view and further explanation, as well as a sound icon button to listen to an explanation via voice. The 'Instructions' menu provides a complete guide on how to use this application effectively, ensuring users can maximize the benefits of each available feature.

○ User Interface

User Interface, or UI, refers to the visual and interactive design of an application that aims to enhance the aesthetics of the display through proper coloring, element placement, and composition, as well as implementing UI/UX functions for an optimal user experience [10]. The following are UI designs for several important elements in the application, including the splash screen, main menu, ARKamera button, guide, and exit option

- Interface Main Menu



Figure 3. Main Menu

The main menu is the first screen that appears when the application is run, which consists of four menu options, namely "Start", "Load", "Instructions", and "Exit".

- Start Menu Interface

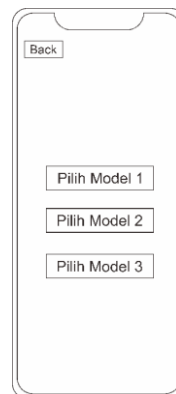


Figure 4. Start Menu

In the "Start" menu, users will be given the option to select 3D models of various traditional houses that they want to see. After the selection is made, the application will display the 3D building model in the form of augmented reality.

- Interface Scan Ar

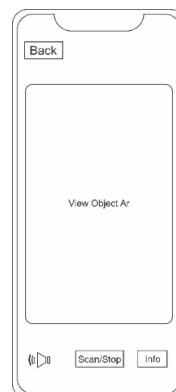


Figure 5. Scan Ar

The interface design that appears when the augmented reality scanning process is in progress. There are several "Sound Icon" options that provide audio explanations related to the building, the "Info" option to display written information and 2D images about the building, and the "Scan/Stop" button which functions to start or stop the scanning process.

- Interface Menu Info



Figure 6. Info Menu

The purpose of the "Info" menu design is to provide information and culture of traditional houses which are displayed along with 2D images of the building.

- Interface Menu Intruction



Figure 7. Instruction Menu

The purpose of the "Instruction" menu design is to provide clear and easy-to-understand information to users on how to use the Augmented Reality application.

C Coding

The next process in development is the coding step, where the design of the system model that has been compiled will be implemented into the form of a user interface [11]. The technical details of the system design are converted into executable codes, creating an environment that can be accessed by users through the interface that has been created. This coding process is an important step in realizing ideas and designs into functional applications.

D Testing

After the coding stage is complete, it is continued with system testing to find errors that appear when the application is running and ensure the system is in accordance with user needs [12]. Black box testing is a software testing method that validates the functionality of an application without looking at its internal structure. In user testing, a group of respondents use the application and provide feedback through a questionnaire. A total of 10 respondents from the surrounding community were selected to evaluate aspects such as ease of use, interface, and feature satisfaction. The data collected helps identify deficiencies, improve application quality, and ensure optimal user experience.

3. Results

A. System Implementation Results

The results of system implementation in research after the system design stage are important stages that show the success of the concept becoming a reality. System implementation includes direct implementation of the previously created system design [13]. The following is an explanation of the results of system implementation:

- Application Icon

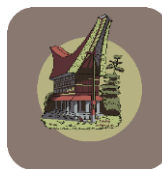


Figure 8. Traditional House Introduction Application Icon

This traditional house introduction AR application icon allows users to easily access information about traditional houses from the home screen (the main screen on a mobile device that displays the application icon), using a simple, clear, brand-consistent design that is in accordance with the platform's design guidelines [14].

- Main Menu Page

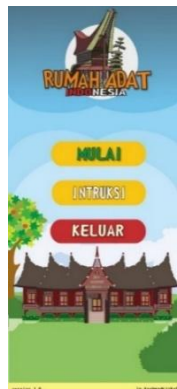


Figure 9. Main Menu Page

This page is the first page that will be accessed after entering the application, which functions to display various menus that can be explored. The available menus include the Start Menu, Instruction Menu, and Exit Menu.

- Instruction Menu Page



Figure 10. Instruction Menu Page

This page has the function of presenting detailed information about the methods and constraints in using the application during the 3D object scanning process. Users can find a comprehensive guide that covers various aspects, from preparations before starting the scan to steps to overcome technical problems. For example, if an object does not appear during AR scanning, this page provides practical solutions and suggestions to ensure a smooth process.

- Start Menu Page

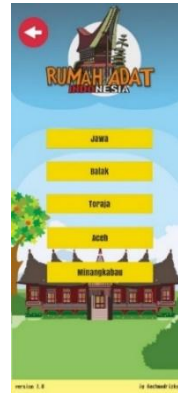


Figure 11. Start Menu Page

This page will display the available traditional house menu options, including Java, Batak, Toraja, Aceh, and Minangkabau. Functions to determine which traditional house objects the user will see and learn about.

- Scan Ar Page



Figure 12. Scan Ar Page

After selecting one of the traditional house models, the application will ask for permission to use the phone's camera. Give the permission, then point the camera at a flat surface so that the traditional house model can appear clearly on the plane.

- Stop Tracking button



Figure 13. Stop Tracking Button

This button has an important function to control the AR scanning process, allowing users to stop the ongoing scan and restart the AR scan as needed.

- Sound Button



Figure 14. Voice Button

This button has a function to activate voice explanations about the history and cultural customs of traditional houses, allowing users to listen to information delivered verbally about the historical and cultural background attached to the traditional house.

- Info Page



Figure 15. Info Page

This page serves to present material about the history and culture of the traditional house displayed. In addition, this page also provides original images or 2D images of the traditional house.

B. System Testing Results

Table 1. System Testing Results [15]

No.	Features / Functions	Testing Steps	Desired Outcome	Results
1	Main Menu	- Open the application and verify navigation to the main menu. - Click the start menu, instructions, and exit.	The user is directed to the page corresponding to the selected button.	Success
2	Instruction Menu	- Open the instructions menu and check the completeness of the user guide. - Make sure the instructions are easy to understand.	The instructions provide a complete guide on how to use the application, including AR scanning and interaction.	Success
3	Start Menu	- Select one of the traditional houses from the start menu. - Verify the flatbed scanner is active and the object appears.	The 3D object of the traditional house appears clearly after successful flat plane scanning.	Success
4	Voice Explanation Features	- Enable the voice explanation feature when the 3D object appears. - Check the content and smoothness of the voice.	The voice provides a precise explanation of the history and cultural customs of the selected traditional house.	Success
5	Stop Tracking Button	- Use the stop tracking button to stop scanning. - Verify the ability to restart.	The scanning of the 3D object can be stopped and resumed properly.	Success
6	Info Button	- Use the info button to open the explanation page about	The written information and original images of the	Success

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- | | |
|--|---|
| the traditional house.
- Check the completeness of the information. | traditional house are available clearly and completely. |
|--|---|
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The data in Table 1 shows the results of testing several features available in this application. Based on the test results, it can be concluded that this study has successfully tested various features well, indicating that the augmented reality application can be run according to its design.

4. Discussion

The implementation of the system in this study marks a crucial phase where the conceptual design transitions into a functional augmented reality (AR) application focused on introducing traditional Indonesian houses. The process began with the deployment of the application icon, allowing users to conveniently access the app from their home screen. Once opened, users are greeted by the main menu, which serves as a gateway to the application's core features, including the Start Menu, Instruction Menu, and Exit option.

The Instruction Menu plays a vital role in guiding users through the application, especially during the 3D scanning process. It provides comprehensive troubleshooting solutions and user tips, ensuring that technical difficulties, such as failure to render AR objects, can be addressed effectively. Meanwhile, the Start Menu allows users to choose from a list of traditional houses—such as those from Java, Batak, Toraja, Aceh, and Minangkabau—making it easy to navigate and explore cultural content.

Once a traditional house is selected, the system prompts camera access for the AR scan to render the 3D object on a flat surface. To enhance interactivity and control, features such as the Stop Tracking button and Audio Explanation button are provided. The former enables users to pause and resume AR scanning, while the latter delivers narrated information on the historical and cultural background of the selected traditional house, enriching the learning experience. The Info Page supplements this by displaying written descriptions and authentic 2D images of the houses.

In addition to functional implementation, system testing was conducted to ensure the stability and reliability of each feature. As shown in Table 1, each function—including navigation, instructions, 3D model display, audio playback, and information delivery—was successfully tested and yielded expected results. This comprehensive validation demonstrates that the AR application performs well according to its design specifications. The positive outcomes from system testing confirm the effectiveness and readiness of the application to serve as an engaging educational tool for introducing traditional Indonesian architecture through augmented reality.

5. Conclusion

This research has successfully developed an augmented reality-based traditional house recognition application using Unity 3D on the Android platform. The implementation of the Extreme Programming (XP) methodology has proven effective in producing software that is adaptive to changes, with high quality and increased productivity. The results of the system testing show that all the main features of the application, including menu navigation, AR scanning, voice explanations, and cultural information, function well and provide a satisfying user experience. This application can play a significant role in preserving and introducing Indonesian traditional house culture to the wider community through an innovative and interactive approach. Thus, augmented reality technology has great potential as an educational and cultural preservation tool in the digital era.

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