Augmented Reality for Presenting Local Wisdom: Sumatera Utara Traditional House

M F Syahputra1, R Aulia1, O S Sitompul1, U Andayani1, D Abdullah2, S Sriadi3, R F Nanuru4, M D Utama4, R T Manurung5, H Djanggih6 and E Mouw7

1Department of Information Technology, Faculty of Computer Science and Information Technology, Universitas Sumatera Utara, Medan, Indonesia
2Department of Informatics, Universitas Malikussaleh, Aceh Utara, Indonesia
3Department of Electrical Engineering, Universitas Negeri Medan, Indonesia
4Universitas Kristen Indonesia Maluku, Ambon, Indonesia
5Graduate Program in Scientific Psychology, Universitas Kristen Maranatha, Indonesia
6Faculty of Law, Universitas Tompotika Luwuk Banggai, Indonesia
7Faculty of Social and Human Sciences, Universitas Halmahera, Indonesia

ncf.fadly@usu.ac.id

Abstract. Augmented Reality is a technology that allows users to see the real world, with virtual objects placed on it or combined with the real world. Augmented Reality itself can be applied to various things, including as an educational media. In the field of education, technology can be used a culture introduction to society. One part of Indonesian culture is traditional houses. Traditional house is a building that symbolizes the culture of the local community. In North Sumatra itself, there are several traditional houses that have different forms. The use of Vuforia SDK in the construction of this application can display augmented objects in the form of 3-dimensional objects and also provide information on the house. This application will run on the Android mobile platform to make it easier for users to access it. In addition, users can choose their own objects to be used as markers to make the application use much easier.

1. Introduction
Information can easily be obtained in this age, which has been easily developed. Humans need a form of mobile information that can be available and used by all ages, both by parents and children. The development of mobile devices currently leads to smartphone devices that are currently hovers in the middle of the community. Its ability which is quite a lot like being able to find information easily, to educate and become an entertainment media.

One that can be utilized through smartphones is augmented reality. Augmented Reality (AR) is a combination of virtual (virtual) and real (real) worlds created by computers. Virtual objects can be text, animation, 3D models or videos that are combined with the actual environment so that users feel virtual objects in their environment [1]. Augmented Reality is a new and fun way. Humans can interact with computers, because they can bring virtual objects to the user's environment, providing a real visualization experience [2].

Indonesia has an extraordinary wealth, starting with natural wealth and cultural wealth. One of them is a traditional house with diversity spread throughout Indonesia. But the diversity of traditional houses
is not supported by applications that can provide information about traditional houses that are useful for the community [3].

Traditional houses are buildings that the building of an area in Indonesia which symbolizes the culture and characteristics of the local community. Until now there are still many tribes or regions in Indonesia that still maintain traditional houses as an attempt to maintain cultural values [4]. In North Sumatra alone, there are several traditional houses. All have a variety of different information that can increase cultural knowledge. As Indonesian citizens, it is expected to know their own culture, especially the beauty of traditional houses. To become a learning media and to introduce customary home culture to be more attractive, technology is used to reintroduce traditional home culture.

In this study the author uses Vuforia SDK, based on android and marker detection using Marker less User-Defined Targets. That is, users can choose and determine their own objects that will be used as markers, for example, magazines, books, illustrated paper, and others. When successfully displaying 3D objects, users can bring up and eliminate information about the custom house.

The number of animals in the museum causes information boards that are less representative to display all animal information in detail. So that the information provided is still not enough, especially in some interesting collections, such as rare wildlife, wild animals whose habitat is not in Indonesia, endangered wildlife, and other interesting wildlife collections. Therefore we need a way to display wildlife information in the museum in detail, interesting and interactive.

Research on Augmented reality has been widely implemented in various fields. Like education, medicine, marketing, culture, and more. In general, Augmented reality is implemented as a medium of recognition or learning. So that makes learning more interesting and interactive.

Research in 2013 with the title Supporting Media for Indonesian Traditional House Learning Using Augmented Reality. This research makes 15 models of traditional houses in Indonesia and uses multiple tracking objects and Fusion AR Tools. However, it does not provide information about the traditional house. In addition, this study used multi-colored markers and did not use black and white markers. [3]

Research entitled Development of Traditional House Based Augmented Reality Book Application. This study made 6 models of traditional houses in Indonesia and provided some information about the traditional house. Using the Nyar toolkit library that still uses Fiducial Markers and multi markers. The application made in 2014 is desktop based. [4]

Research in 2015 made Augmented Reality to increase the interest of fourth grade students of SD Negeri 3 Somawangi in learning and knowing Javanese traditional houses using the Vuforia library, but still using pre-defined markers, namely student textbooks. [1]

Research in 2014 under the title Car Advertisement for Android Application in Augmented Reality. Using ARToolkit and mobile-based to create a marketing ad for Perodua Myvi Car to be more attractive. Has 4 features, namely, translate, rotate, scale, and take screenshots. [5]

In 2009, research entitled Applying Augmented Reality to Visualize the History of Traditional Architecture in Taiwan. Create 3D objects from Yang Ancestral Hall in Jidung, Taiwan with 5 different forms and by using Fiducial Marker. Provides building structure information to visualize historical traditional buildings in Taiwan. [6]

The difference in this research is that it will be made use of is the Vuforia library that detects markers using markerless User-Defined Targets. That is, users can choose their own objects that will be used as markers, for example, magazines, books, illustrated paper, and others. When successfully displaying 3D objects, users can bring up and eliminate information about the custom house. Our previous research in this cultural preservation is the implementation of augmented reality in historical building with finger recognition adaptation [7].

2. Methodology

2.1. General architecture

Augmented Reality application system for North Sumatra Traditional Houses based on Android to provide information on traditional houses in North Sumatra by displaying 3D object content into real reality so that the provision of information becomes real-time, the system also displays brief information on the house, about the application, and how to use the application. The name of the application is
ARRA - Augmented Reality Traditional House of North Sumatra. The general architecture of this application can be seen in Figure 1.

![Figure 1](image)

**Figure 1.** General architecture.

The following is an explanation of the stages in the general architecture:

a. **Input**
   
The user runs the Augmented Reality North Sumatra Traditional House application on the smartphone and presses the Augmented Reality button so that the display will appear selecting the custom home object that will be displayed. After selecting, the AR Camera display will appear. The user then directs the camera and scans the object that is used as a marker. After that, press the camera button to make the object become a marker.

b. **Process**
   
   Creates custom 3D house objects through 3D Studio Max, then exported to OBJ or FBX format then exported via Unity 3D. After making the object chosen as a marker, the system on the smartphone will do tracking objects to identify the markers used by the user, then the system will adjust according to the selected 3D objects. Then the system will render 3D objects. And displays custom 3D house objects to the smartphone screen.

c. **Output**
   
   The result of the output is a 3D custom house object. In addition, the user can also press the Info button to display the custom home information, the user can also deactivate the Info button. If you press the selected info, an explanation of the selected info will be released.

2.2. **3D object of the traditional house**

The development of three-dimensional objects will be done with two applications, namely 3D Studio Max and Adobe Photoshop. The 3D objects to be produced are 8 traditional houses of North Sumatra. 3D objects are displayed on the AR Camera application after the camera device is directed to an object that is used as a marker by exporting three-dimensional objects that have been created into the .fbx format and then entered into the Unity 3D application as a place to process the Augmented Reality application of the Traditional House of North Sumatra.

In the development process of a three-dimensional object through the design stage to provide maximum results for three-dimensional objects created. The formation of a North Sumatra traditional house in 3D form is designed using the 3D Studio Max application and its texture can be done with the Adobe Photoshop application.

After the object is created it is necessary to make color and detail or texture to complete the object that has been created using the Adobe Photoshop application. Adobe Photoshop can create textures on 3D objects by importing 2D vertex textures from objects.

In Figure 2 is the final result of the formation of 3D objects by importing the .fbx and .jpg files from the specified object after passing through the stages that have been explained to Unity to be used as object models.
2.3. Marker
In this study, the author uses a User-Defined Target from Vuforia. That is, the user selects the object that he makes as a marker that will be used as a tracking image then the image image is edited as an image tracker. Users can feel Augmented Reality anywhere and anytime by selecting objects / images that are around them as markers, for example, such as photos, book covers, or posters, so users do not need to carry a marker that has been prepared beforehand.

User-Defined Targets can be used when used under enough light and lighting. The surface of the object to be used as a marker must be clear. If used in the room will work well. Some good object / image characteristics that can be used as User-Defined Targets are, the image contains many details, good image contrast, and has a non-repetitive pattern.

3. Result and Discussion
3.1. Implementation
The implementation of the North Sumatra Traditional House Augmented Reality application is carried out by implementing the Vuforia SDK and User-Defined Target libraries into the application by using the developing Unity3D tool to build applications. The study was conducted on 8 North Sumatra traditional house objects. The traditional houses that will be displayed are the traditional houses of Toba Batak, Karo Batak, Mandailing Batak, Simalungun Batak, Pakpak, Malay, North Nias, and South Nias Batak. Views that will be designed in this application, namely the splash screen page, main menu display page, augmented reality menu page, AR Camera page, guide menu page and menu page about.

![Figure 4. Main menu page.](image1.png)

![Figure 5. Menu Augmented Reality.](image2.png)
After the splash screen page, the user will be directed to the main page. In the main view, there are four menus. The four menus are, Augmented Reality, Guide, About and Exit. The main menu display on the application can be seen in Figure 4.

In the Augmented Reality menu, there are 8 buttons that can be selected according to the object of the house you want to appear and the Back button. Augmented Reality menu display on the application can be seen in Figure 5.

![Figure 6. AR camera page view.](image)

![Figure 7. Guide menu.](image)

The function of this page is this is a page where the user can see the home object that was previously selected in the Augmented Reality page. As in Figure 6, there are 3 buttons on this page: Capture, Info, and Back. Capturing serves to capture objects that will be used as markers. Information serves to bring up and hide information. Back, function to exit the AR Camera page.

The Guide menu display contains information on how to use this application, so that users are easily used in the application. The Guide menu page display on the application can be seen in Figure 7.

3.2. Testing
System testing is performed to test the performance of components that have been designed and implemented into the system. This test aims to ensure that each component functions properly and runs as desired.

3.2.1. Marker testing
Marker testing is done to prove that the user can use the marker that he chooses to display the custom house object. This test was carried out on 8 different markers that will be used to display 8 3D objects of custom homes. The test is done by opening the Augmented Reality application of the Traditional House of North Sumatra, then activating AR Camera by pressing the Augmented Reality button contained in the main view of the application, then selecting the custom home object that you want to display. Then point the camera at the marker that has been selected, then press the Capture button. If the marker has good image quality, then the object will appear and can provide information. Take a look at Figure 8.

![Figure 8. Marker testing.](image)
marker that has a complicated pattern or picture. The better the marker selected, the easier the object of the house to appear will be better. In Figure (b), the house object has been successfully raised.

3.2.2. Testing information display
Information display testing is done to prove whether the system can display information display when the object appears successfully. One example of the results of testing the display of information carried out on one of the house objects is in Figure 9.

![Figure 9. Information display testing.](image)

Look Figure 9, Figure (a) is a display when information is deactivated when an object appears. While Figure (b) is a display when information is activated when an object appears. Users can choose which information they want to display, when the info is selected, the information display will appear as shown in Figure (c). Each house object has a different amount and information.

3.2.3. Distance Detection Setting
The test is being done to find out from any distance the system is able to detect markers. This test is performed using one 3D house object on one marker. In the distance test, the closer the distance between the camera and the marker, the greater the marker size detected by the camera so that the marker image can be captured properly. The results of the test distance can be seen in Table 1.

| No | Distance | Preview Display | The Result       |
|----|----------|-----------------|-----------------|
| 1  | 15cm     | ![image]        | Well Detected   |
| 2  | 30cm     | ![image]        | Well Detected   |
| 3  | 60cm     | ![image]        | Well Detected   |
| 4  | 120cm    | ![image]        | Well Detected   |

3.2.4. Position detection testing
Detection position testing is performed to find out which position the marker can be detected by the system after the system has captured the object into a marker. The test was carried out using one 3D house object on one marker. Position testing results can be seen in Table 2.
Table 2. Position detection testing.

| No | Position | Preview Display | Result of Marker Detection |
|----|----------|-----------------|---------------------------|
| 1  | Up       | ![Up Preview Display](image) | Well Detected             |
| 2  | Front    | ![Front Preview Display](image) | Well Detected             |
| 3  | Right    | ![Right Preview Display](image) | Well Detected             |
| 4  | Left     | ![Left Preview Display](image) | Well Detected             |
| 5  | Back     | ![Back Preview Display](image) | Well Detected             |

4. Conclusion and future research

4.1. Conclusion
A for some conclusions found in this study after implementing the implementation phase and testing the system, it is obtained, namely:

- The Augmented Reality application of the North Sumatra traditional house can display the AR Camera system and display information on custom homes.
- By detecting markers that are selected by the user, the smartphone can read markers and display 3D objects of custom homes and information properly.
- The maximum distance in scanning objects is 120 cm. And a good position is from the 30 cm position.

4.2. Future research
Suggestions that the writer would like to provide for the development of research in the next Augmented Reality field, namely:

- 3D objects of traditional houses that are presented are still in small amounts, it is hoped that in the future there will be more, especially traditional houses throughout Indonesia.
- Applications are still offline, so it is expected that the application can be based on the internet to make it easier to add data and can be developed again to be used on other platforms.

References
[1] Supanji R W 2015 Aplikasi “Ar-Rumah Adat” Sebagai Media Pembelajaran Mengenal Rumah Adat Di Pulau Jawa Berbasis Augmented Reality Pada Perangkat Mobile Android (Studi Kasus: Sd Negeri 3 Somawangi)
[2] Fernando M 2013 Membuat Aplikasi Android Augmented Reality menggunakan Vuforia SDK dan Unity
[3] Pramono A 2013 *Media Pendukung Pembelajaran Rumah Adat Indonesia Menggunakan Augmented Reality* 1 122-132

[4] Faisal R M 2014 *Pembangunan Aplikasi Magic Book Rumah Adat Tradisional Berbasis Augmented Reality*

[5] Yee T S, Arshad H and Khalid W 2014 *Car Advertisement for Android Application in Augmented Reality* 1 80 – 91

[6] Chen C, et al 2009 *Applying Augmented Reality To Visualize The History Of Traditional Architecture In Taiwan.*

[7] Syahputra M F, Siregar R K, Rahmat R F 2017 Finger recognition as interaction media in augmented reality for historical buildings in Matsum and Kesawan regions of Medan city *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)* 10325 LNCS, pp. 243-250