

Augmented Reality at the Yogyakarta Aircraft Museum: An Introduction to Colonial Era Aircraft

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ABSTRACT

Augmented Reality (AR) technologies have revolutionized learning approaches through immersive digital experience, interactive environment, simulation and engagement [1]. While augmented reality (AR) technology is being considered by educators for its potential to help students visualize abstract concepts, currently there are barriers from the high cost of developing complex AR applications [2]. This technology can help the public in understanding the role of ancient military aircraft owned by the Air Force during the Japanese and Dutch colonization. AR differs from Virtual Reality (VR) in that AR devices overlay digital content onto the physical world [3]. In addition, AR can also help in explaining the specifications of each aircraft owned by the Dirgantara Museum. Thus, the introduction of military aircraft to the AR-based community can be an effective solution in attracting public interest in learning the history of military aircraft. AR is effective in attracting public interest in learning Indonesian history and being interested in joining the Indonesian Air Force.

General Terms

Technology, Aircraft, History, Application.

Keywords

Augmented Reality, Technology, Yogyakarta Aircraft Museum.

1. INTRODUCTION

Digital technology has shown to allow a significantly wider and more varied audience to access museum material in some capacity and allow direct interaction with heritage material [4]. Many people don't understand history, especially about the aircraft in the museum. The application of augmented reality technology is needed as a method of introducing aircraft in the museum. This technology utilizes 3d objects as recognition media. Three-dimensional (3D) object detection utilizes numerous onboard sensors to determine the position, size, and motion information of surrounding objects [5].

By looking at the community's need for digital-based information, an interesting information delivery system is needed regarding the introduction of military aircraft in the colonial era. the aircraft will be displayed in the form of complex information along with a display that resembles its original form through a smartphone. Smartphone applications are a potentially powerful way to provide [6] visitors. Therefore, these problems can be solved through Augmented Reality technology so that information about the introduction of military aircraft in the colonial era can be displayed in a complex manner and displayed in 3D objects, later this application will be realized in an Android-based application that can be used by all circles.

Application development based on the Waterfall development method. Various programming languages are playing

increasingly critical roles in prototyping the backend software, connectivity, and user interfaces [7]. The C# programming language and Vuforia SDK are the main basis for creating the system. Objects can be detected because there is a field embedded in the system. Planes are ubiquitous in built environments as walls, ceiling and floor slabs and as components of other objects such as square columns [8]. With this system, it is expected that visitors can more easily access information when visiting the Yogyakarta Aircraft Museum.

2. RESEARCH METHOD

The system is designed using an architecture diagram. There are two platforms that can be used, namely mobile-based and web-based. Mobile-based applications are used by users (visitors), while web-based applications are used by admins.

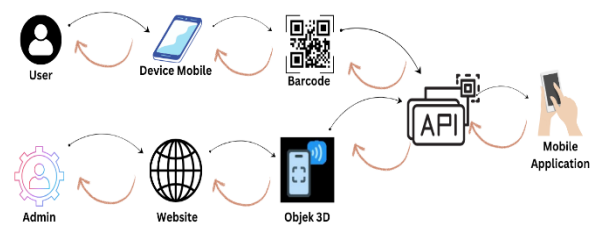


Fig. 1 Architecture Diagram

Mobile applications and web applications are connected with APIs so that the database can be managed properly. Visitors can scan the barcode that has been provided through the application to access information from the aircraft at the Yogyakarta Aircraft Museum.

Augmented Reality (AR) has arisen as a promising technology for providing crucial task-related information on the right time, it allows utilization of information from other systems in modern production systems and visualize data in a perceivable way by combining geometries and animations [9]. The way AR works is by utilizing components such as cameras, sensors, output devices, and artificial intelligence. Cameras and sensors function to collect environmental data and user interactions. This data is processed to determine the placement location of virtual objects

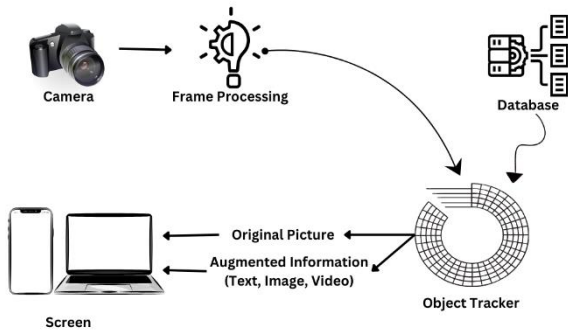


Fig. 2 Augmented Reality Works

2.1 Data Collection Procedure

This research collected data using the observation method in the form of interviews to employees of the aircraft museum. Because the museum still uses the old system, visitors are less interested in what is presented in the museum.

2.1.1 Observation

Data was obtained by searching for reference materials from journals, books, and other sources on the internet. The author also made direct observations to the aircraft museum in Yogyakarta. The data was collected and taken into consideration.

2.1.2 Interview

At this stage, data was obtained from interviews with previous aircraft museum employees. From the results of these interviews it can be concluded that visitors to the Dirgantara Museum on average visit most on Saturdays or Sundays and most visitors there are less active in reading the specifications of the aircraft. Most visitors visit the museum on Saturdays or Sundays and most visitors are less active in reading the specifications of each aircraft. In addition, there is a lack of manpower to act as a Tour Guide at the museum, so when visitors are overwhelmed, employees only let visitors look around without learning more details about the aircraft. The staff only let visitors look around without learning more details about the specifications of the aircraft in the museum.

2.1.3 Data Collection Time

The data was collected over a period of 1 month in conjunction with observational visits to the Yogyakarta Aircraft Museum.

2.2 System Design Logic

This process describes the overall flow of the system. When opening the application, the user will be shown a splash screen page, then a screen page will appear with a QR Code scan menu. After scanning, a 3d object will appear along with the existing information.

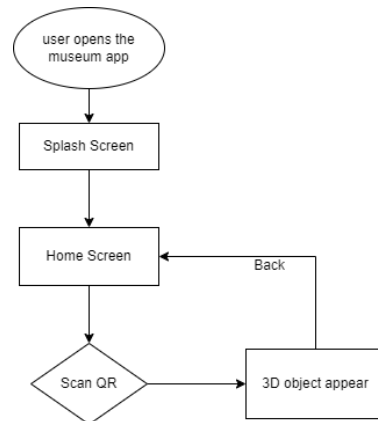


Fig. 3 System Design User

User can open the museum application, after which the user will be directed to the homescreen through the splash screen. On the homescreen, the user can scan the QR code to display a 3d object that contains information on.

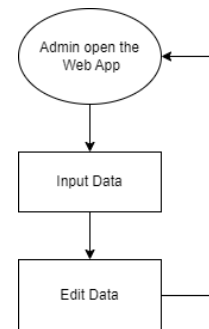


Fig. 4 System Design Admin

Admin can open the web application to input and edit the data. the data will be stored in the database. We need a system to manage it and the system to do this is called Database Management System (DBMS) [10]. This system is created using a MySQL database. MySQL is a relational database server that supports the well-known SQL (Structured Query Language) database language [11].

2.3 Physical Design

The physical design of the application is in the form of wireframes.

2.3.1 Splash Screen

The Splash Screen page is implemented when the application starts by displaying the application logo brand, then visitors can press the get started button to start the application.

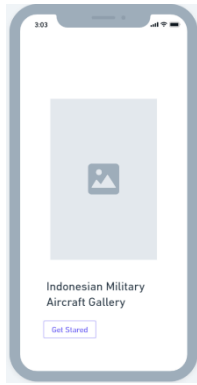


Fig. 5 Splash Screen

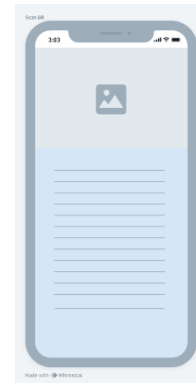


Fig. 8 Barcode Scan

2.3.2 Home Screen

The home screen page is implemented by displaying an airplane and several menus. there is a button to scan the QR Code

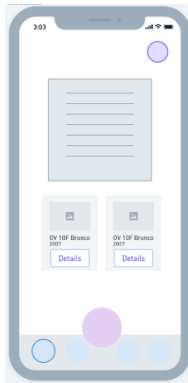


Fig. 6 Home Screen

2.3.2.1 Screen Detail

The screen detail page displays the 3d object from the scan along with information about the object.

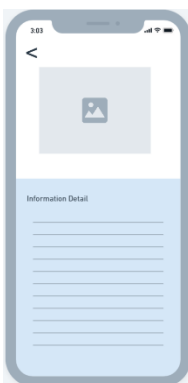


Fig. 7 Screen Detail

2.3.3 Barcode Scan

The barcode scanning page will display the scanned object and its information.

2.3.4 About Application

This page displays information about the app creator.

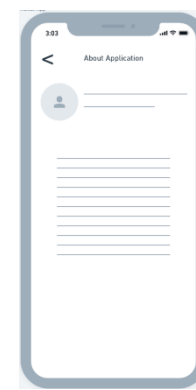


Fig. 9 About Application

2.3.5 Dashboard Admin

The page used for admin to add data in the form of 3d objects.

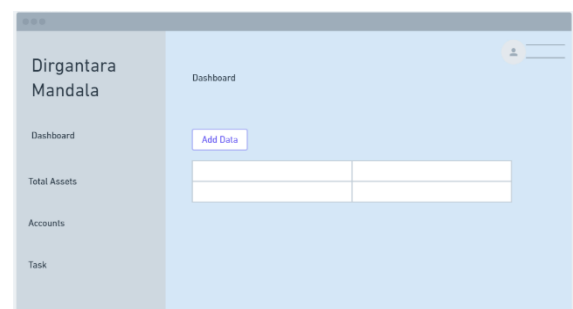


Fig. 10 Dashboard Admin

2.3.6 Add Data

The add data page is used to edit data so that it can be saved again

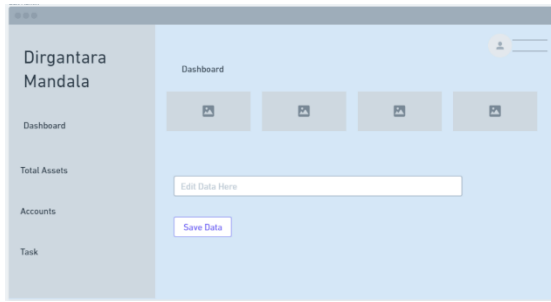


Fig. 11 Add Data

2.3.7 Edit Data

This page displays a pop up that is filled in when there are data changes.

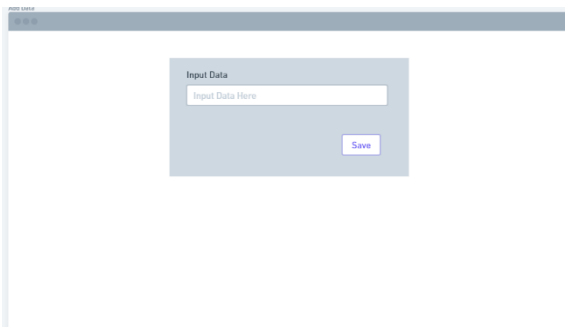


Fig. 12 Edit Data

3. RESULT AND DISCUSSION

3.1 Assumption

This system is made with augmented reality technology to help the performance of officers in providing services. With this system, visitors can also easily access information about the object. With this application is expected to increase public interest in visiting the Yogyakarta Aircraft Museum.

3.2 Hypothesis

This hypothesis is made based on assumptions obtained and proven in the research stage. This research hypothesizes that "Augmented Reality Applications at the Yogyakarta Aircraft Museum are able to be a means of introducing Colonial Era Aircraft to visitors".

3.3 Run an Experiment

The implementation process of the application design carried out in the previous chapter will be explained in this chapter. Implementation aims to translate software requirements into an actual form that is understood by the computer or in other words, this implementation stage is a continuation of the design stage that has been carried out. The admin system was created using the PHP programming language. The goal is to test the suitability of the results of making the system against the analysis of the needs that have been made before [12].

3.3.1 Splash Screen

The Splash Screen page is implemented when the application starts by displaying the application logo brand, then visitors can press the get started button to start the application.

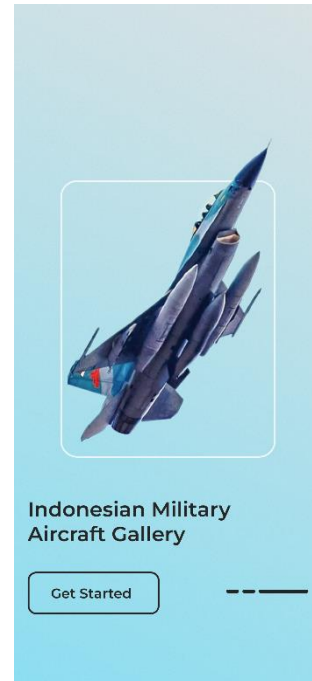


Fig. 13 Splash Screen

3.3.2 Home Screen

The home screen page is dominated by a blue color design. It displays information about the aircraft and there are several required menus.



Fig. 14 Home Screen

3.3.3 Screen Detail

The detail screen page displays information about the aircraft in the museum.

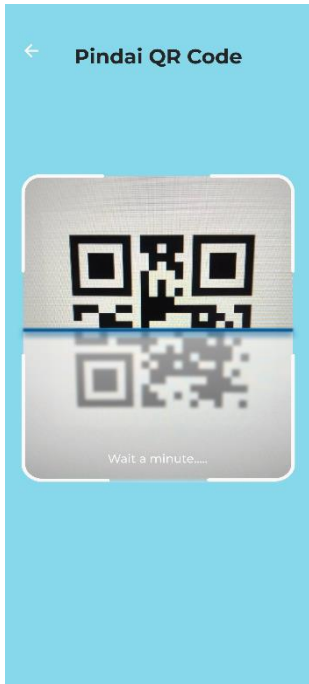


Fig. 15 Screen Detail

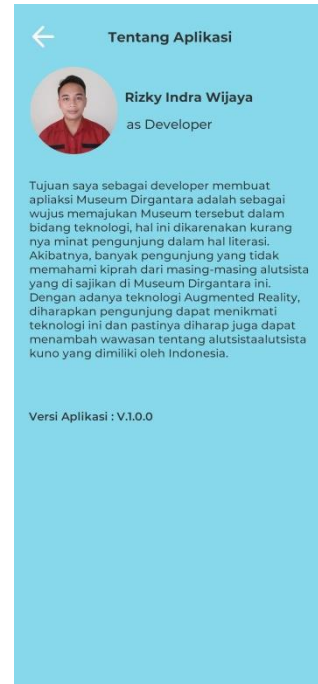


Fig. 17 About Application

3.3.4 Barcode Scan

This page displays a 3d object when successfully scanning a QR Code.



Fig. 16 Barcode Scan

3.3.5 About Application

Display app creator information.

3.3.6 Dashboard Admin

A page managed by the admin to add 3d object marker data.

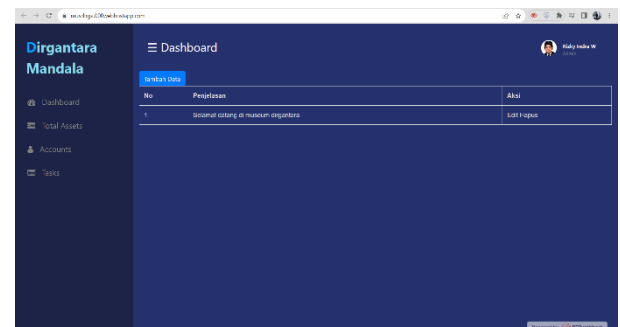


Fig. 18 Dashboard Admin

3.3.7 Add Data Pop Up

Pop up page managed by admin to add data changes

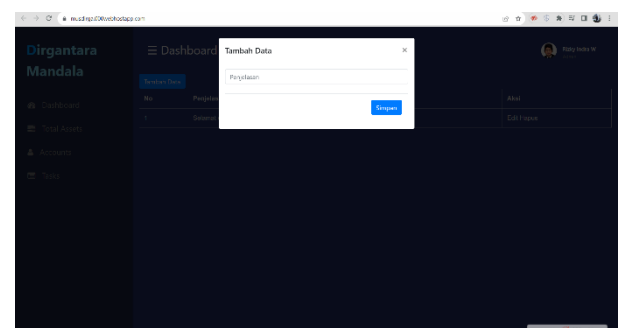


Fig. 19 Add Data Pop Up

3.3.8 Edit Data

Edit data page managed by admin to add data changes

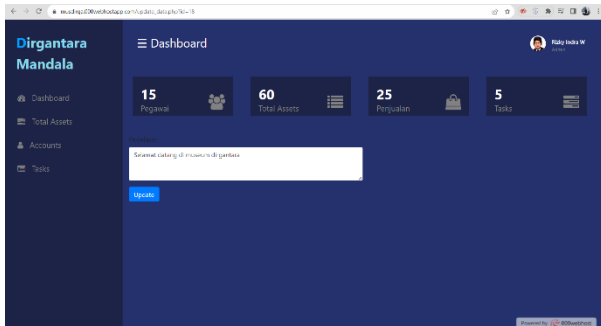


Fig. 20 Edit Data

3.4 Discussion of Result

Software testing is the main technology to ensure the quality of the software [13]. There is a survey that indicates 45% of development cost is spent on software testing [14]. The goal is to test the suitability of the results of making the system against the analysis of the needs that have been made before.

Table 1 Black Box Testing

Unit	System Testing	System Reaction	Testing Result
Splash Screen	Get Started Button	Displays the next page, which is the home page	Success
Home Screen	Details Button	Displays the Aircraft Details Page	Success
Home Screen	QR Button	Displays AR Scan Page	Success
QR Scan	Scan Barcode	Displays 3D Object	Success

Respondents' results regarding application satisfaction can be seen based on the test table.

$$4/4 \times 100\% = 100\%$$

So it can be concluded that the features in the application have been successfully tested, and obtained a score of **100%**.

4. CONCLUSION

Based on the research results, this system can be used to assist activities at the Dirgantara Mandala Museum. This is because the system provides a Details page and a QR scan page to help visitors gain additional insight. And of course this makes it easier for museum employees to convey material about defense equipment in the museum. With this application, it is hoped that it can improve the old system to be more effective and efficient. From the design of the application that has been done, the following conclusions can be drawn

- 1) The system designed with a web base can facilitate the admin in doing CRUD markers as 3D objects.
- 2) The system was built using the PHP programming language and data storage using MySQL so as to produce a system that can manage data precisely and accurately.

- 3) With this system can make work more efficient and save costs and energy.
- 4) Development of applications that apply augmented reality technology as one of the computer sciences that are expected to be useful.

5. REFERENCES

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