

## Utilization of Augmented Reality as a Medium for Medicinal Plant Information

Andrea Sandi Triatmaja<sup>1</sup>, Adam Sekti Aji<sup>2</sup>

<sup>1,2</sup>Department of Informatics, Faculty of Sains and Technology, Yogyakarta University of Technology

**ABSTRACT :** Knowledge of medicinal plants is starting to go unnoticed by the millennial generation. Many data mention that the use of medicinal plants in the community decreases every year. Some surveys provide data that teenagers' knowledge of medicinal plants is very low, especially in big cities. Augmented Reality (AR) is a technology that combines three-dimensional graphics with the real world in real-time with the help of a smartphone camera device. AR can be utilized as a learning media to find out information on family medicinal plants through markers. With AR the information displayed will be more interactive for users. By using the image matching method, which identifies an image (Image Target) and then brings up 3d plants and brief plant information that matches the identified image, AR can provide a new method for information media. The result of the development of this application is a learning media that runs on a Smartphone by utilizing interactive Augmented Reality technology, the application will provide information about medicinal plants, how to use them, and diseases that can be treated. In addition to information, the application will also display 3-dimensional objects of plants.

**KEYWORDS :** Augmented Reality, Smartphone, SDK Vuforia, Software, Medicinal Plants

Date of Submission: 12-11-2023

Date of acceptance: 28-11-2023

### I. INTRODUCTION

Rationalizing Medicinal plants have significant socioeconomic and health benefits, especially in developing countries with high poverty rates and limited health care coverage [1]. People are placing a greater emphasis on medical care, which has led to an increasing the demand for medicinal plants [2]. In certain countries, traditional or ethnic medicines have heavily relied on medicinal plants for disease prevention and treatment, rehabilitation assistance, healthcare provision, and promotion of human reproduction [3]. Therefore, medicinal plants are very important as learning that can improve people's health and well-being because medicinal plants contain various active compounds that have pharmacological effects on the human body.

Augmented Reality (AR) is a technology that incorporates 2D or 3D virtual objects into a real environment in the form of images, text, or video. AR is commonly used in mobile applications by using the phone's camera to track the user's movements and align virtual objects with the real world. Augmented Reality has become a medium to contribute to human life, such as games, virtual tourism objects, and learning media [4]. AR aims at showing a "real-world" scene with overlaying additional information [5]. By utilizing Augmented Reality technology can improve user experience, productivity, and as an effective learning media.

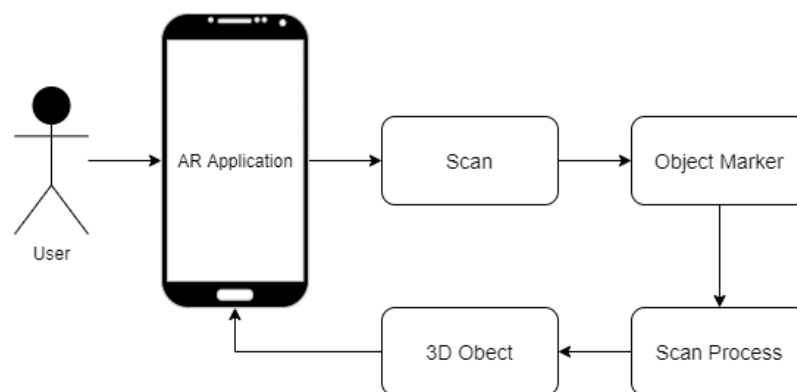
In recent years, mobile technology has become more accessible and available; it has increased its processing power and multimedia capabilities, allowing AR learning experiences to become increasingly accessible in various educational settings [6]. Augmented reality technology is applied to this system to help students know the layout of the campus. With the progress in information technology, many techniques can be used for supporting collaborative work [7]. The system development uses a location-based method with markers.

The purpose of this research is the application of Augmented Reality Technology using the markerless location-based method. System created using Unity3d and Vuforia SDK. For the development of the environment the Unity 3D Engine as well as freely available models and plugins for Unity are leveraged. In unity3D, I achieved many interactive functions such as interface jump, output control with the development language C# [8]. Vuforia is a free software development kit for implementing mobile augmented reality [9]. Vuforia AR Software

Development kit utilizes technology to recognize and analyze camera input from the real world developed by Qualcomm and fully supported by the Unity game engine [10]. The software development tool (SDK) Vuforia was also used, which contains many libraries that facilitate the creation of augmented reality mobile applications and provides different types of options for viewing, taking video and for exploration of recurring events of the captured images, in order to calculate in real time the position of the camera and the location of the markers [11]. The programming languages used are PHP and C#. PHP in particular has been widely employed in servers around the world as part of the LAMP (Linux-Apache-MySQL-PHP) platform [12]. One of the defining features of PHP is the ease for developers to connect and manipulate a database [13]. C# is a simple, modern, and powerful programming language suitable for developing a wide range of applications, from web applications and desktop applications to mobile applications and games. Then MySQL is used as a storage place for various information in the database of a system. MySQL is an open-source database management system (DBMS) that runs under Windows and many versions of UNIX [14]. In MySQL you pre-define your database schema based on your requirements and set up rules to govern the relationships between fields in your tables [15]. By utilizing these tools will help data base engineer in designing a good and normal data base [16].

## II. RESEARCH METHOD

The system design is made using AR Core which implements Augmented Reality technology. With this, the system can display a 3D model on an android smartphone device. Visualization of the system design can be seen in Fig. 1.



**Fig. 1. Architecture Diagram**

Based on the design above, it can be explained the steps taken by users in processing applications to present the learning experience of medicinal plants by utilizing Augmented Reality technology with the Android-based location-based markerless method, users need a smartphone that has several sensors in it and supports ARCore services, in addition to sensors, an internet connection is also needed when running the application, then the system will perform a rendering process or scan of the environment. After successfully rendering, the system will display a 3D object of medicinal plants along with the information.

### A. Data Collection Procedure

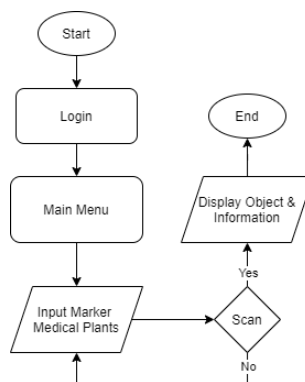
The way researchers get data is by observation by looking at medicinal plants and how they are used. Observation is a data collection technique by going directly to the field where the case study will be taken. The data taken in the form of plant names, the benefits of medicinal plants, which will appear as 3D objects.

### B. System Design Logic

The system design in this application uses a model (UML) that describes the object-oriented design analysis process to improve communication and understanding of software systems, and helps document software systems. UML uses visual modeling tools to enable developers to obtain an accurate and complete understanding of the target system through the integrated engineering definition, analysis, design, production, testing and maintenance process of the structural and behavioral characteristics of system requirements [17]. A key purpose of UML diagrams is to share knowledge about the system among developers [18]. Therefore, UML is a suitable tool that can be used to improve the development of software systems.

### 1) Flowchart

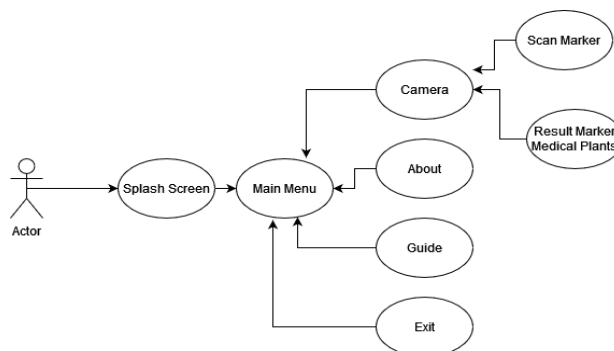
A reversible flowchart is meant to be a programming language model that can be reversed in the same way as a classic flowchart which is the model of many widely used programming languages.



**Fig. 2. Flowchart**

### 2) Use Case Diagram

A use case diagram describes the interaction between the user and the system when the user runs the system. UML use case diagram automatically make easy the understanding and help designers to interpret the same user story in one way, which combines the teams in the design process [19].



**Fig. 3. Use Case Diagram**

#### a. Main Menu

On the main menu, the user will be given a button in the form of a Start button that will go to a page that displays menu options. And if the user presses the Next button, it will automatically be directed to the next page which contains the scan menu, usage guide menu, about application menu, and exit application menu.

#### b. Scan Menu

This menu will go to the main part of the application, which is through a camera directed to the location point that has been determined by the application designer. By using the rear camera and location enabled on the user's smartphone, the 3D object will automatically appear.

#### c. Help Menu

This menu serves to provide information and assistance to users in using the application in this case the steps or how users use medicinal plant markers.

#### d. About Menu

This menu is a valuable tool that can help users to learn more about the app they are using. Users can find out more information about the app and medical plants.

e. Exit Menu

In this menu if the user presses the exit button it will exit the application, so the application will close and complete all windows and processes running in the application.

3) Activity Diagram

An activity diagram is a type of Unified Modeling Language (UML) diagram that shows the flow of activities in a system to describe the behavior of the system and how different activities interact with each other. In a UML activity diagram, it is required to cognize all feasible start-to-end paths with all associated control entities for testing a use-case sufficiently [20].

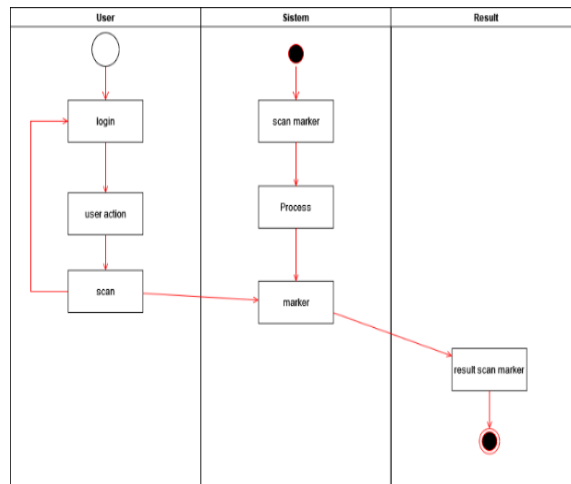


Fig. 4. Scan Camera Menu

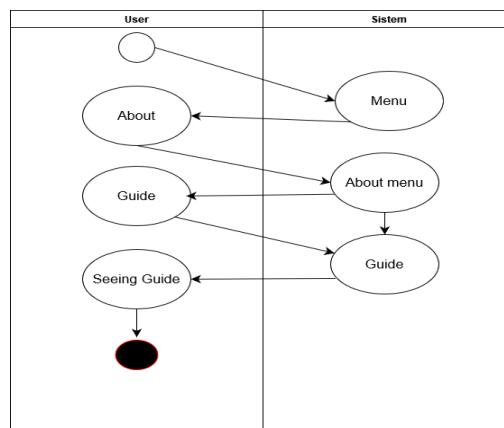


Fig. 5. Application Guide Menu

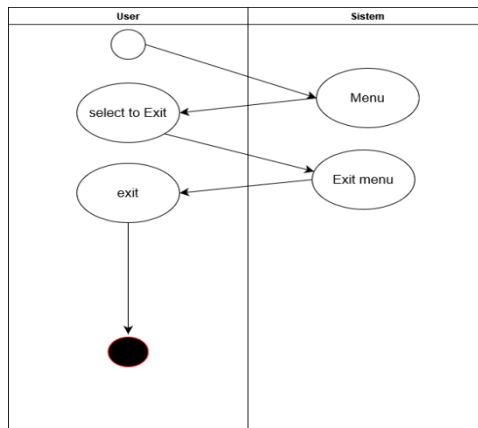


Fig. 6. Exit Menu

4) Sequence Diagram

In the picture below it can be explained that when the user opens and selects the scan menu.

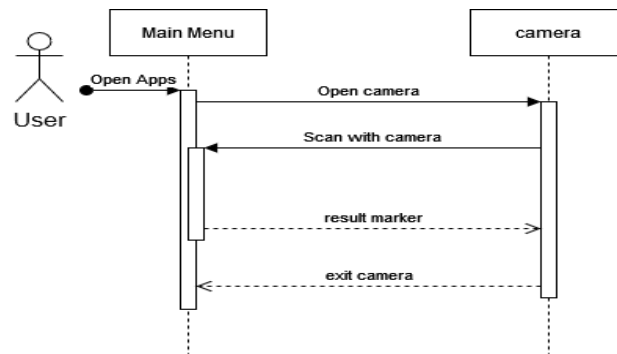


Fig. 7. Scan Camera Menu

In Fig. 8 it can be explained that when the user opens the application and the next page appears, namely the main menu. Then when the user selects the About menu, the user will automatically be directed to the contents page of the about menu. The about menu contains application information that contains the designer, and also related information from the application.

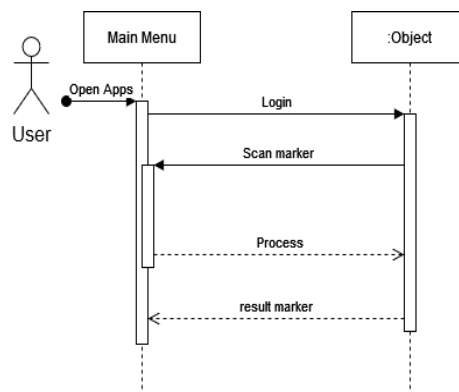


Fig. 8. About Menu

In Fig. 9 it can be explained that, when the user opens the application and the next page appears, namely the main menu. Then the user selects the Guide menu, then the user will automatically be directed to the contents page of the Guide menu. The guide menu contains information about the steps in using the application.

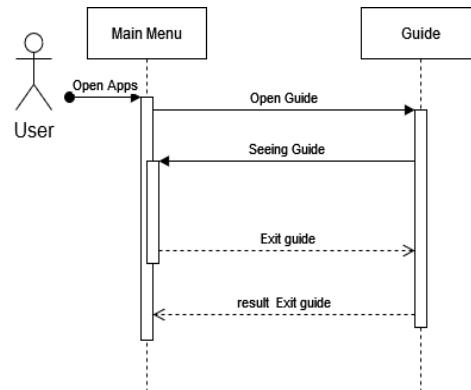


Fig. 9. Guide Menu

In Fig. 10 can be explained that when the user opens the application and the next page appears, namely the main menu. Then when the user selects the Exit button, the application will automatically stop the work process. Which means the user is no longer operating it.

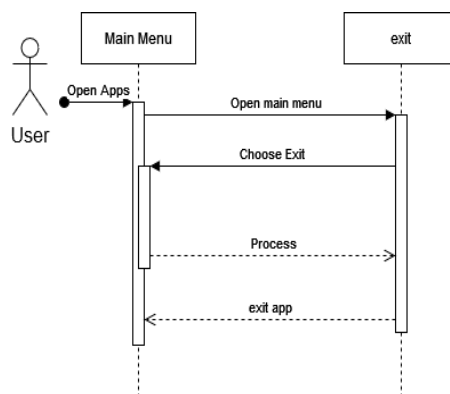


Fig. 10. Exit Menu

5) Class Diagram

In Fig. 11 can be explained that in the design of the application and its appearance using text and images. Where in the class diagram in this application contains several class names such as splash screen, main menu, scan, guide, about, and application. With attributes as in the picture, each class has an output process or output generated from the class name.

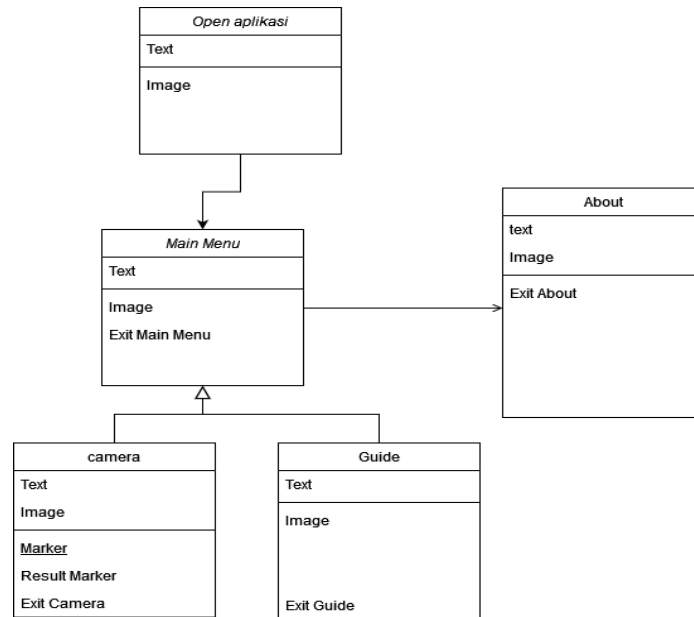


Fig. 11. Class Diagram

### III. RESULTS AND DISCUSSION


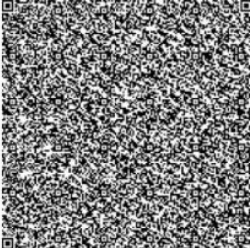
#### A. Implementations

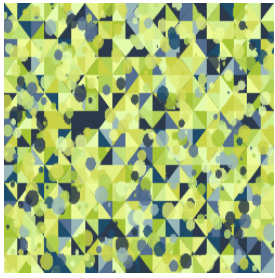



Implementation aims to realize a system that can be used by users in accordance with the design that has been made. The final result at the implementation stage is an AR application system that displays 3D objects and information on medicinal plants as learning media.

##### 1) Design Object 3D Page

The following are some 3D objects that are designed in a way that makes it easier for users to find the location they are looking for.

Table 1. Design 3D Object

No	3D object name	Picture
1	Galangal	
2	Cinnamon	

3	Betel Leaf	
4	Cactus Plants	
5	Sledri Leaf	
6	Binahong Leaf	

2) *Start Menu Page*

This display is the first display that appears and serves to start the application if the user presses the Start button on the screen.



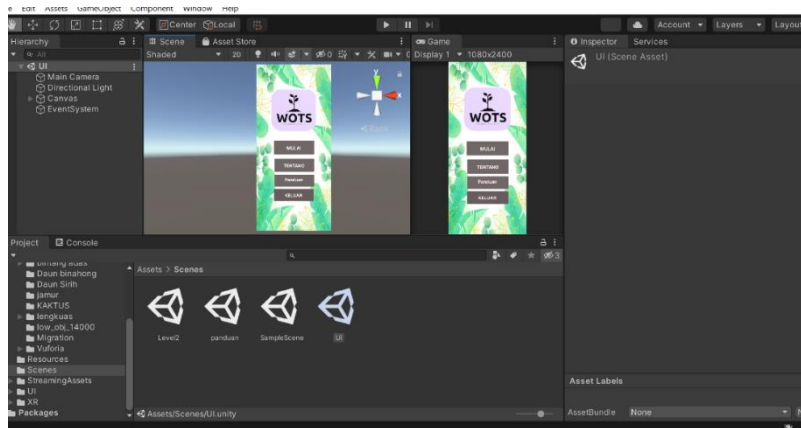
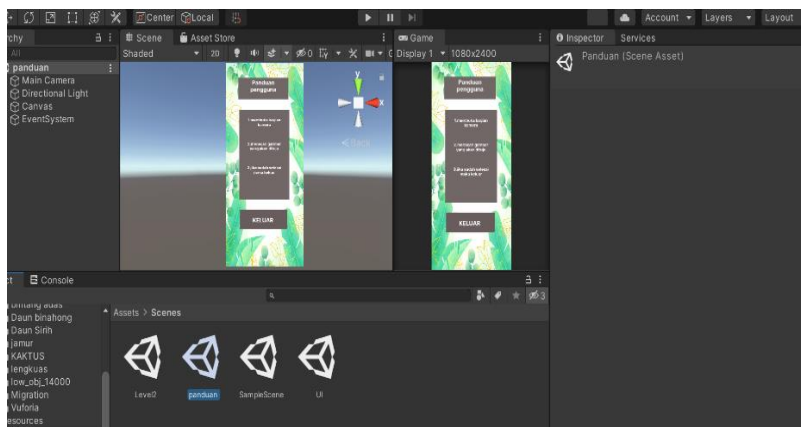


Fig. 12. Start Menu Page

3) Guide Page

This menu displays the steps on how to use the application. When the user presses the Guide button icon, it will automatically be directed to the contents of the guide menu page.



4) Camera Menu Page

The camera menu page contains several lists related to the Medical plant menu name that will be directed to the camera to render 3D objects.

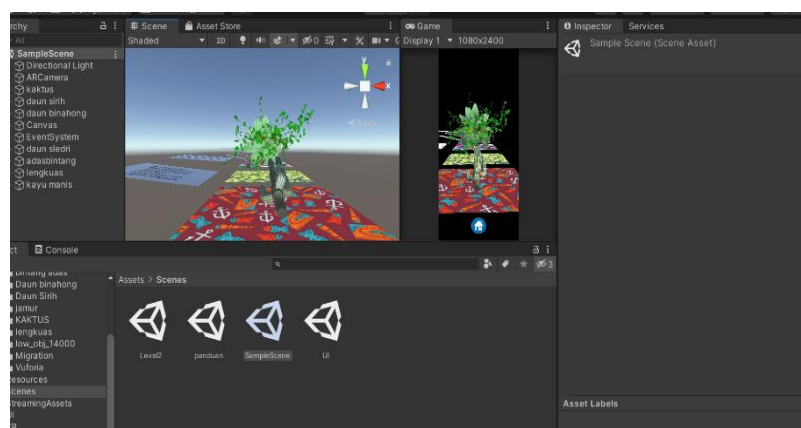


Fig. 13. Camera Menu page

5) About Menu Page

Once the user presses the camera, the user will be prompted to show the sign of the medicinal plant, the camera will automatically start scanning.

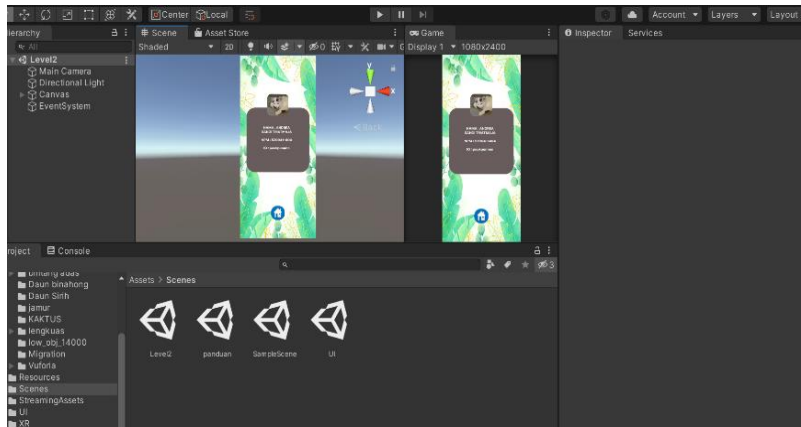


Fig. 14. About Menu Page

B. Discussion of Result

The implementation of the application has been completed and the next is to conduct testing which aims to find out whether there are errors in the program or not.

Table 2. Implementation

No	Device	Android Type	Installation Process	Good Process
1	Xiomi NOTE 9, Ram 6 GB	Android 11	Successful	Successful

Table 3. Testing

No.	Question	Result	
		Successful	failed
1	Display the Page Menu	1	0
2	When the Start button is pressed, it will display the AR Camera	1	0
3	When the Exit button is pressed, the application will close	1	0

Table 4. Results

No	Menu	Expected Results	Application Display	Description
1.	Splash Screen	Display the main page of the application		Success
2.	Main Menu	Display information wots application		Success
3.	Guide	Display the Guide Menu		Success
4.	About	Display the list on the About menu		Success

IV. CONCLUSION

Based on the results of designing Augmented Reality applications for the introduction of medicinal plant information, it can be concluded that this application is useful as an attractive and effective learning media to the public about medicinal plants because it can display 3D plant objects and complete information about these plants. With this application, it can help people to know and learn about medicinal plants so that traditional ways of treatment are also not abandoned.

## REFERENCES

- [1] M. Asigbaase, "Conservation and economic benefits of medicinal plants: Insights from forest-fringe communities of Southwestern Ghana," *Trees, Forest and People*, vol. 14, 2023.
- [2] Y. Zhang and Y. Wang, "Recent trends of machine learning applied to multi-source data of medicinal plants," *Journal of Pharmaceutical Analysis*, 2023.
- [3] L. Zhaogao, W. Yaxuan, X. Mengwei, X. Haiyu, L. Lin and X. Delin, "Molecular mechanism overview of metabolite biosynthesis in medicinal plants," *Plant Physiology and Biochemistry*, vol. 204, 2023.
- [4] R. Rusli, D. A. Nalanda, A. D. V. Tarmidi, K. M. Suryaningrum and R. Yunanda, "Augmented reality for studying hands on the human body for elementary school students," *Procedia Computer Science*, pp. 237-244, 2023.
- [5] R. Golomingi, A. Dobay, S. Franckenberg, L. Ebert and T. Sieberth, "Augmented reality in forensics and forensic medicine – Current status and future prospects," *Science & Justice*, vol. 63, no. 4, pp. 451-455, 2023.
- [6] M. Silva, K. Bermudez and K. Caro, "Effect of an augmented reality app on academic achievement, motivation, and technology acceptance of university students of a chemistry course," *Computers & Education: X Reality*, vol. 2, 2023.
- [7] P. Boonbrahm, C. Kaewrat and S. Boonbrahm, "Effective Collaborative Design of Large Virtual 3D Model using Multiple AR Markers," *Procedia Manufacturing*, vol. 42, pp. 387-392, 2020.
- [8] Y. Liang, "Digital Circuit Learning System Based on Unity3D," *Open Journal of Social Sciences*, pp. 333-343, 2018.
- [9] I. Ouali, M. B. Halima and A. Wali, "Augmented Reality for Scene Text Recognition, Visualization and Reading to Assist Visually Impaired People," *Procedia Computer Sciences*, vol. 207, pp. 158-167, 2022.
- [10] H. Pranoto, P. P. Saputra, M. Sadekh, H. Darmadi and Y. Yanfi, "Augmented reality navigation application to promote tourism to local state attraction "Lawang Sewu"," *Procedia Computer Sciences*, vol. 2016, pp. 757-764, 2023.
- [11] E. Cieza and D. Lujan, "Educational Mobile Application of Augmented Reality Based on Markers to Improve the Learning of Vowel Usage and Numbers for Children of a Kindergarten in Trujillo," *Procedia Computer Science*, vol. 130, pp. 352-358, 2018.
- [12] T. Amanatidis and A. Chatzigeorgiou, "Studying the evolution of PHP web applications," *Information and Software Technology*, vol. 72, pp. 48-67, 2016.
- [13] C. Supaartagorn, "PHP Framework for Database Management Based on MVC Pattern," *International Journal of Computer Science & Information Technology*, vol. 3, no. 2, 2011.
- [14] J. L. Harrington, "Installing and Running MySQL," in *SQL Clearly Explained*, Morgan Kaufmann, 2003, pp. 3-8.
- [15] M. M. Eyada, W. Saber, M. M. E. Genidy and F. Amer, "Performance Evaluation of IoT Data Management Using MongoDB Versus MySQL Databases in Different Cloud Environments," *IEEE Access*, vol. 8, pp. 110656-110668, 2020.
- [16] D. I. Inan and R. Juita, "Analysis and Design Complex and Large Data Base using MySQL Workbench," *International Journal of Computer Science & Information Technology*, vol. 3, no. 5, 2011.
- [17] F. Wang, "UML diagram classification model based on convolution neural network," *Optik*, 2022.
- [18] G. Bergstrom, "Evaluating the layout quality of UML class diagrams using machine learning☆," *Journal of Systems and Software*, vol. 192, 2022.
- [19] M. Elallaoui, K. Nafil and R. Touhni, "Automatic Transformation of User Stories into UML Use Case Diagrams using NLP Techniques," *Procedia Computer Science*, vol. 130, pp. 42-49, 2018.
- [20] V. Arora, M. Singh and R. Bhatia, "Orientation-based Ant colony algorithm for synthesizing the test scenarios in UML activity diagram," *Information and Software Technology*, vol. 123, 2020.