Design and Development of an Augmented Reality Application as a Promotional Media for Como Mineral Water Products by CV. ASIA RAYA

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***Abstract*— The development of digital technology offers new opportunities in promotional strategies, one of which is through the use of Augmented Reality (AR). This research aims to develop an Augmented Reality application as a promotional medium for COMO mineral water products from CV. Asia Raya. The application is designed to display 3D objects of COMO products by scanning markers embedded in brochures. The development process was carried out using Unity, Vuforia, and Blender with the Marker-Based Tracking method. Testing was conducted on the functionality of the application and website, marker readability based on distance, angle, and lighting parameters, as well as the 3D object display speed and the application's effectiveness through questionnaires. The results show that the application can present products interactively, with an average 3D object display speed on brochure media of 1.45 seconds. In addition, questionnaire results from 50 respondents indicated a high level of satisfaction in terms of ease of use (85.8%), visual appeal (84.3%), and promotional effectiveness (84%). This application is expected to serve as an innovative digital promotion alternative and enhance product attractiveness in the market.**

Keywords*— *Augmented Reality, Bottled Water Product, Interactive Application, Marker-Based, Promotional Media.

I. INTRODUCTION

CV. Asia Raya is a new company in the bottled water industry under the COMO brand. As a newcomer, it faces major challenges in building brand awareness and attracting consumer attention. In a competitive market dominated by established brands, effective and engaging promotional strategies are essential. Promotion plays a crucial role in introducing products to a wider market, shaping a positive image, and building consumer trust in product quality [1]. In today's digital era, engaging and interactive promotion is increasingly important. One promising way to achieve this is by using Augmented Reality (AR) as an innovative promotional medium [2].

Augmented Reality (AR) is an interactive technology that blends 3D virtual objects into the real world. It offers benefits such as effectiveness, affordability, and ease of use, making it suitable for product promotion through media like brochures or packaging [3]. The second study, titled *"Design of a Furniture Catalog Promotion Application Using Augmented Reality Technology"* [4], discusses the use of AR to create a more attractive and interactive promotional medium for furniture products.

Tegar Putra Socrates and Fatni Mufit [5] found that using Augmented Reality in physics education improves students' conceptual understanding, learning interest, and critical thinking. AR is seen as an innovative solution to overcome abstract concepts and low engagement in physics learning. Riski Meilindawati, Zainuri, and Isti Hidayah (2023) conducted a literature study on the use of Augmented Reality in mathematics learning. Using a Systematic Literature Review method, they found that AR media improves learning outcomes and supports the development of various mathematical skills in students [6]. Muhammad Rifki Zuliansyah developed an Augmented Reality-based learning media to support elementary school education on endangered animals in Indonesia. The AR application aims to help students better understand protected species and assist teachers in creating engaging and interactive learning experiences [7]. Nasya Nabila Nasoba, Qadhli Jafar Adrian, and Dyah Ayu Megawati developed an Android-based Augmented Reality application to promote furniture products at Sunny Meubel in Metro City. The study aimed to integrate a furniture catalog into AR technology, allowing customers to visualize 3D furniture models in real-world spaces. This approach helps increase consumer interest and enables sellers to showcase unavailable products using virtual representations [8].

Augmented Reality (AR) is a technology that combines virtual objects with the real world in real time, allowing users to interact with 3D content from multiple angles. It enhances user engagement and improves information retention. AR is interactive, immersive, and effective for delivering content, with three key characteristics: integration of real and virtual environments, real-time interaction, and 3D object usage [9]. Tracking and reconstruction are core principles of how Augmented Reality works. The process begins with marker detection using image processing algorithms. Tracking data is used to reconstruct real-world coordinates. AR can not only add virtual objects but also hide real ones by covering them with graphics that blend into the environment [10]. Marker-Based Tracking is an AR method that uses visual markers, such

as images or icons, to trigger virtual content when scanned by a camera. It is one of the earliest and most widely used tracking techniques in AR [11]. Markerless Augmented Reality is an increasingly popular method in AR development that does not require physical markers to display digital elements [12].

Android is an open-source, Linux-based mobile operating system developed by Android Inc. and later acquired by Google. It is widely used due to its flexibility and developer support [13]. Unity 3D is a software used to create 3D games and real-time animations. It includes an IDE called MonoDevelop, which integrates scripts directly into Unity for immediate processing [14]. Visual Studio Code is a lightweight yet powerful source code editor for desktop. It offers built-in support for JavaScript, scripting, and Node.js, and can be extended to support other programming languages such as C++, C#, Python, and PHP [15].

II. METHOD

A. *Type of Research*

This research is classified as a development study focused on the creation of an Augmented Reality (AR) application. The bottled water product application serves as a marketing medium developed by combining text and visual elements. Therefore, the research employs the Marker-Based Method, where a marker functions as a special identifier with a distinct pattern that, when detected by the camera, allows a 3D object to be displayed.

The choice of the Marker-Based method for the COMO bottled water application was based on the consideration that this method is more user-friendly. Markers are designed in the form of logos or labels on the product packaging, making it easier for users to scan directly without needing to explore the surrounding physical environment as required in markerless technology. While markerless AR offers better tracking accuracy and greater flexibility, Marker-Based AR allows users to simply scan a specific marker to instantly access the information, making it more accessible and convenient for a wider audience.

B. *Research Procedure*

The research procedure can be described as follows :

Figure 1. Research Procedure Flowchart

The research was conducted through several stages. First, a literature study was carried out by reviewing previous research and sources relevant to the topic. This stage focused on understanding the basic concepts of Augmented Reality (AR) and identifying the software tools needed for application development. Next, the system design stage involved defining the application concept and usage scenarios, such as how users interact with the app to view product information. It also included creating or selecting appropriate 3D models and determining the visual markers to be used for triggering AR content.

Following the design, the application development stage was implemented using AR development platforms such as Unity and Vuforia. At this stage, 3D models and promotional content were integrated into the AR application. Once developed, the application testing phase was conducted to ensure that all features functioned correctly as intended. This included testing marker readability under various parameters such as distance, angle, and lighting conditions.

Subsequently, the analysis stage was conducted by evaluating the results obtained from testing, based on predefined criteria. Finally, in the conclusion and recommendation stage, the research outcomes were summarized, and suggestions for further development or improvement of the AR application as a promotional medium were provided.

C. *Research Planning*

The research planning was designed to ensure that all activities are well-structured and aligned with the research objectives. The following section presents an overview of the planned research approach.

a. *System Block Diagram*

The system block diagram is presented below and can be seen in Figure 2.

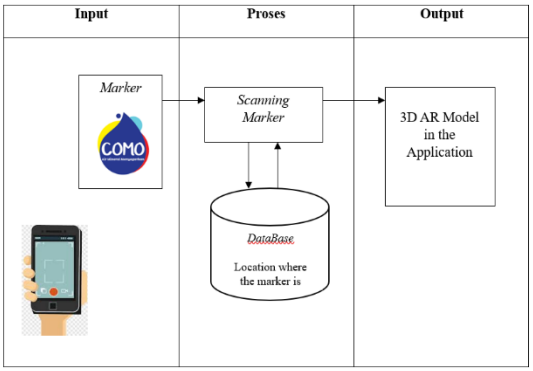

Figure 2. System Block Diagram

The block diagram shown in Figure 2 illustrates the input, process, and output flow of the Augmented Reality (AR) system. The input stage involves the system detecting a marker using the device's camera. The camera scans and captures the marker from the real world, and this visual data is then interpreted as input for the system. The database serves as the storage for marker data, where the system processes the input and identifies the corresponding output. The output stage

displays the processed information in the form of a 3D object. Through this workflow, the camera captures the marker, the system retrieves and processes the related data from the database, and then renders the virtual element in real-time. The result is displayed on the device screen, creating an interactive experience for the user.

b. Marker Detection Flowchart

The marker detection flowchart is presented as follows :

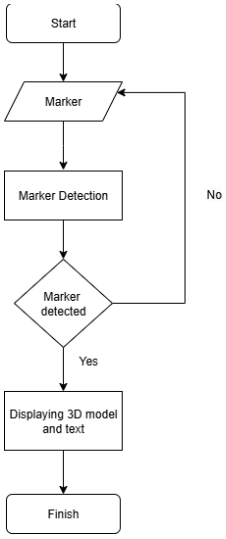

Figure 3. Marker Detection Flowchart

The flowchart shown in Figure 3. illustrates the process of marker detection in the Augmented Reality system. The process begins with launching the application. Once the application is running, the system is directed to detect a marker using the device's camera. The marker is typically a predefined image or pattern. During the marker detection stage, the system attempts to recognize the marker in front of the camera by processing the captured image. If the marker is successfully detected, the process continues to the next step; if not, the system returns to the previous step to reattempt detection. Once the marker is recognized, the system displays a 3D object along with relevant text information associated with the marker. The process concludes when the AR content has been successfully rendered and displayed on the screen.

c. Application Start Activity Diagram

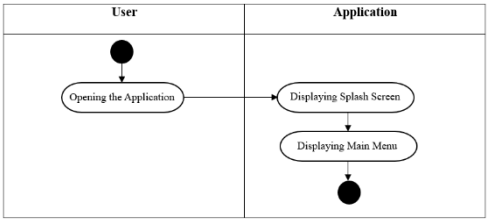

Figure 4. Application Start Activity Diagram

Figure 4 above shows the activity diagram that illustrates the initial flow when the user starts using the application. The process begins when the user opens the application on their device. Once the application is launched, the system automatically displays a splash screen, which typically contains the logo or a short animation as the application's identity. After that, the application directly presents the main menu, which serves as the central interface for users to access other features.

d. Product Menu Activity Diagram

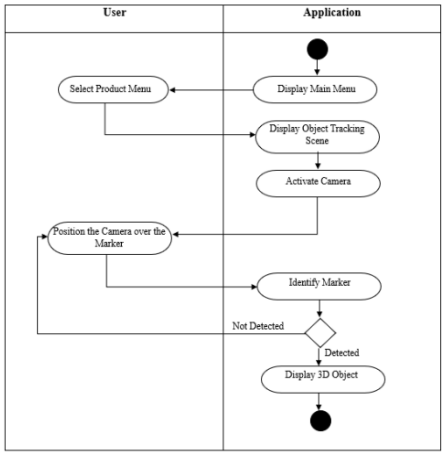

Figure 5. Product Menu Activity Diagram

The diagram above illustrates the activity flow between the user and the application system when using the Augmented Reality (AR) feature in the product menu. The process begins when the user selects the "Product" menu from the main interface. The system will then automatically display the object tracking scene and activate the device's camera as part of the marker tracking process.

Next, the user is prompted to point the camera at the designated marker. The application will proceed with the marker identification process. If the marker is not detected, the application will continue to wait until the marker is successfully recognized. Once the marker is detected, the application will immediately display the corresponding 3D product object.

e. Information Menu Activity Diagram

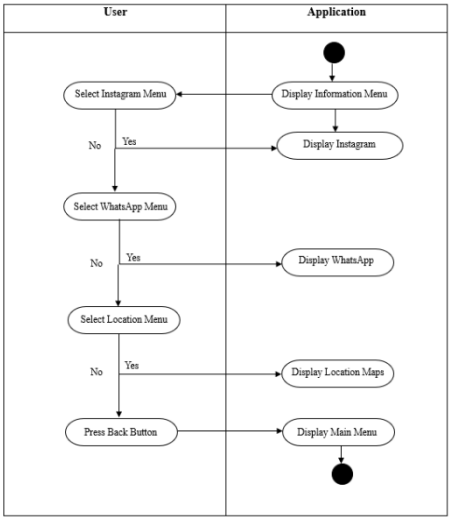

Figure 6. Information Menu Activity Diagram

Figure 6 above shows the activity diagram that explains the flow of using the Information Menu within the application. The process begins when the system displays the Information

Menu, and the user is given options to access several submenus: Instagram, WhatsApp, and Location. If the user selects the Instagram menu, the application will open a link directing to the company's Instagram page. If not, the user can proceed to choose other available menus.

Next, if the user selects the WhatsApp menu, the application will launch the WhatsApp service according to the predefined contact number. Similarly, when the user selects the Location menu, the system will open a maps application that shows the company's location. At the end of the flow, when the user selects the Back button, the application will return to the main menu.

f. Instruction Menu Activity Diagram

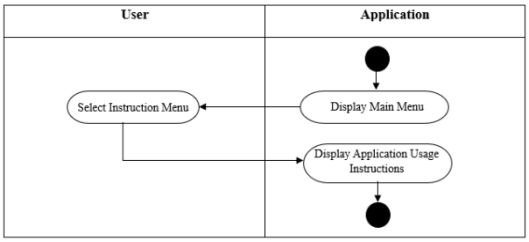

Figure 7. Instruction Menu Activity Diagram

Figure 7 above shows the activity diagram that illustrates the interaction flow between the user and the application when accessing the Instruction menu. The process begins with the application displaying the main menu, after which the user selects the Instruction menu to learn how to use the application. Once this option is selected, the system immediately displays usage instructions in the form of an information screen that explains the steps or guidance for the user.

g. Questionnaire Menu Activity Diagram

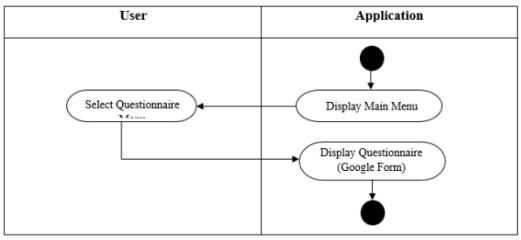

Figure 8. Questionnaire Menu Activity Diagram

Figure 3.8 above illustrates the activity diagram that shows the process flow when the user accesses the Questionnaire menu within the application. The process begins when the application displays the main menu, and the user selects the Questionnaire menu to provide feedback on the application they have used. Once the menu is selected, the application displays a questionnaire form that is directly linked to Google Form.

h. Application Design

1. Main Menu Page

On the application's home screen, four main menus are displayed: the Product menu, Information menu, Instruction menu, and Questionnaire menu.

Figure 9. Main Menu Page

2. Product Display Design

Figure 10. Product Display Design

If the user selects the Product menu, several types of products will be available. Swipe the screen (the arrow logo in the image is for illustration purposes only) to choose the product type, then scan the corresponding marker to display the product in 3D form.

3. Information Display Design

If the user selects the Information menu, several options will appear, such as Instagram, WhatsApp, and Location, which provide information related to marketing.

Figure 11. Information Display Design

4. Instruction Display Design

If the user selects the Instruction menu, it will display guidance on how to use the application.

Figure 12. Instruction Display Design

5. Questionnaire Button Display

If the user selects the Questionnaire menu, they will be redirected to a Google Form to fill out several questionnaire questions.

Figure 13. Questionnaire Button Display

i. Website Design

1. Profile Page Design

This page is designed to display general information about the company CV. Asia Raya, such as a brief history, vision and mission, and other related details.

Figure 14. Profile Page Desain

2. Product Page Desain

This page contains a list of COMO bottled water product types produced by the company. On this page, visitors can view an overview of all available packaging variants.

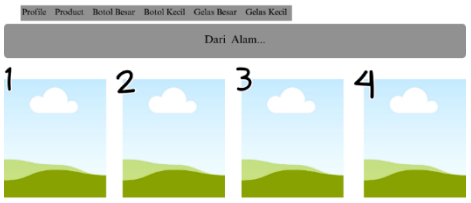

Figure 15. Product Page Desain

3. Large Bottle Page

This page displays detailed information about the bottled water product in the large bottle packaging.

Figure 16. Large Bottle Page

4. Small Bottle Page

This page displays a complete description of the bottled water product in the small bottle packaging.

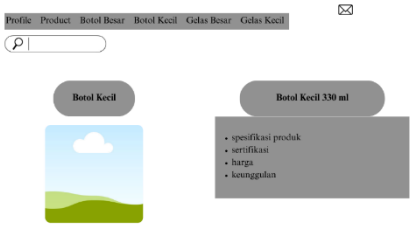

Figure 17. Small Bottle Page

5. Large Cup Page

This page contains information about the bottled water product in the large cup packaging.

Figure 18. Large Cup Page

6. Small Cup Page

This page displays the bottled water product in the small cup packaging.

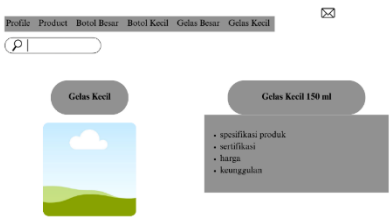

Figure 19. Small Cup Page

j. 3D Product Design

The following is the 3D design of COMO products :

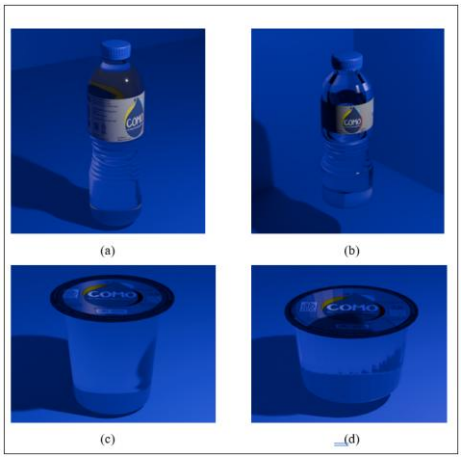

Figure 20. 3D Product Design

D. Tools and Materials

The hardware used in the design process was a Lenovo IdeaPad Slim 3 laptop. The complete specifications of this device are detailed in Table I

TABLE I.
SPECIFICATION

Specification	Description
Type/Model	Lenovo ideapad slim 3
Processor	Intel® Core™ i5-1135G7 Processor (4 Cores / 8 Threads, 2.40 GHz, up to 4.20 GHz with Turbo Boost, 8 MB Cache)
RAM	8 GB
Storage	512 GB
Display Size	14 Inch FHD (1920 x 1080)
Camera	720p HD
Audio	Stereo, Dolby Audio
Graphics	Integrated Intel® Iris® Xe Graphics
Connectivity	Bluetooth, Wi-fi

In addition to the device used for system design, this research also required a specific device to test the developed system. The device used for system testing in this study was an Android smartphone, namely the Samsung Galaxy Note 10. The detailed specifications of this smartphone are presented in Table II.

TABLE II.
SPECIFICATION

Specification	Description
DISPLAY	Dynamic AMOLED, HDR10+ 6.3 inch 1080 x 2280 pixels
MEMORY	Internal : 256 GB RAM : 8 GB
CAMERA	12 MP (wide), 12 MP (telephoto), 16 MP (ultrawide) 10 MP, f/2.2, 26mm (wide)

The supporting software used in the development of the Augmented Reality application in this study includes several tools and platforms. The system was built on the Windows 11 operating system as the primary development environment. Unity Hub version 3.10.0 was utilized for managing and building the AR project, while Blender 3D version 2.8 was used to design and model 3D product visuals. Visual Studio 2022 served as the code editor and integration tool during development. Additionally, the application employed the Vuforia SDK for marker-based AR tracking functionality. Canva was also used to create visual assets and graphic materials used in the application interface and promotional elements.

E. Testing Parameters

The testing in this study includes functional testing of the application and website, accuracy testing of marker readability, rendering speed testing, and a questionnaire evaluation of the Augmented Reality application.

III. RESULTS AND DISCUSSION

The research was conducted at the office of CV. Asia Raya, located in Dusun Sukorejo, Karangjati Village, Pandaan District, Pasuruan Regency, East Java Province. This study was carried out over a period of four months, from March to June 2025. It included the design and development of the Augmented Reality application, as well as the final evaluation process of the developed application.

A. Implementation Results

The implementation results of this research consist of an Augmented Reality (AR) application and a supporting promotional website. The AR application was successfully developed to display 3D models of COMO bottled water products through marker scanning, providing an interactive promotional experience for users. Meanwhile, the website serves as a complementary platform that presents company information, product descriptions. Both platforms were designed to work in harmony, supporting the overall promotional objectives of CV. Asia Raya.

a. Application Results

In this section, the author presents the results of the application that was developed using Unity Hub, with a minimum requirement of Android 8.0 (API Level 26).

1. Main Menu Page

Figure 21 shows the main menu page of the COMO bottled water Augmented Reality promotional application. This page appears after the splash screen and features the COMO logo as the application's main visual identity. There are four main navigation buttons: Product, Information, Instruction, and Questionnaire — each serving a different function.

Figure 21. Main Menu Page

2. Product Menu Page

In Figure 22 at the center of the page, there is a yellow guide area with the text "Point the Camera at the Marker," which serves as the display area for the Augmented Reality 3D object when the marker is recognized by the camera.

Figure 22. Marker Not Detected

Figure 23 shows the Product Menu page display in this application, featuring four packaging variants of COMO bottled water: Large Bottle, Small Bottle, Large Cup, and Small Cup. Each product type is displayed separately.

Figure 23. Marker Detected

3. Information Menu Page

Figure 24 shows the display of the Information Menu page in the application, which provides direct access to communication and promotional channels for COMO bottled water products by CV. Asia Raya. This page features three main buttons: Instagram, WhatsApp, and Location. The Instagram button directs users to the official account @comomenyegarkan to view promotional content and product information. The WhatsApp button facilitates communication or ordering with the marketing team. Meanwhile, the Location button opens a digital map showing the position of the CV. Asia Raya office or factory.

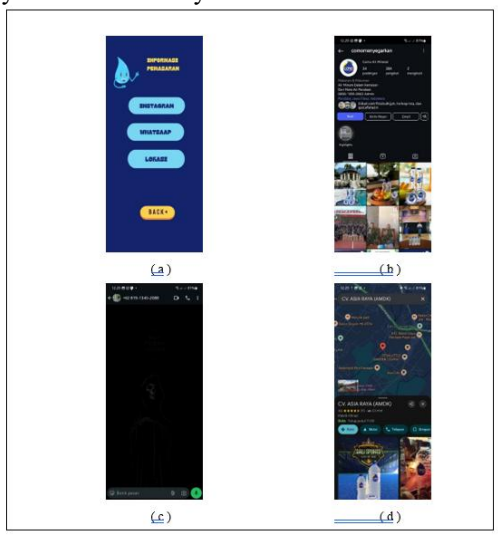

Figure 24. Information Menu Page

4. Instruction Menu Page

Figure 25 shows the display of the Instruction Menu page in the application, which functions as a usage guide to help users operate the application features correctly, especially when using the Augmented Reality technology. The instructions provided relate to how to scan each product in the Product Menu, including specific information about the marker that needs to be pointed at the camera. These instructions aim to ensure that the AR 3D object appears accurately according to the marker used.

Additionally, there is a reminder for users to fill out the questionnaire after using the application as a form of feedback that will be useful for future application development. A Back button is provided at the bottom of the page to return to the main menu.

Figure 25. Instruction Menu Page

5. Questionnaire Menu Page

Figure 4.6 shows the display of the Questionnaire Menu page in the application, which serves as a means to collect feedback from users regarding their experience using the COMO Augmented Reality application. On this page, users are directed to a Google Form containing several questions related to ease of use, visual appeal, and promotional effectiveness.

Figure 26. Questionnaire Menu Page

b. Website Results

In this section, the author presents the results of the website that was designed using the Odoo Website Builder.

1. Profile Page

The Profile menu on the COMO website serves as the company profile display of CV. Asia Raya, presenting brief information about the company's background, vision and mission, core values, and other related details. In addition, it also highlights that COMO products have met the Indonesian National Standard (SNI), are certified by the Food and Drug Monitoring Agency (BPOM), and have received the Halal label from the Indonesian Ulema Council (MUI), as proof of the company's commitment to quality and consumer trust.

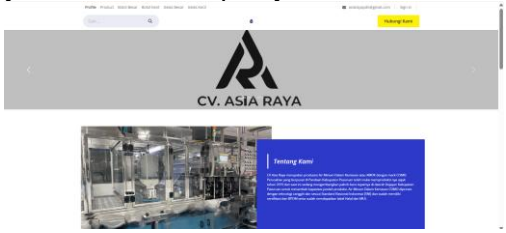

Figure 27. Profile Page

2. Product Page

The Product menu on the COMO website showcases various product variants of COMO bottled drinking water (AMDK) produced by CV. Asia Raya. On this page, visitors can view visual representations of the four main packaging types offered, namely bottles and cups in various sizes.

Figure 28. Product Page

3. Large Bottle Page

On the Large Bottle menu of the COMO website, one of the product variants is displayed — COMO bottled water in 600ml packaging. The product information is organized into several key sections, such as Product Specifications, Certifications, Price, and the Advantages of COMO 600ml Mineral Water, which can be expanded or collapsed according to the user's preference.

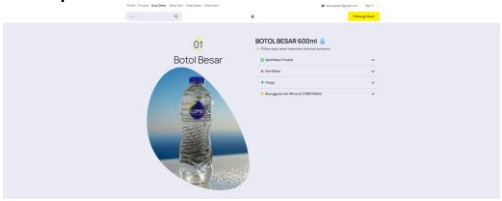

Figure 29. Large Bottle Page

4. Small Bottle Page

The Small Bottle menu on the COMO website displays information about the bottled water product in 330 ml packaging. This page presents a product visual along with detailed specifications, which can be accessed through several sections such as product specifications, certifications, pricing, and product advantages. The pricing information is explained in detail.

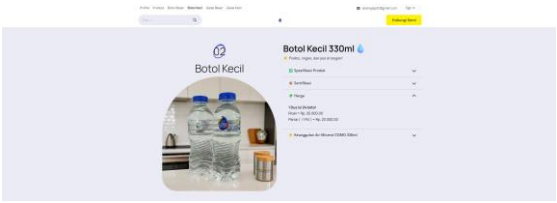

Figure 30. Small Bottle Page

5. Large Cup Page

The Large Cup menu on the COMO website contains information about the bottled water product in a cup packaging that is larger than the standard variant. The page features a main product photo showcasing the packaging design and includes several interactive sections with details such as product specifications, certifications, pricing information, and product advantages.

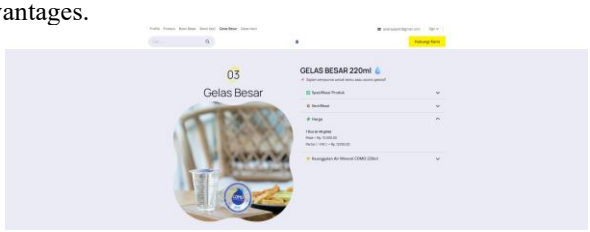

Figure 31. Large Cup Page

6. Small Cup Page

The Small Cup menu contains information about COMO bottled water in small cup packaging. Similar to the other product pages, this menu displays a product photo along with interactive sections that can be expanded or collapsed, such as product specifica tions, certifications, pricing, and product advantages.

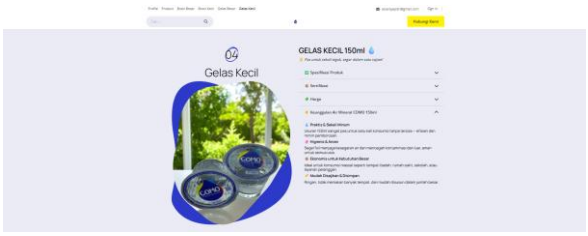

Figure 32. Small Cup Page

c. Application Installation Testing

After the system was developed, installation testing of the Augmented Reality application was carried out on several smartphone devices with different brands and Android operating system versions, as shown in Table III

TABLE III
APPLICATION INSTALLATION

No	User Name	Smartphone Brand	Android Version	Installation Result
1.	Firsya	Samsung Note 8	9	✓
2.	Hifza	Samsung Note 10	12	✓
3.	Ilhan	Samsung A71	13	✓
4.	Hellen	Samsung S23	14	✓
5.	Naya	Redmi note 12	15	✓

Based on the test results, it was found that all respondents successfully installed the application without encountering any technical issues. The devices used in the testing included a Samsung A71 with Android version 13, Samsung Note 10 with Android version 12, Samsung Note 8 with Android version 9, Samsung S23 with Android version 14, and Redmi Note 12 with Android version 15. These results indicate that the application runs well across various devices and different versions of the Android operating system. This proves that the application distribution process was carried out properly, allowing it to operate optimally on a wide range of user devices.

d. Application Functionality Testing

Next, functionality testing was carried out on several features that had been developed. This was done to ensure that each feature in the application functions properly (Table IV).

TABLE IV.
APPLICATION FUNCTIONALITY TESTING

No	Feature Testing	Result	
		Successful	Not Successful
1.	*Splash Screen* When the application is opened for the first time, the initial screen appears for five seconds	✓	
2.	*Main Menu Page* Displays the buttons for Product, Information, Instruction, and Questionnaire menus.	✓	
3.	*Product Page* Displays the product variation menu along with 3D product models, text animations, and audio.	✓	
4.	*Information Page* Displays the Instagram, WhatsApp, and Location buttons, each directly linked to their respective URLs.	✓	
5.	*Instruction Page* Displays guidance on how to use the application.	✓	
6.	*Questionnaire Page* Displays the questionnaire via Google Form.	✓	

Based on the testing results, all features of the Augmented Reality application functioned properly and as intended. The splash screen displayed correctly for five seconds before transitioning to the main menu, which successfully showed navigation buttons for the Product, Information, Instruction, and Questionnaire pages. The product page displayed 3D models with accompanying text animations and audio, while the information page correctly linked to Instagram, WhatsApp, and the company's location. The instruction page clearly presented usage guidance, and the questionnaire page successfully loaded the Google Form. Overall, the application met all functionality requirements, with each feature operating according to its design and purpose.

e. Website Functionality Testing

Next, functionality testing was carried out on several pages and features of the website that had been developed, as shown in Table V.

TABLE V.
WEBSITE FUNCTIONALITY TESTING

No	Feature Testing	Result	
		Successful	Not Successful
1.	*Profile Menu Page* Displays information about the company's profile.	✓	
2.	*Product Menu Page* Displays photos of four types of products.	✓	
3.	*Large Bottle Menu Page* Displays various information related to the large bottle product.	✓	
4.	*Small Bottle Menu Page* Displays various	✓	

No	Feature Testing	Result	
		Successful	Not Successful
	information related to the small bottle product.		
5.	*Large Cup Menu Page* Displays various information related to the large cup product.	✓	
6.	*Small Cup Menu Page* Displays various information related to the small cup product.	✓	

Based on the testing results, all features and pages of the website functioned properly without any issues. The Profile page successfully displayed complete company information, including background, vision and mission, and general details. The Product page clearly presented images of the four main product types, and each individual product page—Large Bottle, Small Bottle, Large Cup, and Small Cup displayed accurate information such as packaging size, product description, and specific characteristics. All pages were accessible and error-free. Overall, the website functionality testing showed excellent results, confirming that the site operates as designed and effectively serves as a digital promotional platform for the company.

f. Accuracy Testing of Marker Readability on Brochure Media

This test was conducted to determine how accurate and consistent the Augmented Reality application is in recognizing markers printed on brochure media, as shown in Table VI.

TABLE VI .
ACCURACY TESTING OF MARKER READABILITY ON BROCHURE MEDIA

No.	Light, Distance, and Angle	Marker Readability Result			
		Large Bottle	Small Bottle	Large Cup	Small Cup
1.	Bright Light, 10 cm, 0°	✓	✓	✓	✓
2.	Bright Light, 10 cm, 30°	✓	✓	✓	✓
3.	Bright Light, 10 cm, 60°	✓	✓	✓	✓
4.	Bright Light, 15 cm, 0°	✓	✓	✓	✓
5.	Bright Light, 15 cm, 30°	✓	✓	✓	✓
6.	Bright Light, 15 cm, 60°	✓	✓	✓	✓
7.	Bright Light, 20 cm, 0°	✓	✓	✓	✓
8.	Bright Light, 20 cm, 30°	✓	✓	✓	✓
9.	Bright Light, 20 cm, 60°	✓	✓	✓	✓
10.	Dim Light, 10 cm, 0°	✓	✓	✓	✓
11.	Dim Light, 10 cm, 30°	✓	✓	✓	✓
12.	Dim Light, 10 cm, 60°	✓	✓	✓	✓
13.	Dim Light, 15 cm, 0°	✓	✓	✓	✓
14.	Dim Light, 15 cm, 30°	✓	✓	✓	✓
15.	Dim Light, 15 cm, 60°	✓	✓	✓	✓
16.	Dim Light, 20 cm, 0°	✓	✓	✓	✓
17.	Dim Light, 20 cm, 30°	✓	✓	✓	✓
18.	Dim Light, 20 cm, 60°	✓	✓	✓	✓

Based on testing using brochure media, the marker readability results are as follows: large bottle at 100%, small bottle at 100%, large cup at 100%, and small cup at 100%.

g. Rendering Speed Testing on Brochures

In this test, the marker was printed on a brochure with an adjusted resolution quality. The application was directed toward the marker from specific distances and angles, and the time required to display the 3D object was measured, as shown in Table VII.

TABLE VII.
RENDERING SPEED TESTING ON BROCHURES

No.	Light, Distance, and Angle	Rendering Speed (seconds)			
		Large Bottle	Small Bottle	Large Cup	Small Cup
1.	Bright Light, 10 cm, 0°	1,09 second	1,16 second	1,03 second	1,22 second
2.	Bright Light, 10 cm, 30°	1,11 second	1,07 second	1,30 second	1,02 second
3.	Bright Light, 10 cm, 60°	1,13 second	1,20 second	1,10 second	1,12 second
4.	Bright Light, 15 cm, 0°	1,26 second	1,23 second	1,20 second	1,16 second
5.	Bright Light, 15 cm, 30°	1,35 second	1,14 second	1,07 second	1,08 second
6.	Bright Light, 15 cm, 60°	1,10 second	1,46 second	1,08 second	1,13 second
7.	Bright Light, 20 cm, 0°	1,13 second	1,45 second	1,39 second	1,06 second
8.	Bright Light, 20 cm, 30°	1,11 second	1,07 second	1,07 second	1,07 second
9.	Bright Light, 20 cm, 60°	1,12 second	1,33 second	1,06 second	1,24 second
10.	Dim Light, 10 cm, 0°	1,53 second	1,61 second	1,06 second	1,21 second
11.	Dim Light, 10 cm, 30°	2,14 second	2,43 second	1,32 second	1,34 second
12.	Dim Light, 10 cm, 60°	1,32 second	1,58 second	1,13 second	1,80 second
13.	Dim Light, 15 cm, 0°	1,48 second	1,13 second	1,35 second	1,70 second

No.	Light, Distance, and Angle	Rendering Speed (seconds) Large Bottle	Small Bottle	Large Cup	Small Cup
14.	Dim Light, 15 cm, 30°	2,40 second	2,80 second	1,68 second	1,89 second
15.	Dim Light, 15 cm, 60°	2,40 second	1,87 second	1,48 second	2,28 second
16.	Dim Light, 20 cm, 0°	1,96 second	1,81 second	1,09 second	2,30 second
17.	Dim Light, 20 cm, 30°	2,30 second	3,09 second	1,91 second	2,51 second
18.	Dim Light, 20 cm, 60°	2,65 second	2,03 second	1,63 second	3,06 second

Based on the test results, shows that the average rendering time on brochure media was relatively fast and stable, with the following results: large bottle at 1.5 seconds, small bottle at 1.6 seconds, large cup at 1.2 seconds, and small cup at 1.5 seconds.

h. Percentage of Questionnaire Results for the Augmented Reality Application

No	Question	SS	S	KS	TS
1.	How easy was it for you to understand the instructions or usage guide when using the application for the first time?	19	32	0	0
2.	How easy was it for you to use the buttons or features in the application's main menu?	24	26	0	0
3.	Do you feel that the application is responsive and fast in detecting the marker?	19	31	0	0
4.	How detailed and realistic is the graphic quality of the 3D model displayed by this application?	23	21	6	0
5.	Does the combination of colors, graphic design, and product information in the application appear clear?	24	26	0	0
6.	How effective are the visual elements such as animation and 3D displays in attracting attention and conveying product information?	21	22	7	0
7.	To what extent does the displayed 3D model help you understand the shape or advantages of the product visually?	23	24	3	0
8.	To what extent does this application influence your interest in purchasing the product?	22	23	5	0
9.	Do you think this application can be an effective promotional tool for the company?	28	17	5	0
10.	Does this application provide a different and more engaging experience compared to promotions through pamphlets, brochures, posters, or banners?	23	24	0	0

TABLE X.
THE RESULTS OF THE QUESTIONNAIRE IN PERCENTAGE FORM

Question	Percentage Score (Y)
1	86 %
2	87 %
3	84,5 %
4	83,5 %
5	87 %
6	82 %
7	85 %
8	83,5 %
9	86,5 %
10	82 %
Average	84,7 %

Based on the overall average of all questionnaire responses, a score of 84.7% was obtained, which falls into the "Excellent" category. This indicates that the developed Augmented Reality application is not only feasible for use but also provides added value by offering a new experience to users in terms of functionality, visuals, and effectiveness in delivering promotional information, as shown in Table X.

IV. CONCLUSION

Based on the problem formulation, planning, testing, and research results, it can be concluded that the Augmented Reality (AR) application developed as a promotional medium for COMO bottled water by CV. Asia Raya was successfully designed and implemented through several stages from needs analysis, design, to development using Unity and Vuforia. The application effectively displays 3D product models when specific markers are detected by the device's camera. The development process involved essential hardware (laptop and Android smartphones) and supporting software including Unity, Vuforia, and Blender. Functionality testing showed that all features, including splash screen, navigation menus, product views, and questionnaire integration, worked smoothly with 100% success. Questionnaire results from 50 respondents revealed high satisfaction levels: 85.8% for ease of use, 84.3% for visual appeal, and 84% for promotional effectiveness, with an overall average of 84.7%, indicating strong potential as a promotional tool. Furthermore, the application achieved an average marker readability rate of 100% on brochure media and a rendering speed of 1.45 seconds, proving its ability to deliver interactive content responsively and reliably.

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