

Integrating Augmented Reality and Simulation Game for Flower Board Design

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ABSTRACT

Augmented Reality was considered one of the technologies that merged the real world with the virtual one. Developers from various fields, including businesses such as floral services, as exemplified by Berkah Florist, had been advancing this technology. In its practical application, Berkah Florist encountered challenges related to efficiency and customer satisfaction in the floral design process. Common methods such as displaying photos or using paper-based designs were time-consuming and susceptible to paper damage, hindering customers from expressing their preferences accurately. To address this, an application was developed to simplify the floral design process and make it more engaging. This research aimed to assist customers and streamline Berkah Florist's operations by facilitating more captivating and effective modeling and visualization of designs. The application was designed based on simulation game principles to attract users from various backgrounds, including those unfamiliar with design, particularly targeting rural communities with limited editing skills. Users could design flower arrangements to be ordered from Berkah Florist. This system simplified the design process for anyone, resulting in flower arrangements tailored to the customer's specifications. The application was developed using R&D and RAD methodologies. It presented floral designs through an AR-enabled camera, replicating real-world conditions. The integration of Augmented Reality in this application attracted interest and engagement from potential customers while reducing boredom. Designed to provide an enjoyable experience for prospective customers, the application aimed to increase their interest in its reuse. As a result, Berkah Florist could enhance customer experience and improve efficiency in the floral design process.

Keywords: Application, Augmented Reality, R&D, RAD, Simulation Game

INTRODUCTION

The rapid advancement of information technology in software and hardware has provided convenience for the public (M. Z. Batubara & Nasution, 2023). One of the highlighted technologies is Augmented Reality (AR), which aimed to integrate the real world with the virtual world (Naba et al., 2022). The development of AR by developers has enabled the application of this technology in various fields, including the business sector such as floral services, exemplified by Berkah Florist.

Berkah Florist was a floral business located at Jl. Rintis, Cinta Makmur Dusun 2 Gang Perjuangan, Kecamatan Panai Hulu. Berkah Florist was one of the emerging floral businesses with an average of 80 transactions per month. The business offered a variety of flower boards with variations in flower types, colors, fonts, boards, and background. However, in practice, Berkah Florist faced challenges regarding efficiency and customer satisfaction in the flower design process. Current methods, such as displaying photos or using paper designs, were considered ineffective due to the significant time consumption and vulnerability to paper damage, causing boredom and inconvenience for customers (Mulyadi et al., 2022).

In response to this issue, research was conducted to innovate and address existing problems by utilizing an application that facilitated the flower board design process and made it more engaging. This application was designed based on simulation game principles to capture users' attention and be user-friendly, catering to both design experts and those unfamiliar with complex editing applications (Romli et al., 2020). Moreover, the application was specifically targeted towards rural communities in the area who generally lacked proficiency in using editing applications. With this application, users could design flower boards to be ordered from Berkah Florist. The advantage of this system was its ability to simplify the design process for anyone, particularly those unaccustomed to design, enabling them to create flower boards according to their preferences. Subsequently, Berkah Florist would produce the flower boards as gifts for the intended recipients, in line with the customers' orders.

To address these needs, new technology was required to assist customers and streamline the modeling and

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visualization process of more appealing and efficient flower board designs. Therefore, a real-time application was needed to facilitate the creation of flower board designs at Berkah Florist, particularly an application based on simulation game principles using Augmented Reality (AR). With this application, users only needed to select options presented at each stage according to their preferences.

This research was developed based on ideas from previous studies, such as the scientific papers "Design and Construction of Augmented Reality for Building Interior Design" (Prasetyo & Soepriyanto, 2020), which discussed the application of Augmented Reality for interior design in architectural drawing courses, and "Development of RC Car Simulator Game Using Augmented Reality" (Setyaji et al., 2019), which elaborated on the implementation of Augmented Reality technology in simulation-based games. The primary target of this game was to create a new user experience by enhancing user interaction with the RC Car Simulator game without the presence of physical objects directly and anywhere without considering a large space to play.

Therefore, this research aimed to provide a solution for Berkah Florist by developing an application that allowed customers to determine the final outcome of their flower board designs. This application was expected to help increase customer satisfaction and streamline the modeling and visualization process of flower board designs, making them more appealing and efficient. Technical considerations were one of the main aspects carefully considered in the development of this application. The researchers understood that not all customers possessed the same level of technical expertise; hence, an intuitive and user-friendly interface was designed. Furthermore, comprehensive guidance and technical support were provided to ensure that every customer could smoothly use the application. With this approach, the researchers were confident that the application not only offered an efficient solution for Berkah Florist's customers but also provided a satisfying and user-friendly experience for all users.

LITERATURE REVIEW

In the research conducted by Setyaji et al. in 2019 (Setyaji et al., 2019), the findings indicated that the study yielded a novel user experience by enhancing user interaction and experience with the RC Car Simulator game without requiring physical objects directly. This process also enabled users to play it anywhere without the need for ample space, as obtained through playtesting.

Furthermore, in 2020 (Prasetyo & Soepriyanto, 2020), research conducted by Prasetyo & Soepriyanto resulted in an Augmented Reality application applicable to interior design education, particularly for students majoring in Architectural Drawing Engineering. This application utilized marker scanning to generate 3D objects for educational purposes.

Also, in 2020, Aristo et al. conducted research titled "Design and Implementation of Mobile Augmented Reality for 3D Hydrosphere Learning Media" (Aristo et al., 2020). The research outcome was a Mobile Augmented Reality application serving as a learning medium for hydrosphere topics, facilitating educators in conveying concepts using 3D objects for better understanding by students.

Based on several studies serving as references in this research, innovations were made in designing and constructing a system incorporating the use of Augmented Reality as a visual design medium for flower arrangements at Berkah Florist, based on the Simulation Game framework. The developed system featured comprehensive and detailed functionalities such as pricing information, types, and sizes. This study employed the Research and Development (RnD) methodology to evaluate system effectiveness, applying the Rapid Application Development (RAD) method for system development.

METHOD

The research process employed the Research & Development (R&D) method to gather data. R&D is a specialized approach aimed at generating and testing new products tailored to specific needs (Syahrani & Samsudin, 2023). Through stages of development and testing, this process ensured the utility of the product within the context of its use in society (Harahap & Triase, 2022).

In addition to R&D, the study also implemented the Rapid Application Development (RAD) approach in system development. RAD is recognized as a method for rapid and iterative software development, focusing on delivering products that provide immediate benefits to users (Hidayati, 2018). With RAD, the development team could flexibly respond to changing needs and create products adaptable to user and environmental dynamics (Nurtjahjani et al., 2022). The combination of these two methods is expected to enhance the validity, quality, and effectiveness of this research and development endeavor (Lusianto et al., 2022).

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Research Method

The research process employed the Research and Development (R&D) method. Below are the steps of the R&D research method:

Research and Information Gathering

To acquire information related to the research problem, the researchers conducted observations, interviews, and literature reviews. Systematic direct observations were carried out on Berkah Florist to observe its design process and to track its location through Google Maps. Additionally, the researchers conducted direct interviews with the owner of Berkah Florist and potential customers to gather information about the design process, variations of flower boards, types of flowers, and other relevant aspects. From both of these techniques, it was found that the system used was still manual. In this system, customers had to choose between sample photos provided by Berkah Florist or design their own using a piece of paper. This inefficiency resulted in a significant amount of time being consumed, causing customers to feel bored and frustrated, and also creating difficulties in designing using a piece of paper. Furthermore, paper media was susceptible to moisture, damage, and often became scattered or lost. Subsequently, a literature review was conducted involving the collection of data and information by exploring knowledge or science from various sources such as books, writings, and other relevant sources related to the research object (A. A. Batubara et al., 2023). Existing data was collected, and relevant theories related to the research topic were studied (Syahputra et al., 2024).

Planning

This stage involved planning for the development of an Augmented Reality application based on a simulation game for the design of Berkah Florist flower boards. The main focus of the planning included identifying the product, its objectives, and benefits, aimed at addressing customer issues in the design process according to their preferences (Murdapa et al., 2022).

System Development

In this stage, system development was carried out using the RAD method and the design of the product was created.

Initial Testing

This stage involved product design testing to evaluate functionality and identify weaknesses in the user interface (UI) of the AR Flower Board Design application based on simulation gaming. It encompassed testing the basic functions of the application, user interactions, interface suitability to user needs, as well as identifying potential errors.

Revision Based on Test Results

In this stage, improvements were made to the application based on the results of the initial testing. These improvements could also be based on feedback from the research site, resulting in a draft product ready for broader testing.

Feasibility Testing

This stage involved testing the effectiveness of product usage. At this stage, the system was tested to determine whether it was suitable for use or if there were still deficiencies in the system.

Final Product Revision

Revisions were made based on the feasibility testing results. If the product's feasibility was appropriate, then no further revisions were necessary.

Implementation

This final stage involved publishing the results of the developed product and making it available for users.

System Development Method



Fig. 1 Rapid Application Development (RAD) Model (Gibran & Viktor, 2017)

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Requirement Planning

This step aimed primarily to identify the system's objectives, the required information criteria, and analyze user needs. Identifying the necessary information criteria for system development included both software and hardware requirements needed to operate the system. Furthermore, this phase also encompassed identifying the current system, which relied on manual methods for designing flower boards. Additionally, it involved identifying the proposed system, where simulation gaming methods were utilized for the flower board design process to enhance efficiency and interactivity.

Design System

This phase involved crafting a system design that aligned with the requirements and could address existing issues. Process Design: Identifying the involved actors and activity flows using UML, including the creation of use case diagram and activity diagrams. Interface Design: Designing the system's interface using Microsoft Visio and storyboards.

Implementation

The process of translating designs into usable applications and conducting black box testing. Application development was based on the previous planning and designs, followed by user testing to ensure optimal performance.

RESULT

Requirement Planning

Designing requirements through identifying problems in the existing system was a crucial aspect. Having a running system served as a benchmark for the development of subsequent systems.

It was found that the existing system was predominantly manual. To design, consumers had to choose between provided sample photos from Berkah Florist or design manually on a piece of paper. This inefficient process consumed considerable time, leading to consumer boredom, frustration, and inconvenience in manual designing. Additionally, paper media was prone to damage, loss, and disarray.

Based on the identification of issues in the existing system, researchers proposed the development of a more efficient application to facilitate both Berkah Florist and consumers. The proposed application was an Android-based simulation game. It aimed to assist consumers in designing desired flower arrangements. Consumers could easily navigate through the application, as it was designed akin to a gaming interface, with options to choose from provided selections. The application utilized Augmented Reality (AR) camera for viewing design objects. Consumers simply selected the type of arrangement, color, flower type, message or inscription, accessories, and the price of the flower arrangement was also displayed. The designs created by consumers were automatically saved to the photo gallery.

Design System

The stages in the design process of the proposed application in this research utilized Unified Modeling Language (UML), specifically the use case diagram and activity diagrams.

Use Case Diagram

The use case diagram served as a modeling tool that illustrated the behavior of the system to be developed. Its purpose was to delineate the specific tasks performed by actors, namely the customers, and their relationship with the activities within the system. This emphasis was grounded in the case study of Berkah Florist's Flower Board Design.

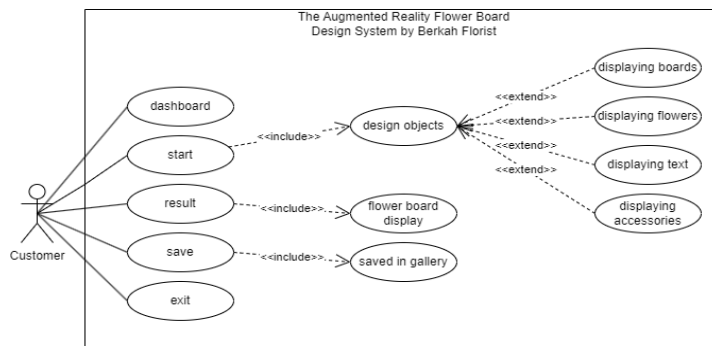


Fig 2. Use Case Diagram

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Through the above use case diagram depicting the role of actors, namely customers, in using the application, customers accessed the dashboard page and could start designing flower boards. Furthermore, the actor received the flower board design results, which were displayed on the camera with Augmented Reality support. Not only that, but the actor could also save the created designs, which were automatically stored in the actor's smartphone gallery, namely the customer.

Activity Diagrams

The subsequent stage following the creation of the use case involved crafting an activity diagram, serving as a depiction of the system's activities within the developed application. It's noteworthy here that the activity diagram delineates the system's activities rather than those performed by the actors. Below is the activity diagram for the Berkah Florist Flower Board Design application.

Dashboard Activity Diagram

Below is an overview of the dashboard activity diagram, illustrating the overall flow of activities within the dashboard system.

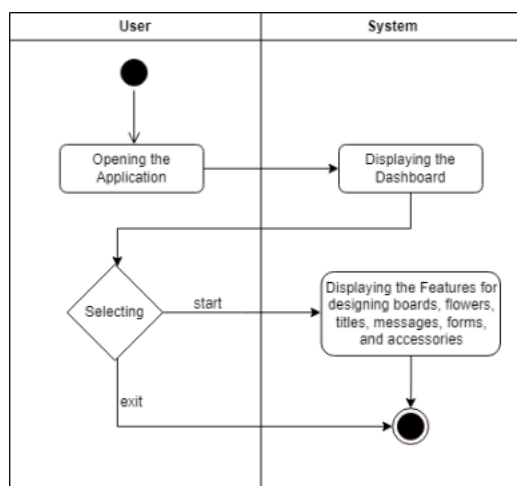


Fig 3. Dashboard Activity Diagram

Design Activity Diagram

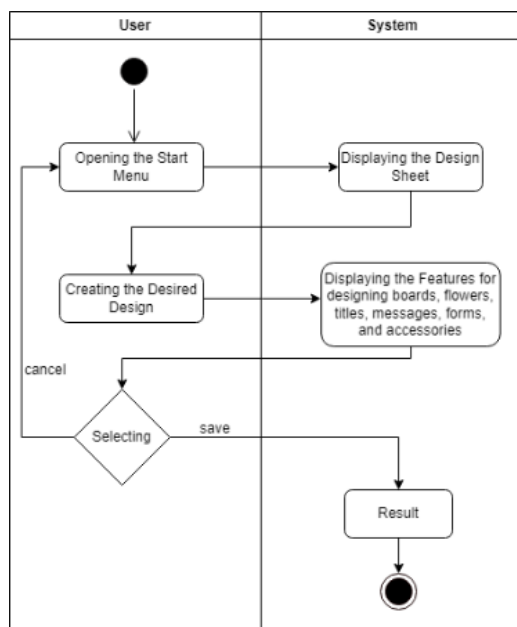


Fig 4. Design Activity Diagram

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The explanation of the activity diagram above illustrates the process of using the application. Firstly, the user opens the start menu and the system displays the design sheet. Then, the user views the available features on the design sheet, such as options for boards with colors and prices, types of flowers, titles, messages, forms, and accessories. After that, the user starts the design process by selecting desired options from each available feature. The system then displays design objects according to the user's choices. If the user wishes to save their design, the system will process it and take them to the save or result page. However, if the user chooses to cancel the process, the system will automatically return to the start menu (dashboard).

Result Activity Diagram

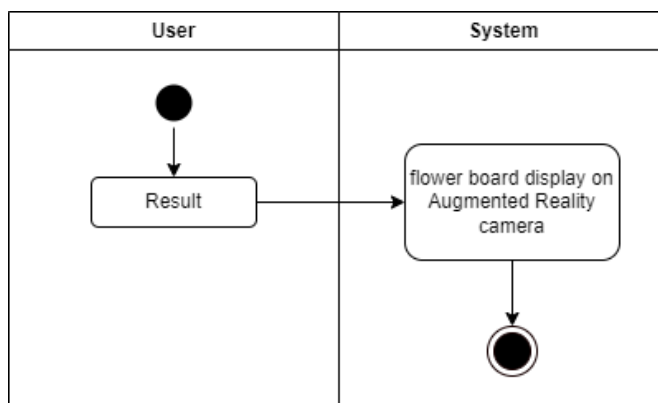


Fig 5. Result Activity Diagram

In the result activity diagram, when the user selected the "result" menu, the system processed it by displaying the result of the created flower board design on the AR camera.

Save Activity Diagram

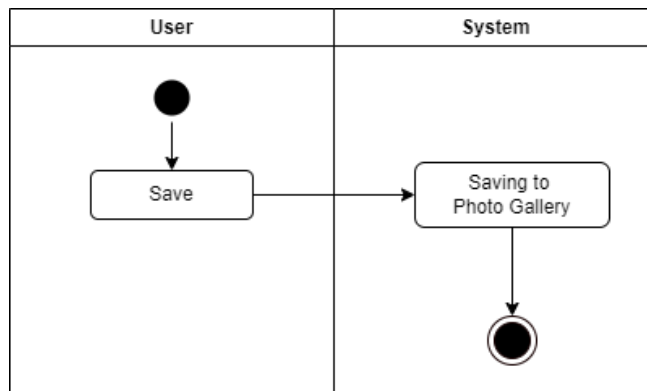


Fig 6. Save Activity Diagram

In the save activity diagram, when the user selected the save menu, the system processed it by saving the design result to the photo gallery.

Exit Activity Diagram

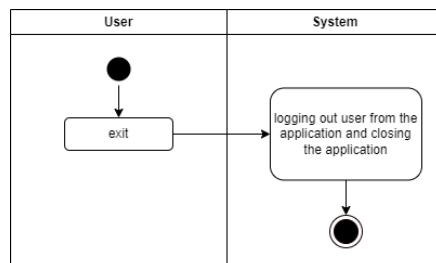


Fig 7. Exit Activity Diagram

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The user received the activity from the exit menu, which caused the system to exit the user from the application and close it.

Implementation

The implementation stage is a process of creating and deploying the application as a whole from both software and hardware perspectives. In the coding phase to develop this system, the utilization of programming languages such as C#, Java, or Kotlin is involved, along with the utilization of suitable Augmented Reality libraries or SDKs. During the Augmented Reality coding stage, the necessary logic is encoded to recognize Augmented Reality markers and obtain input from the device camera, as well as to display objects corresponding to the detected markers.

The following is an implementation of the system built in the Augmented Reality Flower Board Design application at Berkah Florist.

Start and Exit Pages



Fig 8. Start Menu Page

Main Menu

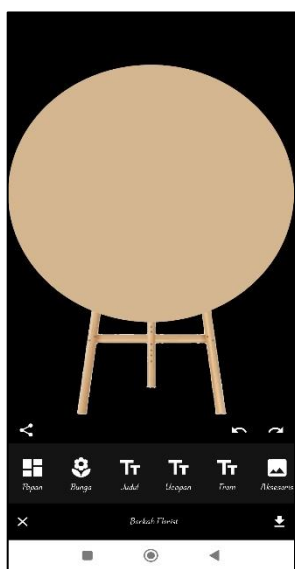


Fig 9. Main Menu Display



Fig 10. Main Menu Display While Designing and Obtaining Flower Board Prices

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Result Menu



Fig 11. Result Display on AR Camera

Blackbox Testing

This testing phase was conducted to verify if the application operated as expected. The testing was carried out after the implementation phase was completed. During this stage, the application underwent blackbox testing, a method that evaluates the application's functionality without knowledge of its internal details. Blackbox Testing was performed by the owner of Berkah Florist and one of the customers to assess how well the application adhered to the design created based on customer needs.

Table 1
Blackbox Testing of the Application by the Owner

NO	Menu Page	Testing Activities	Testing Results
1.	Splash screen and dashboard menu	Testing on image and display duration	Success
		Testing on the functionality of the start and exit buttons	Success
2.	Main menu	Testing on the functionality of the board button and display	Success
		Testing on the functionality of the flower button and display	Success
		Testing on the functionality of the title button and display	Success
		Testing on the functionality of the message button and display	Success
		Testing on the functionality of the form button and display	Success
		Testing on the functionality of the accessory button and display	Success
		Testing on the display of board prices	Success
		Testing on the undo and redo buttons	Success
		Testing on the share button	Success
		Testing on the save button	Success
3.	Result menu	Testing on the Augmented Reality (AR) camera system	Success
		Testing on the camera motion FPS system	Success
		Testing on the 3D object camera	Success
		Testing on the design results and saving to the gallery	Success

Table 1 depicted the results of system testing by the owner, where menu pages were successfully displayed. This indicates that the application's functionality and appearance met the expected standards.

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Table 2
Blackbox Testing of the Application by the Customer

NO	Menu Page	Testing Activities	Testing Results
1.	Splash screen and dashboard menu	Testing on image and display duration	Success
		Testing on the functionality of the start and exit buttons	Success
2.	Main menu	Testing on the functionality of the board button and display	Success
		Testing on the functionality of the flower button and display	Success
		Testing on the functionality of the title button and display	Success
		Testing on the functionality of the message button and display	Success
		Testing on the functionality of the form button and display	Success
		Testing on the functionality of the accessory button and display	Success
		Testing on the display of board prices	Success
		Testing on the undo and redo buttons	Success
		Testing on the share button	Success
		Testing on the save button	Success
3.	Result menu	Testing on the Augmented Reality (AR) camera system	Success
		Testing on the camera motion FPS system	Success
		Testing on the 3D object camera	Success
		Testing on the design results and saving to the gallery	Success

Based on Table 2, which represents the results of testing from the customer's perspective, the application performed well. However, it is worth noting that the application requires a capable smartphone to operate optimally, especially in utilizing features such as the Augmented Reality (AR) camera, FPS camera motion system, and 3D object recognition. The Augmented Reality application currently lacks the feature to directly access stored templates for editing purposes.

Overall, based on the testing results from both parties, the owner and the customers, all pages and menus functioned well according to their intended purposes, and their appearance aligned with the desired design.

DISCUSSIONS

The Augmented Reality Flower Board Design application, based on simulation gaming, required minimum specifications on smartphones to operate optimally. These specifications included a 2.0GHz Octa-core processor, 6 GB RAM, 128 GB ROM, and Android Version 12 Snow Cone. These specifications were necessary for the application to function properly. If these specifications were not met, some parts of the system might not operate optimally, especially when using features such as the Augmented Reality (AR) camera, FPS camera motion system, and 3D object recognition. Based on the black box testing conducted, the application operated overall in accordance with its design. However, from the customer's perspective, there were additional features that would be beneficial. For example, the Augmented Reality application should ideally have a feature to directly access stored templates for editing purposes. This would allow customers to reuse templates they had previously designed and ordered, enabling them to redesign them if desired.

CONCLUSION

The development of the Augmented Reality (AR) application aimed to assist the Flower Board owners at Berkah Florist in promoting their products and facilitating prospective consumers. This application could showcase flower board designs through an AR camera that simulated real-life conditions. Based on blackbox testing, all functions of the Augmented Reality (AR) application operated smoothly. The utilization of Augmented Reality (AR) technology in the Flower Board application at Berkah Florist captivated prospective consumers, preventing them from feeling bored with the application and ensuring their active engagement. Moreover, users, particularly prospective consumers, found the application enjoyable, as it resembled playing a game, thus prompting them to reuse the application.

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From the system developed, the author realizes that there are still many shortcomings in the flower board design application based on a simulation game using Augmented Reality (AR). The author hopes that this system can be further developed for the IOS operating system. Furthermore, the design catalog that is still available in the smartphone's gallery and can be shared via WhatsApp social media is expected to be displayed again through the AR camera. Additionally, it is hoped that this Augmented Reality application can be further developed to have templates that can be directly used and edited.

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