

## DEVELOPMENT OF VT-UNUJA APPLICATION AS A WEBVR-BASED CAMPUS ENVIRONMENT INTRODUCTION MEDIA

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**Abstract**—Conventional campus introductions are often limited in providing an immersive experience to prospective students, especially for those who cannot attend in person. This encourages the need for technology-based solutions that can overcome these limitations. This research develops a WebVR-based VT-UNUJA application as a campus introduction media that offers an interactive experience with 360-degree panoramic image features, hotspot descriptions, navigation, and voice-over. The purpose of this research is to create an application that can increase user understanding of campus locations and facilities more efficiently and easily accessible. The test results show that this application is effective in improving user understanding, with a high level of satisfaction with the ease of use and interactivity of the application. The benefits of this research are to contribute in improving campus professionalism in presenting information digitally, as well as providing innovative alternatives for other educational institutions in supporting the orientation process for prospective students.

**Keywords:** campus environment, introduction media, VT-UNUJA, WebVR.

**Intisari**—Pengenalan kampus secara konvensional seringkali terbatas dalam memberikan pengalaman yang imersif kepada calon mahasiswa, terutama bagi mereka yang tidak dapat hadir langsung. Hal ini mendorong perlunya solusi berbasis teknologi yang dapat mengatasi keterbatasan tersebut. Penelitian ini mengembangkan aplikasi VT-UNUJA berbasis WebVR sebagai media pengenalan kampus yang menawarkan pengalaman interaktif dengan fitur gambar panorama 360 derajat, deskripsi hotspot, navigasi, dan voice-over. Tujuan penelitian ini adalah untuk menciptakan aplikasi yang dapat meningkatkan pemahaman pengguna mengenai lokasi dan fasilitas kampus secara lebih efisien dan mudah diakses. Hasil pengujian menunjukkan bahwa aplikasi ini efektif dalam meningkatkan pemahaman pengguna, dengan tingkat kepuasan yang tinggi terhadap kemudahan penggunaan dan interaktivitas aplikasi. Manfaat dari penelitian ini adalah memberikan kontribusi dalam meningkatkan profesionalisme kampus dalam menyajikan informasi secara digital, serta memberikan alternatif inovatif bagi institusi pendidikan lain dalam mendukung proses orientasi bagi calon mahasiswa.

**Kata Kunci:** lingkungan kampus, media pengenalan, VT-UNUJA, WebVR.

### INTRODUCTION

Education plays a crucial role in developing marketing quality [1]. It is of paramount importance for educational institutions, particularly those in the higher education sector such as colleges or universities, must adopt effective marketing

strategies on digital platforms. Campuses must use information and promotional media to meet market needs [2]. Information media is a tool for collecting and organizing information, making it useful for recipients [3]. Campuses that use information media appear more professional and attract prospective students [4]. This is done to enhance

the quality and reputation of the campus, which can indirectly contribute to building the campus brand within the community [5].

Higher education institutions require more interactive tools or media to effectively convey the essence of their campus environment and reinforce their institutional image [6]. Conventional media, such as brochures or websites, often fail to provide the in-depth campus experience that prospective students look for when making their decision. It is imperative & essential that a campus have an effective method of demonstrating its capabilities, potential, and excellence to the broader community, particularly to prospective students [7],[8]. Recent studies show that effective social media marketing and positive perceptions of prospective students have a significant impact on their decision to attend college [9]. The decision-making process of prospective students in choosing a campus is often influenced by various factors, including the campus environment and image, the availability of facilities, and the academic atmosphere offered [10].

As a higher education institution, the University of Nurul Jadid (UNUJA) should implement information and promotional media to introduce the campus environment. A significant proportion of students, prospective students, and visitors from outside the city may lack familiarity with the buildings on the UNUJA campus [11]. The current introduction to the UNUJA campus environment includes websites, brochures, and other media, but the information provided is insufficient. Students are unaware of the buildings designated for teaching and learning activities. To locate faculty buildings, classrooms, or laboratories, students must still come to campus, as UNUJA lacks an easily accessible online campus introduction media. In the digital era, a campus environment introduction media has become a crucial necessity.

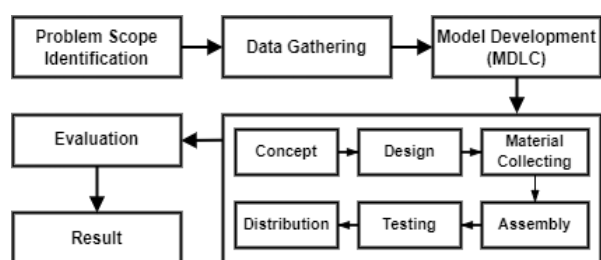
The advancement of technology has elevated interactivity to a paramount objective in the realm of application development. Virtual tours represent a technology that can be utilized for this purpose. A virtual tour is an interactive medium that employs waypoints as navigational cues to display supplementary image objects within the primary panoramic image, contingent on the direction of the mouse [12]. Web-based virtual tour applications, also known as WebVR, are employed by a multitude of entities, including hotels, resorts, universities, and tourism sites, as a pivotal promotional instrument on a global scale. Recent studies show that WebVR has proven its effectiveness in increasing user engagement and attraction through immersive visual experiences [7]. Another study found that the use of WebVR can improve users'

understanding and recall of information because of the interactive presentation that encourages active engagement [13]. Nevertheless, few universities employ virtual tours as a means of promoting or introducing their campus. Instead, campuses typically rely on webpages comprising text and images as a promotional tool for prospective students.

The objective of this study is to leverage the VT-UNUJA application to enhance the introduction of the campus environment to prospective students, visitors, and the general public. With features such as 360° panoramic imagery, interactive hotspot navigation, and audio descriptions, the app is expected to provide a more immersive and informative experience than traditional media. The application will assist users in identifying rooms, laboratories, and other facilities owned by UNUJA with greater clarity and realism. These resources can be accessed through the website. Consequently, this application can serve as a means of introducing an interactive campus environment, enhancing campus branding, and providing convenient access to information searches. Additionally, it can be utilized as a promotional tool for the campus through the use of WebVR technology.

**MATERIALS AND METHODS**

This research has several stages that can be seen in Figure 1. This research focuses on the development of WebVR-based virtual tour applications in the UNUJA campus environment using the Multimedia Development Life Cycle (MDLC) development method.



Source : (Research Results, 2024)

Figure 1. Research Stages

**Problem Scope Identification**

Limiting the scope of the problem serves to narrow the focus of the research, making it easier to collect, analyze, and interpret the research data. In this way, research can be carried out more efficiently and comprehensively, according to the objectives set.

**Table 1. Object Data (Campus Building)**

Building Name	
UNUJA Front Gate	Building D
Entrance (View 1 & 2)	Women's Parking Lot
Mosque	Building E
Auditorium	Building F
Building A	Building G
Library	UNUJA Canteen
Building B	Front Gate of Nurul Jadid Islamic Boarding School
Student Gazebo	Entrance of Nurul Jadid Islamic Boarding School
Building C	Entrance Hall 1
Men's Parking Lot	Hall 1

Source : (Research Results, 2024)

The scope of the problem must be defined by defining the area to be studied. This process involves searching and analyzing data, specifically data related to buildings and rooms on campus. The building and room data is used as the object of research to generate relevant information and an in-depth understanding of the problem under study, as illustrated in Table 1.

**Data Gathering**

The data collection process was carried out by taking 360-degree panoramic image data of the UNUJA campus environment, creating hotspot descriptions, and recording audio for the voice-over feature.

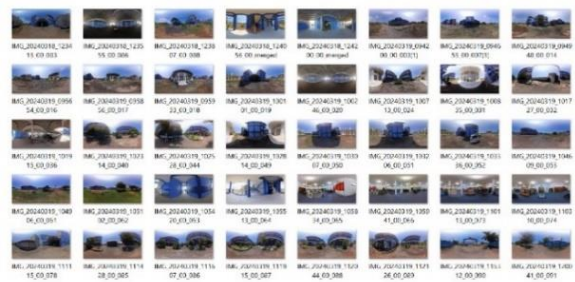
**1. Image Collection Process**

At this stage, the locations to be shot are identified and mapped. These locations should be carefully selected to ensure complete and representative coverage of the campus environment, by identifying key locations on campus and determining optimal shooting points. Image collection was carried out using the Insta360 X3 camera. This device was chosen for its ability to capture 360-degree images and videos with high detail and quality, enabling more comprehensive and accurate analysis.

**2. Panoramic Image Result**

At this stage, panoramic images were taken at the previously marked building locations, according to the research object, based on the data in Table 1, which includes the main facilities of the UNUJA. This process was crucial for accurately representing each area and building on campus.

Figure 2 shows several 360-degree panoramic photos taken at UNUJA. These photos were taken based on a predetermined division of shooting locations.

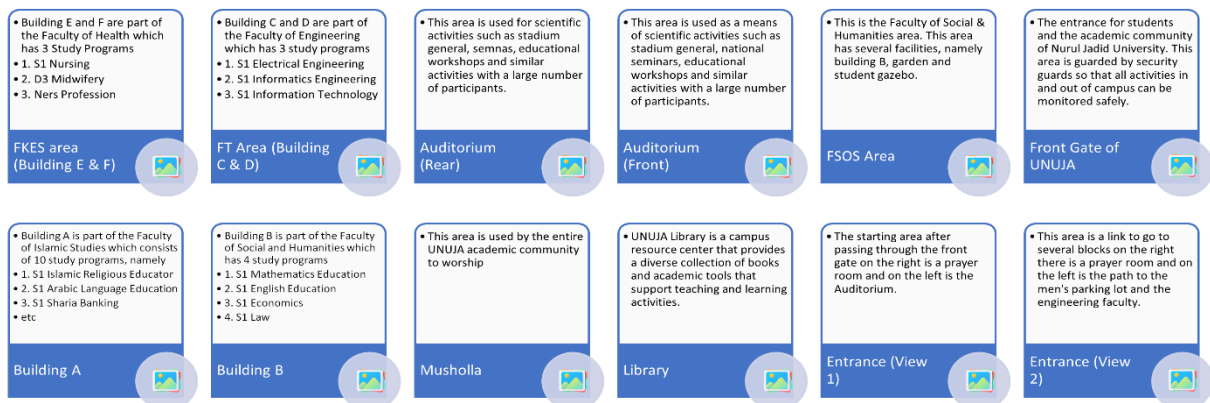


Source : (Research Results, 2024)

**Figure 2. Panoramic Image Collection**

**3. Hotspot Description Creation Process**

At this stage, relevant information about UNUJA's facilities is collected. This information may include data about the location, facilities, uses, and others. Once the information is collected, the next step is to create a hotspot description. The hotspot description provides additional information about a specific location or object depicted in the panoramic image, helping users understand the context and details that are not immediately apparent from the image. The results of the hotspot description are then configured to meet the needs. This configuration includes adjusting the format, layout, or additional information that needs to be included about UNUJA-owned facilities. The results of creating the hotspot description are shown in Figure 3.



Source : (Research Results, 2024)

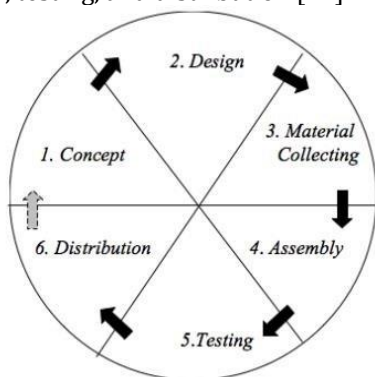
**Figure 3. Hotspot Description Creation Results**



4. Voice Over Recording Process  
Voice-over helps convey information more clearly and is easier to remember because it is presented as audio narration. This feature aids users in gaining a better understanding.

**Model Development**

The development process adheres to the Multimedia Development Life Cycle (MDLC) development method, as illustrated in Figure 4. MDLC consists of six stages of system development, namely concept, design, material collecting, assembly, testing, and distribution [14].



Source : (Research Results, 2024)  
Figure 4. Multimedia Development Life Cycle

This method offers a number of advantages over other development frameworks, including the inclusion of the "material collecting" stage. This stage is a crucial element in multimedia development, where materials such as images, videos, and sounds are gathered to support the application content [13]. Furthermore, this framework is well-suited for the development of engaging multimedia-based products [15]. It employs a combination of various visual and audio elements to create a more dynamic and interactive experience for users [16]. MDLC was also selected for its suitability for WebVR-based applications that require effective interactive presentation of information.

**RESULTS AND DISCUSSION**

**Concept**

In the conceptual phase, the specifics of the proposed application were delineated, as illustrated in Table 3. The primary objective was to provide students with information about the campus environment. The application was designed as a website to ensure convenient accessibility for both desktop and mobile users. The concept of project division was employed to design the appearance of

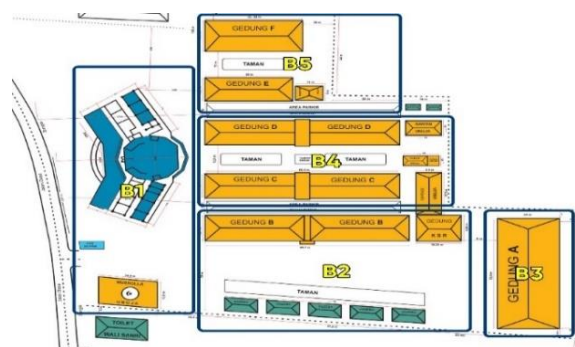
specific locations in the application, based on the campus-owned buildings.

**Table 2. VT-UNUJA Application Concept**

Name	Description
Title	Virtual Tour University of Nurul Jadid (VT-UNUJA)
Purpose	Introducing the environment and facilities of University of Nurul Jadid
Genre	Simulation
Platform	Website
Target User	All ages
Interactivity	Select a menu, view a 360-degree panoramic image
Features	E-Panorama, hotspot description, panoramic list, panoramic thumbnails, hotspot navigation, voice over, quick access, floorplan, settings

Source : (Research Results, 2024)

During the conceptual stage, the locations for capturing 360-degree panoramic images were also identified, as illustrated in Figure 5. Determining these locations is critical to ensuring more accurate coverage of the campus environment.



Source : (Research Results, 2024)  
Figure 5. Floorplan UNUJA

**Table 3. Building Data Grouping**

Code	Building Name
B1	UNUJA Front Gate Entrance (View 1 & 2) Mosque Auditorium
B2	Building B Student Gazebo
B3	Building B Library
B4	Building C Building D Men's Parking Lot UNUJA Canteen
B5	Building E Building F Women's Parking Lot
Hall	Front Gate of Nurul Jadid Islamic Boarding School Entrance of Nurul Jadid Islamic Boarding School Entrance Hall 1 Hall 1

Source : (Research Results, 2024)



The image will be classified into several parts according to the building data grouping. This grouping includes information such as building codes and building names, as illustrated in Table 3.

**Design**

The app design began with a high-fidelity prototype (hi-fi) design visualized in Figure 6. At this stage, the focus of the design was on the layout of each element and a visual representation of the implementation for each feature in the previously mapped virtual tour application. Figure 6 describe the initial loading screen that appears when users first access the application. Figure 6 describe the menu integrated within the official website of the University of Nurul Jadid. This menu is equipped with a range of features, including settings, a hotspot list, and a hotspot thumbnail, which are designed to facilitate users in exploring the information and facilities available on campus.



Source : (Research Results, 2024)  
 Figure 6. Hi-Fi for Main Menu

**Material Collecting**

This stage began with interpreting data that had been collected during the data gathering phase, starting with grouping panoramic image results, hotspot descriptions, and voice-over recordings. The result will be classified into several parts according to the data grouping. This grouping includes information such as building codes, building names, number of data, and data size, as illustrated in Table 4, 5, and 6.

Table 4. Interpretation Results for Hotspot Description

Code	Number of Description Hotspot	Data Size (KB)
B1	6	200
B2	3	82
B3	3	131
B4	1	43
B5	1	41
Hall	0	0

Source : (Research Results, 2024)

Table 5. Interpretation Results for Panoramic Image

Code	Building Name	Number of Images	Data Size (MB)
B1	UNUJA Front Gate	1	37,4
	Entrance (View 1 & 2)	2	74,3
	Mosque	2	38,85
B2	Auditorium	2	70,2
	Building B	4	112,5
	Student Gazebo	2	79,8
B3	Building G	1	37,2
	Building A	4	111
B4	Library	5	130
	Building C	5	183
	Building D	5	143,6
B5	Men's Parking Lot	3	104
	UNUJA Canteen	2	73
	Building E	3	76
Hall	Building F	13	165,3
	Women's Parking Lot	2	74,5
	Front Gate of Nurul Jadid Islamic Boarding School	3	123
Hall	Entrance of Nurul Jadid Islamic Boarding School	8	330
	Entrance Hall 1	7	221
	Hall 1	4	120,5

Source : (Research Results, 2024)

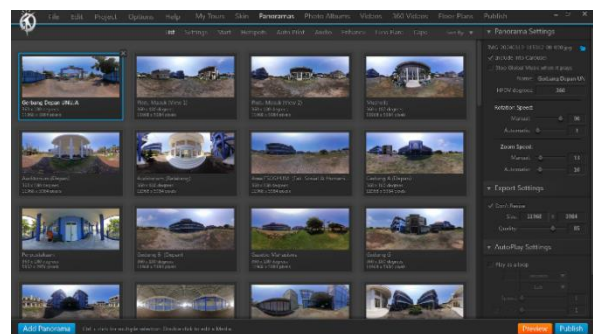
Table 6. Interpretation Results for Voice Over Recordings

Code	Number of Voice Over Recordings	Data Size (KB)
B1	5	824
B2	3	730
B3	2	477
B4	2	345
B5	0	0
Hall	0	0

Source : (Research Results, 2024)

**Assembly**

This stage began with the creation of a virtual tour application using 3DVista software. The process started by entering the panoramic image data that had been taken during the Material Collection stage into the 3DVista. Each panoramic image was named according to the identity of the actual location listed in Table 3, as illustrated in Figure 7.



Source : (Research Results, 2024)

Figure 7. VT-UNUJA Project in 3DVista



The name listed on each panoramic image was displayed in the panoramic list and panoramic thumbnails, as shown in Figure 8. So, users could easily identify the location they wanted to explore in the virtual tour of the campus.



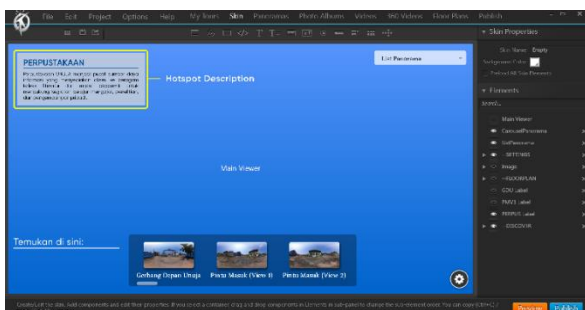
Source : (Research Results, 2024)  
 Figure 8. Display of Panoramic List and Panoramic Thumbnails

The next step is to create points or hotspots for each location marked in the panoramic image visualized in Figure 9. These hotspots functioned as navigation buttons, allowing users to move from one location to another within the application.



Source : (Research Results, 2024)  
 Figure 9. Hotspot Creation Process

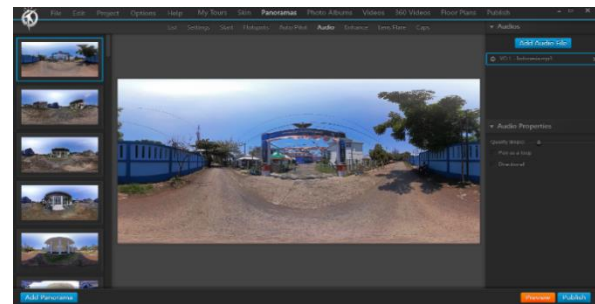
Additionally, hotspots were designed as interactive buttons that could display additional content, such as a video or set of images.



Source : (Research Results, 2024)  
 Figure 10. Addition of Hotspot Description

Figure 10 describe the process of adding descriptions to each hotspot was undertaken with the intention of facilitating access to more detailed information about the hotspot or the surrounding

area. The description provided users with additional context and useful explanations.



Source : (Research Results, 2024)  
 Figure 11. Representing Hotspot with Voice Over

The next step is to add voice-over to represent each hotspot, as illustrated in Figure 11. To enhance the interactivity of visitors in receiving information from the system, it is necessary to have a guide feature that explains specific parts through audio [17]. This features serves to explain the scope of the hotspot area or the surrounding area, and also completes the information that has not been covered in the hotspot description.

To assist users in understanding the overall campus layout, a campus map or floor plan will be added at this stage. This floor plan will feature an interactive map that displays the positions of buildings, facilities, and other important areas owned by the campus.

The last step, after making sure that all visual elements and information in the virtual tour application are working well, is to "publish" the application. The publishing process provides several publishing format options that can be configured according to the developer's needs. The format options can be seen in Figure 12, which provides the format for online application access.



Source : (Research Results, 2024)  
 Figure 12. Publishing Format for Web/Mobile

### Testing

This stage is conducted subsequent to the successful execution of the application, with the objective of ensuring the seamless functioning of all

application components by accessing the url <https://vtour360.vtunuja.site/>. The Black Box Testing method is employed in this stage to evaluate the functionality of all components contained in the application prior to its distribution to end users, as illustrated in Table 7.

**Table 7. Black Box Testing Results**

Test Item	Expected Result	Result
Virtual tour website	Can access the website according to the domain	Valid
Virtual tour menu	Displays and can access all the available features	Valid
Switching hotspots	Can access every hotspot that has been available and in accordance with the navigation	Valid
Full screen feature	Application display becomes full screen	Valid
Show thumbnail feature	Display the panorama list	Valid
Hide thumbnail feature	Hide the panorama list	Valid
Show hotspot feature	Display the hotspot sign	Valid
Hide hotspot feature	Hide the hotspot sign	Valid
Mute audio feature	Enable background audio	Valid
Unmute audio feature	Disable background audio	Valid
Zoom in feature	Zoom in the panoramic image	Valid
Zoom out feature	Zoom out the panoramic image	Valid
Navigation feature	Move the panorama view right, left, up, down	Valid
Description feature	Display a description of each selected hotspot	Valid
Voice-over feature	Display a voice-over of each selected hotspot	Valid

Source : (Resesarch Results, 2024)

In addition, testing is performed by distributing questionnaires to users and then calculating the results to draw conclusions about the evaluation of the application being built. The questionnaire survey administered to 48 respondents consisting of prospective students, students, and general public. This questionnaire contains 12 questions, as illustrated in Table 8, 9, and 10.

**Table 8. Respondent Items**

Category	Number of Respondents
Prospective Students	15
Students	18
General Public	15

Source : (Resesarch Results, 2024)

**Table 9. Questionnaire Items**

Question
Is this application easy to use?
Is the look and design of this application attractive?
Is the application already responsive on your device?
Is it easy to navigate or move between hotspots?
Is the information presented at each hotspot clear?

Is the panoramic list and panoramic thumbnails feature work properly?  
 Is the quick access feature helping you to access additional information easily?  
 Is the hotspot description feature helpful in understanding the information on each hotspot?  
 Is the voice over feature helpful in understanding the information on each hotspot?  
 Are all available features working properly?  
 Would you recommend this application to others?

Source : (Resesarch Results, 2024)

**Table 10. Statistical Results of Answers**

Test Item	Answer					Total
	SA	A	AE	D	SD	
Question 1	28	19	1	-	-	48
Question 2	26	21	1	-	-	48
Question 3	26	17	5	-	-	48
Question 4	28	18	2	-	-	48
Question 5	34	12	2	-	-	48
Question 6	30	15	3	-	-	48
Question 7	29	17	2	-	-	48
Question 8	32	15	1	-	-	48
Question 9	33	11	3	1	-	48
Question 10	26	21	1	-	-	48
Question 11	31	16	1	-	-	48
Question 12	33	14	1	-	-	48

SA: Strongly Agree, A: Agree, AE: Agree Enough, D: Disagree, SD: Strongly Disagree

Source : (Resesarch Results, 2024)

Based on the data from the test results using a Likert scale, the formula for the total score, ideal score and percentage of feasibility, obtained a total score of 2635 from the ideal score of 2880, so that the percentage of feasibility of this application reached 91.49% with the respondents interpretation is "Strongly Agree".

The data results show that the VT-UNUJA application successfully achieved one of the research objectives, namely increasing the accessibility of campus information through a more immersive experience. WebVR technology allows users to feel the atmosphere of the campus in depth, overcoming the limitations of traditional promotional media that tend to be static. Compared to static websites and brochures, the 360° panoramic view in VT-UNUJA is considered more effective in strengthening the understanding of the campus environment, thus supporting an interactive campus image.

### Distribution

After the application passes the testing process with positive results, the next stage is to carry out the publication process on web hosting. By uploading the application file to web hosting, users can access the application easily through a web browser according to the domain that has been set. Users only need to enter the assigned domain

“vtour360.vtunuja.site” into their browser to start using the application.

### Discussion

The results of this study show that the WebVR-based VT-UNUJA application successfully improves users' understanding of campus locations and facilities in an interactive and immersive way. Through the features of 360-degree panoramic images, hotspot descriptions, and voice-over, users can explore the campus independently, which is different from conventional methods such as live tours or the use of brochures. Test results showed a high level of satisfaction with the app's ease of use and interactivity, indicating that the app is effective in delivering campus information digitally.

When compared to previous research published in related journals, such as that conducted by Agung (2023) who developed VR applications for higher education, this research provides innovation in terms of the application of WebVR technology that is more affordable and can be accessed more widely, without requiring special hardware. Previous research generally focuses on VR applications that require devices such as VR headsets and computers with high specifications, while the VT-UNUJA application offers a web-based solution that can be accessed through a browser with simpler devices, such as smartphones or computers.

These findings show that virtual campus introductions using WebVR technology not only increase understanding but also reduce geographical barriers often faced by prospective students. The implications of these findings are significant for educational institutions, especially in today's digital age, as it provides a new, more efficient and practical way to deliver information to prospective students from different regions. In addition, the use of WebVR technology can be a means to improve campus professionalism in presenting information in a more modern and interactive manner.

A limitation of this analysis is the lack of an in-depth evaluation of the long-term impact of using the app on the new student orientation process. While the app was successful in improving user understanding, there is no data that measures whether it can also improve student engagement or satisfaction after they join the campus. Therefore, further research with a larger sample and long-term testing is needed to provide a more comprehensive picture.

### CONCLUSION

The VT-UNUJA application is able to improve the user experience when using WebVR in education. The application successfully achieves this goal by showing significant improvement in providing information about the campus environment, building locations, and other facilities. These include 360-degree panoramic images, the ability to switch between hotspots, hotspot description, voice over, and the floorplan. For further research, it is recommended to add a more detailed point or hotspot in each room. The app also needs further development, such as the addition of 360-degree video features. Although this research was conducted in the context of Nurul Jadid University, the results obtained show the potential of the VT-UNUJA application to be applied in other educational institutions that use WebVR technology for educational purposes. It is recommended that other educational institutions consider the application of WebVR technology in learning systems to enhance interactive and immersive learning experiences.

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