Development of Virtual Reality Applications - Digital Display for MSME "Tenun Ikat Bandar" Products

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Abstract

Covid-19 has dramatically impacted the SME sector since April 2020. The government has taken steps to support SMEs as part of the national economic recovery efforts during the pandemic. However, surveys conducted by institutions like BPS, Bappenas, and the World Bank have shown that SMEs need help with loan repayment and meeting expenses for electricity, gas, and employee salaries. SMEs face the challenges of layoffs, limited access to raw materials and capital, declining customers, and production and distribution constraints. Furthermore, changing consumer behavior, business competition, and activity restrictions require proactive measures from SMEs. To address these challenges, a team has proposed a sustainable solution - virtual outlets. Based on virtual reality technology, these outlets allow SMEs to display and sell their products in a digital environment. Visitors can explore every aspect of the virtual outlets, simulating the experience of visiting physical stores without needing in-person visits. This aligns with the new standard of physical/social distancing. Visitors can conveniently support SMEs through online transactions by leveraging virtual outlets, eliminating the need to visit physical stores.

Keywords: Virtual Reality, VR, Digital Product, Marketing, Small Medium Enterprise (SME)

DOI: https://doi.org/10.35145/jabt.v4i3.134

1.0 INTRODUCTION

Covid-19 has had a significant impact on the MSME sector since April 2020. One of the efforts to restore the national economy carried out by the government during the COVID-19 pandemic was to encourage the MSME sector, which has an essential role in the national economy because many workers are directly involved. Moreover, the number of MSMEs in Indonesia reached 64.19 million, with a dominant component of micro and small enterprises (UMK), namely 64.13 million (99.92%) of the entire business sector. This group also feels the negative impact of the Covid-19 pandemic.

Meanwhile, survey results from institutions such as BPS, Bappenas, and the World Bank show that this pandemic has caused many MSMEs to have difficulty paying off loans and electricity, gas, and employee salary bills. Even some of them were forced to do layoffs. Other obstacles experienced by MSMEs include the difficulty of obtaining raw materials, capital, declining customers, and hampered distribution and production. In addition, changes in consumer behavior and business competition maps must also be anticipated by business actors due to activity restrictions. Consumers are doing more activities at home by utilizing digital technology.

One part of the efforts of the national economic recovery program (pen), which is focused on strengthening the resilience of SMEs during the current Covid-19 pandemic, is the city government of Kediri collaborating with the Indonesian Bank Kediri representative office, as well as the Kediri City Chamber of Commerce and Industry (Kadin), Java. East held the exhibition "UMKM virtual expo 2020" as an online exposition of umkm and was successfully recorded in the muri record. Photos of virtual expo activities can be seen in Figure 1.

Figure 1. Virtual Expo activities

"UMKM virtual expo 2020" is a form of virtual reality photography or immersive photography, namely in the form of a photography technique to continuously display photos of a location, seamlessly and without frames/borders, in a 360 perspective to the horizontal and vertical. The organized virtual expo activities are formed in a virtual tour, namely, a simulation of a natural environment displayed online, usually consisting of a collection of panoramic photographs, images connected by hyperlinks, videos, or virtual models of the actual location. , and can use other multimedia elements such as sound effects, music, narration, and writing. This activity is a bridge in accelerating the digitalization of SMEs in the city of Kediri which is created from synergies between institutions that are expected to accelerate the recovery of the performance of SMEs affected by the pandemic.

Covid-19 so that it can encourage regional economic recovery; the result to be obtained with this virtual exhibition is that the market share of the Kediri city SMEs can be more expansive. UMKM products are not only sold or known only in the Kediri area.

Various types of research have been carried out relevant to developing virtual reality applications with various case study implementations. Pratama et al. (2019) developed a virtual reality application to recognize various objects around the house in English (case study: SD Cerdas Mandiri Denpasar) using technology as a learning medium in English subjects in elementary schools. This learning media in the form of a virtual reality application invites users to see the shapes of objects around the house so that users know how objects form around the house and provide new experiences in exploring the virtual world. Testing this study used five testing processes:

1. Blackbox test with five respondents describing the suitability of the application
2. Whitebox test with appropriate results
3. Media expert test with appropriate results
4. Content expert test with results is appropriate.
5. Test the user's response with 20 respondents with an average result of 87.37%, which indicates a scale range of 80% -100%, which means that the respondents think that they strongly agree.

Saurik et al. (2019) conducted research with the title virtual reality technology for campus information media. In this research, the problem is how to provide users an immersive campus building environment by handling information media designed to be delivered interactively and communicatively. This research takes a case study of a building in a private university in Surabaya. Each building has a room on each floor: the administrative center, lecture activities, multipurpose room, lecturer room, and student activity room. This research aims to produce a VR application with mobile output for campus buildings, immersive layouts, and handling of dynamic information contained in them. Dynamic information content can be handled by using a gyroscope for VR movement and content, providing information for text and images. Musril et al. (2020), conducted research to implement virtual reality technology in computer assembly learning media. The research is motivated by problems that occur in computer assembly learning. When learning is carried out, it is not supported by the number of computer hardware components following the number of students. Hence, students need help understanding and practicing the subject matter. The limited number of display components is due to budget constraints for procurement. Many of the visual components in the school were damaged due to mistakes made by students during practice. Therefore, computer assembly learning media must be developed using virtual reality technology. The research was carried out using the research and development (R&D) method of the Four-D (4D) development model. The 4D development stages are defined, designed, developed, and disseminate. The multimedia development model used in this study is the Luther-Sutopo version of the multimedia development model, which consists of six stages: concept, design, material collecting, assembly, testing, and distribution. In this study using research stages that combine 4D and the Luther-Sutopo version of the multimedia development model. The results of this study are computer assembly learning media based on virtual reality, which consists of an explanation of hardware components and a computer assembly simulation section. This learning media uses an Android smartphone, VR box, and controller. The product validity test result is 0.79 with valid criteria. For practicality, test results obtained a value of 84.11 with very practical criteria. In contrast, the effectiveness test results obtained a value of 0.78 with high effectiveness criteria.
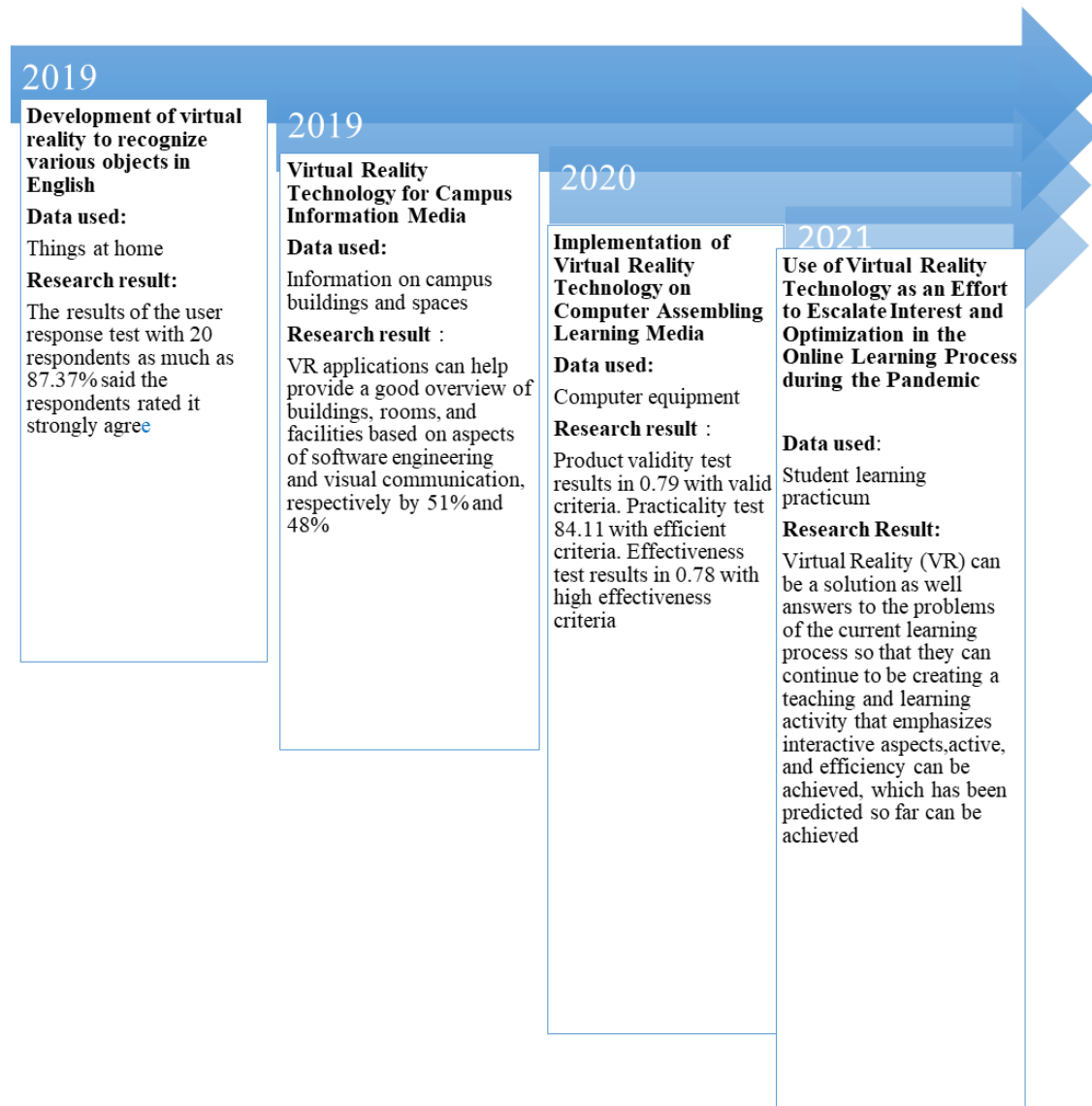
2019

Development of virtual reality to recognize various objects in English

Data used:

Things at home

Research result:

The results of the user response test with 20 respondents as much as 87.37% said the respondents rated it strongly agree

2019

Virtual Reality Technology for Campus Information Media

Data used:

Information on campus buildings and spaces

Research result :

VR applications can help provide a good overview of buildings, rooms, and facilities based on aspects of software engineering and visual communication, respectively by 51% and 48%

2020

Implementation of Virtual Reality Technology on Computer Assembling Learning Media

Data used:

Computer equipment

Research result :

Product validity test results in 0.79 with valid criteria. Practicality test 84.11 with efficient criteria. Effectiveness test results in 0.78 with high effectiveness criteria

2021

Use of Virtual Reality Technology as an Effort to Escalate Interest and Optimization in the Online Learning Process during the Pandemic

Data used:

Student learning practicum

Research Result:

Virtual Reality (VR) can be a solution as well answers to the problems of the current learning process so that they can continue to be creating a teaching and learning activity that emphasizes interactive aspects, active, and efficiency can be achieved, which has been predicted so far can be achieved

Figure 2. State of The Art

Ariatama et al (2021) conducted research entitled Use of Virtual Reality (VR) Technology to escalate interest and optimize the online learning process during a pandemic. This research was conducted because of learning media.Virtual reality (VR) is an alternative solution to provide students with new and fun learning practices. VR presents interesting videos/images with an adjusted time duration. This study uses a literature study approach by collecting various materials and information; then, an analysis is made based on the documentation and reflections that have been prepared. The use of VR encourages innovation in learning media that is different from before to increase students' participation and critical thinking perspectives and to bring students closer to VR technology. Technological characteristics suitable for use, such as virtual reality (VR) media can be implemented in the teaching and learning process amid the current pandemic which aims to attract students' interest and feel the atmosphere like in class when offline learning takes place. From the previous research that has been described, it will produce a state of the art as shown in figure 2.

Other research in virtual reality topic also has been conducted in different application for example in education by Al Farsi et.al(2021) which provide comprehensive overview of virtual reality applications in educational institutions, in interior design which conducted by Rahmat(2019), and in Gaming and Health which has been conducted by Gouveia(2023) . Based on the activities of this virtual expo, the proposing team created a sustainable plan to market MSME products by creating virtual outlets. This virtual reality-based virtual outlet is a virtual form of a physical outlet or shop that is used by SMEs to display and sell their products. Through this virtual outlet, visitors can see every corner of the contents of the outlet just like when visiting a physical store but without having to come directly to a physical store because, in this new average period, everyone must implement physical/social distancing to reduce the transmission of Covid-19. In addition, with this virtual outlet, visitors do not have to bother going to physical outlets/shops owned by SMEs but simply by visiting virtual outlets and making

transactions online if there is a product they want to buy. This virtual outlet is an effort to accommodate the problem of MSME partners in marketing their products, not just exhibitions.

2.0 METHODOLOGY

The stages of research need to be explained so that the research carried out runs systematically and measurably so that what is planned can be realized properly and correctly. This research has five main stages: analysis, design, development, implementation, and evaluation.

a. Analysis
In this first stage, the activities carried out are analyzing the development of the model/method, gathering information and needs, then analyzing and defining the needs that must be met by the application to be built. At this stage, a search for references is carried out regarding the critical theories and how to apply them in virtual reality technology. After all the theory has been collected, what is done next is to do a needs analysis about limiting the problems of the application that is made by taking into account the availability of time and the ability to make the application, as well as what things are needed in making the application.
1) Problem Analysis
• Development of application development for digital virtual reality display applications for MSME products in Kediri City to be able to display MSME products in real-time without touching the product.
• Development of application for the development of a virtual reality display application for MSME products in the City of Kediri as a form of implementing physical distancing accompanied by detailed product information.
2) Requirement Analysis
• Functional Requirements

Based an analysis of the functional requirements needed in the development of digital virtual reality display applications for MSME products in the City of Kediri are as follows:
- Applications can display MSME products
- Applications can display workshops
- The application can display the application's main menu
- Applications can display product information
- Applications can redirect to the marketplace
• Non-Functional Requirements
Based on the Analysis of non-functional requirements needed in the development of digital virtual reality display applications for MSME products in the City of Kediri are as follows:
- The hardware component specifications required for application development are as follows:
1. Laptop with a core two duo processor with a speed of 2.2GHz
2. 4GB of ram
3. VGA with 512 GB of memory
4. Keyboard and Mouse as input devices.
5. Monitor at least 1024x768, and speakers as output devices
- The hardware component specifications required by users who access this application are as follows:
1. Minimum dual-core processor with a speed of 1.6 GHz
2. Android with a minimal android version of the ice cream sandwich
3. Android with at least 1GB of RAM
4. VGA minimum memory of 256 MB
5. Hard drive that has at least 50 MB of free space
6. Virtual box
From the results of the needs analysis, Figure 3 is a representation of business processes in the form of use cases.
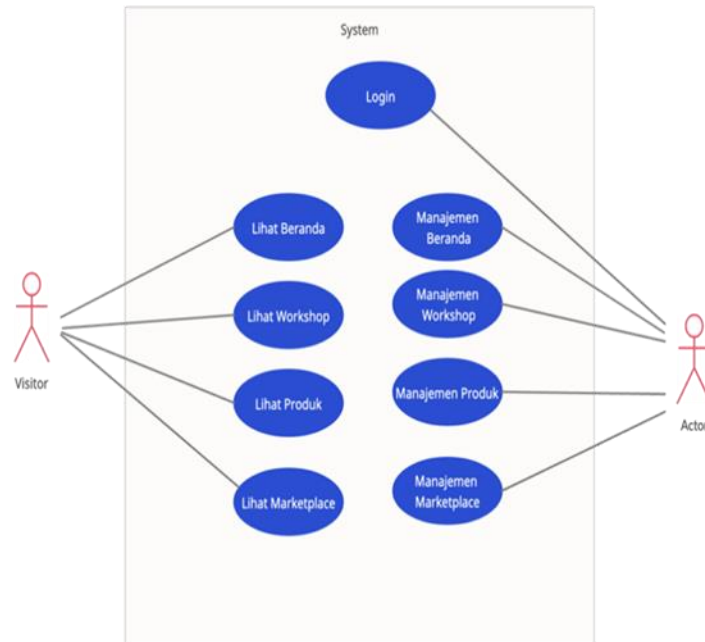
Figure 3. Use Case diagram

From Figure 3, it is found that the system will consist of two users: admin and visitor. Each user has access rights in the form of:
1. Admin can manage the homepage, workshops, products, and marketplace links
2.Visitors see the homepage, workshops, products, and marketplace
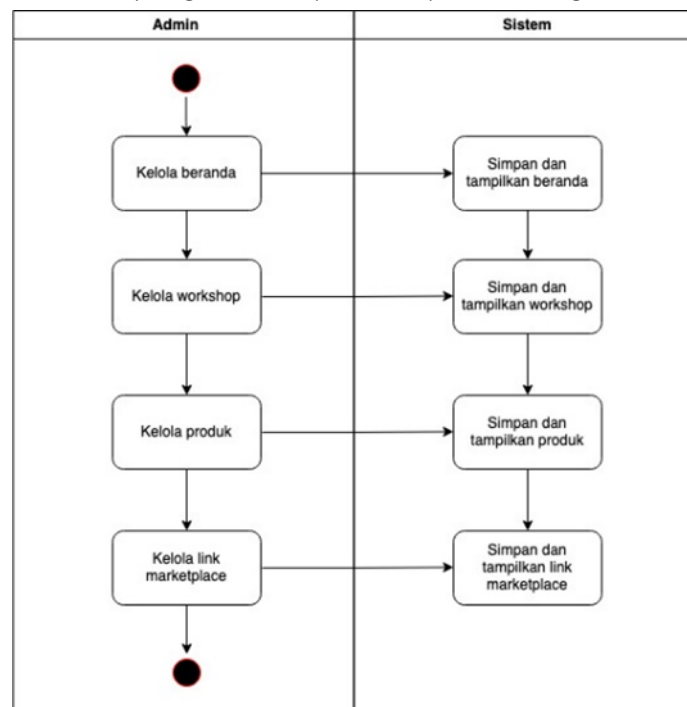If illustrated with an activity diagram, it will produce a picture like Figure 4 below:

Figure 4. Activity diagram

b. Design
The system to be built is a website-based application that conducts virtual tours via gadgets or computers. The website platform was chosen because it has several advantages, including being easily accessible via a browser and making it easier for users to access the application without downloading and installing it first. Virtual tours are used because they have several advantages, including displaying visual information that is better and more interactive than static visual information so that it becomes a solution to existing problems.

Front End
• Visitors using computers or gadgets that are connected to the internet access the virtual tour website domain address.
• The system will request data from the server.
• If the requested data has been successfully obtained, the virtual tour website page will be displayed
Back End
• Admin uses a computer connected to the internet to access the admin website domain address.
• Admin can manage virtual tours.
• The data required for virtual tour management is sent from XML and database through the server.
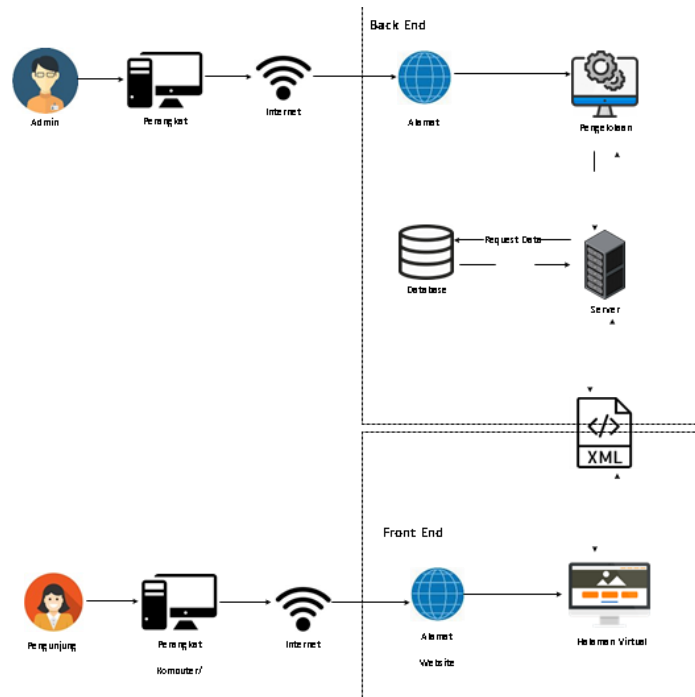
Figure 5. System Design

c. Development
To create a virtual tour, the first step is to collect photos in the Puspa Iptek Sundial area at essential and strategic points. Photographs were selected and carried out at locations that were considered essential and strategic in the Puspa Iptek Sundial environment and the Bandar Ikat Weaving environment. From these areas, 18 photo locations were obtained, consisting of 14 photos in the Sundial Science and Technology Center area and four in the Bandar Ikat Weaving area. Then the photos that have been collected are combined or called the stitching process, the output of which is a panoramic photo. The panoramic photos that are formed are converted into a panoramic cube consisting of six photos, namely left, right, front, back, top, and bottom. And the next step is to add a hotspot as a link between one panorama and another panorama.
1) Photo Collection
The primary data is needed to build a virtual tour application: location photo data. In taking photo data, appropriate shooting techniques are needed so that panoramic photos can produce optimal panoramas when displayed in a virtual tour application.
2) Photo Capture Techniques
In the shooting technique, the photo is taken circularly horizontally up to 360 degrees on each part. The process of taking a photo begins by shooting the center rotates, the bottom rotates with a camera tilt angle of 45 degrees, and the top rotates with a camera tilt angle of 45 degrees. An overview of this photo-taking technique can be seen in Figure 6.
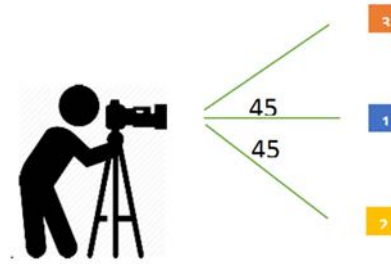
Figure 6. Photo Capture Technique

The exposure setting used for shooting in manual mode; this technique avoids different light readings by the camera from each shooting direction. To produce an optimal panorama between one photo and another, at least 30% of the parts must overlap or have the same object.

d. Implementation

The implementation phase is when the application is ready to be introduced, and feasibility testing is carried out. At this stage, implementing a virtual reality display application for MSME products in the City of Kediri as a form of implementing physical distancing during this pandemic will be implemented for one or two MSMEs in the City of Kediri.

e. Evaluation

The evaluation phase is carried out after the implementation phase is complete. The testing phase is carried out to know the deficiencies and weaknesses as well as errors (errors) of the application being developed so that the application can still be repaired to reduce errors that occur before the application is released to the broader community. Software testing focuses on testing to assess whether the developed software meets the needs of end users and assesses whether the software development process is following the methods used at the testing stage; several types of testing will be carried out, namely black box testing, white box testing and response testing user.

3.0 RESULTS AND DISCUSSION

Process implementation is a transformation from interface design to the application interface. The process implementation will also pay attention to several features and functions that refer to the database design that will be made.

1. Implementation

Home page

The home page is where visitors can see the verandah of the Bandar Ikat Gallery, where there are several finished products from the city of Kediri's woven fabric.
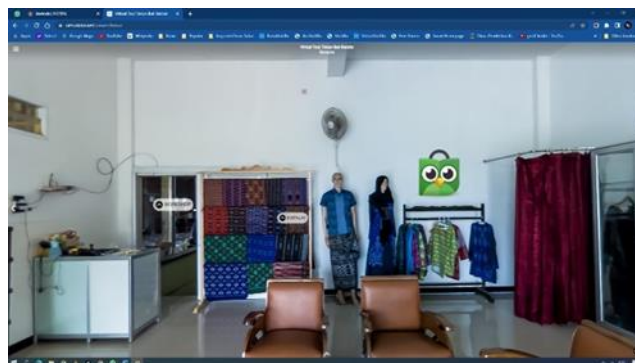

Figure 7. Home page

On this page, visitors can do a panoramic view by dragging the mouse as the main navigation. Visitors can see firsthand the condition of the Bandar Ikat gallery.
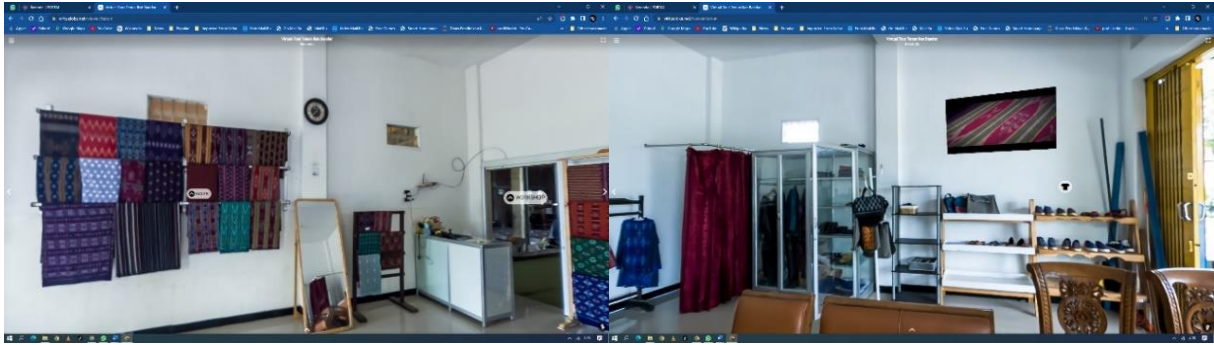
Figure 8. Home page with 360º Panorama

There is a hotspot button that functions as navigation for visitors so they can explore the following view, as shown in Figure 9 below.

Figure 9. Navigation hotspot button

Product Catalog Navigation
Visitors can also view detailed product information and other product catalogs by clicking on some navigation buttons attached to the product, as shown in Figure 10.
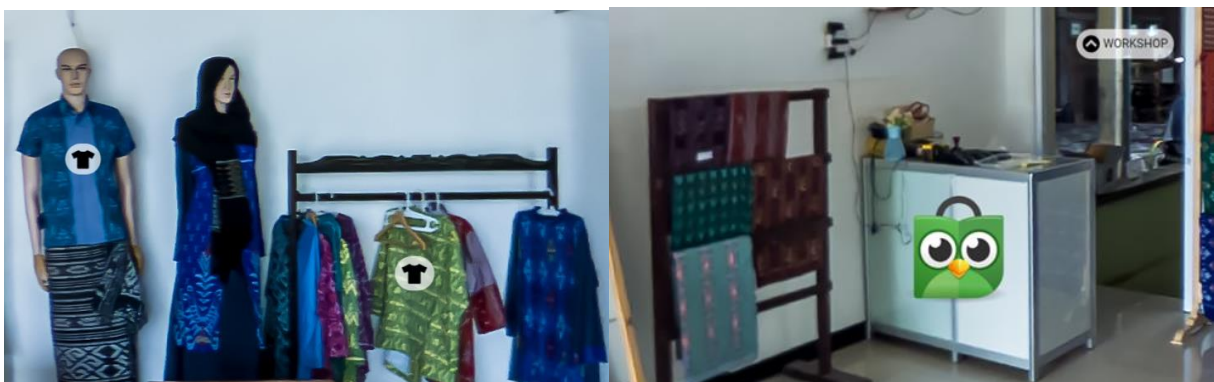

Figure 10. Product Shopping Navigation Buttons

Product Information Popup Pages
The information popup page is where visitors can see detailed information on the selected product displayed in an iframe.

Figure 11. Product Information Popup Pages

Product Details Page

The product detail page is an advanced page of information popups. On this page, all product data based on product_id will be displayed.
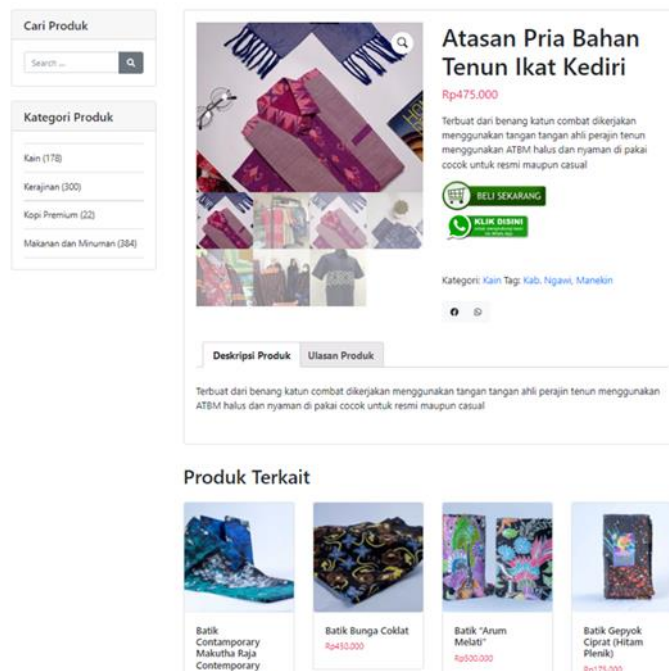
Figure 12. Detail Product Page

Dashboard Page

The admin can manage all virtual tour data and 360 room management on this page, setting hotspot markers and POIs. This page also provides information on reports of data on the number of visitors, frequently viewed pages, and several virtual tour system settings functions.
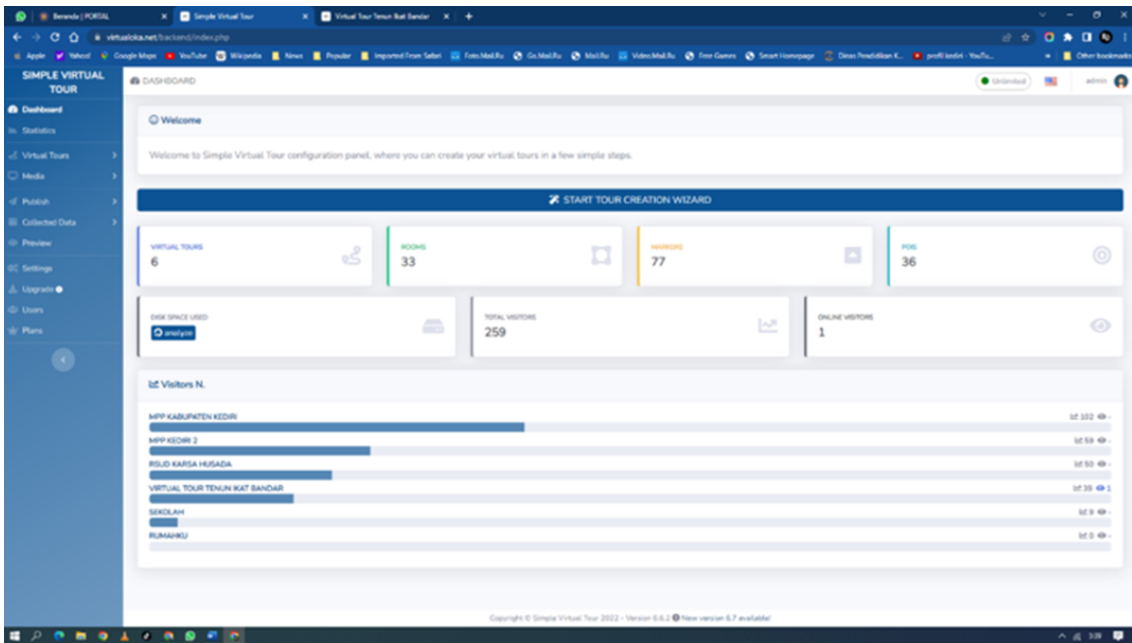
Figure 13. Dashboard Page

Room 360º page

Admins can add a 360 room on this page and make 360 room configuration settings.
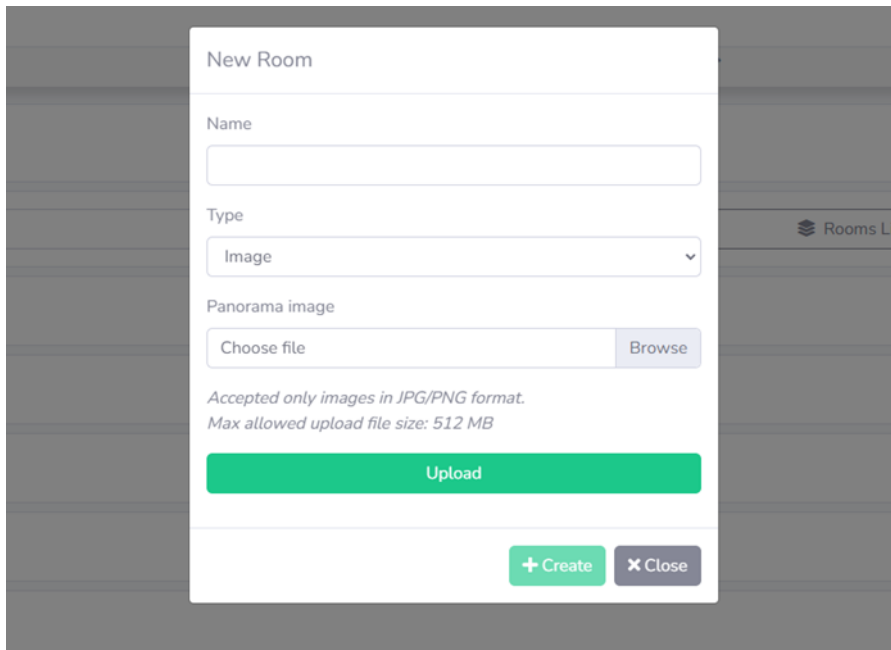
Figure 13. Room 360º page

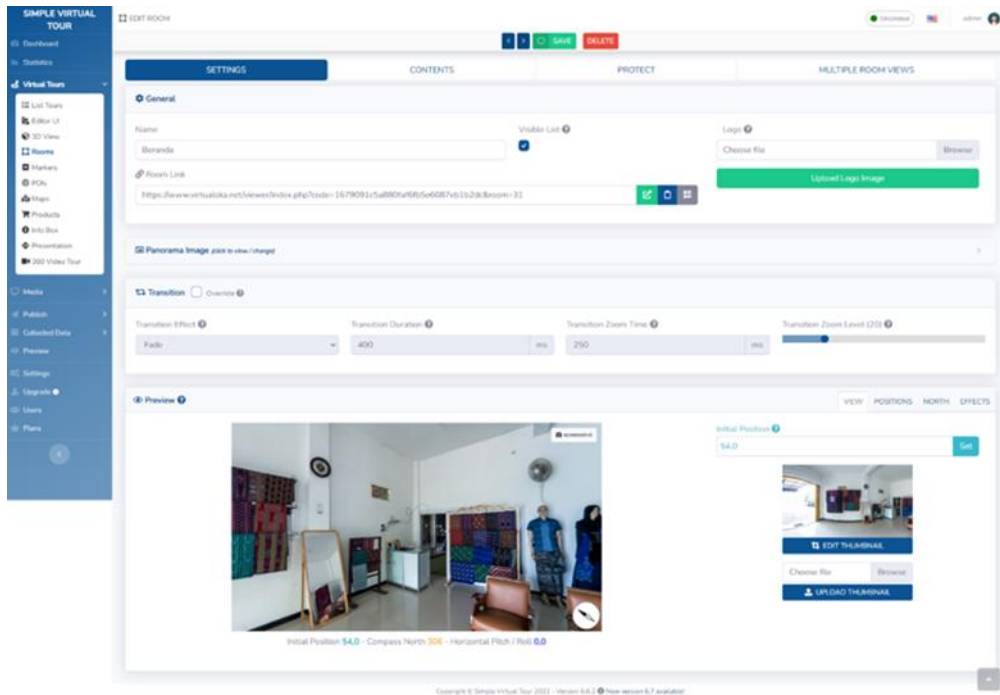In this page 360 room configuration settings also can be done by admin.

Figure 13. Room 360º page

Catalogue Product Page

On this page, the admin can manage woven product data, manipulate product data, add product photos, and make shopping arrangements.
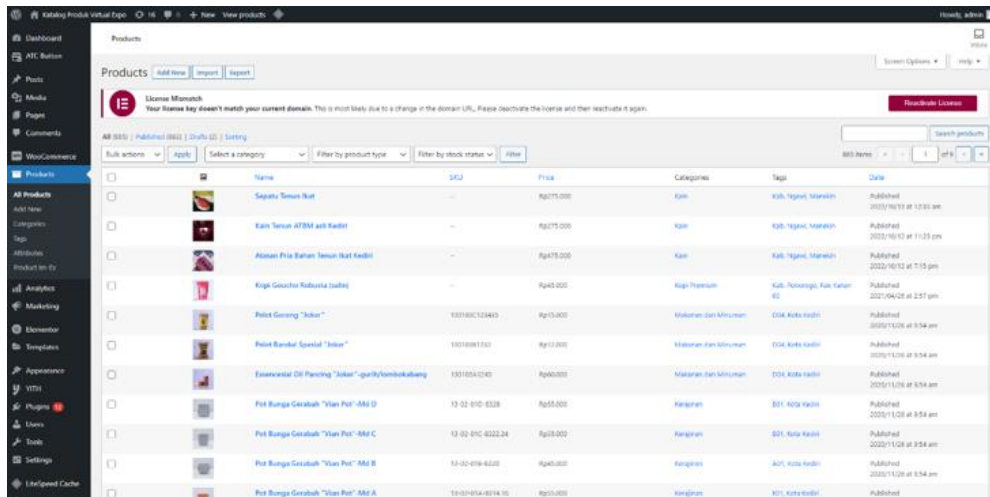

Figure 14. Catalogue Product Page

Input Product Page

The admin can add product data on this page by adding product names, product specifications, product photos, prices, and full descriptions.
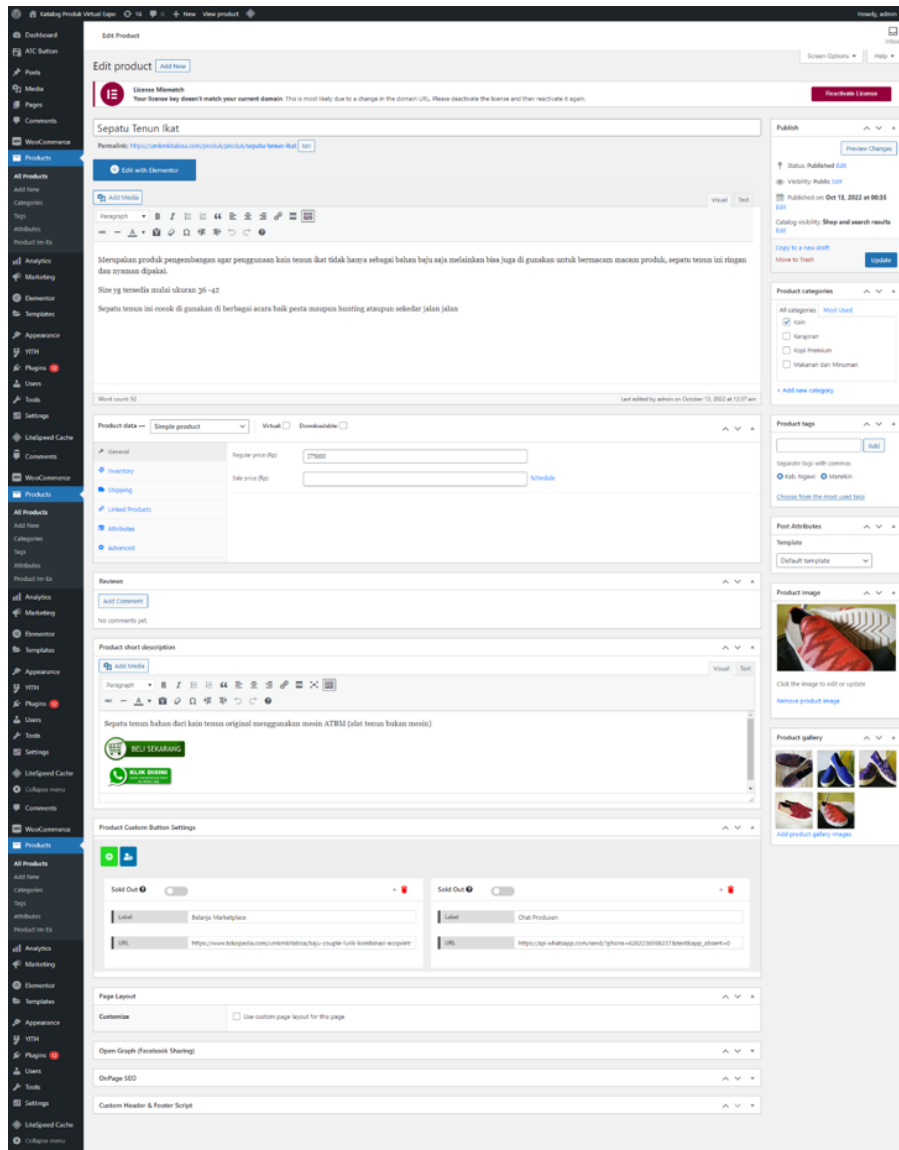
Figure 15. Input Product Page

2. Testing
Room Management Testing
In this test, the admin can manage room view 360 data, add room data, determine the yaw point at the first view, and set the type of room view whether to use images in JPEG format or 360 video in MP4 format shown in Figure 16.
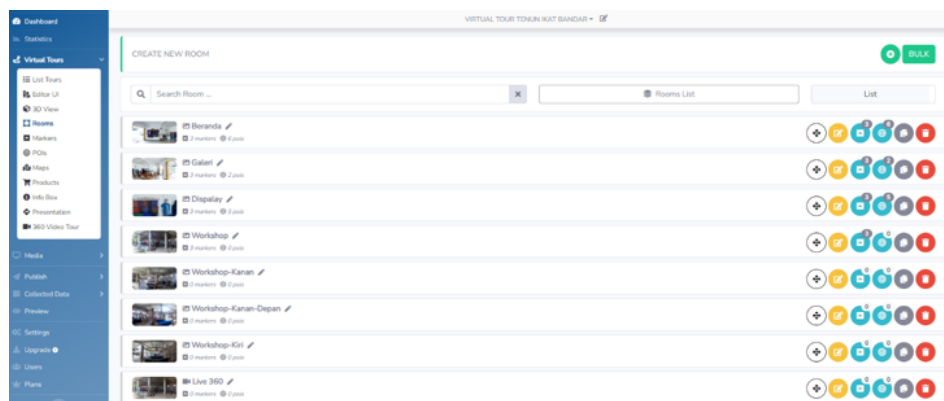

Figure 16. Room Management Testing

In adding room data, the add button is in the corner of the table; then, the admin will be directed to the add room form. After that, the admin is required to fill in all the required data, and then the admin must press the save button. The process of adding room-type 360 video files is shown in Figure 17.
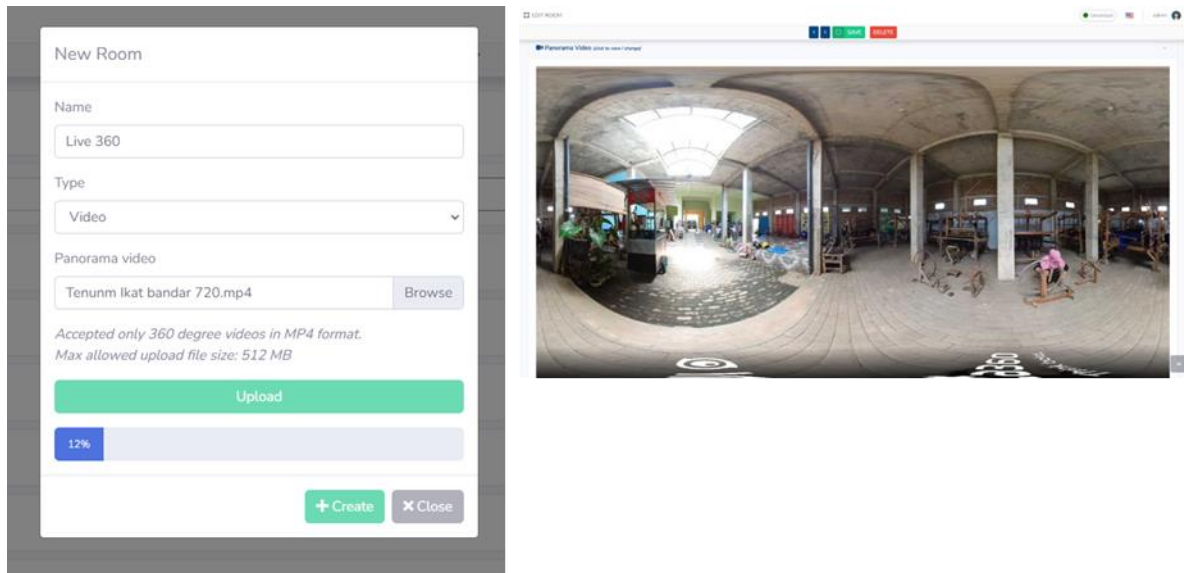

Figure 17. Added Room 360 Video Testing

Marker Management Testing

In this test, the admin can do markers in the room to determine navigation to the next room. Marker management starts with adding the data link for the intended room/room, setting icon types, deleting markers, and viewing association data. To manage the data, a menu is needed to manage markers.
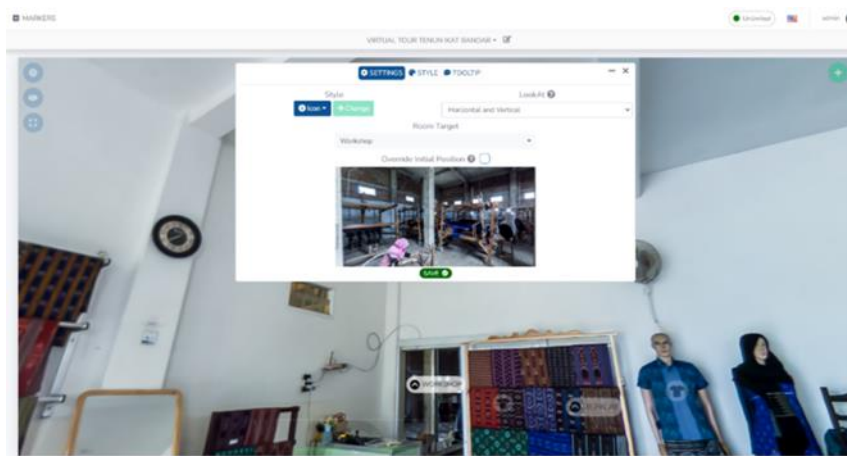

Figure 18. Marker Management Testing

3. Blackbox Testing

The black box testing is carried out by observing the performance of the system that has been made. Testing is carried out to determine whether the developed method can work as expected. This test is carried out by carrying out test scenarios and answering several questions. Table of Black Box test results.

No	Testing Scenario	Step	Expected Result	Result	Conclusion
1	Enter the virtual tour start page	The user enters the virtual web page for the Bandar Ikat Workshop tour	Enter the virtual tour home page	Users can enter the virtual tour start page as expected	Success
2	Access the virtual tour page	The user enters the virtual tour menu on the main page/by	Featuring a virtual tour of the Bandar	The application can display a virtual tour of the	Success

No	Testing Scenario	Step	Expected Result	Result	Conclusion
		pressing the button with the floor name.	Ikat weaving workshop	Bandar Ikat weaving workshop	
3	Access the navigation buttons on the page	The user presses the navigation buttons right, left, down, up, and zoom out	Panoramas can scroll according to navigation	Panoramas can scroll according to the navigation.	Success
4	Accessing the hotspot button on the virtual tour page of the Bandar ikat workshop	The user presses the hotspot button in the virtual tour	Panorama can move from one room to another	Panorama applications can move from one room to another	Success
5	Accessing the panorama list menu on the Virtual tour of the Bandar ikat workshop page	The user presses the button with the floor name	Displays a panoramic list of each floor of the Bandar Ikat Workshop	Displays a panoramic list of each floor of the Bandar Ikat Workshop	Success

4.0 CONCLUSION

It has been successfully designed and implemented virtual reality that can be used to market the results of UMKM Ikat Bandar Weaving. From the results of testing the application can run smoothly and display product galleries, product displays and workshop rooms properly, including there is a hotspot button that functions as navigation for visitors so they can explore the view. One of the challenges in implementing virtual reality technology is the need for up-to-date devices, such as 360 cameras, as well as specialized techniques for capturing objects and addressing user limitations that still need to be fully understood within this technology. To assist users, a manual or guide is offered to provide comprehensive instructions on properly utilizing this technology.

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