# Optimizing Tourism Promotion for Situ Bagendit Through Innovation in a Web-Based Virtual Tour Application

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**Abstract**

Situ Bagendit is a well-known natural lake tourist destination in Garut, West Java. However, information about Situ Bagendit is still difficult for the public to access. Information is often spread by word of mouth and social networks, which highlights the need for more effective promotional media. This research aims to create a virtual tour to promote Situ Bagendit and address the issue of information accessibility for tourists. The application was developed using the Multimedia Development Life Cycle (MDLC) method, utilizing VR technology and 3DVISTA software, and incorporating images and videos captured with a mobile or 360° camera. The application is hosted on Instagram, featuring interactive elements such as chat and location information via Google Maps. The research findings indicate that the virtual tour application was successfully built with features like a gallery, videos, information, WhatsApp, and Google Maps. It received a score of 80.25 on the System Usability Scale (SUS), earning an "Excellent" rating and falling within the "Acceptable" category. This application is expected to increase tourist interest in visiting Situ Bagendit.

**Keywords:** 3DVISTA, Tourism Promotion, Situ Bagendit, System Usability Scale, Virtual Tour

## I. INTRODUCTION

Garut, a city in West Java, holds significant tourism potential. Its natural beauty and rich cultural heritage have made it a favorite destination for visitors from various regions, both local and international [1]. One of the most captivating tourist attractions is Situ Bagendit, a natural lake located in Banyuresmi sub-district, Bagendit village, Garut. Situ Bagendit offers a variety of engaging activities for visitors, particularly enjoying the beautiful natural scenery surrounding the area. Despite its popularity, access to information about Situ Bagendit remains limited and is often disseminated only through word of mouth or social networks [2]. In 2022, after undergoing improvements, the number of tourists visiting Situ Bagendit reached 110,537. However, this figure decreased to 98,139 visitors in 2023 [3].

Promotion of tourist attractions often relies on photos and text, which can be less engaging. To increase tourist interest, more interactive promotional strategies are needed. One effective approach is to use Virtual Reality (VR) technology. With VR, users can experience information in a more immersive and engaging way. VR allows users to fully immerse themselves in a digital environment, providing a direct and profound experience [4]. VR will be used in Virtual Tours, which typically use 360-degree photos, making the experience more vivid and lifelike. Users don't just view a location; they feel as though they are actually there, merging elements of the real world and digital in one cohesive experience. Previous research has shown more than a 50% increase in interest across all aspects of evaluation when using VR Tours for information dissemination tools [5].

This research utilizes the MDLC (Multimedia Development Life Cycle) method in system development. The Multimedia Development Life Cycle is an approach that outlines the application development process from inception to completion, ensuring time efficiency and quality outcomes. The MDLC method includes six core stages: concept, design, material collecting, assembly, testing, and distribution [6].

Several previous studies related to Virtual Reality (VR) technology demonstrate its significant potential in enhancing tourist interest. Research has led to the development of an Android application called *Katalog Pariwisata Garut*, designed to provide comprehensive information about various tourist destinations in Garut [7]. The second study produced an Android application called Virtual Reality *Media Promosi Penangkaran Rusa Sambar*. This application showcases various features of the deer breeding area in Penajam Paser Utara [8]. The third study resulted in a virtual tour that can

depict tourist attractions in Desa Kenderan [9]. The fourth study resulted in a virtual tour of the National Museum's ceramics room, developed using the Multimedia Development Life Cycle (MDLC) methodology [10]. The fifth study resulted in a VR Tour designed as a promotional media for tourism in Riau Province [5]. However, there are gaps in these applications, such as the absence of a chat feature and a location information feature in the form of Google Maps to help users find tourist locations. Therefore, this research aims to design a web-based VR Tour as a promotional tool for the Situ Bagendit tourist attraction using the MDLC methodology. The application is expected to provide comprehensive information and increase tourist interest in visiting.

## II. RESEARCH METHODOLOGY

This study applies the Multimedia Development Life Cycle (MDLC) method, an approach that visualizes the application development process from the initial stage to the final stage, ensuring time efficiency and quality outcomes [11]. The MDLC method involves six main steps: concept, design, material collecting, assembly, testing, and distribution. This process is iterative, allowing certain stages to be repeated if evaluations indicate a need for changes (Figure 1). However, the planning stages (concept and design) must be completed first [12].

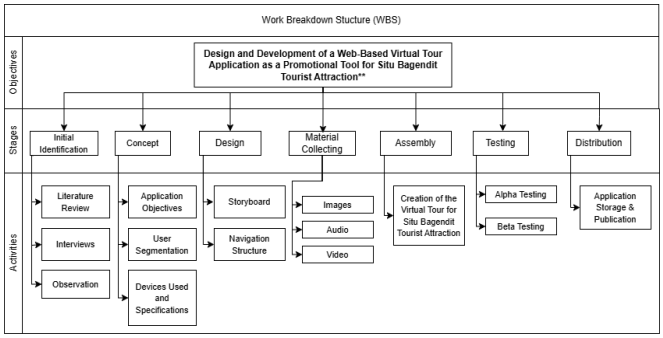


Figure 1. Work Breakdown Structure

The explanation of the Work Breakdown Structure is as follows:

1. The first stage in this study framework is initial identification. In this stage, several activities are carried out, including a literature review where the researcher gathers various references from journals, books, and related studies. Additionally, the researcher conducts interviews with relevant parties and observes the Situ Bagendit tourist attraction. The primary goal of this stage is to identify the research problem.
2. The second stage is the concept phase, which involves establishing the goals and concept of the application to be developed. Additionally, the researcher defines user segmentation and the device specifications that will be used in the application development.
3. The third stage is design. In this phase, a storyboard is created to illustrate or describe each scene, including the multimedia elements to be applied. This stage may also involve developing the navigation structure to make it easier for users to interact with the application, ensuring that the application is more user-friendly.
4. The fourth stage is material collection. This phase involves gathering the necessary materials for application development, such as audio, images, and video.
5. The fifth stage is assembly. In this phase, the application design is implemented using 3DVista software to create the virtual tour, with the goal of integrating all collected materials, such as images, text, audio, and video.
6. The sixth stage is testing. In this phase, the virtual tour undergoes alpha testing using black-box testing methods to verify that the application operates according to the specified requirements. Additionally, beta testing is conducted using the System Usability Scale (SUS) to assess the application's usability.
7. The seventh stage is distribution. This phase involves releasing the application that has successfully passed all testing, and then uploading it to a web hosting service so it can be disseminated and accessed by users.

## III. RESULT AND DISCUSSION

### A. Initial Identification

This stage involves collecting information related to the content to be presented in the virtual tour. This information is gathered through various methods to obtain more detailed insights, such as observation, literature review, and interviews [13].

1. Literature Review
   The literature review was conducted by examining various references such as books, journals, and related studies. From this review, essential data was obtained, which became the primary foundation for designing the VR tour application. The findings include information on the history, culture, and tourism potential of Situ Bagendit, which were then used as references to develop informative and accurate content for the application.
2. Interviews
   Interviews were conducted with the Chairperson of the Community Empowerment Institution, who manages the local tourism site of Situ Bagendit. From these interviews, detailed data was gathered concerning the history of the tourist site, the development of its facilities, and the management policies in place. Additionally, the interviews revealed information about the role of the local community in supporting tourism and the challenges faced in preserving the site's attractiveness and sustainability. The data collected from the interviews provided valuable insights to ensure that the virtual tour content is relevant and accurate, reflecting the actual conditions on-site.
3. Observation
   The researcher conducted direct observations of the Situ Bagendit tourist site to gather empirical data on the environmental conditions, available facilities, and tourist visitation patterns. The results of these observations

provided a detailed picture of the strengths and weaknesses of the site's facilities, as well as the experiences felt by visitors during their stay. This information was then processed into key elements for the interactive design of the virtual tour, such as tour routes, information points, and highlights of the tourist attractions.

**B. Concept**

In the concept stage, the researcher first establishes the objectives for creating the application, then determines the user segmentation for the virtual tour application, and identifies the tools and device specifications to be used in the development of the application.

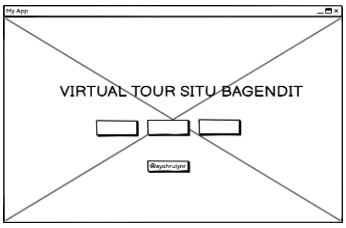
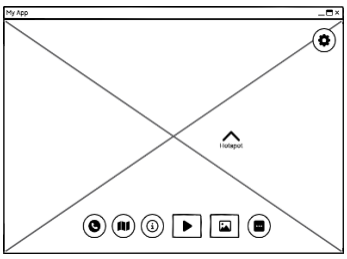
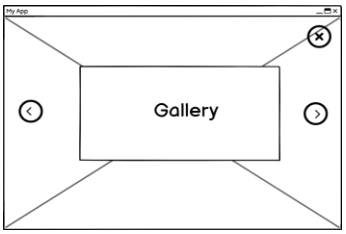
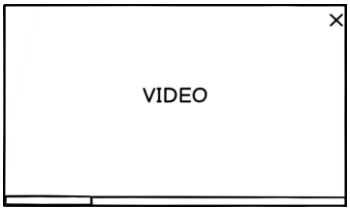
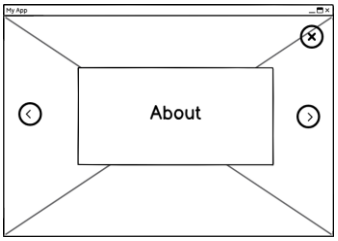
1. Application Objective
   The goal of this application is to develop a web-based virtual tour system to promote the tourist attraction of Situ Bagendit. The application will feature various interactive elements, such as a 360° image gallery, guided tour videos, integration with Google Maps for location navigation, and live chat functionality through WhatsApp for direct communication with the management. Additionally, the system will utilize Virtual Reality (VR) technology to provide a more immersive experience for users, supported by 3DVISTA software. The virtual tour will also be integrated with social media platforms, such as Instagram, to enhance accessibility and dissemination of information to potential tourists.
2. User Segmentation
   This virtual tour application is designed for potential tourists who wish to obtain detailed information about Situ Bagendit prior to their visit, prospective visitors from distant locations, tourism managers and partners who need promotional tools, as well as the VR technology enthusiast community interested in interactive and multimedia experiences.
3. Devices Used and Specifications.
   a. Specifications for running the web-based virtual tour wapplication on a computer:
      1) Operating System: Windows 7 or later.
      2) RAM 1 GB
      3) CPU Intel Pentium IV
      4) Storage 1 GB
   b. Specifications for running the web-based virtual tour application on Android:
      1) Sistem Operasi Android Nougat 7.0
      2) RAM 1 GB
      3) CPU Quad-core 1 GHz or faster
      4) Storage 4 GB

**C. Design**

During the design phase, detailed planning is carried out for the virtual tour application, including the user interface design, navigation structure, and storyboard. The user interface will integrate visually appealing and intuitive elements to facilitate easy exploration of the application's features. The navigation structure is designed to ensure a clear and easily followable flow of information, allowing users to quickly access image galleries, videos, and location details. The storyboard is used to plan the user experience comprehensively, ensuring that each element functions harmoniously to create an immersive virtual experience. Design decisions are based on principles of usability and accessibility, incorporating feedback from potential users to ensure the application is not only aesthetically pleasing but also functional and user-friendly.

1. *Storyboard Design*
   In this stage, the storyboard is designed, which provides an overview of the application's activities. The following Table 1 is a detailed explanation of the application's storyboard:

Table 1. Storyboard Design

| Scene | Description |
|---|---|
|  | This page displays a background image of Situ Bagendit taken from a drone, the application title, and a loading animation. It then transitions to the main page of the application. |
|  | The main page features the virtual tour interface, where users can view 360-degree images of Situ Bagendit from various points. It also includes numerous buttons and background sound. |
|  | This page displays the gallery, where users can view images related to Situ Bagendit. |
|  | The background features an aerial view of Situ Bagendit captured by a drone, the application title, and a watermark of the system creator. |
|  | This page displays the information section, where users can view images along with details about Situ Bagendit. |

2. Navigation Structure
The navigation structure is the flow of information within a multimedia system. This navigation structure is used for a detailed depiction of the system [14]. The following is the navigation structure of the system developed in this study, as shown in Figure 2.

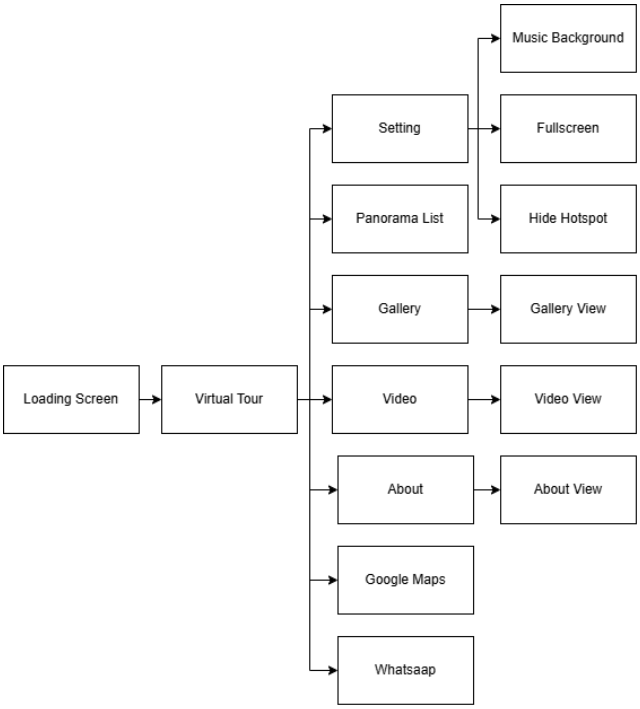


Figure 2. Navigation Structure

A loading screen is the first thing displayed when opening the application. After that, a virtual tour page appears with several options, such as WhatsApp, Google Maps, About, Video, Gallery, Panorama List, and Settings. These options are connected through navigation buttons that direct users to the desired scene. Each scene also includes a navigation button to return to the main screen.

**D. Material Collecting**

At this stage, the researcher gathers materials, preparing various resources to be used, including sound, images, and videos created by the researcher, as well as from other sources. These can be seen in the following Table 2.

1. Image Materials

Table 2. Image Materials

| No | Function | File Name | Type | Extension | Source |
|---|---|---|---|---|---|
| 1 | Backsound | Bg1 | 2D | .JPG | https://youtu.be/HFZiE8FE6bQ?feature=shared |
| 2 | Panoramic image | Gerbang masuk | 2D | .JPG | Image capture results |
| 3 | Panoramic image | Parkiran mobil | 2D | .JPG | Image capture results |
| 4 | Panoramic image | Parkiran bus | 2D | .JPG | Image capture results |
| 5 | Panoramic image | Parkiran motor | 2D | .JPG | Image capture results |

Image materials are in .JPG or .PNG format. These image materials are divided into three categories: Background, Buttons, and Objects. Buttons are created using Adobe Illustrator, which is a vector-based graphic design program.

2. Audio Materials

Table 3. Audio Materials

| No | Function | File Name | Extension | Size | Source |
|---|---|---|---|---|---|
| 1 | Backsound | Bg1 | .MP3 | 4.34 MB | https://youtu.be/HFZiE8FE6bQ?feature=shared |

Audio materials are in .mp3 file format and will be used as background music. These audio materials are sourced from YouTube (Table 3).

3. Video Materials

Table 4. Video Materials

| No | Function | File Name | Extension | Size | Source |
|---|---|---|---|---|---|
| 1 | Video features | Situ bagendit | .MP4 | 341 MB | https://youtu.be/762PyHQYIII?feature=shared |

Video materials consist of a series of clips that are recorded and edited to convey information visually. These video materials are sourced from YouTube and will later be used for the video feature (Table 4).

**E. Assembly**

The assembly phase is the stage of application development where all materials prepared in the previous stages are implemented [12]. In the process of creating this application, 3DVISTA software is used to implement the virtual tour design. After collecting materials such as 360° images, videos, and location information, these materials are organized and integrated according to the defined navigation structure and storyboard. The assembly process involves placing content in the appropriate locations within the application, setting up interactions such as click-to-reveal additional information, and configuring menus and navigation buttons to facilitate user movement between galleries, videos, and location information. Once the application is assembled, testing is conducted to ensure that all features function correctly, and adjustments are made based on feedback to improve the application's performance and functionality. This application allows users to explore Situ Bagendit virtually with interactive navigation that simplifies access to various

information about the tourist attraction. The results of the Situ Bagendit Virtual Tour application are shown in Figure 3.

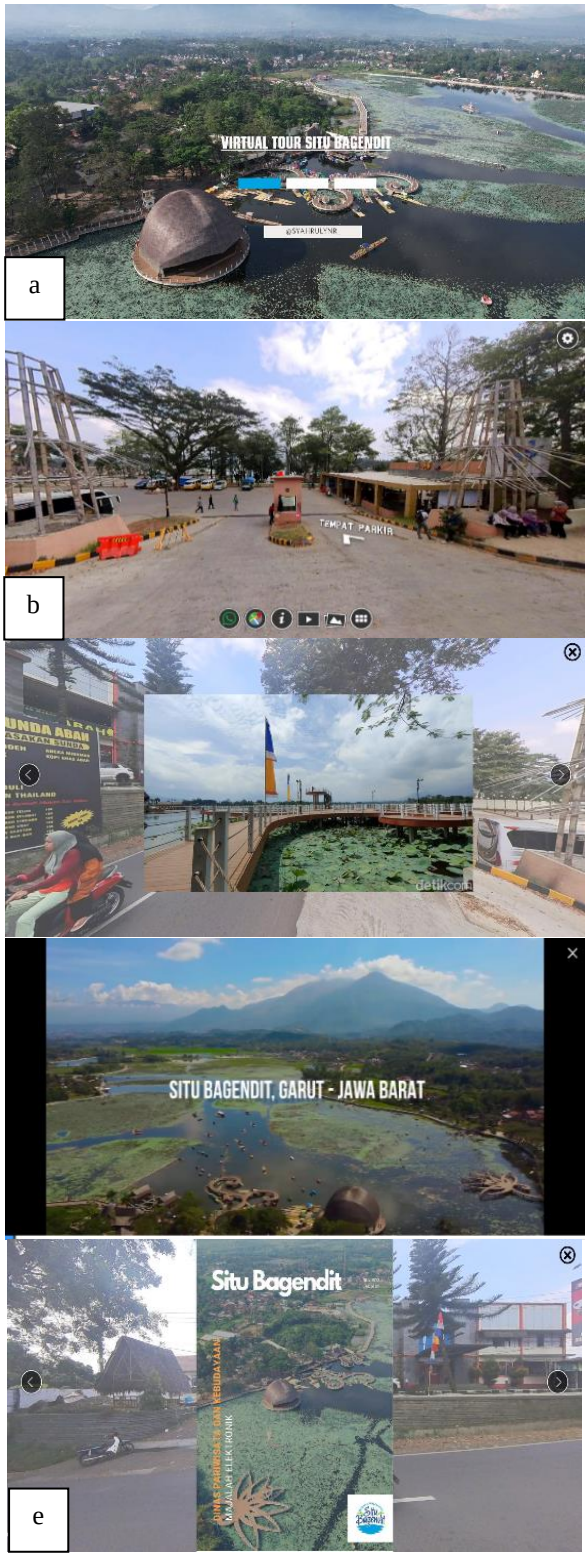



Figure 3. Application Display

Figure a. shows the login page, Figure b. illustrates the main page, Figure c. displays the gallery feature page, Figure d. showcases the video feature page, and Figure e. presents the information page.

**F. Testing**

This testing is conducted using two methods: alpha testing and beta testing. For alpha testing, black-box testing is used, while beta testing employs usability testing (SUS).

1. Alpha Testing

   In this study, black-box testing was performed by checking each menu navigation and displayed page individually, assessing the functional results to ensure the application operates correctly [15]. This can be seen in Table 5.

Table 5. Black-box Testing Results

| No | Test Class | Test Item | Test Results |
|---|---|---|---|
| 1 | Application Installation | Installation of device applications on the web | "Successful" |
| 2 | Login Page | Displays the application, showing the application title, loading screen, and the creator's watermark when first opened. | "Successful" |
| 3 | Main Page | Displays the main menu and the virtual tour of the Situ Bagendit tourist attraction. | "Successful" |
| 4 | Button *"Setting"* | Displays the background music button, fullscreen button, and hotspot button. | "Successful" |
| 5 | Button *"Backsound"* | Starts and stops the music | "Successful" |
| 6 | Button *"Fullscreen"* | Activates and deactivates fullscreen mode | "Successful" |
| 7 | Button *"Hotspot"* | Displays and hides hotspots | "Successful" |
| 8 | Button *"Panorama List"* | Shows and hides the pop-up panorama image list | "Successful" |
| 9 | Button "Gallery Feature" | Displays photos related to the Situ Bagendit tourist attraction | "Successful" |
| 10 | Button *"Close"* in the Gallery Feature | Closes the gallery view | "Successful" |
| 11 | Button *"Next"* in the Gallery Feature | Displays the next image | "Successful" |
| 12 | Button *"Previous"* in the Gallery Feature | Displays the previous image | "Successful" |
| 13 | Button "Video Feature" | Displays videos of the Situ Bagendit tourist attraction | "Successful" |

| No | Test Class | Test Item | Test Results |
|---|---|---|---|
| 14 | Button "*Close*" in the Gallery Feature | Closes the video view | "Successful" |
| 15 | Button "Info" | Displays photos and information about the Situ Bagendit tourist attraction | "Successful" |
| 16 | Tombol "*Close*" in the info feature | Close the gallery view | "Successful" |
| 17 | Tombol "*Next*" in the Gallery Feature | Display the next image | "Successful" |
| 18 | Button "*Previous*" in the info feature | Display the previous image | "Successful" |
| 19 | Button " *Google Maps*" | Redirect to Google Maps and display the location of the Situ Bagendit tourist attraction | "Successful" |
| 20 | Button " *Whatsapp*" | Redirect to WhatsApp to contact the admin or manager of the Situ Bagendit tourist attraction | "Successful" |
| 21 | Button "*Pilihan Panorama"* | Display the selected panorama | "Successful" |

2. Beta Testing
In the beta testing phase, a usability test was conducted with potential tourists or the general public to obtain reliable and valid data regarding user experience or functionality issues. Participants were asked to complete a questionnaire consisting of 10 questions. A sample of 30 respondents may be sufficient to provide an initial insight. The calculation used for the questionnaire follows the System Usability Scale (SUS) and was presented to 30 respondents, as shown in Table 6-7 below.

Table 6. Usability Test Questions

| Code | Questions |
|---|---|
| P1 | I think I will use this virtual tour application again. |
| P2 | I find the virtual tour application complicated to use. |
| P3 | I find the virtual tour application easy to use. |
| P4 | I need help from others or a technician to use this virtual tour application. |
| P5 | I feel that the features of the virtual tour application work as expected. |
| P6 | I find there are many inconsistencies in this virtual tour application |
| P7 | I believe others will quickly understand how to use this virtual tour application. |
| P8 | I find this virtual tour application confusing. |
| P9 | I feel there are no obstacles in using this virtual tour application. |
| P10 | I need to get accustomed to using this virtual tour application first. |

Table 7. Scale *Likert*

| No | Questions | Score |
|---|---|---|
| 1 | Strongly Agree (SA) | 5 |
| 2 | Agree (A) | 4 |
| 3 | Neutral (N) | 3 |
| 4 | Disagree (D) | 2 |
| 5 | Strongly Disagree (SD) | 1 |

In the final stage, the questionnaire results are calculated. The SUS (System Usability Scale) score is computed as follows: for odd-numbered questions, the respondent's answer is subtracted by 1, while for even-numbered questions, 5 is subtracted from the respondent's answer. The resulting scores are then summed and multiplied by 2.5 [16]. The next step is to obtain the System Usability Scale result and then calculate the average of the questionnaire results.

Odd-numbered questions:
P1,P3,P5,P7,P9 – 1 = Calculation Results.
Even-numbered questions:
5 - P2,P4,P6,P8,P10 = Calculation Results.

Example:
P1 = 5 then, 5 – 1 = 4
P2 = 2 then 5 – 2 = 3

Table 8. Respondent Feedback Results

| No | Calculated Scores for Questions | | | | | | | | | | Total | SUS Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | | |
| **1** | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 1 | 35 | 88 |
| **2** | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 37 | 93 |
| **3** | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 28 | 70 |
| **4** | 4 | 3 | 3 | 4 | 4 | 3 | 3 | 4 | 4 | 2 | 34 | 85 |
| **5** | 3 | 3 | 3 | 3 | 1 | 2 | 3 | 3 | 2 | 3 | 26 | 65 |
| **6** | 3 | 3 | 4 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 28 | 70 |
| **7** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 28 | 70 |
| **8** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 40 | 100 |
| **9** | 3 | 3 | 3 | 1 | 3 | 4 | 2 | 3 | 1 | 3 | 26 | 65 |
| **10** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 1 | 37 | 93 |
| **11** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 1 | 37 | 93 |
| **12** | 4 | 0 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 1 | 25 | 63 |
| **13** | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 21 | 53 |
| **14** | 3 | 2 | 2 | 2 | 3 | 4 | 2 | 3 | 3 | 1 | 25 | 63 |
| **15** | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 4 | 2 | 36 | 90 |

| No | Calculated Scores for Questions | | | | | | | | | | Total | SUS Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | | |
| **16** | 3 | 4 | 4 | 3 | 4 | 3 | 4 | 4 | 4 | 3 | 36 | 90 |
| **17** | 4 | 3 | 3 | 2 | 3 | 3 | 4 | 3 | 3 | 2 | 30 | 75 |
| **18** | 3 | 4 | 3 | 2 | 3 | 4 | 3 | 4 | 3 | 1 | 30 | 75 |
| **19** | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 4 | 1 | 35 | 88 |
| **20** | 3 | 3 | 3 | 1 | 2 | 1 | 3 | 3 | 1 | 1 | 21 | 53 |
| **21** | 4 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 2 | 36 | 90 |
| **22** | 4 | 4 | 4 | 2 | 4 | 3 | 4 | 4 | 4 | 3 | 36 | 90 |
| **23** | 4 | 4 | 4 | 2 | 4 | 3 | 4 | 4 | 4 | 3 | 36 | 90 |
| **24** | 4 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 3 | 4 | 35 | 88 |
| **25** | 3 | 3 | 4 | 4 | 4 | 2 | 4 | 2 | 4 | 3 | 33 | 83 |
| **26** | 4 | 3 | 3 | 3 | 4 | 2 | 3 | 4 | 4 | 4 | 34 | 85 |
| **27** | 3 | 4 | 4 | 3 | 4 | 0 | 4 | 1 | 4 | 0 | 27 | 68 |
| **28** | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 39 | 98 |
| **29** | 4 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 33 | 83 |
| **30** | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 39 | 98 |
| **Total SUS Score** | | | | | | | | | | | | 2408 |

From Table 8, it can be seen that the "Total" column is obtained from the P1 to P10 columns. The SUS Score column is calculated by multiplying the total score by 2.5. After obtaining a total SUS score of 2408, this number is divided by the number of respondents to produce an average score of 80.25 (Excellent / B), which is considered Acceptable. The results of the System Usability Scale evaluation can be seen in the following Figure 4:

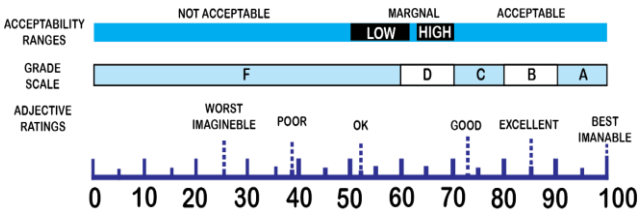



Figure 4. Determination of SUS Evaluation

### G. Distribution

The Distribution phase is the final stage in the Multimedia Development Life Cycle (MDLC) methodology. This phase follows the testing stage, where the application is ready for use by the public. Distribution involves uploading the application to the web and sharing it on the Instagram account of the Situ Bagendit tourist attraction so it can be accessed and used by users. Additionally, the publication stage involves disseminating information through research journals, which will be posted in national or international journal repositories. A summary of the system, in the form of a poster, is also created and published on campus media.

## IV. CONCLUSSION

The conclusion derived from this study indicates that the web-based virtual tour application for promoting Situ Bagendit tourism has been successfully designed and effectively enhances the accessibility of tourism information. The application offers various interactive features, such as a photo gallery, videos, location information, and integration with Google Maps, which significantly facilitates tourists in obtaining information about the tourist destination. Based on the results of the System Usability Scale (SUS) testing involving 30 respondents, the application received an average score of 80.25, which falls into the "Excellent" and "Acceptable" categories. Approximately 50% of respondents gave scores above 85, and 30% provided scores above 90, indicating that the application is highly user-friendly and interactive. Additionally, black-box testing revealed that all application features functioned correctly, with a 100% success rate for 21 test items. The application is projected to boost tourist interest, considering that similar VR-based virtual tours have been proven to increase tourist interest by up to 50%. Therefore, this virtual tour application has great potential to contribute significantly to increasing the number of visitors to Situ Bagendit.

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