



Development of an Android-Based Tourism Application for Banyumas Regency using the Waterfall Model

Arnelka Hananta¹, Novian Adi Prasetyo^{2*}, Amalia Beladonna Arifa³

^{1,2,3}Department of Informatics Engineering, Telkom University, Indonesia

¹arnelkahananta@gmail.com, ²novian@telkomuniversity.ac.id, and ³amaliabela@telkomuniversity.ac.id

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ABSTRACT

Tourism is a key sector for regional economic growth and needs to be supported by the use of technology. This research aims to design and build an Android-based tourism application for Banyumas Regency using the Waterfall method. The application provides information on various tourist destinations, including nature, artificial attractions, culinary spots, and hotels. The development process followed the sequential stages of needs analysis, system design, implementation, testing, and maintenance. Unified Modeling Language (UML) diagrams were used for system modeling, while Android Studio and Firebase Firestore served as the main development tools. System functionality was validated through Blackbox Testing, while usability was assessed using the System Usability Scale (SUS) method. The application successfully passed functionality tests across multiple smartphone models and achieved an average SUS score of 84.83, indicating excellent usability. The research concludes that the tourism application effectively assists users in finding tourism information in Banyumas Regency. Future improvements are suggested by adding features such as distance-based recommendations and advanced search functions to enhance user experience.

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*Corresponding Author:

Novian Adi Prasetyo

Department of Informatics Engineering, Telkom University, Indonesia

Jl. Telekomunikasi No. 1, Bandung Regency, West Java, Indonesia (40257)

Email: novian@telkomuniversity.ac.id

1. INTRODUCTION

Tourism is an activity related to recreational travel (Big Indonesian Dictionary). According to Law No. 10/2009 on tourism, tourism is a wide variety of tourism activities supported by various facilities and services provided by the community, businessmen, government, and local governments[1]. The tourism sector is also an economic activity that has become a mainstay and development priority for several countries, especially for developing countries such as Indonesia, which has a large area potential with abundant tourist attractions, many natural beauties, various historical, cultural heritages, and people's lives. In addition, tourist objects are one of the natural resources to be proud of, where each region has its own uniqueness, both in terms of beauty and customs, so that it attracts tourists to visit it. One of them is a tourist attraction in Banyumas Regency[2].

Based on data on the number of visitors to Banyumas tourism objects in 2015 obtained through the official website of the Banyumas Central Statistics Agency[3], the number of tourist visitors reached 1,219,231 people. Then in 2016, there was an increase in the number of visitors to Banyumas tourism, reaching 1,499,212 visitors.

But in 2017 only got hundreds of growth in the number of visitors. The number of visitors in 2017 reached 1,499,894 people.

Based on observations made at the Banyumas Regency Tourism Office, they have used technology to help promote the attractiveness of tourism objects in Banyumas through social media, Instagram, and the video-sharing site YouTube. However, this method is still not enough to provide comprehensive information about the various tours in Banyumas. Seeing this problem, it is necessary to use technology to package various tourist information in the Banyumas area. One of them is by developing a tourism information application for the Banyumas area. The application can contain various types of information, such as tourist names, photos, and locations. Therefore, an Android-based application was chosen because Android is the most widely used mobile operating system in Indonesia[4], making it accessible to the majority of users without requiring special devices. Additionally, Android offers an open and flexible development ecosystem and supports integration with services like Google Maps and Firebase, which are essential for providing real-time location-based information. The development process employed the Waterfall method because it aligns with the needs of a project that has well-defined specifications and sequential workflows[5]. This method allows each development phase—from needs analysis, design, implementation, to testing—to be carried out systematically and well-documented. This research was motivated by the need for a more integrated and complete tourism information medium in Banyumas Regency, as previous promotional efforts through social media were insufficient to meet the information needs of tourists in accessing diverse tourism data in one easily accessible platform.

2. METHOD

In this study, there are several stages in conducting research, starting with conducting a preliminary study, collecting data, identifying problems and research objectives, and designing an application using the waterfall method[6],[7]. The flow of research in this study is shown in Figure 1. The first stage is a preliminary study that serves as the foundation for conducting research. The second process is data collection by obtaining data that will be needed in this research. Then the system design process uses the waterfall method. The waterfall method is a method in software development where the work must be done sequentially, starting from the concept planning stage, modeling, implementation, testing, and maintenance.

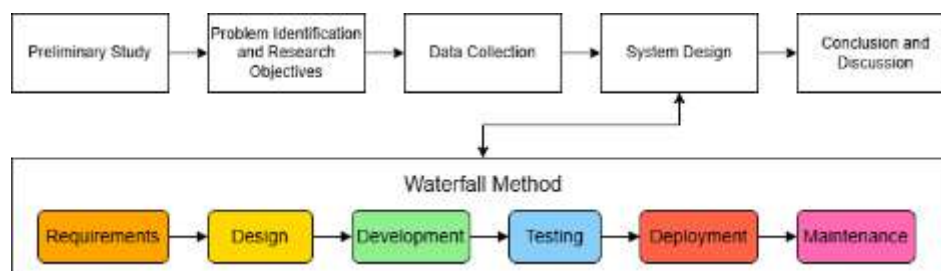


Figure 1. Research flow

2.1. Preliminary Study

In this study, a reference is needed as a basis for conducting the research stages. Furthermore, the references used by the authors include journals, theses, and websites that are still related to this research as a reference.

2.2. Problem Identification and Research Objectives

The problem in this study is the large number of tourist attractions found in the Banyumas Regency area. Because of these issues, we need a platform that can accommodate the Banyumas Regency's tourist information.

2.3. Data Collection

Data collection in this study was obtained through the Banyumas Regency Youth, Sports, Culture, and Tourism Office when the authors carried out internship activities. In addition to being obtained through the local office, data is obtained through the internet, especially on visitor data for Banyumas tourism objects. In addition to tourist attraction visitor data, there is location data collection for each tourist attraction that will be entered into the application.

2.4. System Design

The system design in this study uses the Android Studio application by applying the waterfall method. The waterfall method is a systematic and sequential information system development model [8]. The waterfall method has the following stages [9]:

2.4.1. Need

At this stage, system developers need communication that aims to understand the software expected by users and the limitations of the software. Information can be obtained through interviews, discussions, or direct surveys. The information is analyzed to get the data needed by the user.

2.4.2. Design

At this stage, the developer makes a system design that can help define hardware and system requirements and also helps in defining the overall system architecture.

2.4.3. Implementation

At this stage, the system is first developed in small programs called units, which are integrated into later stages. Each unit is developed and tested for functionality which is referred to as unit testing.

2.4.4. Verification

At this stage, the system is verified and tested to determine whether the system fully or partially meets the system testing requirement. Testing can be categorized into unit testing (performed on certain modules of code), system testing (to see how the system reacts when all modules are integrated), and acceptance testing (done with or on the customer's behalf to see if all customer needs are satisfied).

2.4.5. Care

This is the final stage of the waterfall method. The finished software is run and maintained. Maintenance includes fixing errors not found in the previous step.

At the system testing stage, using Blackbox Testing [10] and System Usability Scale (SUS) methods [11]. The BlackBox testing method serves to test the functionality of the application. Testing on BlackBox testing testers do not need to have knowledge of certain programming languages. Then the SUS method is used to test the usability [12] of the application.

3. RESULTS AND DISCUSSION

The system design in this study uses the Android Studio application by applying the waterfall method, starting from needs analysis, design, implementation, system testing, and maintenance. BlackBox testing and the System Usability Scale (SUS) are used for this system's testing.

3.1. Needs Analysis

The stage of needs analysis for the system design process is obtained during internship activities. The need for the system to be made is the menu of restaurants, hotels, nature tourism, artificial tourism, and historical tourism. Then, for the details of each menu, there are place names, prices, photos, descriptions, and locations. To be able to display name, price, photo, description, and location on the application, internet access and location access are required.

3.2. Design

At the design stage, there is a Unified Modeling Language (UML) modeling process [13]. UML is a method in visual modeling that is used as a means of object-oriented system design [14]. Model diagrams used in this study are use case diagrams, activity diagrams, and sequence diagrams. After the UML modeling process, the application design is carried out.

3.2.1. Use case diagrams

The use case diagram serves to describe the relationship between the user (users) and the application system [8]. The use case diagram design is based on the needs analysis that has been obtained. Figure 2 is a use case diagram for the Dolan Banyumas application.

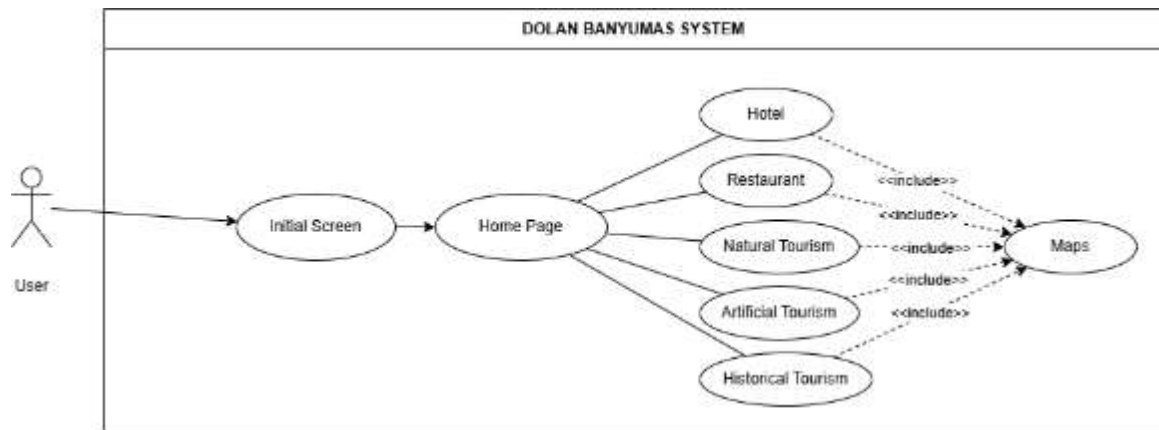


Figure 2. Use case diagram

3.2.2. Activity Diagram

Activity diagram serves to describe the flow of work or activities of a system [15]. Figure 3 is an activity diagram for the Dolan Banyumas application. The first activity diagram is when the user opens the application, the application will display the initial display page, and then display the home page. Then the user will select the menu located on the home page. Then the application will display a list of places. In the list of areas, there is a location button that can display the location page when the user presses the button.

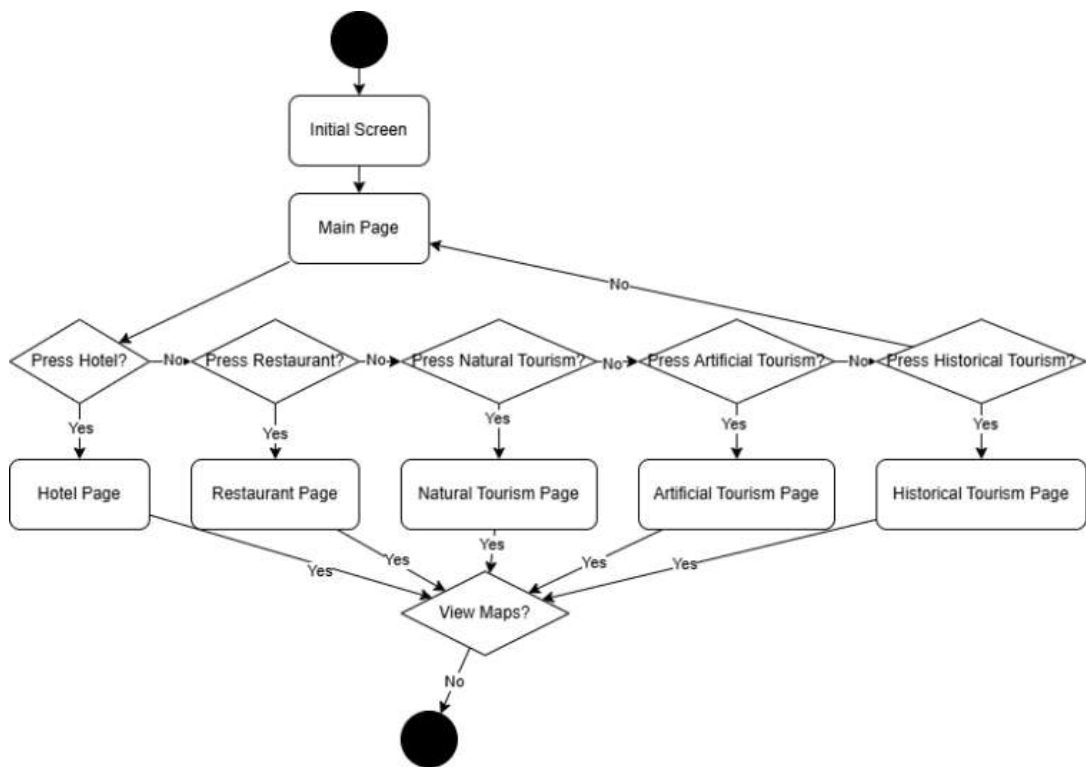


Figure 3. Activity diagram

3.2.3. Sequence Diagrams

Sequence diagrams have a focus on behavior within the system, illustrating how objects interact with other objects. In the sequence diagram, there are objects and messages sent between objects [14]. In the sequence diagram in Figure 4, there is an actor who opens the application, then displays the initial screen, and will automatically displays the home page. Then the actor selects the menu contained on the home page, and the application will display a list of places. On the place list page, the actor can press the location button to display the location page.

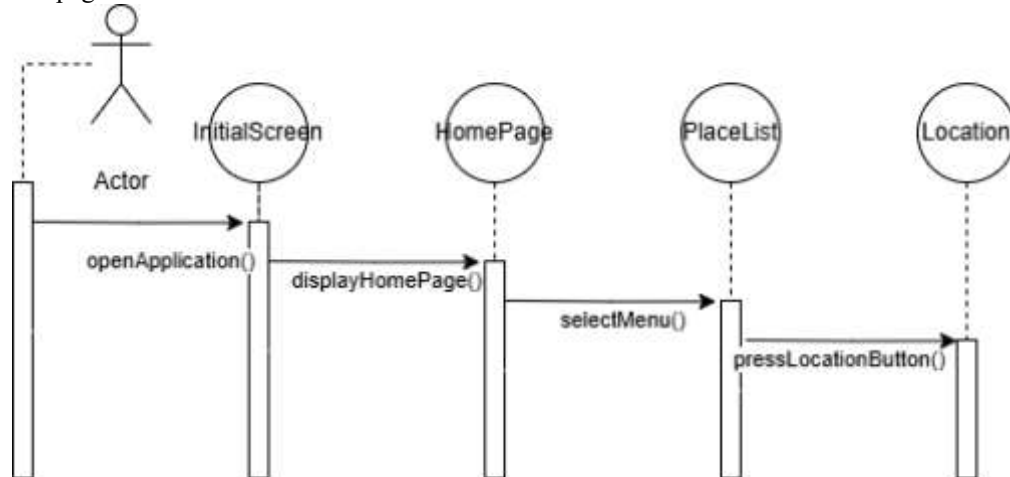


Figure 4. Sequence diagram

3.3. Application Display Design

Figure 5 shows an application display design that contains 4 designs that have been made. The first draft design is the initial display page, then the home page, the place listing page, and the location page.

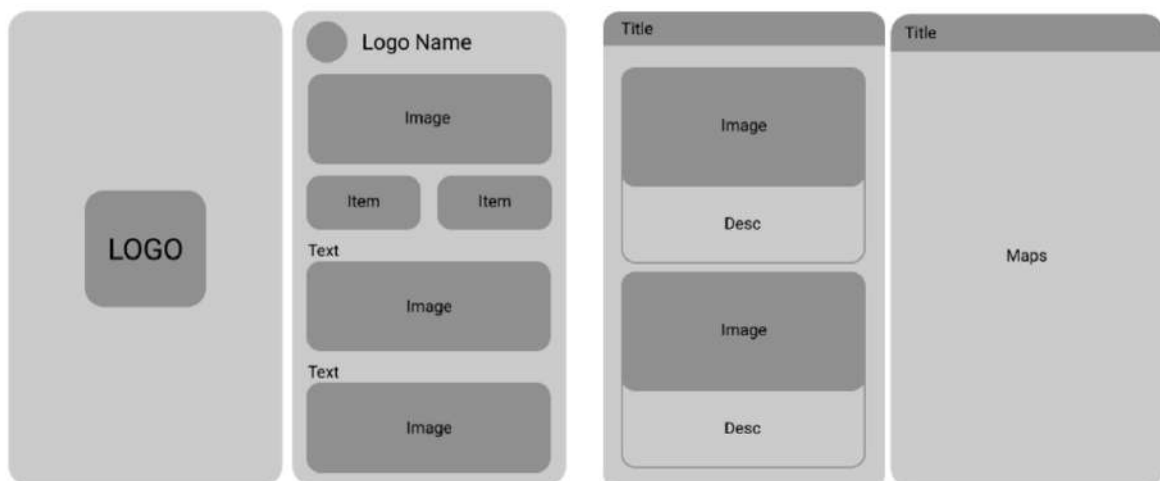


Figure 5. Mockup application

3.4. Implementation

After the design process is done, the next process is the implementation of the application by coding using Android Studio. Android Studio is the official IDE for Android application development [16]. Then for the database use Firebase Firestore. Using Firebase Firestore allows all connected devices to receive updates within milliseconds [17]. Figure 6 shows the result of coding using Android Studio.

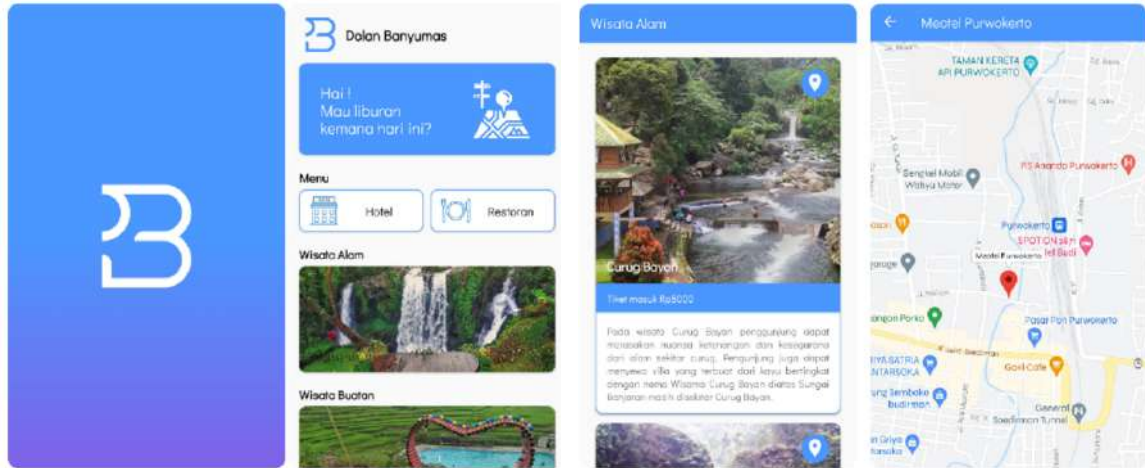


Figure 6. Result implementation

3.4.1. System Test

Stages of system testing are carried out after the implementation process has been completed. System testing is carried out using Blackbox Testing and System Usability Scale (SUS) testing methods.

3.4.2. Blackbox Testing

The Blackbox Testing method is a method used to test software without having to pay attention to software details. This test only checks the output value based on the respective input values [18]. Testing the Dolan Banyumas application was carried out on 4 different smartphones. Code A is Xiaomi Redmi Note 9 Pro, code B is Asus Zenfone 3 Max, code C is Samsung Galaxy A51, and code D is Realme 3 Pro. Table 1 is a table of test results that have been carried out with 4 smartphones.

Table 1. Result Blackox Testing

Test Parameters	Expected results	Test result			
		A	B	C	D
Open the app	The application can be run by smartphone	✓	✓	✓	✓
Open the home screen	Show initial view	✓	✓	✓	✓
Go to main page	Show main page	✓	✓	✓	✓
Press the hotel button	Show hotel page	✓	✓	✓	✓
Press the restaurant button	Showing restaurant page	✓	✓	✓	✓
Push the nature tourism button	Showing the nature tourism page	✓	✓	✓	✓
Pressing the artificial travel button	Showing Artificial Tourist Pages	✓	✓	✓	✓
Pressing the historical travel button	Show historical tourism page	✓	✓	✓	✓
Pressing the location button	Show location	✓	✓	✓	✓

3.4.3. System Usability Scale (SUS)

The SUS method is a usability testing tool that uses 10 predetermined questions as the test tool [19]. To calculate the score on the SUS has its own rules. For odd-numbered questions, the score answered on the questionnaire is reduced by 1. For even-numbered questions, subtracted 5. Then all scores are added up and then multiplied by 2.5 [20]. In the SUS test for the Dolan Banyumas application, there were 15 respondents who had filled out a survey via Google Forms. In Table 2, the SUS test is the calculated result and produces an average value of 84.83.

Table 2. Result SUS Testing

Code	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	*2.5
R1	3	4	4	4	4	4	4	4	4	3	95
R2	4	3	3	4	4	3	4	4	4	3	90
R3	4	4	4	4	4	4	4	4	4	3	97,5
R4	3	3	4	3	2	3	3	3	2	2	70
R5	4	4	3	3	4	4	3	4	4	4	92,5
R6	4	4	3	3	4	4	4	4	3	3	90
R7	3	4	4	4	3	3	3	4	4	4	90
R8	3	3	4	3	4	4	3	4	4	4	90
R9	4	3	4	2	4	3	4	3	4	2	82,5
R10	3	4	4	4	4	4	4	4	3	3	92,5
R11	4	4	4	4	4	4	4	3	3	1	87,5
R12	4	4	4	3	3	3	4	3	4	1	82,5
R13	3	2	3	2	3	2	3	2	3	0	57,5
R14	3	4	4	4	4	2	4	4	4	4	92,5
R15	3	2	3	2	3	2	3	2	3	2	62,5
Average											84,83

4. CONCLUSION

This research successfully designed and developed an Android-based tourism application for Banyumas Regency using the Waterfall development method. The application provides comprehensive information on various tourism categories, including natural, artificial, culinary, and historical destinations. The development stages need analysis, system design, implementation, testing, and maintenance, which were systematically carried out, supported by modeling through UML diagrams and implementation using Android Studio and Firebase Firestore. Functional testing with Blackbox Testing demonstrated that the application operates well across different smartphone models. Meanwhile, usability evaluation through the SUS yielded an average score of 84.83, indicating that the application is highly usable and well-received by users. In conclusion, the application effectively facilitates access to tourism information in Banyumas Regency. Future work may include enhancing features such as route recommendations, integration of distance-based suggestions, and an advanced search function to further improve user experience.

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BIOGRAPHIES OF AUTHORS



Arnelka Hananta is a UI/UX Designer at PT Panin Sekuritas Tbk in Indonesia. He holds a Bachelor's degree in Information Technology from Telkom University, Indonesia. His research and professional interests include UI/UX design, mobile application development, and user-centered design, with a focus on creating solutions for complex problems through minimalist design principles. He has prior experience in Android application development during his internship at the Banyumas Regency Youth, Sports, Culture, and Tourism Office, where he developed an Android-based tourism information application. Currently, he is actively engaged in user experience design projects and continues to build expertise in digital product development. He can be contacted at email: arnelkahananta@gmail.com



Novian Adi Prasetyo is a lecturer and researcher at Telkom University, Indonesia. He holds a Master's degree in Informatics Engineering and is currently pursuing a Doctoral degree (Ph.D.) in Computer Science at IPB University, Indonesia, focusing his research on blockchain technology. His scholarly contributions include studies in web programming, mobile programming, computer vision, usability testing, expert systems, and augmented reality, with several publications indexed internationally. His research interests particularly center on user experience enhancement, application development, and the implementation of blockchain for secure information systems. He can be contacted at email: novian@telkomuniversity.ac.id



Amalia Beladonna Arifa is a lecturer and researcher at the Department of Informatics, Telkom University (Purwokerto), Indonesia. She holds a Master's degree in Computer Science. Her research interests include data mining, machine learning, sentiment analysis, topic modeling, and user experience analysis. She has published various scientific works focusing on the application of artificial intelligence, decision support systems, and educational technology innovations. Currently, she is actively involved in projects related to the integration of machine learning techniques in real-world applications. She can be contacted at email: amaliabela@telkomuniversity.ac.id