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# *Mobile Application Design for Smart Tourism with Augmented Reality Using User-Centered Design Method*

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***Abstract***

*Indonesia has many beautiful and attractive tourist destinations. However, limited information about these locations has made tourists less interested in exploring the cities. Traditional methods of providing information about tourist sites, such as print media, have proven to be less effective in providing information. To address this issue, it is necessary to utilize information technology. One way to do this is by designing a tourism app with Augmented Reality (AR) using the User-Centered Design (UCD) method. UCD is a method that involves the user in every step of the process. Users will be involved in every process, from the design of the application to the final product. Users will be given a questionnaire related to the design until it gets the required interface design. In this study, an average score of 4.16 was obtained, which show the application design can provide complete travel information of user needs.*

***Keywords:*** *Tourism; Indonesia; User-Centered Design; Interface Design; Augmented Reality Application*

**Abstrak**

Indonesia mempunyai wisata yang indah dan menarik, namun karena terbatasnya informasi, wisatawan menjadi kurang tertarik untuk mengetahui apa saja yang ada di kota tersebut. Penyampaian informasi mengenai lokasi wisata dengan menggunakan media cetak, brosur dan spanduk di tempat wisata kurang efektif dalam memberikan informasi. Karena kemajuan teknologi sudah sangat pesat, maka diperlukan suatu cara untuk memanfaatkan teknologi informasi. Melalui perancangan aplikasi pariwisata dengan *Augmented Reality* (AR) menggunakan metode *User-Centered Design* (UCD). UCD adalah metode yang melibatkan pengguna dalam setiap langkah proses. Dari perancangan aplikasi yang dibuat, pengguna akan terus terlibat dalam setiap prosesnya. Pengguna akan diberikan kuisioner terkait perancangan, jika perancangan belum sempurna, proses UCD akan diulangi hingga mendapatkan desain antarmuka yang dibutuhkan sehingga dapat memenuhi kebutuhan informasi lokasi pengguna. Dari penelitian ini, didapatkanlah rata-rata skor 4.16 yang menunjukan rancangan aplikasi ini dapat dengan mudah digunakan oleh pengguna.

***Kata Kunci****: Pariwisata; Indonesia; User Centered Design; Augmented Reality Application*

## 1. Introduction

Development of information technology in Indonesia is very rapid. The use of information technology is now widely used to support and solve a problem that usually arises in an organization, company or individual [1]. The presence of information technology is also very instrumental in pushing the advancement of all sectors, especially in the tourism sector. Tourism activities in Indonesia have started to grow and thrive, even started to become a trend and lifestyle of its own in the community. Based on data from the Central Statistics Agency (BPS) with the full support of the Ministry of Tourism of Indonesia, the number of trips during 2022 reached 895.12 million trips, which represented an increase of 447.08 percent compared to the previous year. This increase allegedly because of improving economic conditions, conducive security and the easy accessibility to tourist destination areas. The widespread use of social media was also very helpful in promoting and disseminating information about travel destinations [2].

Tourism promotion is done not only through print media, online media, and social media. The use of smartphones can also be used to implement a variety of travel services, such as electronic travel guides and digital interactive map [3]. However, due to lack of resources and travel information services, tourists are less effective in making tours. This is because there is some potential for tourism in the regions in Indonesia unspoiled or a lot of opportunities because of various limitations.

With mobile devices that are present, the more popular tourism applications. With the addition of the Augmented Reality (AR) feature which can project virtual graphics into the real environment, is expected to help users absorb the necessary tourism information in an intuitive way [4]. From the issue above, required designing tourism with Augmented Reality application using User-Centered Design (UCD) methods to address the problems encountered. UCD methods are one of the important concepts in conducting interactive application design as its goal [5]. UCD here considered in a broad sense, practice the following principles, the active involvement of the user for a clear understanding of user requirements and tasks, repetitive design and evaluation, and multi-disciplinary approach. UCD not only as usability testing or software engineering. UCD is a modular method or process that can be identified are involved in the practice of UCD [6].

Designing the tourism application with Augmented Reality using the User-Centered Design is expected to enable users to determine what kind of content Augmented Reality/Augmented Reality interface design needed to meet the needs of tourism location information to the user. The usefulness of the application and user satisfaction is the main goal of this method of User-Centered Design. Tourism applications expected to be more in line with user needs.

## 2. Literature Review

Augmented reality is a complex interdisciplinary field that utilizes IT technology in various fields such as medicine, education, architecture, industry, tourism and others, thereby augmenting real-time, real-world views with the addition of additional information in a chosen format. The use of Augmented Reality is also presented in the tourism domain [7].

Based on research conducted by Dai-In Danny Han, it can be seen that previous user needs in the context of software and mobile computing are still relevant for current and emerging technologies, the idea of appropriate application of AR as a new media in tourist destinations has sparked this research. The app will provide a platform to host relevant tourism information, reconstruct and relive stories from the past, and help tourists create emotional experiences from intangible products. With the aim of establishing Dublin city's image as an 'innovation testing ground', Dublin city aims to be the first European city to implement AR infrastructure, which will not only benefit tourists but also its citizens and other stakeholders, such as SMEs and the city [8].

From a methodological point of view, the usage-based study illustrates how the UCD approach can be applied to the design and evaluation of smartphone interfaces in the travel and tourism domain regarding mobile AR design. This proposed framework can be used as a frame of reference by designers and developers who are not familiar with knowledge acquisition in urban environments and/or AR interfaces that facilitate knowledge acquisition in different types of environments and for different user groups [9].

Research was conducted to determine the usability in the context of Augmented Reality from UCD applications to AR tourism applications. The first thing to do is domain analysis, interviews and tourist observations. It then proceeds through four rounds of iterative prototyping; designing, building, and testing at every stage. Rather than developing a framework, as was done in previous work [10], this research implemented a full application. To evaluate the system empirically, a tourism scenario in an English city was created. Participants will assess whether the application can be used or not, and find technical problems can interfere with AR [11].

Research on Mobile Application Design for Smart Tourism with Augmented Reality Using User-Centered Design Method, uses a different approach, namely using the User-Centered Design method where the user will be fully involved until the application is completed.

## 3. Research Method

This study focused on tourism application interface design with Augmented Reality with the method of User Centered Design. The flowchart can be seen in Figure 1 [12].

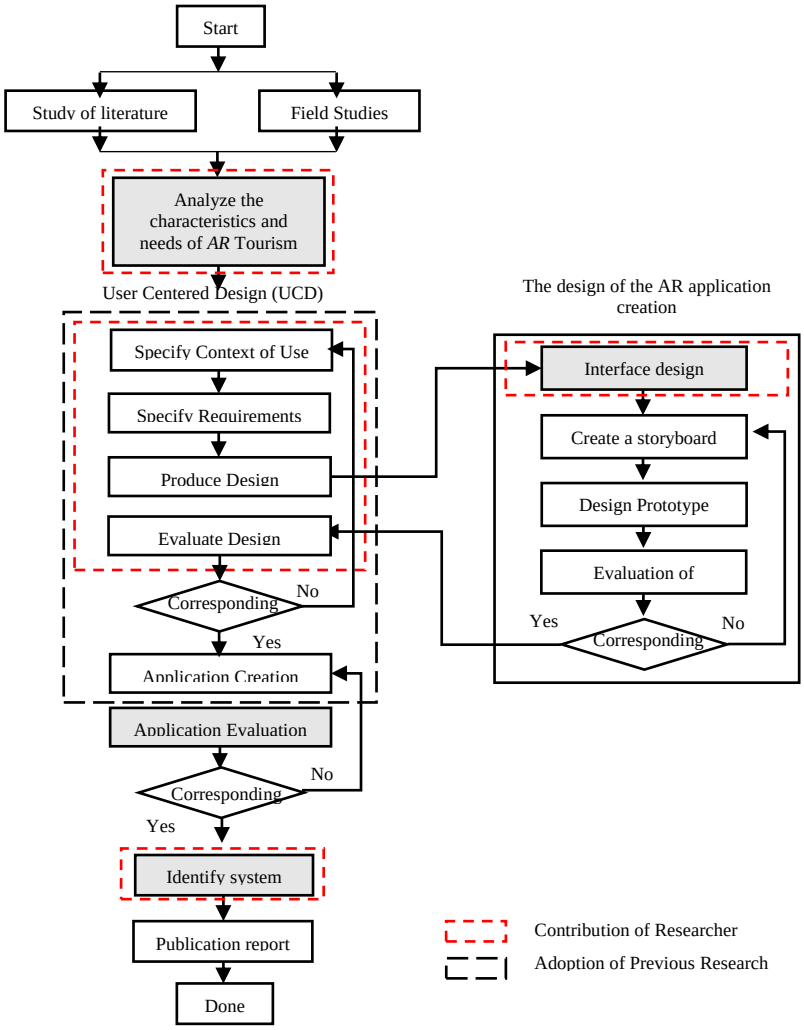


**Figure 1.** Flowchart of Research

### 3.1. Collecting the Data

Collecting the data is done by two methods, that is study of literature and field study. The study of literature is used to search the literature or literature sources related to either of the internet, the results of other studies, and journals that can help reinforce theories that exist, as well as obtain real data about application design tourism, Augmented Reality, and User-Centered Design methods.

Field studies conducted to three cities in Indonesia, Sampit (East Kotawaringin), Sleman, and the province of Bali. The stage field study was conducted to obtain information about each city tourism.

### 3.2. Needs Analysis and Design

Stages system needs analysis conducted for the photographing system needs both functional and non-functional. This stage will result in system specifications and functionality needs what are to be available in the system as well as precise information architecture to provide information about anything related to the research topic. The design phase of the system is made to design a system based on the specifications of the system, the needs of system functionality and system architecture. This phase resulted in the design of system architecture, database, and system interfaces. At this phase, User-Centered Design method will be used.

1. Understand the Context of Use (Requirements Analysis System)

In this stage, the analysis and identification of the overall application needs [13]. In this process, every work of our application interface based on user requirements ie the tourists. The tourists who will visit the three regions in Indonesia will ask for opinions or suggestions regarding the application interface.

2. Specify the Context of Use
   Activities in this phase are to identify which users will be using the application product, in this case, are tourists. Then identify the purpose of the user and the organization that must be met for product successfully created [14].
3. Specify the User Requirements
   This requirement specification stage is the stage of identifying the needs or objectives that must be met for the successful application of products made.
4. Produce Design Solutions to Meet the Requirements
   After three previous stages are completed, in this section to design a complete design. Interface design process describes the physical and non-physical design. The physical design is based on the design of the interface while the non-physical design is based on the UCD process.
5. Evaluate the Designs Against Requirements
   The evaluation stage is the stage design to evaluate the design. If the results of the evaluation show have fulfilled all the needs, it can be continued in the implementation phase, but if the results of the evaluation provided recommendations for repairs, the activities will be back on stage Specifying context of use. Such activities continue ongoing until getting a design that meets all requirements [15].

## 4. Result and Discussion

### 4.1. Needs Analysis Results

At this stage, the researchers identified a list of user needs through observation and questionnaires. Based on observations and questionnaires users, there is some information that is required for system design. Information required in designing applications with augmented reality tourism contained in Table 1.

Table 1. Results of Needs Analysis

| Analysis | Result |
|---|---|
| **Characteristics and User Needs** | 1. Age between 17-30 years<br>2. Having knowledge of Augmented Reality<br>3. Having the desire to conduct a tour. |
| **Characteristics Application AR Tourism** | 1. Applications have the ability to connect applications via the internet.<br>2. Applications have the ability to display a list of tours.<br>3. Applications can provide location information for tourist spots.<br>4. The app can provide guidance or navigation to the tourist sites.<br>5. Augmented Reality Applications can display travel.<br>6. Application requires additional facilities (messages, suggestions, etc.).<br>7. Information sites categorized into 3 categories, natural attractions, culinary, tourism, and culture.<br>8. The application provides a feedback rating and menu. |

### 4.2. Tourism Application Architecture

In this application, as shown in Figure 2, the architecture in the form of client-server software. The client is a device that receives then will display and launch applications (computer software) and the server is a device that provides and acts as the manager of data, applications,

and security. This application is designed to help disseminate and manage information about tourist sites on mobile and web platforms. The system is divided into two parts: a mobile application and a web application. The mobile application is used by tourists who are looking for information about the location of tourist sites using AR. The web application is used as a web administrator and handles tourist data management. The application will run on the Android platform, while the web browser can run on Google Chrome. The mobile application is developed using the Java programming language. Android Studio is used as the programming environment, while MySQL is used as the database. Both applications, mobile and web, will refer to the same database.

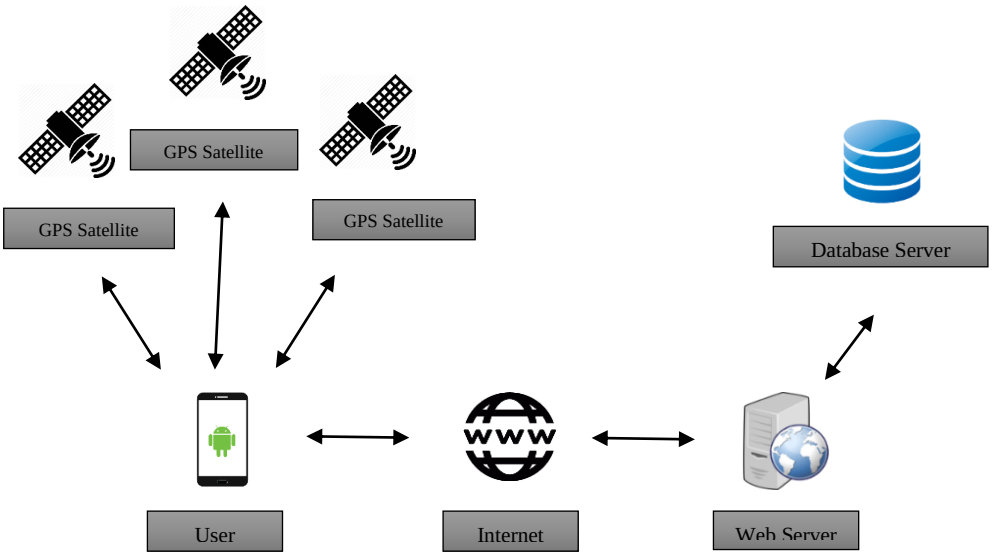


**Figure 2.** Application Architecture

### 4.3. Result

The results are identified by requiring users needs. Some of the requirements provided by the user and has been applied to the mobile tourism application prototype. The tourism application prototypes can be seen in Figure 3.


**Figure 3**. Home Interface

Figure 3, this interface is used to display all the data travel, culinary, art or culture that is at the closest location of the user. Data is displayed in a list. Users can view the details of travel, culinary, arts, and culture or by touching an item in a list.


**Figure 4.** Category Interface

Figure 4, category interface is used to display data by category like travel, culinary, art, and culture are at the closest location of the user. The data will be displayed in a list. Users can view the details of travel, culinary, arts, and culture or by touching an item in a list.

**Figure 5.** AR Interface 1


**Figure 6.** AR Interface 2


**Figure 7.** AR Interface 3

Figure 5, AR interface used to display data with Augmented Reality nearest travel, travel icon will be displayed. Figure 6 is an interface when one of the tourist icons is selected or touched by the user. Figure 7 displayed when the user wants to tourist sites and choose the navigation button, the app will direct the user to get to the destination in question.

### 4.4. Interface Design Evaluation Result

After prototyping applications do tourism, the stage is done is an evaluation of the application of tourism. Tourism application evaluation was conducted to measure the quality of the application. The evaluation was done by 54 votes to 3 different destination tourist area. Each of these 18 people to tourist destinations Sampit (Central Kalimantan), Bali, and Sleman (Yogyakarta). Users are asked to try a dab give its assessment of the tourism application by filling a questionnaire has been prepared. There are 10 indicators that show the quality of tourism with Augmented Reality application using *UCD*. The results of the evaluation of the application can be seen in Table 2.

Table 2**.** Evaluation of Application

| *NO.* | **INDICATOR** | **SCORE** |
|---|---|---|
| **1.** | Applications can provide tourist information. | 4.3 |
| **2.** | The application helps introduce tours. | 4.3 |
| **3.** | Application help make decisions. | 4.3 |
| **4.** | Content is easy to understand. | 4.2 |
| **5.** | Display user-friendly (easy to use). | 4.2 |
| **6.** | The choice of colors according to the characteristics of the user. | 3.8 |
| **7.** | The existence of a consistent button. | 4.1 |
| **8.** | The inscription on the clear and consistent application. | 4.1 |
| **9.** | The images on the clear and appropriate applications. | 4.2 |
| **10.** | Navigation existence is very helpful. | 4.1 |
| | Average | 4.16 |

Table 2 shows the results of evaluation. The evaluation results indicate the application gets a score of 4.16 on a scale of 5.

From the results of the interface design evaluation and testing of the application indicate that it is easy to use and provides the necessary navigation information for users. The use of color, button placement, and screen consistency are important factors in application design.

Based on these evaluations, the application is considered to have been successfully developed as proven by the results of testing on users. This research can be used as a reference for further development, such as building applications on platforms other than Android, and improving the application interface to make it more attractive.

## 5. Conclusion

Augmented Reality Tourism application using the UCD process has been designed to meet the needs and purpose of this study. This application can be easily used by the user, because applications can provide complete travel information, helping to introduce travel and help make decisions when you want to travel. The results were analyzed with an average score of 4.16 indicates that research is successful visual design applications with Augmented Reality tourism according to user needs.

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