Mobile Application Design for Heritage Tourism Uses Gamification Approach in Indonesia

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Abstract—Heritage tourism is a trip traveling in certain areas that have historical value and ancestral heritage, such as temples, museums, palaces, etc. Indonesia is a country that has diverse historical heritages that have the potential to be developed because there are historical sites and are considered as tourism potential. The purpose of this study is to utilize gamification to explore tourist attractions and provide an explanation of historical knowledge to visitors. The method of gamification can be used to provide knowledge and exploration experience on heritage attractions. The proposed application design is a mobile application design with a gamification approach consisting of game mechanics and game dynamics, which can be used to facilitate tourists to get information and travel experiences to explore heritage tourist attractions. This research was conducted in 3 temples in Indonesia, namely Gedongsongo temple, Prambanan temple, and Borobudur temple. The prototype design test was conducted on 100 tourists who visited 3 of the temple's tourists. The evaluation result 86% of users agree with the proposed prototype design. Based on USE evaluation, it shows that this research was successful in designing prototype legacy tourism mobile applications to explore temple tourism. The design of this application is suitable for users based on four variables: Usability, Ease of Use, Ease of Learning, and Satisfaction.

Keywords—Mobile Application, Heritage Tourism, Gamification.

1 Introduction

Tourism is a trip carried out for a vacation or recreation in a place or area that has the power for tourists to visit. One of the tourist attractions that attract visitors is heritage tourism. Heritage tourism is a tourist trip carried out by tourists to find out a historical value that is inherited from the ancestors [1]. Indonesia is one nation that has a diverse historical heritage that has the potential to be developed in heritage tourism. This authentic heritage has existed since the forefathers and preserved by the next generation. Each region has a culture that has a history that is different and has the characteristics of local wisdom. The development of heritage tourism is used to preserve and promote the cultural and historical heritage in an area or city [2].

Culture and cultural identity are exciting things in tourism. Efforts to preserve cultural heritage are not only done in Indonesia but also in all the countries in the world, one of which is the United Kingdom, precisely in the Cyprus Pattichion City Museum [3]. Also, by developing heritage tourism, it is useful to preserve the culture of the region; it can also improve the economy in that area [4]. Heritage tourism can be developed and processed well, and structured can attract domestic tourists and foreign tourists so that they come and visit the tourism sites.

Technology can be utilized to develop heritage tourism. With the development of technology, especially mobile applications, it can be used to assist in delivering information on cultural history in heritage tourism. The appropriate concept in this millennial era is to combine games to convey knowledge or information to users. Educational games can be used as a way to provide education as if they were playing but also get knowledge/information from these tourist attractions [5]. Gamification techniques are increasingly popular to be applied in learning applications by using game design elements to improve the non-game context [6]. In making gamification, there must be an element of knowledge, hands-on, and a sense of happiness when playing it so that it will be more exciting and not dull and different traveling experiences.

In Indonesia, there are many tourist attractions, especially cultural heritage tourism, such as in Bali, Malang, Yogyakarta, Semarang, Bandung, Banten, Aceh, Lampung, Toraja, Magelang, East Nusa Tenggara, etc. This research focuses on unique heritage sites temples located in three regions, namely Yogyakarta, Semarang, and Magelang, which have vast areas to explore. One factor why many visitors do not explore tourist attractions as a whole is because of the breadth of tourist attractions, and visitors do not understand the overall tourist attractions. Also, tour guide facilities are provided at paid tourist attractions, so that most visitors are reluctant to use them. Therefore, many users are less interested in adventure and less get the information and history contained in this relic tourist attraction.

By applying gamification can solve solutions for the exploration of heritage sites as a whole. The gamification approach used consists of game mechanics, and game dynamics can increase learning interest so that they are interested in adventure experiences at heritage tourism sites. This study aims to design a prototype of a mobile application for heritage tourism by using gamification to provide information and tourism experience in the exploration of heritage sites. Prototype evaluation uses USE testing by utilizing four criteria are usefulness (UU), Ease of use (EU), Ease of learning (UL), and satisfaction (US) [7].

2 Related Work

The tourism industry sector in Indonesia, every year is always increasing. Based on data in 2018, the number of tourist visits in June 2018 increased by 15.21 percent compared to June 2017 [8]. Heritage, culture, old buildings, temples in an area can be used as a tourist attraction heritage. Tourism development strategies can be developed with a mobile application. Methods that can be used include gamification, UCD, AR, etc. The purpose of the development strategy is to increase the attractiveness of tourists,

provide information, a pleasant travel experience in visiting the tourist attractions. Heritage is one of the historical heritages which has historical meaning and value in an area. In each region, the journey of history has a different culture. The importance of cultural and historic preservation as a generation to generation learning is not lost [1]. Information about historical heritage from generation to generation needs to be conveyed. In its delivery, it can be packaged in a heritage tourism destination.

Heritage tourism is a tourist trip that has historical heritage value in an area that has a place of historical and cultural literacy as a tourist attraction [9]. This heritage tourism destination is one of the ways to learn and preserve heritage as a history of inheritance from previous generations of ancestors who have meaning and wisdom in a local area. Besides, by developing heritage tourism in an area, it can be useful to preserve the history of the heritage and culture of the region; it can also improve the economy in that area [4].

Indonesia is one of the countries that have heritage tourism. One of the heritage tourism found in Indonesia is temple tourism such as Prambanan Temple, Borobudur Temple, Ratu Boko Temple, Gedongsongo Temple, Ijo Temple, Plaosan Temple, etc. In this study, choosing three temples that have a large area to be explored are Prambanan Temple, Borobudur Temple, and Gedongsongo Temple. Prambanan Temple is a Hindu temple that is a historical-cultural heritage that has been recognized by UNESCO since 1991 [10]. In the Prambanan temple area, there are four areas, namely Rorojonggrang, Lumbung, Bubrah, and Sewu. While, Borobudur Temple is a relic of Buddhism in Magelang, Central Java [11]. In Borobudur, has three Zones, namely Kamadhatu, Rupadhatu, and Arupadhatu. The last one is the Gedongsongo Temple, which is a relic of Hindus culture in 1804. There are five Regions in Gedongsongo Temple, namely Gedong I, Gedong II, Gedong III, Gedong IV, and Gedong V.

Gamification is one of the learning methods applied in learning applications by using game design elements to improve the non-game context. Gamification is a popular mobile application for various types of subjects. Gamification can be used to utilize electronic technology for education/learning processes [12] [13]. Gamification can be used in several fields such as education [14][15], health [16][17], culture [1], business, tourism [5], etc. Using the game approach helps users know the information or knowledge in the game.

The design elements contained in gamification include points, levels, badges, leader boards, prizes and rewards, progress bars, storylines, feedback [18][19]. With these elements successfully applied to improve end-user involvement, satisfaction, and task performance in different domains, effectiveness is often mixed, very context-specific, and varies among individuals. Gamification also provides commitment, motivation to users [20], increases competition team [21], and can convey information and knowledge with a game-based approach [22][23]. In the tourism sector, the concept of gamification can use Augmented Reality (AR) [24][25], Geocaching [26], and GPS-based applications.

Game-based learning can be used to encourage student participation, innovation, and maintain commitment during lessons and improve learning skills. Game-based learning outcomes that can be used to help students develop their performance and abilities to become more active and ready to have active participation in society [27].

Gamification in tourism and culture can contribute to the delivery and preservation of information on the history of ancestral war-culture found in heritage tourism places and can add to tourism marketing [5]. Besides, the purpose of making educational games can be used as virtual communication between players. The presence of a virtual interface can provide a different and memorable holiday experience. Therefore the gamification method can be used as a form of tourism marketing to increase visitor attraction [28]. The presence of gamification in tourism is a new way of delivering learning, marketing innovation, raising awareness about the history of heritage and culture and can enhance a pleasant, impressive and fantasy (can imagine) tourism experience that can lead to a high level of satisfaction in traveling [5].

This research will focus on exploration and provide historical information about heritage tourism. Heritage tourism that is used in this research is temple tourism in Indonesia, namely Gedong Songo, Prambanan, and Borobudur, which have a large area to explore.

3 Methodology

The research methodology proposed there are several stages, namely literature studies, and field studies, data collection, system requirements analysis, prototype design and manufacture, prototype testing. The research flow chart is the research workflow starting from start to end. The flow diagram of the contribution of this research is, as shown in Figure 1.
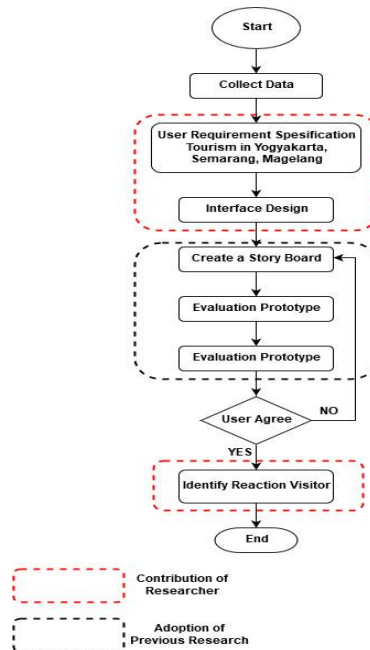

Fig. 1. Flowchart research

Figure 1 explains the research contribution diagram. Contributions in this study are highlighted in red, and the adoption of previous studies highlighted in black. The contribution of this research is to identify users and design for the exploration of heritage tourism, which has a large area. Prototype design focuses on the user-designed with a gamification approach to facilitate the delivery of information and explore heritage tourism. Gamification design consists of game mechanics and dynamic games. After that evaluating the results is the design feasible to use or needs to be improved, which is assessed by the user, namely tourists.

In this study, gamification consists of two parts, namely game mechanics and game dynamics, which have several elements, including levels, missions, scores, virtual items, as in table 1.

Table 1. Gamification Design/Model Used [29].

Game mechanics	Game dynamics
Points	Reward
Level	Status
Trophies, Badges, Achievements	Achievement

Based on table 1, some elements of in-game mechanics and game dynamics. Game mechanics are game inputs that cause a series of responses from the system, while progressive games are playing patterns derived from Game Mechanic that are arranged in such a way in the form of stages through which the player passes. Mechanisms and dynamic elements of the game include player action, Progression of Play, levels, missions, quizzes, virtual items [29]. The game rules in this game choose the player to be used, the progression of play (game level), and collect points. Levels in this game are mission assignments and quizzes to assess the progress of the play. Points earned in completing missions and quizzes can be exchanged into prizes for players.

After that, prototype testing is done to test the user/user related to the proposed gamification application design. This phase will identify the reaction of users or visitors at the cultural heritage tourism site to the design and prototype of the proposed application. Prototype test using USE Questionnaire (Usefulness, Satisfaction, and Ease of use) by adapting previous research conducted by research Gao, et al. [7]. This stage will identify the reaction of users or visitors at heritage sites, especially temples, to the design and prototype of the proposed application. The assessment was represented in the form of a questionnaire containing ten questions given to 100 tourists who had visited the temple's tourist attractions. To be able to measure the success of the prototype design, a questionnaire was made with a scale indicator 1-5 on each question. It was calculated using various c_i scales (95% confidence intervals) by categorizing questions based on the variables of usability, satisfaction, Ease of use, and Ease of learning.

Table 2 contains the statements used for questionnaires given to respondents. Range 1-5 explains for "1" strongly disagrees, and "2" disagree, "3" neutral, "4" agree, "5" strongly agree. The statement was tested by a survey of statement comprehension, to find out whether respondents could understand the report.

The question has been tested for validity and reliability with a total of 30 correspondents — the reliability test results using the SPSS tool using Cronbach alpha as in table

3. Based on the results of the reliability statistics in table 3, the Cronbach alpha value > 0.6 so that it can be concluded that the questioner passed the reliability test.

Table 2. Questionnaire [7].

No	Question	Scale				
		1	2	3	4	5
1	It helps me to explore heritage tourism, especially temples.					
2	It is useful in exploring heritage tourism, especially temples.					
3	It can make it easier for me to explore and get information about heritage tourism, especially temples.					
4	It is simple to use.					
5	It is easy to use.					
6	I quickly remember how to use it.					
7	It is easy to learn to use it.					
8	I learned to use it quickly.					
9	It is fun to use.					
10	I am satisfied with it.					

Table 3. Reliability of Statistics.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.874	0.878	10

4   Result and Discussion

At the data collection stage, after observation and interviewing visitors at the temple tourist sites are Gedongsongo temple, Prambanan temple, Borobudur temple, the proposed gamification application design can be used to explore the temple sites that have large areas. With the concept of gamification, the exploration of temple attractions becomes more interesting. The results of the prototype design are proposed for the research of heritage attractions, especially temples with the concept of gamification using game mechanics and game dynamics elements. The results of the prototype design for the menu page, as shown in Figure 2.
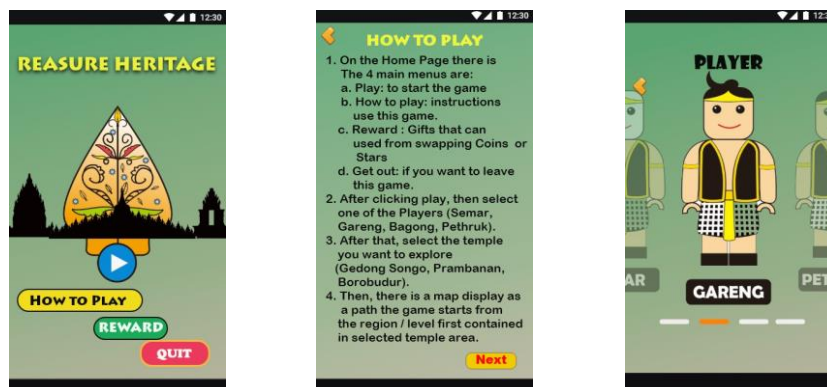
Fig. 2. The main menu

Based on figure 2, the menu contained in this game. There are three menus: play, how to play, and quit. The play menu is a menu that must be done by the user in starting the game by selecting the player first before completing a mission in exploring. The avatar used in this application is a Punakawan figure. Punakawan is Javanese puppet characters who have a humorous and fun personality, namely Semar, Gareng, Petruk, and Bagong. Next, a menu of how to play that is instructions on how to play and rules about the game. The game exploring tourist attractions consists of an explanation of the mission that must be performed by the player. In each task, some challenges must be passed by the player (see Figure 3) to choose of category and figure 4 to select the level.
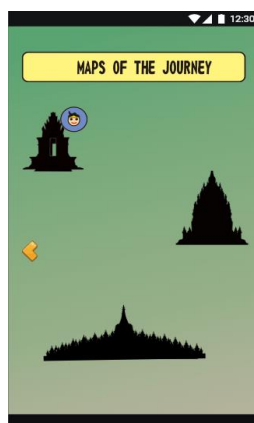

Fig. 3. Category

Figure 4 shows the menu of categories and levels that users use in tourism exploration. There are three choices of temples to explore, namely Gedongsongo, Prambanan, Borobudur. Each temple provides a map so that players can start exploring from the

first area that must be explored until the last area. To ensure that the player is in the area, the player must take a photo first to unlock the level in the game.

Fig. 4. Maps and level

The next step is to complete the mission to explore the tourist sites, as shown in Figure 5.
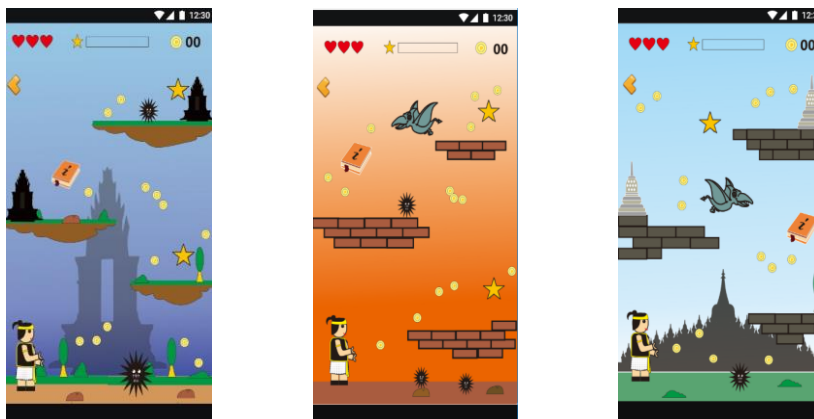

Fig. 5. Gameplay

In gameplay, players must complete the mission, which is divided into two parts, namely completing the quiz and retrieve information. The mission to complete the quiz is that the player must be able to collect coins and stars. Coin collection is used to be exchanged for weapons to fight enemies in the gameplay. Because if an enemy attack a player, the lives of the player will be reduced. Collect stars used to be exchanged for gifts for players. Each star obtained has a challenge that must be resolved, namely a question related to the area in which the player is exploring. These questions can be answered if the player is in the area according to the level being played. If the question is successfully answered, then the player gets one star, if it is wrong in answering, then

it does not get a star. Also, players must complete the mission of gathering information at the tourist site by taking the book icon. The book icon contains information about knowledge and a brief history of tourist attractions explored that can add expertise and knowledge for players.

Figure 6 shows the design display for questions, answers, and information. In this mission, it is useful for players to explore the tourist site to be more interesting because there are challenges, namely questions, obstacles, enemies, and rewards that can be exchanged by players such as in Figure 7. On the answer page, there is a brief explanation for the correct answer. While on the information page, there is a history or brief knowledge of the area being explored.
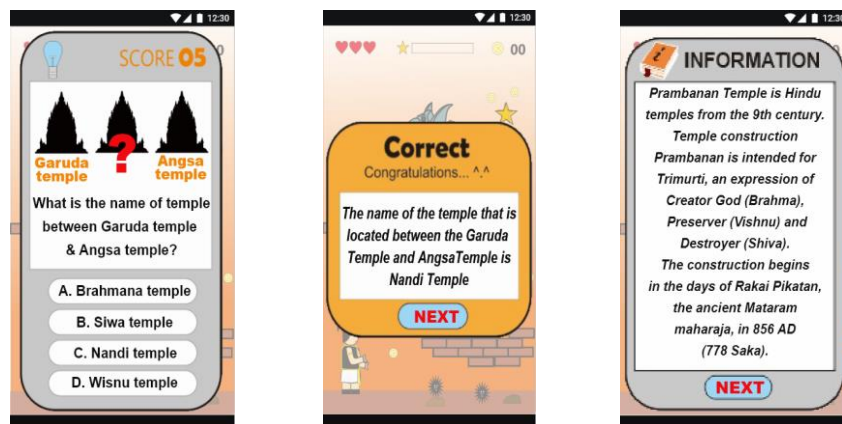

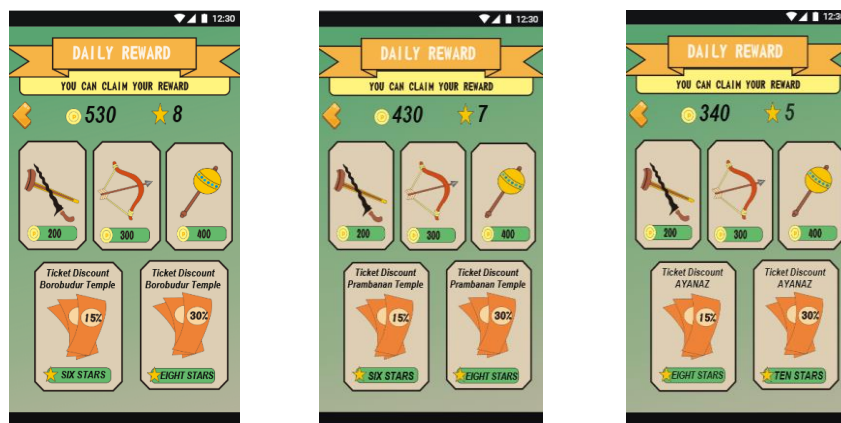**Fig. 6.** The question, answer, information

Fig. 7. Reward

Based on Figure 7, the reward proposal obtained is in the form of a ticket price cut. The reward varies based on the temple, which is explored by collecting stars. In exploring the Gedongsongo temple, stars must be collected to claim discounted tickets, eight stars for 15% discount, and ten stars for a 30% discount. While exploring the Prambanan temple and Borobudur temple, you must collect six stars to claim a 15% discount and eight stars to claim a 30% discount.

Based on the results of the prototype design, it can be concluded that the use of gamification design as in table 4.

Table 4. The results of the user's perspective

Elements of Gamification	Application of design
Points	It is obtained after completing the mission game. Points consist of coins and stars collected by players.
Level	In this application has three temple places, each temple there are different levels used to explore the temple area.
Rewards	Virtual items that can be used to help complete gameplay are weapons to fight enemies. Original items as gifts given in this game are discounted tickets.
Status	Performance and progress status.
Avatar	There are four players to choose from in this application: Semar, Gareng, Petruk, Bagong.
Achievements	Can be accessed if the user has completed the quiz and mission gameplay.

Table 5 is the result of applying the design gamification. The points element is used to evaluate the level of understanding of information from the quiz/question given according to the tourist area explored. The level element is used in the overall exploration of tourist attractions by area. The reward element is used to give rewards when the mission is successfully completed. The status element is used to see the user's progress or performance in the overall temple area.

The prototype design testing phase uses a questionnaire by adapting the USE questionnaire consisting of 10 statements. It is categorized into four variables, namely usefulness, Ease of use, Ease of learning, and satisfaction. The prototype test was carried out with 100 tourists from 3 different temple sites are Gedongsongo temple, Prambanan temple, and Borobudur temple. The results of testing the prototype design in table 5.

Table 5. The results of the user's perspective

Question	Variable	Information			
		Mean	*Stdev*	*95% Confident Interval*	*Percent %*
Q1	Usefulness	4.42	0.55	4.31 to 4.53	88%
Q2	Usefulness	4.35	0.63	4.23 to 4.47	87%
Q3	Usefulness	4.31	0.65	4.18 to 4.44	86%
Q4	Ease of Use	4.27	0.63	4.14 to 4.4	85%
Q5	Ease of Use	4.26	0.56	4.15 to 4.37	85%
Q6	Ease of Learning	4.16	0.71	4.02 to 4.3	83%
Q7	Ease of Learning	4.25	0.66	4.12 to 4.38	85%
Q8	Ease of Learning	4.47	0.56	4.36 to 4.58	89%
Q9	Satisfaction	4.29	0.62	4.17 to 4.41	86%
Q10	Satisfaction	4.23	0.63	4.1 to 4.36	85%
Overall average percentage					86%

Based on the 95% confidence interval calculation data in table 5 for the use of application design variables (usefulness) in questions 1, 2 and 3 if tested in the actual population is between "4.31 to 4.53", "4.23 to 4.47", and "4.18 to 4.44" which means 95% of the population agree that the design of this application is useful for tourists in heritage tourism. In questions 4 and 5, the variable Ease of use (Ease of use) is in the confidence interval "4.14 to 4.4" and "4.15 to 4.37". The result means that 95% of the population agrees that this application is easy to use. The Ease of learning application (Learning Ease) variables in questions 6, 7 and 8 are in the confidence interval "4.02 to 4.3", "4.12 to 4.38", and "4.36 to 4.58" which means 95% of the population states agree that the design of this application is easy to learn. The variable satisfaction in the user application (satisfaction) in question 9 and 10 are in the confidence interval "4.17 to 4.41" and "4.1 to 4.36," which means that 95% of the real population agrees or is satisfied in using this tour guide service application. Based on table 5, the average score from the resulting test is 86%, which shows that the design of the application is in line with user expectations. The results are grouped into four categories, such as table 6.

Table 6. The results USE into four categories/variable

Variable	Mean score	Scale
UU (Usefulness)	4.36	87% (very good)
UE (ease of use)	4.265	85% (very good)
UL (ease of learning)	4.2933	85.67% (very good)
US (satisfaction)	4.26	85.5% (very good)

Based on table 6 shows the results of testing using USE with four categories, namely Usefulness, Ease of Use, Easy of Learning, and Satisfaction. The highest value is on the usability aspect, which is 87% because, in its application, users find it helpful to explore the tourism reserve, which is a temple that has a large area. Also, other aspects such as aspects of Ease of use that are 85% and Ease of learning that is 85.67%, which means users agree that this application can help in the learning process and the process

of accessing information. For the satisfaction aspect, the results are 85.5%, which shows the design of this application according to the user.

5   Contribution

The contributions of this study are as follows:

1. Designing tourism applications using a game-based or gamification approach to explore heritage tourism namely temple tourism
2. Increasing user knowledge about heritage tourism, especially temple tourism, in Indonesia.

6   Conclusion

Heritage tourism is vacation trips and places that have heritage value as an attraction—in this study, proposing the design of heritage tourism applications using the gamification approach. Based on the above results that using the gamification method can be used to explore heritage attractions, especially temple tourism. It also can be used in delivering information about the history and knowledge of the temple attractions to be more interesting. It is testing the prototype design with a questionnaire consisting of 10 statements that have been tested for reliability testing. The questionnaire was given to 100 tourists who visited Gedongsongo, Prambanan, and Borobudur temples by trying out prototype designs directly. The results showed 86% of users agreed with the proposed prototype design. Based on the 95% confidence scale that shows this research succeeded in designing a prototype of a heritage tourism mobile application to explore temple tourism that suits the user based on four variables, namely Usefulness, Ease of Use, Ease of Learning and Satisfaction as shown in table 4. In further research, it can be developed by adding other heritage tourism such as museums, palaces, etc. The application design can be developed by adding 3D concepts to make it more interesting.

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