Usability Testing to Measure Real Perception Generation Level in Introduction of Bengkulu University Building Based on Virtual Tour with 360° Object Modelling

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ABSTRACT.
The development of photography technology creates a 360 ° camera that carries an ultra-wide twin1-lens folded optical lens (a small double lens with a folding design). This technology can produce spherical panoramic images. Spherical panoramas are borderless and seamless image objects used to create virtual tours. Bengkulu University, with the broadest environment in Southeast Asia, has more than 30 buildings with several floors and rooms. It's making it challenging to find the location of the building or event for incoming guests. The purpose of this study is to analyze the level of generation of a real perception of the introduction of the Bengkulu University building by a 360^0 virtual tour application. Usability testing is intended to analyze the level of perception generation, to introduce the Bengkulu University building to the guest. This research was carried out by collecting 360^0 photos for each building and room, then built a web-based virtual tour application that can display the location and directions to go to the building or office, then information on each building or outdoors will be displayed according to the shape of the object model 360^0. Users can run a virtual tour application using a smartphone and VR-box to get a real perception like being in the building or room. Usability testing is done by making a questionnaire based on three components of usability testing (effectiveness, efficiency, and satisfaction), to obtain the level of perception generation from buildings with 3600 object modelling. Usability testing of the 360^0 Virtual Tour of University Bengkulu was carried out with a total of 100 respondents. The results were obtained by generating of usability testing were 94% (Effectiveness 96.1%, Efficiency 96.6%, and Satisfaction 89.2%).
Keywords: virtual tour, 360^0 camera, usability testing, spherical panoramic, University of Bengkulu

Introduction

The mental model is the generation of users' real perceptions about the cognitive presentation of an object, which states a logical estimate formed. The mental model creates a framework that allows users to do work. If the user's mental model is close enough to the way the system works, then the user can use the system without experiencing significant difficulties. Direct manipulation can be applied in the concept by the mental model, which has the advantage of having a clear analogy with a real job. The advantages of the metal model such as; reducing learning time, providing challenges for practical work exploration, good visual appearance, easy to operate, and the availability of various tools to design multiple direct manipulation dialogues [1].

Usability testing is a qualitative analysis that determines how easily a user uses an application's interface. An application is called usable if its functions can be carried out effectively, efficiently, and satisfactorily. Effectiveness is related to the user's success in achieving goals in using the software. Efficiency refers to the smoothness of users to achieve these goals. Satisfaction relates to the user's acceptance of the software. Usability

testing is done to determine the level of real user perception arising from the application [2].

The University of Bengkulu as one of the universities with the broadest environment in Southeast Asia has several supporting facilities in the form of buildings totalling more than 30 buildings with multiple floors and rooms. A large number of buildings makes the University of Bengkulu academic community in particular, and the outside community, in general, have difficulty finding the location of buildings and rooms. These problems can be solved by providing information about the location of the building or room to be sought by visitors.

In this study focuses on providing information or location of buildings and rooms that are done by generating real perception in the form of presentation in a mental model. Mental models that will be carried out in this study, namely by measuring the level of construction of the ultimate perception of the end by presenting the search for the location of buildings or rooms based on virtual tours, and providing information about the building or room with 3600 object photo modelling.

As photography progressed, it was discovered the technique of taking pictures with a 360 ° angle that produced a spherical panorama or often referred to as photosphere. This technique was formerly called

immersive photography, where the method of taking pictures by uniting six photos to be used as a spherical panorama [3]. The images consist of an all-around side that put together produce a spherical panorama. It produces an image object without borders (borderless) and not cut (seamless), which is usually used to create a 360 ° Virtual Reality or Virtual Tour. Since the invention of the 360° camera, immersive photography techniques began to be abandoned by the 360 ° image. It has been able to produce spherical panoramas without having to take six photos to put together. In other words, immersive photography techniques still exist in the process of creating spherical panoramas using a 360 ° camera.

The development of 3600 image taking techniques and virtual tours are expected to help guests to find out the location and presence of buildings in the Campus environment, by visualizing and mapping the location of buildings with 360 object modelling [4]. The design of 360^0 University of Bengkulu's virtual tour applications can provide good perception and facilitate users in determining the location of buildings at the University of Bengkulu.

LITERATURE REVIEW

Virtual Tour

Virtual Tour is a technology that places a user in an image and allows the user to increase situational awareness as well as increase the viewing power, capture, and analyze of virtual data significantly [5]. Presentation of a virtual tour can be done by utilizing images or video, but it can also use a 3-dimensional model.

Virtual Tour is a development of virtual reality technology known as virtual reality photography. Virtual reality is a technology that allows users to interact with an environment that is simulated by a computer (computer-simulated environment), an actual environment that is imitated or truly an environment that only exists in the imagination [4]. So that the virtual tour application that is built can provide the images that move from one hotspot point to another hotspot, which indicates a virtual location with a 360 ° object [6], as shown in Figure 1.

Figure 1. Hotspost Points

Cylindrical and Spherical Panoramic Photos

For performance using icons, you can use cylindrical panoramic photos in virtual tour application [3], as shown in Figure 2 or spherical type in Figure 3.

Figure 2. The Cylindrical Panoramic Photo

In Figure 2, the vertical cylindrical panorama can only capture no more than 180 ° [3]. While the spherical type, as shown in Figure 3, allows looking up and down so that the object image displayed 360 °.

Figure 3. The Spherical Panoramic Photos

In Figure 3, spherical panoramas that produce 360 ° objects make it possible to see above, below and back with a full 360 ° rotation that cannot be seen by the human eye. The human eye has a maximum of about 180 ° with two eyes.

Ricoh Theta Camera

Ricoh Theta camera is a 360 ° camera that carries an ultra-wide twin-lens folded optical lens (a small double lens with a folding design) so that it can produce spherical panoramic images. Ricoh THETA camera can be seen in Figure 4.

Figure 4. Ricoh Theta camera

Usability Testing

A user-based evaluation is conducted to uncover usability problems. Then, users participate in a satisfaction questionnaire to observe user-based evaluation. The questionnaire paper is distributed to the respondents. The technique of selecting respondents is done randomly. So that samples are obtained from the general public. Before performing the calculations by using the Likert Scale, the interval should be looking for firstly [7].

METHODS

In this study, a Bengkulu University virtual tour will be built which visualizes and maps the location of buildings and rooms with 360 ° object modelling. The building data is in the form of a spherical panoramic image that starts from the main door of the building to the room/door in each building. Each building will have a hotspot/marker as a starting point to explore the building or to jump to the next

buildings — the design of this virtual tour application using the Tour-Dreamweaver application and use of the Google Maps API. The app is designed with web-based; the application can be run using a browser on a smartphone and can be run in VR mode. The flow-chart of this study is shown in Figure 5.
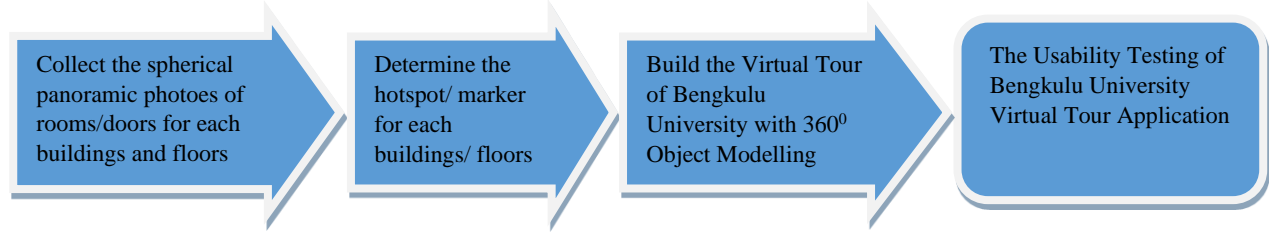

> Collect the spherical panoramic photoes of rooms/doors for each buildings and floors

> Determine the hotspot/ marker for each buildings/ floors

> Build the Virtual Tour of Bengkulu University with 360^0 Object Modelling

> The Usability Testing of Bengkulu University Virtual Tour Application

Figure 5. Flow-chart of The Study

Spherical Panoramis Photoes of Bengkulu University's Building

In this study, a spherical panoramic photo of each building and floor at the University of Bengkulu using data obtained by taking directly. The data consists of the name of the room in each building and photos of buildings outside the room using a 360 ° camera.

Hotpsot/ Marker of Bengkulu University Virtul Tour

The Map of Bengkulu University buildings using API map from Google. On the Map will display a marker/hotspot that indicates the location of the building at Bengkulu University. The display of the Bengkulu University building's Map which became a hotspot/marker on the Virtual Tour application. The Hotspot/marker in this virtual tour application is shown in Figure 6.
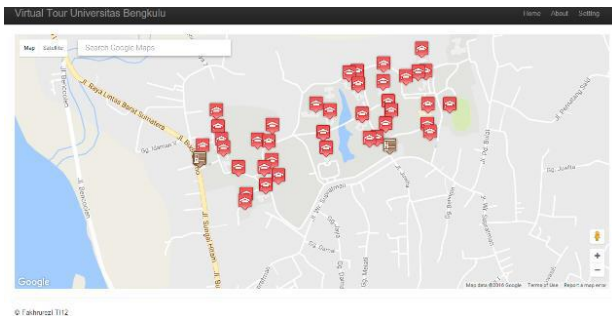

Figure 6.The Hotspot/ Marker

360^0 Virtual Tour Application of Bengkulu University

The virtual tour interface displays a 360 ° virtual object that allows users to see unlimited directions. The display of the virtual tour interface is shown in Figure 7. In Figure 7, there is a green hotspot point as a marker of movement from one virtual point of a 360 ° object to another, with information displayed in Bahasa Indonesian. The information presented in the building of each room will appear when the cursor is brought near the hotspot. The information display time of only 2 seconds is due to the automatic movement to visualize 360 ° objects.

Figure 7. 360^0 Virtual Tour Application Interface of Bengkulu University

The Usability Testing of Application

The usability testing tool is adjusted to the usability component, namely effectiveness, efficiency and user satisfaction. Effectiveness and efficiency are measured using an observation sheet, while satisfaction is measured using a questionnaire. Besides, scenarios are needed to guide respondents in using the application. Scenarios are a collection of tasks that respondents must do when using the app [2].

The questionnaire was designed using language that was easily understood by respondents. Respondent satisfaction is measured using a Likert scale, which is 1 to 5 with (1) Strongly Disagree (SD), (2) Disagree (DI), (3) Doubtful (DO), (4) Agree (A), (5) Strongly Agree (SA).

Then, the observatory conveys the intent and purpose of the evaluation, the rules of conducting the test, explains the instrument used and allows the respondent to take steps according to the task in the scenario. If the respondent accepts the actions by the mission then is given a value of "Yes", conversely if it is not successful, the value is "No". After all the scenarios have done, the respondent is asked to rate the application by filling out the questionnaire.

The test questionnaire in the study was designed with three elements of observation, which include efficiency, effectiveness and satisfaction. Each item has a question function, which indicates the level of real perception generation for the application user/respondent. The level of the construct of perception for the respondent is expressed by giving a Likert value (values 1-5). If the respondent states that he did not produce any information from this application, then the respondent can provide a small value for the scenario for each element. In contrast, if the respondent gets a sound perception generation from this application, then the respondent can give substantial value to the plot on each aspect of usability.

The level of effectiveness and efficiency is measured using the user's success rate (percentage of tasks completed correctly by the user. Effectiveness and efficiency are calculated using the following Equation 1:

$$\text{Effectiveness, efficiency (\%)} = \frac{(\sum_{i=1}^{n} X_i)}{n} \, x \, 100\% \quad (1)$$

For ; X_i = the value of respondent-i success, X_i = {0, 1}

i = respondents

n = the number of respondents

Satisfaction (Equation 2) is the percentage comparison between the satisfaction value of the i-respondent (Xi) with the multiplication between the maximum weight of the scale and the number of respondents (n).

$$\text{Satisfication (\%)} = \frac{(\sum_{i=1}^{n} X_i)}{5 \, x \, n} \, x \, 100\% \qquad (2)$$

For ; X_i = the value of respondent-i

X_i = 1 (Strongly Disagree)

X_i = 2 (Disagree)

X_i = 3 (Doubtful)

X_i = 4 (Agree)

X_i = 5 (Strongly Agree)

i = respondents

n = the number of respondents

Usability applications are averages of effectiveness, efficiency, and satisfaction, as written in the following Equation 3.

$$\text{Usability (\%)} = \frac{\text{effectiveness} + \text{efficiency} + \text{satisfaction}}{3} \% \quad (3)$$

RESULTS AND DISCUSSION

The 360^0 Virtual Tour application is built on a web-based platform using the Codeigniter framework. By using the Tourweaver application, spherical panoramic photos from every room and building at Bengkulu University presented as 360^0 virtual tours. Presentation of hotspots is done by making location points embedded on the map using the Google Maps API. This application can be run using a desktop or mobile by using VR Box to experience Virtual Reality.

Based on measurement tools for usability testing, namely effectiveness, efficiency, and satisfaction, were observed with 100 respondents from different backgrounds. The effectiveness observation element consists of the ease of finding menus on the application page, the ease of finding the location of the building and reading information and finding the hotspot on app. The results of observations of 100 respondents found effectiveness (equation 1) usability testing obtained by 96.1%.

The efficiency observation element consists of ease to understand using the application, can open one by one marker/hotspot, move the cursor 360^0, follow the instructions for use. The results of efficiency observations (Equation 1) of usability testing is 96.6%.

The satisfaction observation element consists of 20 parts, consisting of easy-to-understand main page views, the position of markers on the map display, exciting systems, easy-to-understand roar information. The results of satisfaction observation (Equation 2) of usability testing were 89.2%.

Usability testing are averages of effectiveness, efficiency and satisfaction, which are calculated using Equation 3. Based on 100 respondents, the result of usability testing of Bengkulu University 360^0 Virtual Tour Application is 94%.

SUMMARY

This paper has developed a 3600 Virtual Tour Application of Bengkulu University integrated with location mapping features. It can introduce the University of Bengkulu building's Map and as one of the strategies to support public information about the campus environment. Availability of this app gives a new experience with generating a real perception of the user. Usability testing is intended to analyze the level of perception generation to introduce the Bengkulu University building to the guest. The parsing of the perception generation level is high of its app with usability testing is good (score is 94%).

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