Vmap (Virtual Mapping) Leap Motion-Base on Facilitating The Making of Environmentally Green Building Design

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***Abstract*— The design of environmentally friendly building is a means to anticipate environmental damage and climate change in the world. In Indonesia we have GBCI (Green Building Council Indonesia) which gives certificate of green building to the proper building. However, only 5% of the buildings in Indonesia have the certificate and the criteria of environmentally friendly buildings. The major cause of the buildings not to have green building certificate is the architectural design concept which does not follow the GBCI criteria. This study is aimed at developing an application for designing environmentally friendly buildings by using Leap Motion. The leap motion can visualize the real building concept before it is built. This application is expected to help the socialization of environmentally friendly building according to GBCI to the planners, building owners, constructors, the government, and the public. Based on the result of the try out 100% of the total 5 experts namely media expert, architect, and building owner agreed to use this application.**

Keywords*— *environmentally friendly, design, leap motion

I. INTRODUCTION

Environmental damage and climate change have become hot issue all over the world nowadays. As a result, it encourages people to change their paradigm and make them have environmentally friendly life. The environmental quality reduction as the result of global warming was aggravated by the uncontrollable determination and utilization of city, unequal ratio between used land and the vacant lot, the opened ground covering for parking lot and road has narrowed the catchment area [1].

The lack of clean air as the result of green house effect needs to be filtered by doing reforestation, making the buildings simpler with good air flow, and equipping enough open spaces for air circulation and natural illumination (40% at minimum). Almost all invention sectors innovate environmental friendly technologies. In architectural sector, UIA (Union Intenationale des Architectecs), an international architects organization has arranged Sb D-50 (Suistainable by Design 2050) program on September 28 2011 in Tokyo Declaration Congress as a follow up of Copenhagen Declaration-Sustainable by Design on 2009. This organization is intended to make all architectural designs in the world apply environmentally friendly building principles [2].

The government already did some efforts to support the environmentally friendly buildings. One of which is the publishing of the Minister of Environment regulation about the implementation system of documents assessment and investigation, and environmental permission publishing. Beside the government efforts, support for environmentally friendly building was done by Green Building Council Indonesia (GBCI) which was established on 2009. GBCI is a non government and non-profit organization which commit to people's education in applying the best practices for environment and one of their programs is making certificate for Green Building in Indonesia which so called as greenship. GBCI is an emerging member of World Green Bulding Council (WGBC) that centered in Toronto, Kanada. This organization has 94 members which represent 94 countries and there was only one GBC in every country. There are 18 buildings that have been certified by GBCI and 50 buildings were still in the process of getting the certificate.

Based on the research by Tjetjeng Sofjan Surjana in Architectural Journal of Bandar Lampug University in 2013, environmentally friendly architectural design concept was still under GBCI rating. This problem has become the concern for all parties in the making of building designs. The researchers suggest that the planner implements sustainable by design concept in designing a building and socializes the environmentally friendly building criteria from GBCI greenship and from the Minister of the Environment regulation.

II. LEAP MOTION TECHNOLOGY

Human-Computer Interaction (HCI) is an important field of study that has gained increasing attention with the emergence of new interaction devices (such as de Nintendo Wii Remote1 and the Microsoft Kinect2). The use of gestural interfaces are arousing interest, since interaction is essential in several domains of application such as art, medical assistance, simulation, etc. [3,4,5].

The Leap Motion controller is a sensor device that aimsto translate hand movements into computer commands. The controller itself is an eight by three centimetre unitthat plugs into the USB on a computer. Placed face up ona surface, the controller senses the area above it and issensitive to a range of approximately one metre. To dateit has been used primarily in conjunction with appsdeveloped specifically for the controller. As of September 2013 there were 95 apps available through theLeap Motion app site, called Airspace. These apps consist of games, scientific and educational apps, andapps for art and music [6].

While the potential for the technology is great, some earlycriticisms have emerged in product reviews in relation to app control, motion sensitivity, and arm fatigue. Onefactor contributing to the control issues is a lack ofprescribed gestures, or set meanings for different motioncontrols when using the device. This meansthat different motion controls will be used in differentapps for the same action, such as selecting an item on thescreen. Leap Motion are aware of some of the interactionissues with their controller, and are planning solutions.This includes the development of standardised motionsfor specific actions, and an improved skeletal model ofthe hand and fingers [7].

III. METHOD

The developed model employed in this study was waterfall. In this model, the method was implemented systematically and chronologically. This method was selected based on the specification needs which have been clearly stated in identification of problems.

This model consists of some steps namely, (1) requirements analysis and definition, (2) system and software design, (3) implementation and unit testing, (4) integration and system testing, and (5) operation and maintenance [8]. The process of developing system in Waterfall can be seen in Figure 1.

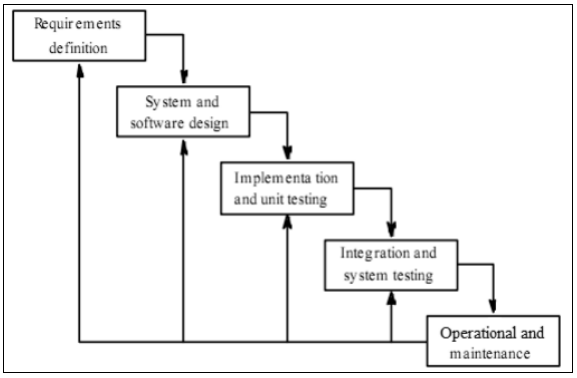

Fig. 1. Waterfall Modeling

A. *Requirements Analysis and Definiton*

Needs analysis, and material and theoretical collection related to Environmentally Friendly Building and VMAP Technology based on leap motion as the material in designing the application were done.

B. *System and Software Design*

In this phase, the design of mockup from VMAP was done. The design can be seen in Fig 2 and the 3D design that will be used in Leap Motion-based VMAP is shown in Fig 3.

C. *Implementation and Unit Testing*

The implementation of Environmentally Friendly Building 3d Design which has been revised by using Unity Version 4.1.5 of VMAP is done in this phase.

Fig. 2. Mockup design

Fig. 3. The 3D Building design

D. Integration and System Testing

In this step, the VMAP application is integrated with Unity program by using Leap Motion. Besides integrating the application, the researchers made a questionnaire for validity and functionality testing of VMAP application leap motion-based. The questionnaire was shown to Media expert, advisors, architecture and property consumers.

If an error occurs during system testing reached more than 20%, the analysis result declared invalid. That is considered valid if the result of a constant percentage of not less than 80% [9].

E. Operation and Maintenance

In this step, the researchers did maintenance to the leap motion-based VMAP application to detect the Bug/Error.

IV. Result

The result of leap motion-based VMAP application development to facilitate designing environmentally friendly house was acquired from the methods of development system which has been discussed in Method of Development chapter. The cycle of system development with Waterfall was done from Requirements Analysis and Definition to Operation and Maintenance. The product can be seen in Fig 4.

Fig. 4. The Result of VMAP Application

TABLE I. Data from Application Functionality and Validity Testing

Try Out Subjects	Method	Result
Media Expert	Black box	100% [Accepted]
Advisors	Black box	100% [Accepted]
Developer	Black box	100% [Accepted]
Property Consumer	Black box	100% [Accepted]

Beside the data above, there are qualitative data from try out subject in the form of suggestion for revised product or developed system so that the developed VMAP application is confirmed valid with revision and suggestion.

V. Conclussions and Suggestions

The developed product was Leap Motion-based Virtual Mapping application that can visualize building design become real and simplifies the consumers in observing every detail of the building.

The product was developed by using Waterfall Development model which has some steps, such as:

1) *Needs analysis and definition*
2) *System and software design*
3) *Implementation and unit testing*
4) *Integration and system testing*
5) *Operation and maintenance*

The try out design utilized in this study was black box testing to test the functionality of alumni information system by using questionnaire as the instrument to collect the data. The questionnaire was a close ended questioner in which the respondents chose the provided answer.

Based on the quantitative data analysis, the expert validation was 100%, and the field testing by three users resulting in 100%. The mean try out result was 100%. From the result of the try out VMAP application was valid and it can be used as its function. The result of qualitative data analysis was in the form of suggestions from the information system expert and the users.

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