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Implementing Augmented Reality on a Multiple Floor Building as a Tool for Sales Product Knowledge

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Abstract—Research into indoor property floor plan associated with the use of augmented reality technologies is very limited. Most sales property developer used conventional ways on how they interact with potential client using brochure which lacks detailed information .This paper propose a solution that is capable of showing the actual size and form of the floor plan by visualizing into a 3d model to aid the salesman in explainig more accurately during meeting with customers. We have applied a simple but effective ways to visualize a 3d floor plan compete with surrounding walls by using augmented reality. Result shown that by using augmented reality, salesman are easier to explain the product knowledge of the housing to the customer as every detailed information are stored in the software.

Keyword— Augmented Reality, Sales Product Knowledge,Multiple Floor Building

1. INTRODUCTION

Innovation and exponential growth of technology offer great opportunities to failitate daily activity of the people of Indonesia. Number of innovations would lead to an amazing breakthroughs that would contribute solving problems in a variety of areas face by the country, such as manufacturing industries, education, banking, financial and many more, in order to provide benefits and new opportunities for the people. However, not every area are covered by technology. In the property industry, developers still run a business using conventional business way. A salesman still uses conventional approach while interacting with customer where the salesman wait for customer to come for them by asking questions. In some cases, the salesman is unable to explain detailed product knowledge in the promotional as a result of a lack of information stated in the brochure in order to keep an aesthetic look of the brochure . In this study, the researcher are finding ways of making a software using augmented reality technology to give an alternative interaction solution for the salesman during conversation with customer. This research is entitled " Implementing Augmented Reality on a Multiple Floor Building as a Tool for Sales Product Knowledge"

A software development methodology refers to the framework that is used to plan, manage, and control the process of developing an information system [1]. Formally, a software development methodology is known as SDLC short for Software Development Life Cycle and

is majorly used in several engineering and industrial fields such as systems engineering, software engineering, mechanical engineering, computer science, computational sciences, and applied engineering [2].

Waterfall is used as an approach for software development life cycle. According Rosa A waterfall is a life cycle application development with the concept of several phase of activity , and should be finished in accordance with each phase before continuing to the next phase through the last. The waterfall phases are analysis system, analysis of design, implementation, testing and maintenance.[3]

Augmented Reality will be implemented in the research to give more interaction to the software developed. This technology has existed already since 40 years ago, after the application was introduced Virtual Reality (VR). At that time, studies conducted technology intended for hardware aspects. Head-Mounted Display (HMD) in which a device such as a helmet placed on the head so that it can see the virtual world, which at that time was the only basic equipment for the technology..

According to Ronald Azuma (1997) defines Augmented Reality as a system that has the following characteristics, combining real and virtual environments,runs interactively in real time, integration in three dimensions [4].

The purpose of Augmented Reality is to combine virtual / real and reality which can interact between each other which result the boundary between the two feels as if there were nothing.

Augmented Reality is now already widely applied in many fields, such as medical purposes [5], education as an interactive learning media [6], Museum [7] the uses of augmented reality technology with barcodes as a means to display the prices of goods on a product[8] as well as other possible field of research

Optimistically, the software developed by using augmented reality approach will provide solutions to the problem faced in the property industry in Indonesia.
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2.Methodology

Waterfall software life cycle and augmented reality are used as an approach model in solving the problem of the research. Waterfall is an approach to develop software system, it is done by planning carefully within each development phases. The Waterfall Model was first Process Model to be introduced. It is also referred to as a linear-sequential life cycle model. It is very simple to understand and use. In a waterfall model, each phase must be completed before the next phase can begin and there is no overlapping in the phases.
Waterfall approach was first SDLC Model to be used widely in Software Engineering to ensure success of the project. In "The Waterfall" approach, the whole process of software development is divided into separate phases. In Waterfall model, typically, the outcome of one phase acts as the input for the next phase sequentially. According to the book Rosa, waterfall is a process of developing or changing a software system by using models that people use to develop system-software in a sequentially order starting from from analysis requirement, analysis design , coding, testing, and support phase.

Waterfall model is the earliest SDLC approach that was used for software development . The waterfall Model illustrates the software development process in a linear sequential flow; hence it is also referred to as a linear-sequential life cycle model. This means that any phase in the development process begins only if the previous phase is complete. In waterfall model phases do not overlap.

The first phases of waterfall is analysis requirement. All possible requirements of the system to be developed are captured in this phase and documented in a requirement specification documentation. researchers are expected to obtain the necessary information as required as ,: search for existing problems, collecting data (physical data, non-physical) and interview.
The second phase of waterfall is system design. The requirement specifications from first phase are studied in this phase and system design is prepared. System Design helps in specifying hardware and system requirements and also helps in defining overall system architecture. Output of the system design is made based on user requirement to be delivered for the next phase to be implemented.
The third phase is implementation ,with inputs from system design, the system is first developed in small programs called units, which are integrated in the next phase. Each unit is developed and tested for its functionality which is referred to as Unit Testing.
The fourth phase is integration and Testing: All the units developed in the implementation phase are integrated into a system after testing of each unit. Post integration the entire system is tested for any faults and failures.
The fifth phase is deployment of system,once the functional and non functional testing is done, the product is deployed in the customer environment or released into the market.

The last phase is maintenance, there are some issues which come up in the client environment. To fix those issues patches are released. Also to enhance the product some better versions are released. Maintenance is done to deliver these changes in the customer environment.

Augmented reality is a new emerging technology that was develop through a process of longtime research in the field of computer vision , it was started by Prof. Azuma , while a virtual reality has the concept of immersing into the virtual environment , augmented reality contrary insstead try to erase the boindary between virtual and reality, where animated object could be interacted in the real world. As an example of the use of augmented reality technology can be seen in the figure below.

Fig 1.Augmented Reality University Brochure

Figure 1 , is an example of the use of augmented reality application as a media campaign, it can be used to show the visual looks of the building represented of the university, along with the brochure as a location marker.

Basically .three components are used for the main interaction in augmented reality technology which are smartphone / tablet ehich serves as a device for the augmented reality software. Second, smartphone camera as a tool of a marker recognition. And a marker as the location of the augmented reality. Those three component must work together at the same time to trigger n animated augmented object.

Fig 2. Augmented Reality Mechanism

Figure 2 is an illustration of the work of the software. It started with the client run the software, use the camera on a smartphone, then directed toward the marker that has been provided, the object will appear augmented reality and user are free to interact with the software.

3. Software Design Analysis

Software design analysis should be made to better understand the concept of the user requirement, the results of the products are developed according to the needs of the user requirement.

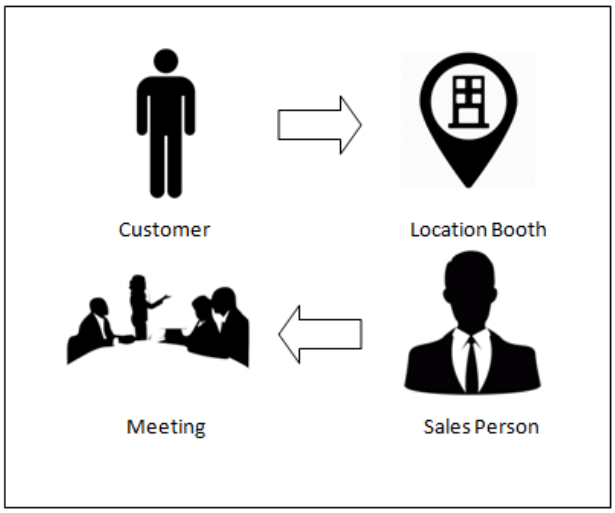

Fig 3. Customer Interaction Flow

Figure 3 showed a pattern of service mechanisms flow for potential customers, when a potential customer visit the sales booth, customer usually comes toward the salesman to get some information of the product The salesman greet the prospective customer and provide information about product knowledge to the prospect customer.

3.1.User Requirement

Implementation of waterfall cycle in this study begins with the first phase which are the need of the user requiremenr. Gathering data is done by Interviewing users in one property developer Alam Sutera Alfa Goldland Realty Tbk. In the interview most of the salesman stated one common problem and difficulties which is interacting with potential client over the years because of the lack of detailed written information in their brochure is one of the major. The following are a list of requirement analysis:

1. Build an augmented reality-based applications to help the product knowledge fot the salesman
2. Build 3d object asset for the buliding plan
3. Build a marker based on the brochure of the property
4. Incorporate product knowledge information which is not provided in the brochure

3.2.Software Design

The second phase of waterfall cycle is software design, where the result of user requirement, will be written into a design model. A good design should always consider the user friendly nature for users. Principles make UI design for new applications easier by transferring knowledge and previous experience in a condensed format, but principles are also loaded with implicit assumptions about the nature of the user experience. In turn, user experience quality depends on the application domain, the context of use, and the user characteristics and goals [10]. Design models will be illustrated by using the flowchart and block design.

3.2.1 Flowchart Penggunaan software

A flowchart is a visual representation of the sequence of steps and decisions needed to perform a process. Each step in the sequence is noted within a diagram shape. Steps are linked by connecting lines and directional arrows. This allows anyone to view the flowchart and logically follow the process from beginning to end.

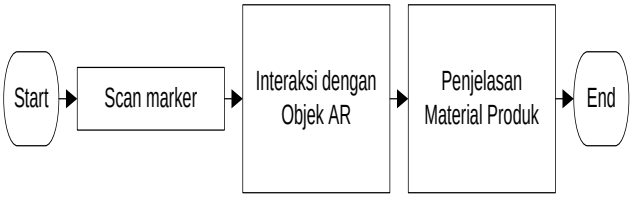

Fig 4. Augmented Reality Flow Used By Sales

Figure 4 ilustrate the flow mecanism augmented reality potential client. The salesman scaned the marker which will augment animated 3d object building plans that can be used by salesman when explaining to potential customers.

3.2.2. Marker Design

Marker used in this study is based on the brochure of New Alba Cluster House which is one of many product

from Alam Sutera Property developer as can bee seen in figure 5.

Fig 5. New Alba Floor Plan

Vuforia SDK (Software Development Kit) is used to make and generate augmented reality marker's. the results of marker analysis are a set of coordinates at the point marker form of a collection oft coordinated point which represent area that could be marked as a marker.

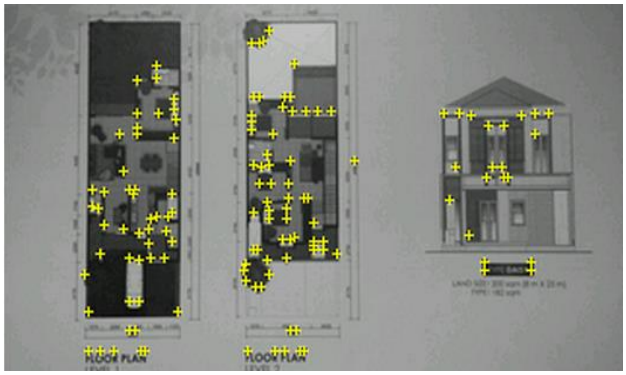

Fig 6. Marker Coordinate Detection

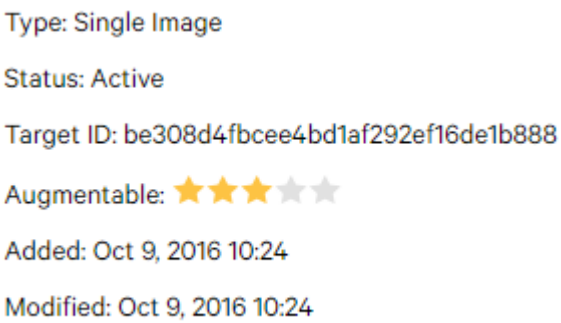

Fig 7. Augmentable Indicator

Based on the figure 7, vuforia the analysis using vuforia, the result is good enough that 3 out of the range 5 where the figure included in the category eligible to be used as a marker.

3.2.3 Menu_Utama Scene Design

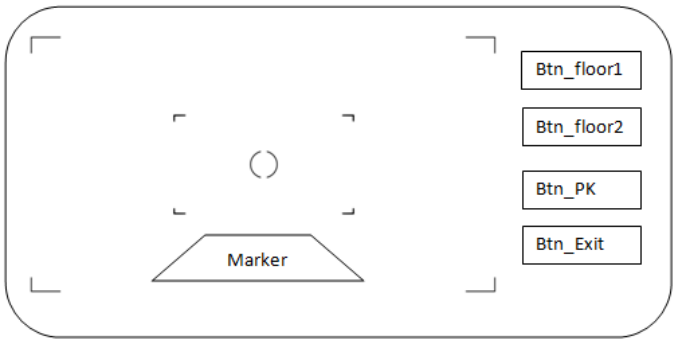

Fig 8. Menu_Utama Scene Design

The figure 8 is a component design on the main menu, while the components used in the scene above are as follows:

- AR_Camera: Used as a scanning tool using the camera sensor to detect the marker.
- Btn_Floor1: Used to display a 3D object ground floor on the brochure.
- Btn_Floor2: Used to display a 3D object second floor of a building on the brochure.
- Btn_PK: Used to display the product knowledge of the building
- Btn_Exit:: Used to exit the application

3.2.4 Detail_Material Canvas Design

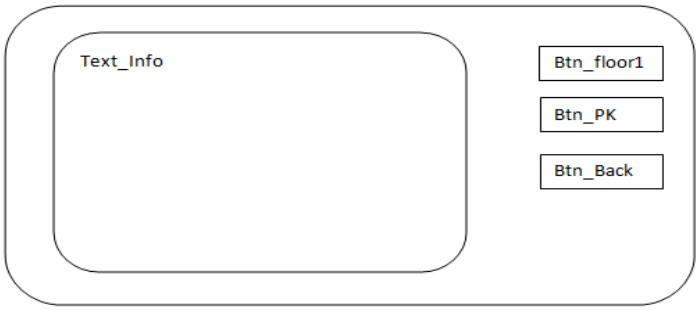

Fig 9.Detail_Material Canvas Design.

The figure 9 is a component design on the Detail_Material canvas while the components used in the scene above are as follows:

- Btn_Floor1: Used to display a 3D object building ground floor of the building on the brochure.
- Text_Info: Used to provide information product knowledge
- Btn_PK: Used to display the product knowledge of the building
- Btn_Back:: Used to return to the main menu

3.2.6. 3D Object Design

Google SketchUp is used to build 3d design of the floor plan. Based on the type of housing plan, two floor plan design part will be build,one for the lower ground and one for the seconf floor. The results of the 3d design of can be seen in figure and figure

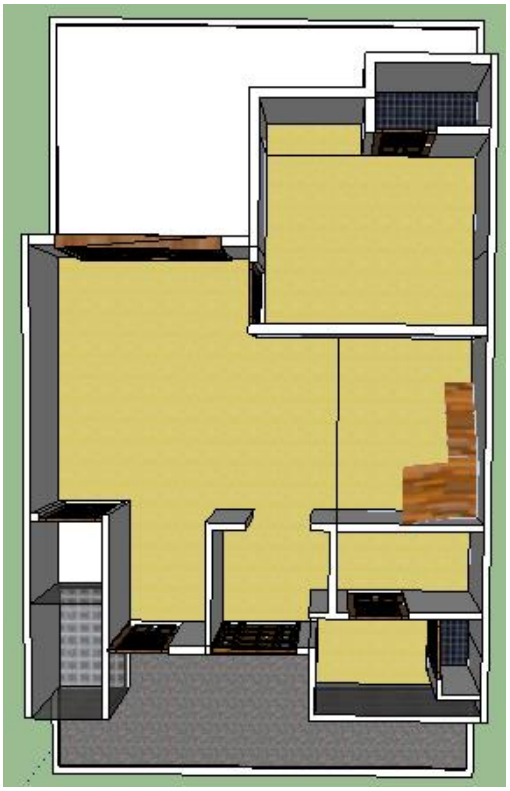

Fig 10. Ground Floor Plan

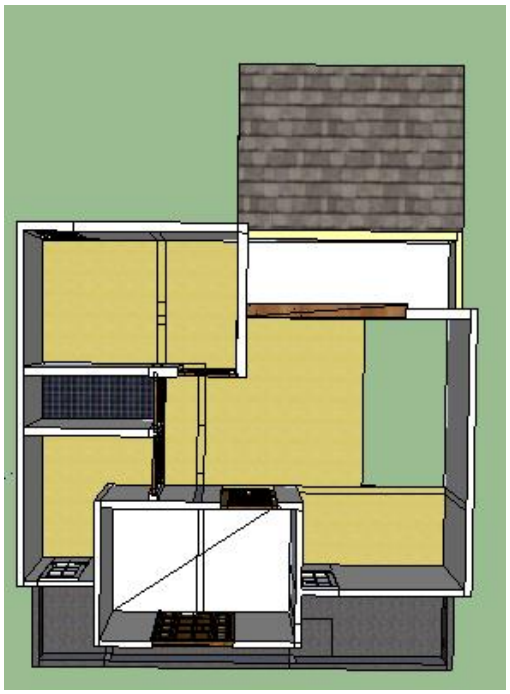

Fig 11. Second Floor Design

3.3 Software Implementation

This phase is where the model design analyzed to be written in the form of code. It started by moving all the asset into a developmnet platfaorm called unity 3d. All asset moved will be arranged to look visualy aesthetic and user friendly. Application development processThe in unity is to includes asset building as in the figure .

Fig 12. Implementation Ground Floor

The augmented reality object is placed on the right side of the floor plan on the brochure, this gives a chance for the user to get a better view and compare betewen the augmented also the floor plan on the brochureobject and o reality After finishing placing the 3d ground floor on the marker, put precicely the second floor of the building as in the figure below

Fig 13. Implementation Second Floor

Placement of the second floor must be precise above the ground floor of the building to avoid the building looks detached from one to the other. It must be ensured when running the application, the lower level of the building still can be seen on top of the view. Then proceed with implementing product knowledge of building materials products to solve one of the problems faced by salesman shown on figure 14.

Fig 14. Product Knowledge

3.4 Software Testing

Software testing is any activity aimed at evaluating an attribute or capability of a program or system and determining that it meets its required results [10]. The purpose of testing can be quality assurance, verification and validation, or reliability estimation. Testing can be used as a generic metric as well. Correctness testing and reliability testing are two major areas of testing. Software testing is a trade-off between budget, time and quality.The software testing used in this research is functionality test that are shown in the table below.

Table 1.Functionality Test

No	Testing Case	Result
1	Multiple floor integration	Success
2	Completeness of 3d model lower grounsd	Success
3	Completeness of 3d model lower grounsd	Success
4	Button testing	Success
5	Information completeness	Success
6	Text Completeness	Success
7	Application Running	Success
8	Application Instalation	Success
9	Marker Scanning	Success
10	Speed of augmented object	Success

From a total 10 cases ,result shown all of the cases suceed given 100 percent succesful testing.

4. CONCLUSION AND RECOMENDATION

4.1 Conclusion

Based on the succesfull testing case, the software developed is ready to be used by the salesman to provide a mean of interaction for potential customers and solution of the problem stated

4.2 Recomendation

In an effort to enrich the research,future research based on this paper should conduct a mean of interaction between augmented object and users to increase client interest

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