Interactive Modeling of Architectural and Regional Design Based on Augmented Reality (AR)

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Abstract. Augmented-Reality is a technology that presents the virtual world into the dimensions of the real world that can be controlled through implicit user interactions with virtual objects. With the rapid development of AR to date, many aspects of technology support the visualization of virtual objects to offer various services to meet the needs of each sector. Although augmented reality applications are used in many areas, AR technology is still relatively new in its use for the advancement of architectural applications. With the current AR technology, the physical form of the mock-up can be replaced by presenting the building design virtually to the real world and providing a different visual accentuation because the mock-up is present in a virtual entity. using the markerless augmented reality method. This method can be used to display 3-dimensional designs without having to use markers or markers so that they can place three-dimensional designs in various fields. In this study, the model that will be used is in the form of a reconstruction of the design of the Gajah Mada Denpasar Heritage Area which is then processed to be visualized interactively through an AR prototype.Heading/Introduction.

Keywords: Augmented reality; interactive modelling; Regional Design

1. Introduction

The development of use of Augmented Reality (AR) is currently starting to be developed in various fields such as health, marketing, art, and tourism, and most developed in the field of video games. With the rapid development of AR to date, many aspects of technology support visualizing virtual objects to offer various services to meet the needs of each sector (Yildiz, 2021).

Although augmented reality applications are used in many areas, AR technology is still relatively new in its use for the advancement of architectural applications. Recent AR developments have encouraged Augmented Reality (AR) prototypes to be used in various architectural and design applications (Wang, 2009). Alternative visualization through augmented reality is felt to be more effective and intuitive and required for the efficient use of digital information today in the architecture industry to present or change the overall architectural design process and method in the future.

Currently, the architectural design process is mostly dominated by two-dimensional design based on computer technology. This process produces three-dimensional works that provide an overview of the design results. As the final result of the architectural design process, the mockup becomes the conclusion of the final physical product in the form of a reduced building prototype. With the current AR technology, the physical form of the mock-up can be replaced by presenting the building design virtually to the real world and providing

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different visual accentuations because the mock-up is present in a virtual entity (Hardywantara, 2019).

To realize AR in architectural modeling, the markerless augmented reality method is. This method can be used to display 3-dimensional designs without having to use markers or markers so that they can place three-dimensional designs in various fields (Kote et al., 2014). The use of markerless AR in displaying building models on all types of flat areas such as floors, tables, and others. The virtual object placed on a flat plane is given an anchor which is used to mark the object's position with respect to the surrounding environment by utilizing the tools available on the user's android smartphone. In this study, the model that will be used is in the form of a reconstruction of the design of the Gajah Mada Denpasar Heritage Area which is then processed to be visualized interactively through an AR prototype.

Based on the description above, this research is aimed at developing the latest side of science and technology through the use of immersive technology. This is expected to be an effort to develop the field of Architecture and its application in the future and to present a more interactive system to users, which can display virtual objects through Augmented Reality technology.

2. Method

To display virtual objects in outline, the steps taken are to prepare the modeling that will be used as a virtual object, followed by attaching a marker or field marker as the base of the virtual object which is visualized as an augmentation of reality through a virtual modeling display in the real world. The research design used to describe the stages of the method in this study is shown in the following figure:

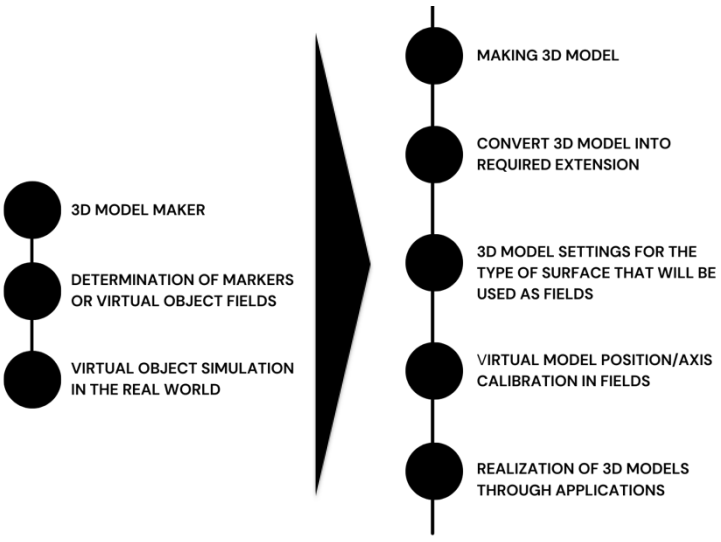

Figure 1. Research Design Diagram

The analytical method used in this study is Marker Augmented Reality which is one of the Augmented Reality methods currently being developed, with this method users no longer need to use a marker to display digital elements, with tools provided by Qualcomm for Augmented Reality development. The analysis process for making interactive modeling is divided into three, namely input, process, and output.

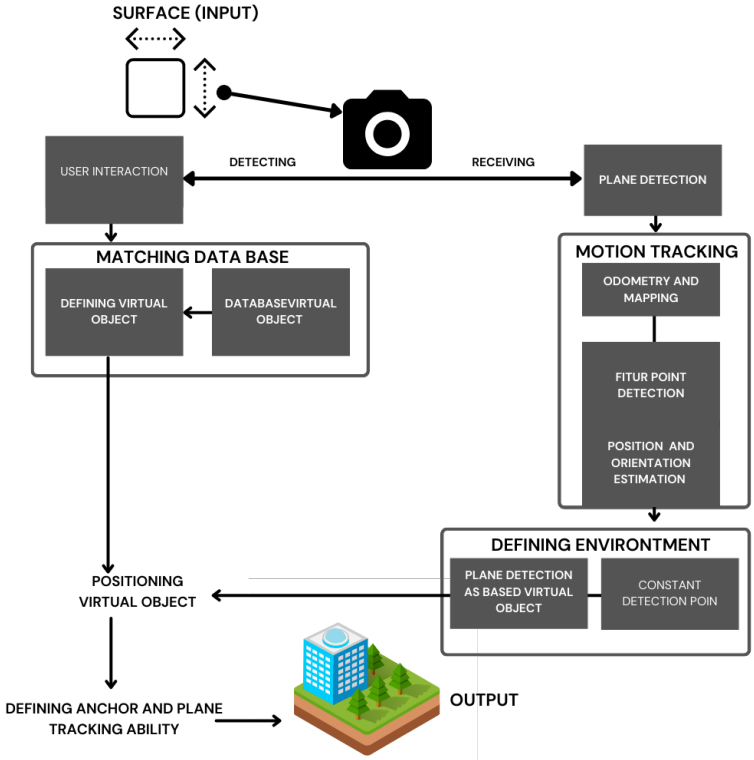

Figure 2. Augmented Reality System Design Flowchart

3. Result and Discussion

The results phase will explain the modeling phase through data in the form of a 3D model of the existing area to the phase of displaying 3D on the available markers. "Augmented Reality aims to develop technologies that allow real-time merging of computer-generated digital content with the real world. AR uses SLAM (Simultaneous Localization and Mapping) technology, sensors, and depth meters. For example, collecting sensor data to calculate distances from the sensor location to the object.

3.1 3D Modeling the Existing Area

Modeling of the existing area is carried out to simulate the study locus environment into 3D which is used as an object to be displayed through augmented reality. The Gajah Mada area is a case study area to be simulated. Apart from being a heritage area, the Gajah Mada area is also easily recognizable and also provides a good representation for imagining the area. The object detail design model is needed so that the output goes well according to the needs. The following is the modeling process carried out.

Determine the corridor nodes that will be 3D bolted, the determination of these nodes is to facilitate the identification of objects in the area because the buildings in the corridor have a similar appearance.

Mapping the face of the building through the street view feature on Google Map. To make it easier to make 3D building facades Global 3D modeling of the region through Sketchup software.

3.2 3D Model Conversion

3D Model conversion is needed because of the difference in the software used, the three-dimensional simulation of the Gajah Mada area is converted into a Collada file so that it can be read by the Unity Engine software. For information, most three-dimensional software uses the called extension. so that the 3d that has been created can run universally in several different applications. COLLADA (for COLLAborative Design Activity) is an exchange file format for interactive 3D applications. It is managed by a non-profit technology consortium, the Khronos Group, and has been adopted by ISO as a publicly available specification. COLLADA defines an open standard XML schema for exchanging digital assets between various graphics software applications that may store their assets in incompatible file formats. The COLLADA document describing digital assets is an XML file, usually identified by the filename extension .dae (digital asset exchange). skp format. changed to Collada by clicking File - Export - 3D Model, then changing the save as type to Collada File.

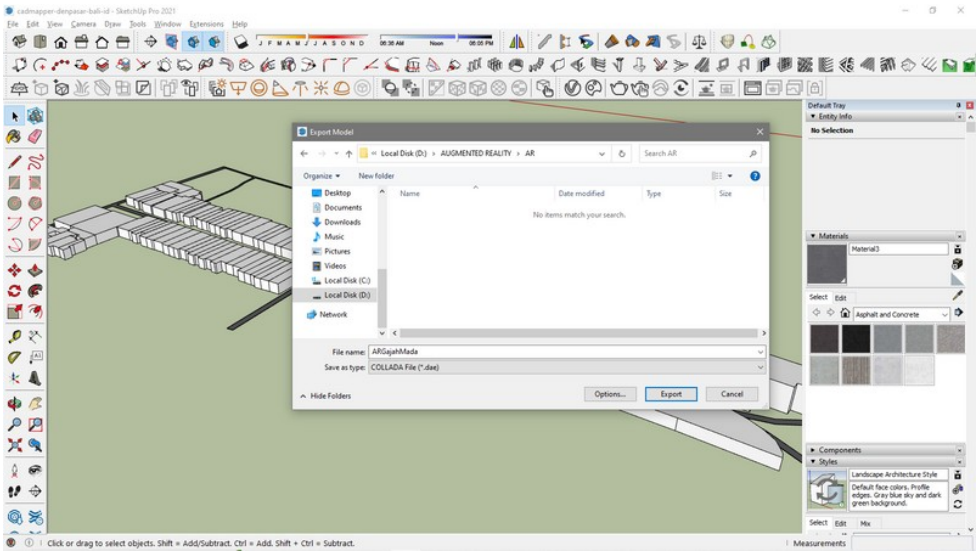

Figure 3. Convert Process Result 3D Model of Gajah Mada Corridor to Collada Extention

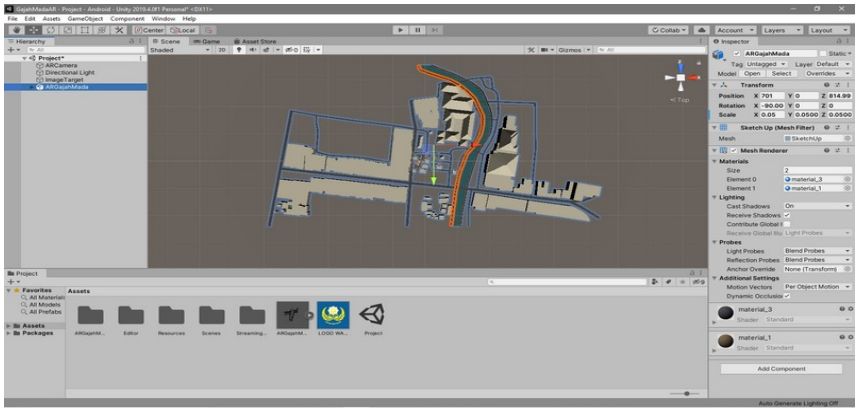

Figure 4. Convert Result 3D Model of Gajah Mada Corridor to Collada Extention

3.3 Augmented Reality Results of Gajah Mada Area Map

The results of augmented reality in the Gajah Mada area are run through a special application so that they can operate augmented reality. This application is run on the basis of the Unity Engine program. To operate this application, it must be installed on each smartphone, once installed point the camera at the baseplane in the form of a map of the city of Denpasar, the smartphone will scan and display the augmented reality model right above the map of the Gajah Mada area.

Figure 5. Augmented Reality operation via Application on Smartphone

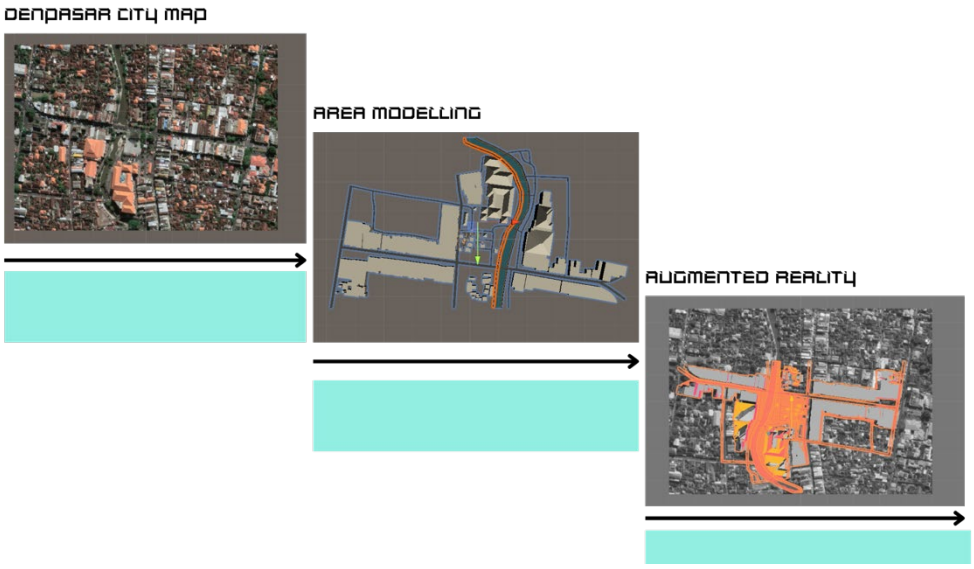

Figure 6. Augmented Reality Scanning Results via an Application on a Smartphone

4. Conclusion

Modeling of the existing area is carried out to simulate the study locus environment into 3D which is used as an object to be displayed through augmented reality. The Gajah Mada area is a case study area to be simulated. Apart from being a heritage area, the Gajah Mada area is also easily recognizable and also provides a good representation for imagining the area.

The plane detection stage starts from determining the flat plane captured by the camera and the surface that can be used as a reference in forming the plane, namely through feature points, then determining the orientation value and the center position of the plane to the environment in the Unity game engine. From the midpoint, the X and Z dimension expansion will be determined so that a simple game object plane is produced. This gameobject will be generated and visualized according to the detection of the flat plane.Conclusions should answer the objectives of the research. Tells how your work advances the field from the present state of knowledge. Without clear Conclusions, reviewers and readers will find it difficult to judge the work.

Reference

[1]. Azuma, R. 1997. A Survey of Augmented Reality. Teleoperators and Virtual Environments, 6: 355-385.

[2]. Hardywantara, F. (2019). Augmented Reality Model Rumah Virtual dengan Teknologi Arcore Berbasis Android.

[3]. Kesim, M., & Ozarslan, Y. (2012). Augmented reality in education: current technologies and the potential for education. Procedia-social and behavioral sciences, 47, 297-302.

[4]. Lotlikar, T., Mahajan, D., Khan, J., Ranadive, R., & Sharma, S. 2013. Augmented Reality-An Emerging Technology. International Journal of Engineering Sciences & Research Technology.

[5]. Wang, X. (2009). Augmented reality in architecture and design: potentials and challenges for application. *International journal of architectural computing*, *7*(2), 309-326.

[6]. Yildiz, E. P. (2021). Augmented reality research and applications in education.

[7]. Febrian, S., Liliana, & Gunadi, K. 2015. Implementasi Pengenalan Multiple Marker untuk Sistem Augmented Reality. Universitas Kristen Petra

[8]. Syahputra, M. F., Lumbantobing, N. P., Siregar, B., Rahmat, R. F., & Andayani, U. 2017. Implementation of Augmented Reality to Models Sultan Deli. Journal of Physics: Conference Series, Departement of Information Technology, Faculty of Computer Science and Information Technology.