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Implementation Of Marker-Based Tracking Method on Augmented Reality in Multimedia Learning (Case Study of STMIK Tegal)

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Abstract
Introducing campus locations for new students or address seekers is an important activity. Multimedia learning is not only a tool for creating harmonious presentations and alternatives that combine visual and audio media; technology can be used for its tools. Augmented Reality (AR) is one of them. Augmented Reality is helpful as a combination of virtual and Reality devices that operate interactively in a realtime natural environment. Based Marker Tracking is a method used to make objects into two dimensions and three dimensions whose process begins with directing the marking object by the user using the camera on the mobile device until the camera reads the object. Light intensity affects detection success, and distance calculation also becomes essential. If the marker is successfully detected, the application will convert it into a 3-dimensional object as the final result. In this study, a location search will be carried out for the STMIK TEGAL Campus Building using Augmented Reality based on the Based Marker Tracking method to produce the most ideal conditions to be able to display 3D objects from the STMIK TEGAL Building, which is a distance of 15 to 25 cm with bright Light using Android, so that this application can be used to find the location of the STMIK TEGAL Building.

Keywords: Augmented Reality, Based Marker Tracking, Multimedia, STMIK TEGAL

I. Introduction

Multimedia learning at this time is beneficial for both business and educational fields [1]. In the business field, multimedia can be used in various media profiles, such as product and company profiles. Some even make it as an information stall (kiosk) and learn in an online learning system [2]. While in the field of multimedia education, this can be used as a teaching medium either in the classroom or independently or self-taught[3]. In everyday life, it can be used as a tool to find the location of a place.

Multimedia [4] is an application from a computer whose presentation combines text, sound, images, animation, audio, and video with tools and links from the computer so that users can interact, navigate, create, and communicate [5]. So, multimedia can also be a presentation tool [6]. Using digital media intermediaries such as mobile applications, multimedia learning offers users various options, enabling technology to make human life easier [7].

Augmented Reality (AR) is a technology that combines two-dimensional (2D) and three-dimensional (3) virtual objects in a three-dimensional (3D) natural environment and then projects these virtual objects in real time [[8]. Until now, many applications have adopted this AR technology as a game, business and educational media. as on smartphones that are capable of displaying 3D objects that are informed, so they do not get bored when used [9], [10]. Marker Based Tracking is Augmented Reality (AR) [11], [12].

In a previous study, [13] which conducted research on Augmented Reality-based distance learning multimedia in the midst of a pandemic, the results of which stated that using Augmented Reality-based multimedia can increase students' science literacy. Likewise [14], [15]. In another study that has been conducted [16] using the Interactive System Multimedia Design and Development (ISMDD) method on Augmented Reality, the introduction of the UKI Maluku building, the results of which are based on tests that have been carried out, have met the standards with a good percentage of success.

Based on the background above, this research will use Augmented Reality technology with the Marked Based method to find the location of the TEGAL STMIK Building The selection of this method is expected to facilitate users in finding locations in the context of introducing the TEGAL STMIK Building. In its application, the operating system on Android will be used so that it is more flexible and can be used anytime and anywhere. Markers will be in the form of posters, to facilitate the process of recognizing and distributing this technology to users. This poster will be detected through an android device to display a three-dimensional animated object.

II. Methods

The method to be used in this research is the Multimedia Development Life Cycle (MDLL) which is suitable for the development of multimedia-based systems which have six stages, namely concept, design, material collecting, assembly, testing and distribution [17]. These stages are shown in Figure 1.

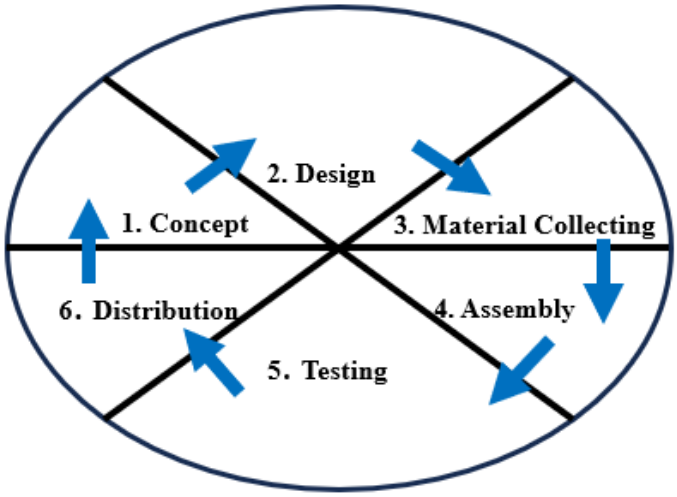

Figure 1. Diagram MDLL

Based on Figure 1, the six stages include:

1. Concept
   This stage begins with determining the purpose of making the application, the target application users and what materials will be used or displayed.
2. Design
   At this stage it aims to make detailed specifications about the project architecture, appearance and material needs.
3. Material Collecting
   Then at this stage is to collect material according to what has been determined or set at the design stage above.
4. Assembly
   Then at this assembly stage will then be made applications based on the design stage, on the results of information obtained at the material collection stage, using programming software such as unity 3D.

5. Testing
   At this stage, it aims to ensure that the results of making the application are in accordance with what has been designed. At this stage, the blackbox method is also carried out on the user interface, by ensuring the accuracy of the model on the marker, button functions and animations obtained. If there is a failure or bug, improvements or revisions must be made.
6. Distribution
   This stage is carried out when testing has been completed and declared suitable for use, then this stage will be disseminated so that this application can be used by users.

   Flow Diagram in this study as a material used to describe the sequence of processes in detail with relationships in other processes in a program [18]. The flowchart of Augmented Reality is shown in Figure 2.

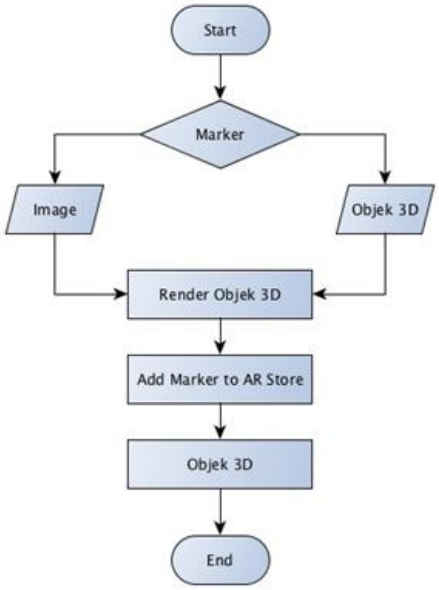

Figure 2. Diagram alur Augmented Reality

7. Android
   Is the operating system used is the development of the Linux system. Android itself was developed by the star up with the same name Android inc, in 2005. Google bought Android and took over the developer's job [19].
8. Unity
   Is a cross-platform game development application, Unity 3D is a tool for creating 3D [20]. Unity 3D can generate terrain, import a model of the main building that has been built into the terrain and placed according to the actual angle. Unity has an SDK provided by quantum to help developers create AR applications [21]. Computer vision to recognize and track planar images (Image targets and simple 3D objects such as squares in realtime [22].

III. Results and Discussions

In this study, which uses the Augmented Reality method, it is carried out as a search and location recognition tool for the STMIK TEGAL Building, the tool that will be used in this study is as in Table 1.

Table 1. Software and Hardware used

Kebutuhan *Hardware*	Kebutuhan *Software*
1. Laptop (Asus X555BA), Processor (Intel Core i7 Gen 10Th), Memory (16GB DDR4) dan Hard Disk (1000 GB) 2. Smartphone (Oppo A31) 3. Printer (Epson L1110)	1. Sistem Operasi (Windows 10 Pro 64 bit) 2. Blender 3D 3. Unity 3D 4. Adobe Photoshop 5. SDK (Vuforia dan Android) and AirDroid

The results of the six steps in the MDLC consisting of 6 stages have been carried out:

1. Concept
   The concept produced at this stage is the purpose of the application, namely the existence of media that can display information about the location of the STMIK TEGAL Building building. Applications used by the Android operating system developed with programming languages on the unity engine, namely C + programming language.
2. Researchers at this stage make designs consisting of system architecture, flowcharts, storyboards and interface designs. The architecture of the system is shown in Figure 2

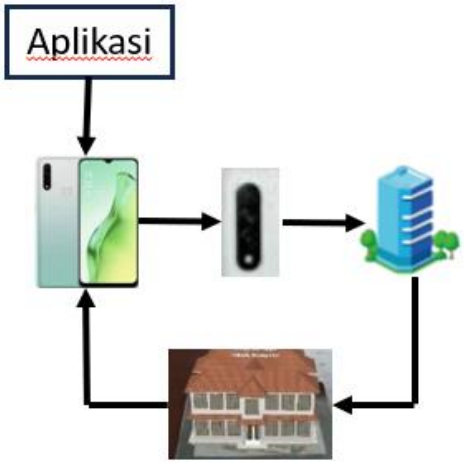

Figure 3. System Architecture

In figure 3 it appears that the application will run on devices with the Android operating system, then this application will use the camera as a marker scanner media, if this marker can be read on the camera to be displayed, namely 3D objects on the layer of Android. While the Skyboard design that will be made as in Figure 4.

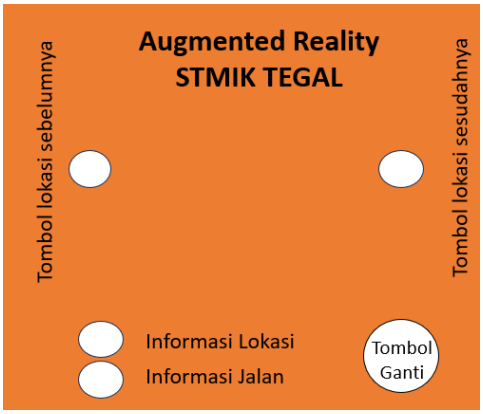

Figure 4. Storyboard Design

The interface design that will be used in this study is designed as in Figure 5. Next, here are the components of the functional picture in a system.

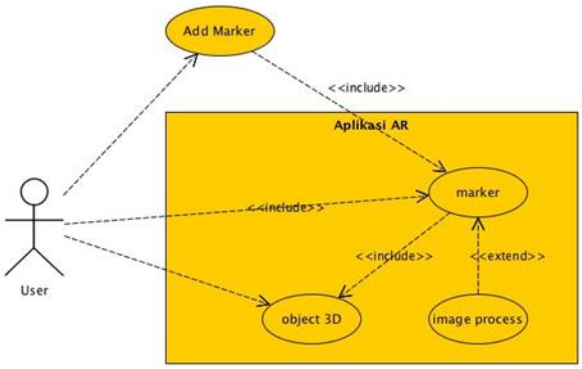

Figure 5. Use Case Diagram of Augmented Reality with Unity app

Figure 5 shows the design of a use case diagram for Augmented Reality, the results of the user interface design are shown in figure 6.

Figure 6. User Interface

At the Material Collecting stage, a needs analysis and collection of materials will be used in application development. Material in the form of information around the Address and location and

appearance of the STMIK TEGAL Building which will be displayed in the Augmented Reality application

The application development process will use several supporting applications such as designing photoshop application assets because it is easier to use while for the formation of 3D objects using ARCHICAD 23 because it can display the design and appearance of buildings and Blender applications for texture and effects and 3D Building object light. The Unity 3D application is also used to perform camera settings, database connections and create interface displays. On the main menu unterface there is a button for the STMIK TEGAL Building, the Building button or location before the STMIK Building and the Building after the location of the STMIK TEGAL Gedaung then the exit button to close the application. In figure 6, you can see the location of the TEGAL STMIK Building seen from the air which illustrates the entire location around the TEGAL STMIK Building.

The Tester stage is carried out by adjusting the scan distance, Light testing distance and testing according to the version of Android owned by use, along with the test results in the table.

Figure 7. Environmental Location of STMIK TEGAL Building

In picture 6, you can see that STMIK TEGAL Building is located next to Saphire housing (left) and next to MAN Building (green). The Tester stage is carried out by adjusting the scan distance, Light testing distance and testing according to the version of Android owned by use, following the test results in table 2.

Table 2. Distance Testing

No	Distance (cm)	Status
1	5	The building is not visible
2	15	Building view
3	25	Building view
4	50	The building began to become invisible
5	100	The building is not visible

Based on application testing based on Light as table 3.

Table 3. Light Testing

No	Light	Status
1	Bright	Building view
2	Dark	The building is not visible

Testing on Android performed on this version is shown in table 4.

Table 4. Android Versions for Testing

No	Versi Android	Status
1	Xiaomi Redmi Plus	The application runs
2	Samsung Galaksi A71	The application runs
3	Oppo A31	The application runs

IV. Conclusions

This researched Augmented Reality technology can be implemented as a tool or medium for recognition or location search of Gedang STMIK TEGAL by displaying 3D objects from the STMIK TEGAL Building. The method used in this application is Marked Based Tracker used by printing markers and inserting them in the prosur can be the easiest way for prospective new students to find out about information through brochures and can see the visualization from the STMIK TEGAL Building, From the test results carried out the most ideal conditions to be able to display 3D objects from the TEGAL STMIK Building which is a distance of 15 to 25 cm with bright Light using Android.

References

[1] I. Listiani, "Analisis Pentingnya Sistem Informasi Manajemen dalam Teknologi Informasi dan Komunikasi Saat Ini," *Informasi, Teknol. dan Komun.*, vol. 1, pp. 1–15, 2021.

[2] C. Bino Evin and A. Didimus Rumpak, "Analisis Pengembangan Desain Grafis Dalam Aplikasi Photoshop Sebagai Peluang Bisnis Mahasiswa Institut Bisnis Dan Multimedia Asmi," *J. Sist. Inf.*, vol. 1, no. 2, pp. 33–40, 2019.

[3] P. W. Aditama, I. Nyoman Widhi Adnyana, and K. Ayu Ariningsih, "Augmented Reality Dalam Multimedia Pembelajaran," *Pros. Semin. Nas. Desain dan Arsit.*, vol. 2, pp. 176–182, 2021.

[4] P. Manurung, "Multimedia Interaktif Sebagai Media Pembelajaran Pada Masa Pandemi Covid 19," *Al-Fikru J. Ilm.*, vol. 14, no. 1, pp. 1–12, 2021, doi: 10.51672/alfikru.v14i1.33.

[5] N. Amalia, "Aplikasi Flash Player Berbasis Multimedia Interaktif Menggunakan Adobe Reader," *EduTech J. Ilmu Pendidik. dan Ilmu Sos.*, vol. 7, no. 2, 2021.

[6] N. A. Suryandaru, "PENERAPAN MULTIMEDIA DALAM PEMBELAJARAN YANG EFEKTIF," *J. Pendidik. dan Pengajaran Guru Sekol. Dasar*, vol. 3, pp. 88–91, 2020.

[7] R. Sumarlin, Mario, D. N. Anggraini, and D. Hidayat, "Review Dan Analisis Multimedia Learning Berbasis Cerita Rakyat Sunda Melalui Mobile APPS," *J. Demandia*, vol. Vol. 07 No, 2022, doi: https://doi.org/10.25124/demandia.v7i2.4404.

[8] T. Abdulghani and B. P. Sati, "Pengenalan Rumah Adat Indonesia Menggunakan Teknologi Augmented Reality Dengan Metode Marker Based Tracking Sebagai Media Pembelajaran," *Media J. Inform.*, vol. 11, no.1, pp. 43–50, 2019, doi: https://doi.org/10.35194/mji.v11i1.770.

[9] I. Hastuti and A. N. Azura, "Dan Pahlawan Lokal Banjarmasin Berbasis Mobile Augmented Reality Pada Museum Wasaka Banjarmasin," vol. 14, no. 1, pp. 18–27, 2022.

[10] Nopriyanti and P. Sudira, "Pengembangan Multimedia Pembelajaran Interaktif Kompetensi Dasar Pemasangan Sistem Penerangan Dan Wiring Kelistrikan Di Smk," *J. Pendidik. Vokasi*, vol. 5, 2015.

[11] M. Santoso, C. R. Sari, and S. Jalal, "Promosi Kampus Berbasis Augmented Reality," *J. Edukasi Elektro*, vol. 5, no. 2, pp. 105–110, 2021, doi: 10.21831/jee.v5i2.43496.

[12] A. A. Aldriyan and S. Amini, "Penerapan Metode Marker Based Tracking Untuk Pembelajaran Anak Berkebutuhan Khusus," *Skanika*, vol. 3, no. 4, pp. 1–6, 2020.

[13] M. Ahied, L. K. Muharrami, A. Fikriyah, and I. Rosidi, "Improving students' scientific literacy through distance learning with augmented reality-based multimedia amid the covid-19 pandemic," *J. Pendidik. IPA Indones.*, vol. 9, no. 4, pp. 499–511, 2020, doi: 10.15294/jpii.v9i4.26123.

[14] H. Bursali and R. M. Yilmaz, "Effect of augmented reality applications on secondary school students' reading comprehension and learning permanency," *Comput. Human Behav.*, vol. 95, no. June 2018, pp. 126–135, 2019, doi: 10.1016/j.chb.2019.01.035.

[15] J. Garzón, Kinshuk, S. Baldiris, J. Gutiérrez, and J. Pavón, "How do pedagogical approaches

affect the impact of augmented reality on education? A meta-analysis and research synthesis," *Educ. Res. Rev.*, vol. 31, p. 100334, 2020, doi: 10.1016/j.edurev.2020.100334.
[16] R. Siwalette and H. Tuhuteru, "Augmented Reality Untuk Pengenalan Gedung Universitas Kristen Indonesia Maluku," *JIPI (Jurnal Ilm. Penelit. dan Pembelajaran Inform.*, vol. 7, no. 4, pp. 1411–1417, 2022, doi: 10.29100/jipi.v7i4.3927.
[17] S. Alisyafiq, B. Hardiyana, and R. P. Dhaniawaty, "Implementasi Multimedia Development Life Cycle Pada Aplikasi Pembelajaran Multimedia Interaktif Algoritma dan Pemrograman Dasar Untuk Mahasiswa Berkebutuhan Khusus Berbasis Android," *J. Pendidik. Kebutuhan Khusus*, vol. 5, no. 2, pp. 135–143, 2021, doi: 10.24036/jpkk.v5i2.594.
[18] S. A. Olii, T. Abdillah, and R. Takdir, "Augmented Reality Katalog Penjualan Perangkat Keras Menggunakan Magic Book Berbasis Android," *Diffus. J. Syst. ...*, vol. 1, no. 2, 2021.
[19] A. Belkhir, M. Abdellatif, R. Tighilt, N. Moha, Y. G. Gueheneuc, and E. Beaudry, "An observational study on the state of REST API uses in android mobile applications," *Proc. - 2019 IEEE/ACM 6th Int. Conf. Mob. Softw. Eng. Syst. MOBILESoft 2019*, pp. 66–75, 2019, doi: 10.1109/MOBILESoft.2019.00020.
[20] Aditya Fajar Ramadhan, Ade Dwi Putra, and Ade Surahman, "Aplikasi Pengenalan Perangkat Keras Komputer Berbasis Android Menggunakanaugmented Reality (Ar)," *J. Teknol. dan Sist. Inf.*, vol. 2, no. 2, pp. 24–31, 2021.
[21] N. Rianto, A. Sucipto, and R. Dedi Gunawan, "Pengenalan Alat Musik Tradisional Lampung Menggunakan Augmented Reality Berbasis Android (Studi Kasus: SDN 1 Rangai Tri Tunggal Lampung Selatan)," *J. Inform. dan Rekayasa Perangkat Lunak*, vol. 2, no. 1, pp. 64–72, 2021.
[22] K. G. Nalbant and Ş. Uyanik, "Computer Vision in the Metaverse," *J. Metaverse*, vol. 1, no. 1, pp. 9–12, 2021.