THE USE OF AUGMENTED REALITY-BASED APPLICATIONS FOR LEARNING

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ABSTRACT

Augmented reality is to create a new environment by combining the interactivity of real and virtual environments in real time so that users feel that the created environment is real. The model used in this study refers to the MDLC (Multimedia Development Life Cycle) type development model with 5 stages, namely Concept, Design, Material Collecting, Assembly, Testing and Distribution. The validity test and effectiveness test involved 1 material expert, 1 media expert and X TKJ class students who were divided into small groups of 6 people and large groups of 20 people. The instrument uses a questionnaire. Student response data was collected on July 06, 2022 at SMK Nusantara 1 Ciputat School. The average result of validity test on material experts is 92%, the average result of validity test on media experts is 92% and, the average result of effectiveness test on students is 94.88%.
Keywords: Learning Media, Augmented Reality, IoT Devices

INTRODUCTION

Learning media is a solution that needs to be developed so that students can not only imagine objects in their minds, but also have a more realistic visual learning experience (more realistic) with their eyes and minds. 3D images and animations are one alternative learning media that can attract students' attention and curiosity, especially in the classroom.

Looking at the past three years when the spread of Covid-19 increased in Indonesia, the government, in this case the Ministry of Education and Culture, finally issued guidelines for all schools to conduct distance learning or online learning. This distance learning has stopped the teaching and learning process at school, so that the teaching and learning process is carried out from home. Teachers also only provide material using Microsoft Power Point (PPT) or Microsoft Word through Google Classroom without further explanation of the ongoing learning. On September 1, 2021, the Ministry of Education and Culture issued a policy again on the implementation of face-to-face learning activities in schools by following health and vaccination protocols for students, teachers and staff at schools before face-to-face learning takes place, this restriction makes the teaching and learning process in schools called Limited Face-to-Face Learning (PTMT).

Based on observations that the author has made during the Limited Face-to-Face Learning (PTMT) period, it is found that many students do not fully understand learning, this is also supported by previous research conducted by the author at SMK Nusantara 1 Ciputat. From the results of the questionnaire distributed to students, there are 11 students who prefer face-to-face learning, they consider face-to-face learning to be more effective because when learning online they only study independently at home with the material provided by the teacher is a 2-dimensional image using Microsoft Power Point (PPT) or Microsoft Word. Currently, computer system subjects on the introduction of IoT Starter Kit devices are still less practical because students and teachers have to go to the practice lab first to introduce IoT

Starter Kit devices and also Augmented Reality-based learning media at SMK Nusantara 1 Ciputat do not exist or have never been realized before.

Based on the explanation above, there must be a solution that can be used by teachers so that students can understand learning and trigger students' curiosity to learn. The introduction of the current IoT Starter Kit device can also help students later in designing an IoT product that can facilitate optimizing work to be more efficient. Teachers really need interesting and practical learning media to explain the IoT starter kit device using 3D images. By using 3D technology and augmented reality, teachers can bring any material to life, making it easier for students to learn lessons faster. The purpose of using augmented reality technology is to make learning materials more interesting and able to describe an object more realistically (real).

THEORY REVIEW

1. **Unity 3D**
   According to Arief, U. M., Wibawanto, H., and Nastiti, A.L (2019), Unity 3D or commonly referred to as Unity is software commonly used to create various kinds of game-based applications, 3D or 2D.
2. **Vuforia**
   According to Arief, Wibawanto, and Nastiti (2019), Vuforia SDK is one of the commonly used plug-ins to support the creation of AR applications.
3. **Android**
   According to Harahap, Sucipto, Jupriyadi (2020) argues Android Inc. was the first company to develop Android and in 2005 it was taken over by Google, the Internet giant.
4. **Augmented Reality (AR)**
   According to Efendi, et al (2015) argue Augmented reality is a technology that combines two-dimensional and/or three-dimensional virtual objects in a three-dimensional real environment and then projects these virtual objects in real time.
5. **Arduino Nano**
   According to Muchtar and Hidayat (2017), the Arduino Nano is an ATmega328-based microcontroller board.
6. **Ultrasonic Sensor**
   According to Akhiruddin (2018), ultrasonic sensors are sensors used to convert sound into electrical quantities and vice versa.
7. **Multimeter**
   According to Suryawinata et al in Priatama, Apriani and Danus (2020) argue Multimeter is a tool that can measure voltage, current, or resistance of an electrical circuit.
8. **DHT 11**
   According to Diatagirma, Notosudjono, Fiddiansyah (2019), this sensor is very easy to use with Arduino which has a very accurate level of stability.
9. **LCD**
   According to Henriques, Agung, Jasa (2018) revealed Liquid Crystal Display (LCD) is a digital display technology that produces images on a flat surface with liquid light energy and color filters, has a polarized molecular structure, layered between two transparent electrodes.
10. **Arduino Uno**
    According to Devi, Erwanto, Utomo (2018), this device can be used to create electronic circuits from the simplest to the most complex.

RELEVANT RESEARCH

1. Research by Harahap, Sucipto, Jupriyadi (2020), entitled "Utilization of Augmented Reality (AR) on Learning Media for the Introduction of Andorid-Based Electronic Components".

This study discusses the use of Augmented Reality-based applications for learning, but the author analyzes in this study the trial subjects are not specifically explained.

2. Research by Kusuma (2020), entitled "Design of Solar System Learning Augmented Reality Applications Using Marker Based Tracking". This study discusses the use of Augmented Reality-based applications for learning, but the author analyzes that in this study there are no product trial results presented.

3. Research by Nuriana (2016), entitled "Introduction to Animals Using Augmented Reality as Learning Media". This study discusses the use of Augmented Reality-based applications for learning, but the author analyzes in this study there are no product trial results presented.

FRAMEWORK OF THOUGHT

It is very important to use interesting learning media. This is because it can affect the soft skills and understanding of students that must be possessed from class X, so teachers are required to be able to find the right learning media. Classroom teaching and learning activities are inseparable from the use of learning media to support the success of learning. However, if teaching and learning activities are still less practical and learning media that is not yet interesting, it will make students feel bored understanding the devices and their functions from the IoT Starter Kit device, especially if the learning media can also be used by students both in the classroom and outside the classroom. Seeing the wider development of technology makes learning media more diverse and more interesting.
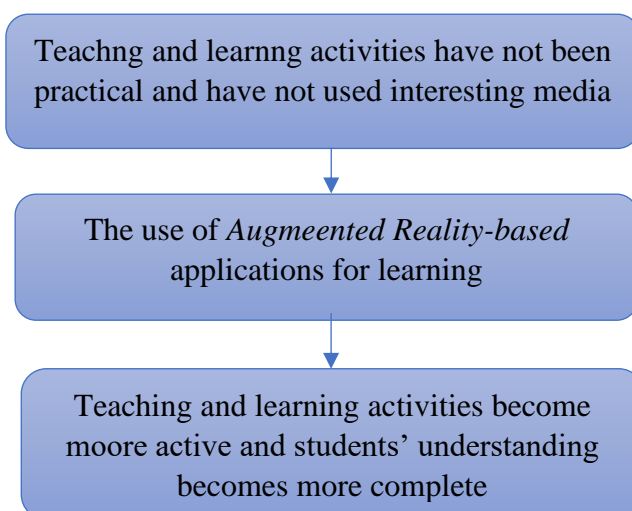
Teachng and learnng activities have not been practical and have not used interesting media

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The use of *Augmeented Reality-based* applications for learning

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Teaching and learning activities become moore active and students' understanding becomes more complete

Figure 1. Research Thinking Framework

DISCUSSION

Based on research into the use of Augmented Reality-based applications for learning, the results obtained from the first to the last stage are as follows

1. **Concept**

   Before this stage, the author conducted an interview with the Vice Principal of SMK Nusantara 1 Ciputat and a computer system subject teacher. This was done to get more in-depth data about the problems and solutions to be provided. He revealed that teaching and learning activities in the introduction of IoT Starter Kit devices are still carried out in the practice lab and also augmented reality-based learning media have never been realized in schools before so it is hoped that the application that has been designed can help the process of teaching and learning activities become more practical.

2. **Design**

   At this stage, the use of Augmented Reality-based applications begins with designing a storyboard. After the storyboard is complete, the researcher designs the appearance of the

application main menu, markers and 3D objects using supporting applications, including: Canva, Blender, and Unity. The design process is carried out with a span of 3 months from March - May 2022.
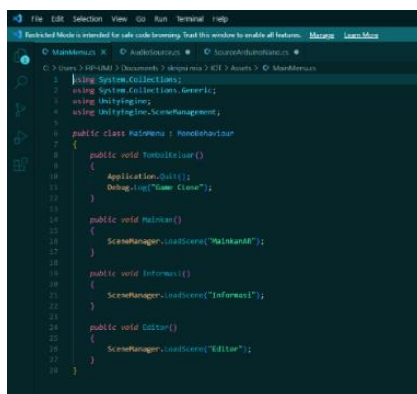
3. Material Collecting

At this stage, the collection of materials that have been previously designed according to the needs of the application is carried out, namely:

a. 2D images that serve as 3D object markers

b. 3D images that function as animation objects in learning media

c. Audio that serves as an explanation of the description and function of 3D objects.

d. Subject matter that is triggered by KD (Basic Competencies) to apply the basics of microcontrollers. Indicators contained in the lesson plan are also expected that students are able to understand and recognize the function of applying microcontrollers in computer systems.

4. Assembly
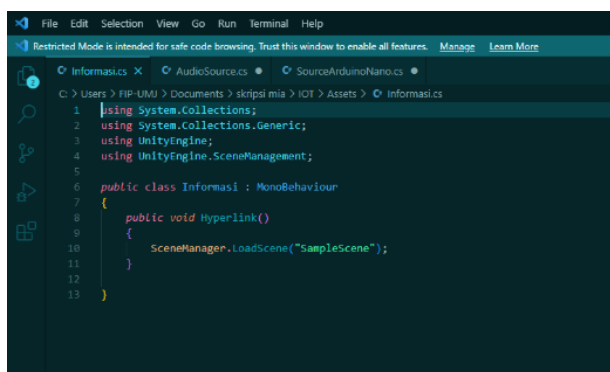
At this stage, enter the C# language script coding into the Visual Studio application which can be integrated into the Unity application. This coding aims to make the application run well.

Figure 2. *Script Button* Main Menu

Figure 2 is a coding that serves to make the button in the main menu can open the display selected by the user.

Figure 3. Hyperlink Script

Figure 3 is a coding that functions to navigate the home button so that when clicked, users can return to the main menu section.

Figure 4. Audio Script

Figure 4 is a coding that functions to display an audio explanation of the IoT device when a 3D object is detected and the user presses the Play button.

5. Testing

At this stage, validity testing was carried out by one material expert and one media expert. In the material expert validity test conducted with Mr. Arisantoso, S.T., M.Kom on June 27, 2022, in the material expert validity test there were no comments when the validation test was carried out. Furthermore, the media expert validity test was conducted with Mr. Saipul Anwar, S.Kom., M.Kom. on June 27, 2022, in the media expert validity test there were also no comments during the validation test.

6. Distribution

At this stage the Sample Scene, Play Scene, Information Scene, and Editor Scene are included in the build settings of the Unity application.
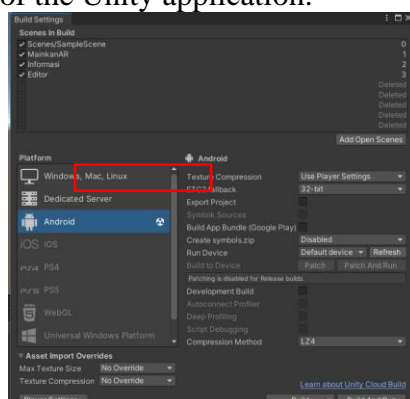

Figure 5. Build Setting

In Figure 5 Android is chosen as a platform, so that this application can be played by TKJ students at SMK Nusanatra 1 Ciputat using an Android smartphone. After the build process is done in the unity 3D application, the AR application can be installed on an Android smartphone, can be seen in Figure 6.
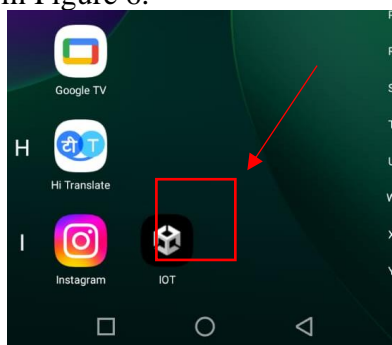

Figure 6. Application that has been built

When the application can be installed on a smartphone, the application can be distributed to students of class X TKJ SMK Nusantara 1 Ciputat.
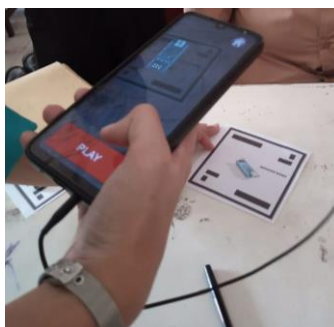

Figure 7. Distribution of AR apps to students

It can be seen in Figure 7 after the distribution of AR applications to students is complete, the author provides a questionnaire to be filled in by students as part of the effectiveness testing conducted on July 06, 2022.

CONCLUSION AND CLOSING

a. Summary

The use of augmented reality-based applications for learning obtained an average score of 94.88%, with this augmented reality-based learning media declared very effective.

b. Closing

The author would like to thank those who have supported this research so that it can run as it should, and the author would like to thank the Principal and Teachers of SMK Nusantara 1 Ciputat who have accepted the author to conduct research.

REFERENCES

Adami, F. Z., & Budihartanti, C. (2016). "Penerapan Teknologi *Augmented Reality* Pada Media Pembelajaran Sistem Percernaan Berbasis Android." Jurnal Teknik Komputer Amik BSI, 2(1), 122-131.

Akhiruddin. (2018). "Rancang Bangun Alat Pendeteksi Ketinggian Air Sungai Sebagai Peringatan Dini Banjir Berbasis Arduino Nano." *Journal of Electrical Technology*, 3(3), 174-179.

Anwar, S. N., Nugroho, I., & Lestariningsih, E. (2015). "Perancangan Dan Implementasi Aplikasi Mobile Semarang Guidance Pada Android." Jurnal Teknologi Informasi Dinamik, 20(1), 148-158.

Arasada, B., & Suprianto, B. (2017). "Aplikasi Sensor Ultrasonik Untuk Deteksi Posisi Jarak Pada Ruang Menggunakan Arduino Uno." Jurnal Teknik Elektro, 06(02), 137-145.

Asmi, J., & Oriza, C. (2020). "Prototype Solar Tracker Dua Sumbu Berbasis Microcontroller Arduino Nano dengan Sensor LDR." JTEV (Jurnal Teknik Elektro dan Vokasional), 6(2), 54-63.

Budi, K. S., & Pramudya, Y. (2017). "Pengembangan Sistem Akuisisi Data Kelembaban dan Suhu dengan Menggunakan Sensor DHT11 dan Arduino Berbasis IoT." Prosiding Seminar Nasional Fisika (E-Journal), 6, 47-54.

Butar, C. M., & Samuel, Y. T. (2019). "Perancangan Sistem Kendali Kendaraan Bermotor Jarak Jauh Menggunakan NodeMCU ESP8266." Jurnal TeIKa, 9(1), 87-97.

Devi, N. S., Erwanto, D., & Utomo, Y. B. (2018). "Perancangan Sistem Kontrol Suhu dan Kelembaban Ruangan pada Budidaya Jamur Tiram Berbasis Internet of Things." Multitek Indonesia: Jurnal Ilmiah, 12(2), 104-113.

Diatagirma, H. N. (2019). "Rancang Bangun Miniatur Alat Pengendalian Peralatan Listrik Pada Rumah Tinggal Berbasis Internet of Things (IoT)." Jurnal Online Mahasiswa (JOM) Bidang Teknik Elektro, *1*(1), 1-13.

Hanafy, M. S. (2014). "Konsep Belajar dan Pembelajaran." Jurnal Online Mahasiswa (JOM) Bidang Teknik Elektro, 66-79.

Harahap, A. S. (2020). "Pemanfaatan *Augmented Reali*ty (AR) Pada Media Pembelajaran Pengenalan Komponen Elektronika Berbasis Android." Jurnal Ilmiah Infrastruktur Teknologi Informasi (JIITI), 1(1), 20-26.

Harsiwi, U. B. (2020). "Pengaruh Pembelajaran Menggunakan Media Pembelajaran Interaktif terhadap Hasil Belajar Siswa di Sekolah Dasar." Jurnal Basicedu, 4(4), 1104-1113.

Hasan, M. N. (2017). "Rancang Bangun Pemandu Tuna Netra Menggunakan Sensor Ultrasonik Berbasis Mikrokontroler." Teknologi Elektro, 16(3), 27-32.

Henriques, P. P. (2018). "Rancang Bangun Sensor Jarak sebagai Alat Bantu Memarkir Mobil berbasis Mikrokontroler Arduino Uno." Majalah Ilmiah Teknologi Elektro, 17(1), 72-29.

Huda, M., Sabanise, Y. F., Sulasmoro, A. H., & Bakhar, M. (2022). "Peningkatan Softskill Kompetensi IoT untuk Siswa – Siswi SMK Muhammadiyah 1 Kramat." Jurnal Dharma Bakti-LPPM IST AKPRIND, 5(1), 84-90.

Irfan, M., & S, Lailis. (2019). "Internet of Things (IoT) Dalam Pengembangan Pembelajaran di Universitas Muhammadiyah Malang." Seminar Nasional Teknologi dan Rekayasa (SENTRA), 44-51.

Kusuma, S. D. (2018). "Perancangan Aplikasi *Augmented Reality* Pembelajaran Tata Surya dengan Menggunakan *Marker Based Tracking*." Jurnal Informatika Universitas Pamulang, 3(1), 33-38.

Mardwianta, B. (2017). "Pembangkitan Energi Listrik Pada Baterai Udara Dengan Bahan Karbon Aktif dan Elektrolit Air Laut." Seminar Nasional Teknologi Informasi dan Kedirgantaraan (SENATIK), III, 44-51.

Martias. (2017). "Penerapan dan Penggunaan Alat Ukur Multimeter Pada Pengukuran Komponen Elektronika." Konferensi Nasional Ilmu Sosial & Teknologi (KNIST), 1(1), 222-226.

Muchtar, H., & Hidayat, A. (2017). "Implementasi Wavecom dalam Monitoring Beban Listrik Berbasis Mikrokontroler." Jurnal Teknologi, 09(01), 1-5.

Muin, A. (2017). "Keterampilan Berbasis Multimedia Interaktif Pada Pembelajaran Seni Budaya di Sekolah Dasar." Jurnal Penelitian Pendidikan INSANI, 20(2), 133-135.

Murtikah, D., & Djuniadi. (2016). "Pengembangan Aplikasi Percakapan Bahasa." Jurnal Digit, 06(01), 1-10.

Mustaqim, I. (2016). "Pemanfaatan *Augmented Reality* Sebagai Media Pembelajaran." Jurnal Pendidikan Teknologi dan Kejuruan, 13(2), 1-10.

Novita, L., Sukmanasa, E., Pratama, M.Y. (2019). "Penggunaan Media Pembelajaran Video terhadap Hasil Belajar Siswa SD." Indonesian Journal of Primary Education, 3(2), 64-72.

Nugroho, A., & Pramono, B. A. (2017). "Aplikasi Mobile *Augmented Reality*