

Interactive Learning Using Augmented Reality Image Marker Type of Application in Online Classrooms

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ABSTRACT

Currently, the world faces a deadly virus knowingly as COVID-19, which has globally impacted the economic, educational, and tourism sectors. As instructed by the world health organization (WHO), the government for each respective country needs to enforce lock down and stay-at-home measures to slow down the spread of the virus. As educational institutions close due to the pandemic, they have adopted a new norm of learning through video conferencing. This study aims to develop interactive and fun learning for the online classroom to overcome the boredom and stressful environment during distance learning by using AR technology in education. AR technology can possibly be used in education tracking an image marker using mobile vision. Then, the functionality of image marker was tested through Google Meet. The results show virtual 3-D models generated by scanning the image marker using mobile devices.

Keywords—Unity, AR, image marker, coronavirus, online education

1 INTRODUCTION

In 2019, a highly dangerous and fatal virus has spread around the world, causing millions of innocent lives to be taken. The deadly virus is known as COVID-19, or coronavirus, which started in China [1]. Therefore, the World Health Organization (WHO) declared to the world to enforce social distancing and quarantine measures. It has recommended governments to lock down their respectful countries and implement stay-at-home measures to help for slowing down the spread of the COVID-19 in their designated countries [1]-[2].

Even though the COVID-19 outbreaks globally harm many sectors such as economy and education, this also allows gaining new skills, knowledge and fully utilizing current technology to overcome the crisis during the coronavirus outbreaks. For example, all institutions can continue their work and studies by adapting distance learning or distance meetings through video conferencing such as ZOOM, Google

Meet, Adobe Connect, and other applications that have similar functions [2]. Thus, for this reason, this allows augmented reality (AR) technology to take place in educational institutions for making learning more enjoyable and interactive, and to overcome the boredom and the feeling of loneliness during the lockdown and stay home measures, since there are no more extracurricular activities for the students during distance learning [2].

This paper proposed an AR image marker type by scanning the marker using mobile vision for learning purposes, to make online classes more enjoyable and interactive during virtual online learning.

2 RELATED WORKS

Students can easily have pleasant conversations, discussions, and face-to-face teaching styles in typical situations, without any restrictions. However, schools and universities need to be closed to prevent the spreading of the virus among students and teachers [2].

In addition, they enforced new teaching and learning styles through video conferencing. Residing at home too long has already had a massive impact on both sides such as stress and depression under different norms [2].

For the students to grasp what they learn, the learning environment needs to be changed accordingly in the current situation. Therefore, considering an AR application during the online classroom help teachers to teach the subject in a more interactive, fun, an less stressful manner, and teach specific subjects like science, especially where having lab experiments does not exist during online sessions [3].

AR is a combination between two things that are actual environment and imaginary environment, generated from computer software like Unity, by pasting the virtual object

onto the actual one by sensor input or GPS data [4]. Some studies already explored AR potential in different fields and disciplines for education purposes like mathematics and geometry [5], architecture and arts [6], and medical education [7]. Some researchers believe that implementing AR applications in education helps students and teachers to collaborate and encourages students to adapt to an active learning process during distance learning [8]-[9].

This paper presented the potential of AR technology within education by using an AR marker type which is able to be scanned using a mobile vision device for making learning more interactive and less stressful during online learning.

3 METHODOLOGY

3.1 The Overview of AR Technology and Proposed Method

AR is dividing into two main types, namely, marker type and marker-less type, as described in [10]-[11]. In this work, the AR marker type was selected without worrying about updating and having limitation issues with sure sensor accuracy and localization technology such Global Positioning System (GPS) for navigating the position of the actual scene and the virtual scene [12]. AR marker type is a 2-dimensional (2-D) image with high contrast visualization that is easily generated in the real world by holding up a printed image in front of the camera device for viewing 3-D models or objects on the marker virtually [12]-[14].

Fig. 1 (a) shows the general workflow of AR image marker type, and Fig. 1 (b) shows the workflow of the AR application for the research purpose.

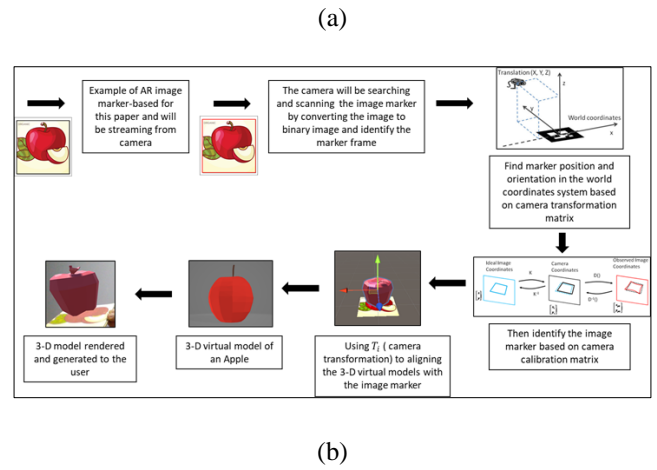
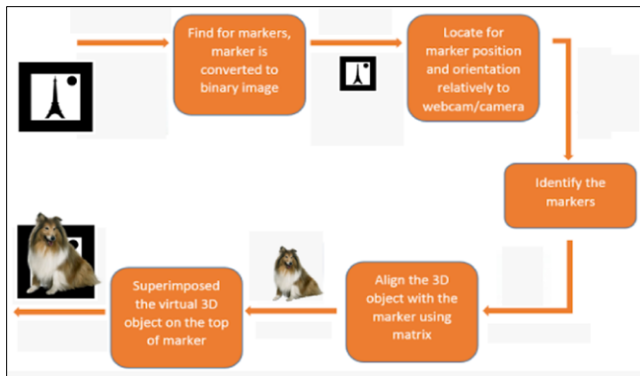


Figure 1: (a) The working principle of AR image marker, (b) The workflow for developing AR image marker in this work.

3.2 Software and Hardware

The software needed for creating the AR application are Unity, Vuforia or Wikitude, Android Studio, and Affinity Designer, as shown in Fig.2. Unity is a platform used to create a 3D environment and 3D model virtually. It is able to integrate with another 3D creation platform such as Polygon from Google [15]. "Vuforia" and "Wikitude" are SDK tools that use computer vision technology for tracking significant images to develop AR technology through mobile vision. Moreover, images must have high contrast and more than 3-stars are considered a perfect marker for building AR applications [16]. Android Studio is a platform for downloading Android SDK and enabling mobile devices to use AR technology for tracking the image marker [17]. Affinity Designer is a graphical tool for editing and resizing the preference images, then saving the file in JPEG format, since the image needs to be printout about 10 by 10 centimeters (cm) or any small size, as long as the mobile vision is able to detect the entire marker [18]. The Polygon website is a free 3D model platform from Google which integrates with Unity [19]. However, the server will be shut down forever on June 30, 2021 [19].



Figure 2: The software for developing AR application and websites for designing the image marker.

The hardware needed for realizing the virtual scene from the actual scene is a mobile devices such as a smartphones or laptops with a built-in camera, as shown in Fig. 3.



Figure 3: Mobile devices for realizing 3D model virtually.

4 RESULTS AND DISCUSSIONS

Fig. 4 shows an edited and high contrast image marker for tracking using mobile vision. In addition, most of the image markers used in this research contain 3-stars for efficient performance.



Figure 4: The AR image marker (apple image) with 3-Stars and high contrast image for smooth tracking.

Challenges encountered during tracks are when the position of the 3D model is not perpendicular with the image marker, due to incorrect settings of scale and layout from the laptop when testing out the AR application. Supposedly, the display system's size and layout should be 100%, as shown in Fig. 5 (a). The apple position issue was solved, and the 3D

model works fine and is perpendicular with the image marker, as shown in Fig. 5 (b).

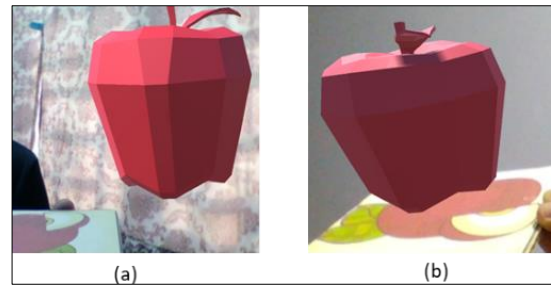


Figure 5: (a) The apple position before changing the scale and layout. (b) The apple position after changing the scale and layout to 100%.

The AR application is well implemented and works fine during online classroom sessions through Google Meet, as shown in Fig.6.

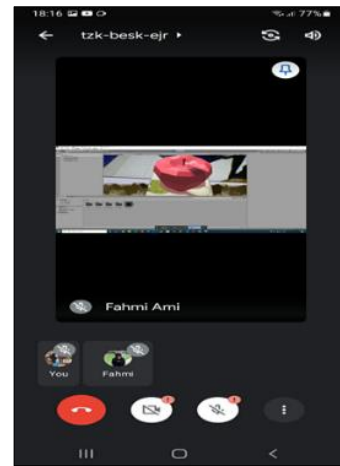


Figure 6: The showcase of AR Image Tracker application during online classroom using Google Meet.

Besides that, AR image marker also works properly with a smartphone for mobile learning and is able to track the marker offline, as shown in Fig. 7.



Figure 7: The showcase of AR image tracker application offline from android smartphone.

In addition, the image marker can be downloaded from the Freepik website [20] and can be download in 3D format from the Google Poly platform [21].

5 CONCLUSION

As COVID-19 cases increase every day, the government has immediately taken action to slow down the virus spread by enforcing lockdown and stay-at-home measures. Besides that, schools and colleges have enforced new learning styles using video conferencing like Google Meet. Therefore, educators need to create class environments that are more interactive and responsive using AR technology for teaching students during online sessions. Due to many distractions during stay-at-home measures and less curricular or social activities, students are not showing interest during online classes. Thus, an advanced technology has been proposed with the intention to increase their interest and attention in lessons using AR image trackers. Mobile vision tracks images for visualizing 3D models from mobile devices in actual scenarios. The AR image marker tracker using mobile vision has been tested during distant learning using Google Meet. Besides that, the students were able to track the AR image marker offline using their own mobile devices. Future research into AR should develop other animation models for other fields such as engineering, chemistry and biology using AR mark-less type.

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