DESIGN AND DEVELOPMENT OF ELECTRONICS ENGINEERING LEARNING-APPS BASED ON AUGMENTED REALITY

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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DESIGN AND DEVELOPMENT OF ELECTRONICS ENGINEERING LEARNING-APPS BASED ON AUGMENTED REALITY

LEE MAN BING

This report is submitted in partial fulfilment of the requirements for the degree of Bachelor of Electronic Engineering with Honours

Faculty of Electronic and Computer Engineering
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DEDICATION

This thesis is dedicated to my beloved family, my supervisor who guide and support me, friend who mentally and morally support me.

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ABSTRACT

Augmented Reality is technology that overlapping the view of real world by computer-generated multimedia contents. Mobile Augmented Reality (MAR) is the application of Augmented Reality that is carried out and performed inside smart phone. The first problem statement is that the technology of Augmented Reality is difficult to be used as mobile device but mostly used in device such as Hololens and Oculus Rift. Thus, in this project, app is developed inside the smart phone so that it can become suitable media for the field of education in electronics engineering. The second problem is that it is difficult for us to interact with the rendered contents generated by the technology of Augmented Reality in smart phone. Thus, this project will find the ways so that smart phone user can interact with the rendered contents or virtual objects generated in Augmented Reality App. In this project, design and development of Electronics Engineering Learning-App is presented by using smart phone camera and Vuforia SDK. Unity 3D and Vuforia SDK allow tracking of marker and hence it can be used as a platform for developing the Augmented Reality App for smart phone. Therefore, the technology of Augmented Reality can be used in learning the electronic components such as microcontroller and electric circuit.

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ABSTRAK

AR adalah teknologi yang dapat bertindih pandangan dunia nyata dengan kandungan multimedia yang dihasilkan oleh komputer. AR mudah alih (MAR) adalah aplikasi yang digunakan di dalam telefon pintar. Masalah yang dihadapi ialah kesukaran AR digunakan dalam telefon pintar dan kebanyakannya digunakan dalam Hololens dan Oculus Rift. Oleh itu, App dihasilkan di dalam telefon pintar supaya dapat digunakan dalam bidang kejuruteraan elektrik dan bidang pendidikan. Masalah yang seterusnya ialah kesukaran untuk berinteraksi dengan kandungan multimedia yang dihasilkan oleh teknologi AR di dalam telefon pintar. Oleh itu, projek ini akan mendapatkan cara agar telefon pintar yang berteknologi AR membolehkan penggunanya berinteraksi dengan kandungan multimedia yang dihasilkan. Dalam projek ini, penciptaan Elektronik kejuruteraan pembelajaran-App secara AR, dibentangkan dengan menggunakan kamera telefon pintar dan Vuforia SDK. Unity 3D merupakan platform yang digunakan untuk membangunkan aplikasi AR untuk telefon pintar apabila digunakan dengan Vuforia SDK. Cara ini membolehkan teknologi AR digunakan dalam proses pembelajaran komponen elektronik dan litar elektrik di dalam bidang kejuruteraan elektronik

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LIST OF SYMBOLS AND ABBREVIATIONS

AR	:	Augmented Reality.
VR	:	Virtual Reality.
E2LP	:	Embedded Engineering Learning Platform
SDK	:	Software development kit.
MAR	:	Mobile AR.
HMD	:	Head-mounted Device.
apk	:	Application Package Kit, file used in Android platform for installation in smart phone.
Marker	:	Non-moving object or image that is tracked and camera.
Rendered contents	:	Multimedia contents which either include graphic, text, image, video, and sound.
Markerless AR	:	AR that do not need marker.
Interaction	:	Any changes made on the generated multimedia rendered contents.

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CHAPTER 1

INTRODUCTION

1.1 Background

AR is a live direct or indirect view of a physical, real-world environment in which they are "augmented" by computer-generated contents such as sound, video, and graphics. This means that AR is a kind of technology in which it modify, change, and render the contents capture by camera from any devices. In this project, design and development of AR Electronics Engineering Learning-App is presented with image processing technology by using smart phone camera and Vuforia SDK. SDK or software development kit is a computer generic program that can enhance the facility and function of certain software in computer or application inside smart phone. It allow the user to check for the presence of the object, then localize it, and soon after that make the identification and verification on that object. In other words, the Vuforia SDK will simply causes the camera of smart phone can have a function

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of AR. The smartphone camera preprocess the image tracked by reduce enhance its brightness and contrast. Vuforia carries out geometric calibration to correct the color calibration in order to ensure an accurate reproduction of colors, and giving response to the image tracked after carries out both the calibration. Before the application is generated into the smart phone, Vuforia SDK must be used by Unity 3D software to modify the function of Unity 3D. Unity 3D is a software that can produce games, but with the using of Vuforia SDK, it can be used as a platform for developing the AR App for smart phone. Thus, Unity3D will act as a platform for Vuforia SDK to work and functioned. The new approaches of image processing technology which involved both the camera and the software are able to detect, track, process, and react with the image by rendering the contents on the target detected. This allows the technology of AR to be used in electronics engineering of learning the electronic components such as microcontroller and electric circuit.

1.2 Problem Statement

The first problem is that the technology of AR is difficult to be used as mobile device but mostly used in device other than smart phone. In this case, before smart phone is introduced as an AR device, this kind of technology mostly used in others advance device such as Oculus Rift and Hololens. Both of these device use advance technology which can provide advance AR experience. In this project, App is developed for smart phone so that it becomes AR device for the field of education in electronics engineering. The second problem is that it is difficult for us to interact with the rendered contents generated by the technology of AR in smart phone. This is the main problem encountered by the technology of AR used in smart phone. Unlike Oculus Rift and Hololens, both of these device user are able to interact with

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the virtual object due to the device are having the support from others sensor such as leap motion sensor. Since leap motion sensor cannot support the smart phone as an AR device, this project will find the ways so that smart phone as AR device at the same time the user can interact with the rendered contents or virtual objects.

1.3 Objective

The main objective of this project is to introduce an AR application into the smart phone as AR device. The following objectives will be achieved throughout the implementation of the system.

a) To develop App for smart phone so that it can track object and image by using smart phone's camera.

b) To implement the algorithms of Unity3D in interacting with virtual multimedia contents in AR application.

c) To design and test mobile AR application in terms of tracking time and distance by using smart phone.

1.4 Scope of project

The scope of work of this project will be concentrated on the designing an algorithm to allow the technology of maker-based AR in smart phone to be used in the studying of electronic microcontroller and circuit in electronic engineering. This project is more concentrated on creating of AR App by using Vuforia SDK and

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Unity3D software. The image processed by Vuforia SDK will result in the generation of rendered contents from the Unity3D software. Besides that, this project is concentrated on building the algorithm by using Unity3D software to interact with the contents of multimedia generated in the AR application. Finally, this project is concentrated on the creation of AR application but not VR which is used and installed by smartphone with Android as its platform.

1.5 Project Significance

Firstly, this project allows the use of smart phone as the mobile AR device instead of others AR device. With the acquired technology, the smart phone has become an important AR device with the development of App into the smart phone in android platform. At the same time, with the advanced technology on the camera of smart phone, it allows the smart phone to take the picture and photo with high quality and resolution. This means that it can track and detect the object effectively AR application.

Secondly, this project improves the process of learning and studying in the field of electronic engineering. With the additional information as rendered contents generated on the scanning on an microcontroller and electric circuit, it allow the user to enjoy the process of learning the electric circuit and at the same time increase their own productivity of learning. Besides that, the generated rendered contents in real time allow the user to learn and study the circuit and microcontroller without searching and referencing the information from other source. Thus, the information will automatically come out and appears after a marker being scanned by AR device.

Furthermore, the significance of this project is that developed algorithm allow the technology of AR in smart phone to be used and applied in the others field. Due to

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the fact that technology of AR is an important part of Industry Revolution 4.0, it is being used in others field such as in medical, marketing, business, and in engineering field. Thus, it is important that the technology of AR can be used in mobile way so that everybody can apply this kind of technology to every mobile phone. Therefore, in the future, the usage of AR technology will be spread around the world in which it is being well-known by all people.

1.6 Thesis Organization

The first chapter of this thesis is about the background of the AR technology and some basic introduction about Vuforia as a software development kit for the developing of smart phone as an AR device. The second chapter of this thesis explains about the source and reference to be used in this project. The third chapter of this thesis is the methodology which provides the procedures and steps to be followed in this project. The fourth chapter outlines the result and its discussion to verify whether the objectives of this project are achieved or not. The fifth chapter of this thesis concludes about the whole project and makes some recommendations on the improvement of this project. Finally, the last part of this thesis will show the program codes used in this project.

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