DESIGN AND DEVELOPMENT OF HAND TRACKING AUGMENTED REALITY APPLICATION FOR SMARTPHONE.

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DESIGN AND DEVELOPMENT OF HAND TRACKING AUGMENTED REALITY APPLICATION FOR SMARTPHONE.

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

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I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Bachelor of Electronic Engineering with Honours.

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DEDICATION

This project is dedicated to my supervisor, Dr NurulFajar Bin Abd. Manap, who gave me an opportunity to have this title of project and provided a lot of suggestion to complete my project. This thesis is also dedicated to my parent who gave me supports to study at University Teknikal Malaysia Melaka (UTeM). Last but not least, this project is dedicated to my friends and also my inspiration mentor, Matthew Hallberg, who made tutorial about Augmented Reality. They gave me a lot of inspiration on my idea to conduct this project.

ABSTRACT

In this project, an augmented reality application is developed with hand tracking technology for smartphone. It allows users to track their hand with smartphone and interact with the virtual object in augmented reality system. Augmented reality is the current trends emerging technology which integrates computer generated virtual objects into real world. During Industrial Revolution 4.0, augmented reality will provide a great bright future to human life with real-time information and improve the efficiency of working procedure. The objectives of this project are to design and develop an algorithm to get the hand detection information from Leap Motion sensor for data transmission to smartphone, to integrate hand motion tracked by Leap Motion sensor and augmented reality (AR) system, and to implement the hand tracking augmented reality (AR) application in smartphone. The overall method to conduct this project is design the algorithm to transfer hand motion data from Leap Motion to smartphone and then integrate hand tracking technique and augmented reality system into smartphone.

ABSTRAK

Dalam Kajian ini, satu aplikasi realiti tambahan telah dicipta dengan teknologi pelacakan tangan untuk telefon bimbit. Aplikasi ini membolehkan pengguna melakukan pelacakan tangan dengan penggunan telefon bimbit dan juga berinteraksi dengan objek virtual dalam sistem realiti tambahan. Realiti tambahan merupakan satu teknologi tren pada masa kini yang mewujudkan objek virtual dalam dunia nyata. Dalam Industri Revolusi 4.0, realiti tambahan telah membawa masa depan yang cerah dalam hidup manusia dengan informasi masa nyata dan juga memperbaiki efisiensi dalam proses. Objektif dalam kajian ini ialah mencipta satu algoritma untuk mendapatkan data dari Leap Motion sensor dan mengirim ke telefon bimbit. Selain itu, objektif kedua ialah mengintegrasikan gerakan tangan yang dijejaki oleh Leap Motion sensor dengan sistem realiti tambahan. Objektif yang terakhir ialah mencipta satu aplikasi yang mengandungi teknologi penjejakan tangan dan sistem realiti tambahan untuk telefon bimbit. Kaedah keseluruhannya dalam kajian in ialah mencipta satu algoritma untuk mengirim data penjejakan tangan dari Leap Motion sensor ke telefon bimbit dan mengabungkan teknologi penjejakan tangan dengan sistem realiti tambahan dalam telefon bimbit.

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LIST OF SYMBOLS AND ABBREVIATIONS

AR	:	Augmented Reality
VR	:	Virtual Reality
HMD	:	Head-Mounted Display
KARMA	:	Knowledge-based Augmented Reality for Maintenance Assistance
LCD	:	Liquid-Crystal Display
GPS	:	Global Positioning System
SDK	:	Software Development Kit
PDA	:	Personal Digital Assistant
IDE	:	Integrated Development Environment
UDP	:	User Datagram Protocol
IP	:	Internet Protocol
GUI		Graphic User Interface

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CHAPTER 1

INTRODUCTION

1.1 Background

In Industry 4.0, augmented reality is playing an important role as the future technology. It enables people to see and learn the information in a new view or in a new perspective. Augmented reality is a technology for users to experience that the supplement of computer-generated virtual information into the real world. In general, this technology "bring" the virtual object that generated by computer into the real world. Although augmented reality has been very famous in the past year, it still in very early stage of development and the existing devices are very expensive to be owned one for development. For example, Microsoft Hololens is one of the augmented reality device, but it was built by a large number of engineers with advanced technologies. Therefore, the cost of the device is much higher to be

purchased. In order to experience the augmented reality in a cheaper way, this project will focus on using smartphone to establish an augmented reality environment. Additionally, the integration of smartphone and Leap Motion device can improve the experiences of users and allow users to interact with virtual objects in augmented reality environment. Leap motion is a device that recognizes hand gesture and sends the detection information to the computer. For instance, Leap Motion detects the hand that performs grabbing action when the users are trying to grab the virtual object.

1.2 Problem Statement

In general, the adoption of augmented reality is needed due to there are some limitations of the virtual reality. Consequently, augmented reality is playing important role as one of the technologies in Industry 4.0. For example, with the implementation of augmented reality in industry and manufacturing, technicians and engineers can receive real-time virtual information that appears in real world and interact with virtual information on the same time. This technology will bring a huge improvement on the working efficiency and also reduce the critical issues such as human errors, low productivity and safety. In augmented reality environment, the virtual object or virtual information can exist in the real world unlike the virtual reality that only allows the appearance of virtual object in computer-generated virtual environment. Since the development of Leap Motion, it allows users to interact with computer-generated virtual object in virtual reality environment. However, the development of Leap Motion is for the purpose that mainly use in virtual reality and not fully implemented in augmented reality. In addition, the

connectivity of the Leap Motion is designed to be only connected to computer via a USB cable. Thus, the integration of augmented reality and Leap Motion on smartphone is limited.

1.3 Objectives

The aim of this project is to build a hand tracking augmented reality smartphone application by using smartphone, computer and Leap motion. The following objectives are needed to be achieved throughout this project.

a) To design and develop the algorithm to get the hand detection information based on hand motion detected and tracked by Leap Motion for transmission of the data to smartphone.
b) To integrate hand motion tracked by Leap Motion and augmented reality system.
c) To develop and implement the hand tracking augmented reality application in smartphone.

1.4 Scope of project

In this project, the devices that needed in implementation of augmented reality system are mainly concerned on using smartphone, Leap Motion and laptop. The scope of this project is focus on the algorithm design of hand motion detecting and tracking by using Leap Motion in augmented reality system. This project is concentrated on the real-time hand tracking with interaction of the software used and