THE DEVELOPMENT OF VIRTUAL ELECTROLYSIS EXPERIMENT BY USING AUGMENTED REALITY

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BORANG PENGESAHAN STATUS LAPORAN

JUDUL: THE DEVELOPMENT OF VIRTUAL ELECTROLYSIS EXPERIMENT BY USING AUGMENTED REALITY

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This report is submitted in partial fulfillment of the requirements for the Bachelor of Computer Science (Media Interactive) with Honours.

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

DECLARATION

I hereby declare that this project report entitled

THE DEVELOPMENT OF VIRTUAL ELECTROLYSIS EXPERIMENT BY USING AUGMENTED REALITY

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SUPERVISOR : _____ Date : 12/9/2021
(TS.NORAZLIN BINTI MOHAMMED)

DEDICATION

To my beloved parents, supervisor and friends who always give the support during the development of project

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First and foremost, I would like to thank my supervisor, Madam Norazlin Binti Mohammed for giving me the guidance and encouragement in the process development of Augmented Reality application.

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Finally, I also like to thank to my friends who helped me in solving the problems when I face the problem of development of Augmented Reality.

ABSTRACT

ARCHEM is a marker-less based Augmented Reality application about the development of virtual electrolysis experiment by using augmented reality. It allows the user to view the 3D apparatus and the 3D animation of procedures that related to the electrolysis experiments. This project aims to study marker-less based AR application and requirements in implementing the electrolysis experiment, develop a marker-less based augmented reality application in learning the electrolysis experiment procedure and evaluate the user acceptance of augmented reality in learning electrolysis experiment compared to studying on textbook. This project will giving the knowledge about the rules of laboratory, the apparatus used, the procedure steps and the result from the experiment of electrolysis. The apparatus and the procedure steps explained is using the 3D models. Therefore, the user can able to rotate and scale the 3D model by their fingers. They can use interact the application by using the button provided. This project will bring the benefit to Form 5 students who will learn the electrolysis experiment but the school does not provide the opportunities to conduct this experiment. The mobile application ARCHEM will be the final product of project.

ABSTRAK

ARCHEM merupakan satu aplikasi yang mempunyai AR marker-less berkaitan pembangunan eksperimen elektrolisis maya dengan menggunakan augmented reality. Aplikasi ini membenarkan pengguna untuk melihat 3D radas and 3D langkah prosedur yang berkaitan dengan eksperimen elektrolisis. Projek tersebut bertujuan untuk mengkaji keperluan AR marker-less dalam pembangunan eksperimen elektrolisis, mengembangkan aplikasi augmented reality marker-less dalam mempelajari prosedur eksperimen elektrolisis dan menilai UAT bagi augmented reality dalam pembelajaran eksperimen elektrolisis berbanding dengan belajar dalam buku teks. Projek ini akan memberi ilmu pengetahuan tentang peraturan makmal, alat yang digunakan, langkah prosedur dan kesimpulan dari eksperimen eletrolisis. Radas dan langkah prosedur akan diterangkan dengan menggunakan model 3D. Oleh itu, pengguna dapat memutar dan menskala model 3D dengan menggunakan jari mereka. Pengguna juga boleh menggunakan butang untuk berinteraksi dengan aplikasi. Projek ini memberi kebaikan kepada pelajar Tingkatan 5 yang akan mempelajari eksperimen elektrolisis tetapi sekolah tidak memberi peluang untuk menjalankan eksperimen tersebut. Aplikasi telefon ARCHEM merupakan produk akhir untuk projek tersebut.

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LIST OF ABBREVIATIONS

FYP	**-**	**Final Year Project**
FTMK		**Fakulti Teknologi Maklumat dan Komunikasi**
UTeM		**Universiti Teknikal Malaysia Melaka**
PSM		**Projek Sarjana Muda**
AR		**Augmented Reality**
MCO		**Movement Control Order**
3D		**Three Dimensional**

LIST OF ATTACHMENTS

CHAPTER 1: INTRODUCTION

1.1 Introduction

Chemistry is the study of the composition of substances, basic form of matter, interaction between matter and the chemical reactions between substances. Chemistry can explain to the people about the innumerable phenomena in the world. For example, the scientists can use the chemistry knowledge to explain the concept about the rusting of iron. Chemicals can occur naturally everywhere, but also some are man made. In the study of chemistry, the most important area is the understanding of elements and what determines how they react. Dmitri Mendeleev was a Russian chemist who developed the first Periodic Table of the Elements in 1834. He listed the 63 known elements in ascending order of atomic mass. When he arranged the elements, he can also group the elements with the similar chemical properties. Thus, the periodic table can be used to explain the relationships between the different element.

For chemistry, there are many different types of experiments that will be carried out in order to understand a part of chemistry knowledge. An experiment is a procedure designed to test whether the hypothesis is true or not. The experiment also is the foundation of the scientific method that help the people to explore the world around them. The experiment mostly conducted in the school laboratory or private laboratory. In order to carry out an experiment, the people needs to remember the rules of laboratory to avoid the accident that easily caused in laboratory. There are five components of a well-designed scientific experiment which are observations, questions, hypothesis, methods and the results. The experimenters need to observe the changes in experiment. The question is the aspect being tested to understand what

the experiment is trying to answer. Every experiments has the different hypothesis to predict the outcome. Methods is the procedures of the experiment that list all the materials and apparatus used in the experiment in specific detail along with the exact procedures. Then, the experimenter must record the result of the experiment to make a conclusion to decide whether the hypothesis is accepted or rejected.

Nowadays, the augmented reality (AR) is one of the biggest technology trends right now. The use of augmented reality in education is being popularity in schools worldwide. Augmented reality can improve the learning outcomes through interactivity compared to the traditional teaching methods. As a result, EON-XR provides a hands on virtual lab for chemistry students that applied in the safe space for experiments which are AR and VR. They can just experience the experiments by using their smart phones or computers. Therefore, this project is to develop a marker-less based augmented reality application in learning the electrolysis experiment procedure.

1.2 Problem Statement

For the science students, there are many types of experiment that they need to conduct in the school laboratory, but some of the school face the problems about the lack of the material or apparatus needed. Thus, the science students from these schools do not have the chance to conduct some experiments. Although they have the procedure of the experiment, but they will be more harder to understand the outcome of that experiments. The experiment in the laboratory is important for them to understand and improve their learning on the concept of certain chapter.

The second problem is the factor of covid-19 pandemic. In 18 March 2020, Malaysia had implemented Movement Control Order(MCO). During this MCO, the students are not allowed to study in school. They are forced to study on online meeting with their teachers. In case, the science students need to conduct an experiment to understand a certain concept of science, especially for chemistry. Therefore, the use of augmented reality on conducting an experiment will give them benefits because they can learn how to carry out an experiment and conclude the reaction of the chemical by using augmented reality at home. For example, AR Lab mobile app is a teaching tool and replacement of traditional class in laboratory.

1.3 Objective

This project embarks on the following objectives:

1. To study marker-less based AR application and requirement in implementing the electrolysis experiment.

2. To develop a marker-less based augmented reality application in learning the electrolysis experiment procedure.

3. To evaluate the user acceptance of augmented reality in learning electrolysis experiment compared to studying on textbook.

1.4 Scope

The target user of this project is focused on Form 5 science students and anyone who is interested in electrolysis experiment. Users can learn the rules of the laboratory to avoid the accidents that can easily occur when working in the lab. This project will also have the feature that the users can learn the different augmented reality apparatus and materials. Users also can view the experiment procedures about electrolysis according to the steps through augmented reality.

1.5 Project Significant

This project will be a marker-less based augmented reality application, which will help the user to understand the procedure of the experiment that related to the electrolysis. Users able to learn the rules of the laboratory. In addition, this project also help users to remember the name of each apparatus easily through augmented reality. As a result, this project will give the significance to user because they able to learn electrolysis through augmented reality and not only in textbook.

1.6 Conclusion

As a conclusion, this chapter describes the objectives of this project that will be carried out to achieve the goal. The next chapter will explain the literature review and methodology of this project.

CHAPTER 2: LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

This chapter will discuss about the literature review and project methodology. The literature review will describe the previous researches about the topic of learning chemistry experiment procedures by using AR or others technologies. Moreover, this chapter will also discuss about the methodology used to develop this project.

2.2 Domain

In domain, there are some elements will be discussed such as the augmented reality and the types of the augmented reality.

2.2.1 Augmented reality

Augmented reality is a technology that lets people to superimpose the digital content such as images, sounds or text over real-life scenes. In 2016, AR become more and more popular after the game Pokemon Go made it possible to interact with Pokemon through the smart phone. Augmented reality is not a fully immersive experience like virtual reality but augmented reality let the people still interact with the real world.

2.2.2 Type of augmented reality

There are 5 main types of augmented reality, which are marker-based augmented reality, marker-less augmented reality, location-based augmented reality, superimposition based augmented reality, and projection-based augmented reality.