

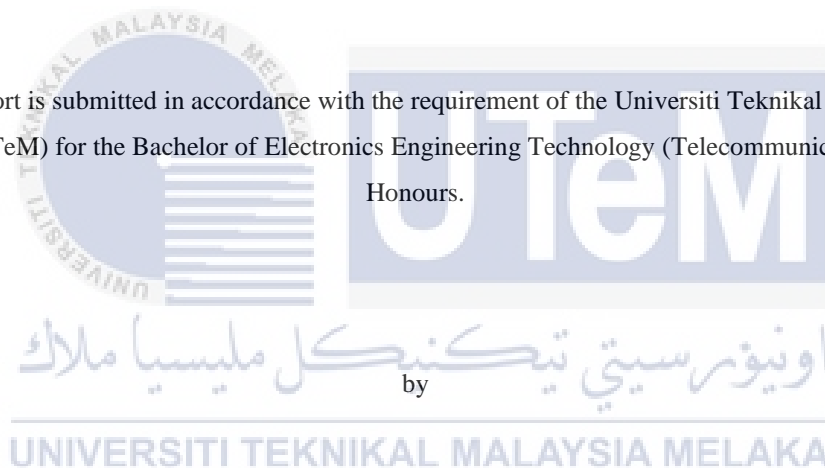


UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF ELECTRICAL ENGINEERING

LEARNING KIT FOR STEM APPLICATION

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronics Engineering Technology (Telecommunications) with Honours.



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2020

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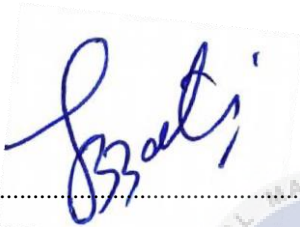
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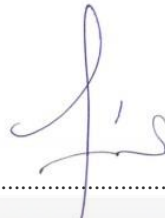
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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfillment of the requirements for the degree of Bachelor of Electronics Engineering Technology (Telecommunications) with Honors. The member of the supervisory committee is as follow:

Signature :

Supervisor : IR. DR. MOHD FARRIZ BIN HJ MD BASAR



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ABSTRACT

Throughout the year, the implementation of the traditional approach (lecture-based) in the teaching and learning process seems to be less effective in increasing the interest among students towards the STEM subjects. Conversely, the use of practical learning method emphasizes on the psychomotor domain so that readers gain a clearer and more effective understanding. Thus, the aim of this project is to develop ten mini projects that related to basic science and electrical engineering, to conduct experiments on ten mini electrical projects and to investigate the performance of each project based on the output results. These projects are developed using low-cost apparatus, a short period of time and easy-to-construct experiment. After that, all projects are discussed in detail form the short description, apparatus used, simple-to-follow procedures with real coloured images, the technical behind, the further investigation which improves the validity in the experiment and the summary of the project. From the findings result, the most influential parameters for each project are predicted to obtain a good performance of the projects. In conclusion, the impact of the implementation from this unique approach, students will increase their understanding towards the fundamental of science and electrical engineering using this learning kit.

ABSTRAK

Sepanjang tahun, pendekatan tradisional (berasaskan ceramah) terhadap proses pengajaran dan pembelajaran dilihat semakin kurang berkesan dalam meningkatkan minat pelajar terhadap mata pelajaran STEM. Sebaliknya, penggunaan kaedah pembelajaran praktikal menekankan pada domain psikomotor yang memberi pembaca pemahaman yang lebih jelas dan berkesan. Oleh itu, tujuan projek ini adalah untuk membina sepuluh projek mini yang berkaitan dengan sains asas dan kejuruteraan elektrik, untuk menjalankan eksperimen pada sepuluh projek mini elektrik dan untuk menyiasat prestasi setiap projek berdasarkan output eksperimen. Projek-projek dibangunkan dengan menggunakan alat yang berkos rendah, dibuat dalam jangka masa yang pendek, dan eksperimen yang mudah dibina. Selepas itu, semua projek dibincangkan secara terperinci dalam bentuk penerangan ringkas, alat yang digunakan, prosedur yang mudah diikuti dengan gambar kehidupan sebenar, teknik di belakangnya, penyelidikan lebih lanjut yang meningkatkan kesahan eksperimen dan ringkasan projek. Melalui hasil kajian, parameter yang paling berpengaruh untuk setiap projek dapat diramalkan untuk mencapai prestasi projek yang baik. Kesimpulannya, hasil daripada menerapkan pendekatan unik ini, pelajar dapat meningkatkan pemahaman mereka mengenai asas sains dan kejuruteraan elektrik menggunakan kit pembelajaran ini.

DEDICATION

This thesis is dedicated to my beloved parents, my family members, my supervisor, and my fellow friends who always support me through thick and thin throughout the process completing this report.



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In the name Allah, the Most Merciful and the Most Gracious. Alhamdulillah and thanks to Allah for giving me this opportunity to complete this project report. I would like to thanks to all my family members for always gives the continuous support and encouragement. On top of that, I would love to express my appreciation to my dedicated project supervisor, Ir Dr Farriz bin Hj Md Basar for his patience and guidance throughout my Bachelor Degree Project (BDP) journey. May Allah bless him and repay his kindness.



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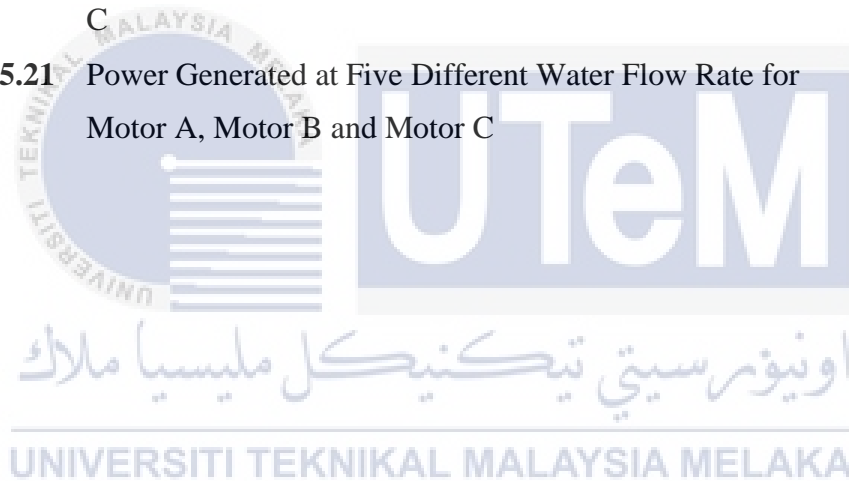


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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter presented the background of the project to get an overview of the project title. Then, the objective, scope of work, problem statement and the significant of the project also included in this chapter.

1.2 Background of Project






Learning kit is very crucial in the process of teaching and learning. It can assist the process of sharing knowledge among the students with respect to the subject taught. The use of learning kit increases the student's interest in learning the STEM subjects and assist them to learn electrical engineering through a misleading experience at the same time. The main purpose of learning kit development is to help student understand the subjects more easily and systemically (Che Ghani C. K., 2019).

The process of teaching and learning in Electrical Engineering topics consists of two parts which are theoretical and practical. In order to master the subject, students are encouraged to have strong basic knowledge about the related subjects. By doing that, students will be able to face more high-level studies in the electrical engineering field. However, the level of difficulties in the subjects sometimes makes them study only to pass the exam without truly understand the content in the studies.

In addition, knowledgeable students somehow rely on the effectiveness of how teachers use the appropriate learning kits towards their teaching process. Apart from that, the way of how the subject is delivered also affects the students. The failure of delivering the subject causes the students to assume the subject to be difficult to understand.

The project includes five topics covering the electricity, electrical applications, magnet, electrical motor and energy. The purposes of the topics are explained in Table 1.1.

Table 1.1: Purposes of the topics in Electrical Engineering Learning Kit.

<i>Topic</i>	<i>Purposes</i>
 Topic 1: Electricity	Provide the basic concept of electricity involving electron and charge, voltage and current, electrical conductor, electrical circuit, switching and battery.
 Topic 2: Electricity Application	Apply the applied physics concepts such as Newton's First Law of motion and Newton's Third Law of motion.
 Topic 3: Magnet	Investigate the effects of magnet's polarity and apply the electromagnet and magnetic field concept.
 Topic 4: Electric Motor	Explain the basic motor construction and the principle of motor and generator which is important in applying the concept of Fleming's Left-Hand rule.
 Topic 5: Energy	Focuses on generating the electricity via renewable energy system with further understanding of the system through the study of the energy conversion that occurs in the system.

Normally teachers used the teaching aids for easier teaching and learning in the classroom. Following this matter, the electrical engineering learning kit is developed as it is capable to affect the process of teaching and learning (Alias 2013). Alias (2013) also stated that the students are most likely to play and not pay attention when the teaching process is delivered by a teacher that is not from the electrical field.

Up to this day, it is quite difficult to find a teaching and learning apparatus for electrical engineering subjects and suitable for students in school. In this project, there are ten compilations of mini experiments complete with the theoretical explanations with the aid of diagrams for each experiment that is suitable for beginners in electrical engineering.

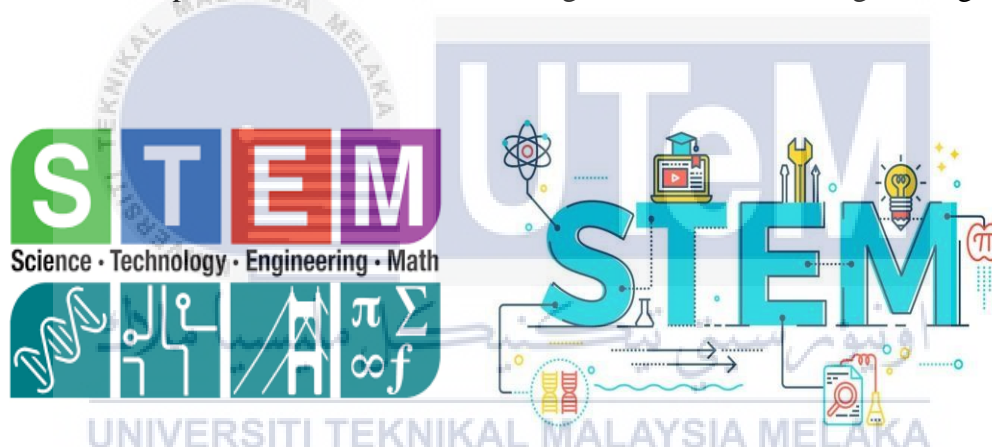


Figure 1.1: STEM's logo by Bebarrel (Ref.: <https://cutt.ly/kuVtulq>)

The implement of STEM subjects in this project is one of the main parts of the development of this project. STEM is a curriculum based on the idea of educating students in four specific disciplines – science, technology, engineering, and mathematics – in an interdisciplinary and applied approach. The STEM integrates the four disciplines into a cohesive learning paradigm based on real-world applications rather than teaching them as separate and discrete subjects. This learning kit is able to provide the STEM understanding especially students in primary school. Figure 1.1 below shows the STEM's logo.

The aim of this study is to develop the electrical engineering learning kit that is suitable for students from primary to secondary school. In fact, students and lecturers in higher education can implement the learning kit through the learning and teaching process whether for formal or informal learning. Apart from that, the parametric analysis is included in order to determine and evaluate the performance of different parameters towards the project's outcomes.

1.3 Problem Statement

STEM originally called Science, Mathematics, Engineering, and Technology (SMET) (David W. White, 2014) introduced by the National Science Foundation (NSF). This mainly created to provide all the students with high critical thinking skills which helps them to become creative problem solvers and gain good opportunities in the workforce. Figure 1.2 shows the shift of enrollment among students in school in 2015 to 2016.

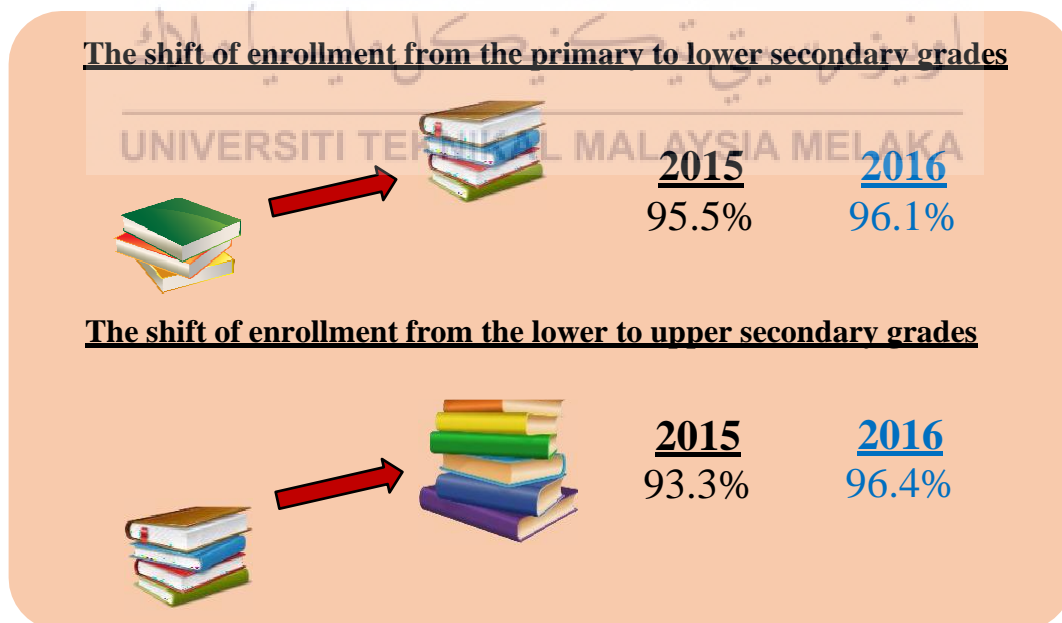


Figure 1.2: Shift of Enrollment in 2015 and 2016 (Ministry of Education, 2016)

A recent report from the Ministry of Education shows that students nowadays are less interested in STEM subjects. The ineffective teaching methods are one of the factors that leads to this situation. As a result, students most likely being misunderstood the content of the subject and drawing them away from choosing STEM as for their choice of study.

Referring to Figure 1.2 (Ministry of Education, 2016), the percentage of students pursuing their studies from primary to secondary school is increasing from year to year. Therefore, the big number of students that are not interested in STEM gives gigantic anxiety and causes a detrimental effect on the formation of youth capable of competing and leading science and technology Malaysia. In addition, there is a lack of learning medium that can assist students to learn the basics of science and engineering effectively.

According to N. Asyikin (2018), Malaysia has been predicted to be short of 236,000 engineers and technical personnel through the estimating steady declining rate of engineering students. Despite various efforts that have been done, it is still unconfirmed whether it helps to increase the interest in engineering.

To date, the scenario of engineering education in Malaysia is still not fully aware the implementation impact of the practical learning in teaching and learning process. In fact, some of the teachers still apply the traditional approach even in critical topics that are more appropriate by conducting an experiment in order to understand the theoretical concepts. Therefore, most of the students will not have a solid understanding regarding the subjects. As for this matter, an urgent solution is needed because the technology development demanding the new engineering model that include the fundamental of science and engineering, technical skill, professional practice, and soft skills to face challenges in the future (N. M. Nor, 2010).

According to above statement, it has influenced the main objective of this research; to develop ten mini experiments based on the basic science and electrical engineering. All these ten mini experiments are mostly used low cost and easy to find apparatus. Through this learning kit, readers will be more excited to practice the projects with the aid of the diagram and the attached video that can be accessed any time through QR code.

1.4 Objective

This study embarks on the following objectives:

- ❖ To develop ten mini projects related to basic science and electrical engineering.
- ❖ To conduct experiments on ten mini electrical projects.
- ❖ To investigate the performance of ten mini electrical projects based on the experimental results.

1.5 Scope of Project

The scope of this project is limited to the following items so that the project could be focused to achieve the stated objective. The scope of this project is listed below;

- ❖ The project focusing on five group of projects including electricity, electrical applications, magnet, electrical motor, and energy.
- ❖ The project development limited to ten mini electrical experiments with low cost and a short period of time.
- ❖ Conduct parametric analysis results based on the experimental result output of each experiment.