



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**LOGIC GATE SIMULATOR: DEVELOPMENT OF AN
ELECTRONIC EDUCATIONAL SIMULATOR TO PRODUCE
KARNAUGH MAP BY LOGIC GATE COMBINATIONAL
CIRCUIT USING ARDUINO**

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

by

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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 fulfilment of the requirements for the degree of Bachelor of Electronic Engineering Technology (Telecommunication) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Digital Elektronik adalah subjek yang penting bagi pelajar yang mengambil jurusan kejuruteraan elektronik. Subjek ini mempunyai jam kredit yang tinggi. Oleh itu, pelajar perlu memberi sepenuh perhatian ketika proses pengajaran dan pembelajaran. Permasalahannya adalah pelajar memerlukan sesuatu yang dapat menarik minat mereka di dalam kelas. Tujuan utama projek ini dijalankan adalah untuk mereka cipta alat bantuan pengajaran yang boleh memudahkan pelajar menyelesaikan soalan-soalan tugas mereka tentang gerbang logika dan menukar gabungan litar dalam bentuk Peta Karnaugh. Simulator gerbang logik adalah pembangunan simulator elektronik bagi kombinasi gerbang logik. *Arduino Mega 2560* digunakan sebagai mikropengawal kepada simulator gerbang logik. Di samping itu, projek ini merupakan projek terbaru yang pernah dihasilkan pada semester ini. Projek ini mempunyai kombinasi perkakasan dan perisian, fungsi projek ini apabila pengguna ingin membuat beberapa kombinasi gerbang logik, pengguna hanya perlu membuat sambungan gerbang logik pada kit dan jawapan akan ditayangkan pada paparan kristal cecair nipis-filem-transistor dalam bentuk Peta Karnaugh. Selain itu, projek ini perlu diisytiharkan dengan masyarakat dahulu sama ada ia berkesan kepada masyarakat atau tidak. Kaji selidik adalah alat penting untuk mengumpulkan data dari masyarakat. Borang kaji selidik ini akan diedarkan kepada pelajar dan tenaga pengajar bagi mendapatkan analisis untuk projek ini. Selepas menganalisis data, penambahbaikan projek ini akan dilaksanakan.

ABSTRACT

Digital Electronics is an important subject for majors electronic Engineering. This subject has a high credit hour. Therefore, students need to give full attention during the teaching and learning process. The problem is that students need something that can attracted them in the classroom. The main purpose of this project is to create a teaching aid tool that will enable students to complete their task questions about logic gate and change the mix of the logic gate circuit in the form of Karnaugh Map. Logic gate simulator is the development of an electronic simulator for a combination of logic gate. Arduino Mega 2560 is used as a microcontroller for logic gate simulator. In addition, this project is the latest project ever produced in this semester. This project has a combination of hardware and software, this project's function when users want to create combinations of logic gates, users only need to create logic gate connection on the kit and the answer will be aired on thin-film-transistor liquid crystal display (TFT LCD) in the form of Karnaugh Map. Additionally, this project needs to be declared with the community first whether it is effective for the community or not. A survey is an important tool for collecting data from the community. This survey form will be distributed to students and instructors for analysis for this project. After analyzing the data, the improvement of this project will be implemented.

DEDICATION

I am grateful to the ALLAH SWT for His grace. Within this report I, Siti Munirah Binti Che Bakar (B071510086) of UTeM Malacca was successfully completed the report of final year project during two semesters. “Especially for my beloved mother Mrs. Norizam Binti Sulong, my supportive father Mr.Che Bakar Bin Muda and to my family who had given me much support, encouragement and advice to complete this project. And do not forget to all dearest fellow friends and UTeM staffs for helping and cheering my day when I lose the direction on doing my project. Thank you so much, I love u all

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LIST OF ABBREVIATIONS

K-Map	Karnaugh Map
TFT	Thin Film Transistor
LCD	Liquid Crystal Display
I/O	Input/Output
IDE	Integrated Development Environment
IC	Integrated Circuit

CHAPTER 1

INTRODUCTION

1.1 Introduction

In this chapter, it aims on creating the framework and introduces the brief idea of the project. It focused on the background of study for this educational kit, the problem statement, the objectives, scope of work and project contribution.

1.2 Background of Study

Based on (Hudedmani, 2018) “teaching learning mechanism is presently transforming into new dimension by making use of latest state of art technologies to present in an easy and lucid manner to the learner”. Development of educational kit based on objective for every subject can help teacher and lecturer. When educational kit has more function, it can attract student to learn that subject. According to (S. S. T. Myo et al., 2014) “digital electronics is now used in all fields of electronics from computers to digital phones and most industrial machines and motor vehicles”. The educational kit in Digital Electronic subject still at in front stage where based on the literature review done only. Logic Gate Simulator related to this subject.

Logic Gate Simulator is an educational kit that help student understanding in Digital System subject but just focus in variety of logic gates. This educational kit will convert the connection that do in this educational kit to Karnaugh Map (K-Map). Student is required to do connection on educational kit. Once the connection completes the educational kit will display the K-Map on TFT LCD. It convenient to use anywhere but

this educational kit suitable to use in classroom and laboratory. This educational kit can be used for discussion assignments, for revision and also for tutorial session with lecturer.

1.3 Problem Statement

In Universiti Teknikal Malaysia Melaka (UTeM), digital system subject will focus to student electric and electronic engineering. For this subject student will learn in theoretically and practically. For theoretical student will learn in lecture and tutorial but for practical student will learn in lab session.

Lecture session will do in a hall with a large group of students. The projector will use to display the lecture note for digital system. Lecturer will explain that note to student by theoretically. Just a few students can stay focus in class like this, but another student will feel bored and sleepy. According (Papadimitriou, 2012), Electrical engineering teachers face great difficulty when they teach electronics course as traditional teaching methods which are no longer adapted to the demand of the professional life of the students due to the complexity of the new technologies.

After chapter finish covered in lecture session, lecturer will have prepared some question for student. All student needs to answer all questions and will discuss during tutorial session. Weakness of tutorial session is not all student will understand that chapter because majority lecturer only picks students randomly to solve the questions. Meanwhile, the rest of students not necessarily understanding it.

During the lab session, educational kit will provide to students in groups. It means each student needs to share the educational kit during experiment and it causes lack of skill from students because of the duration time of experiment not enough to

explore any devices like educational kit and do the experiment in the same time. Additionally, some students may not completely learn in the lab.

1.4 Objectives

The main objectives of this project are to make an improvement from the previous E-Logic kit by M. Z. Omar (2017) by showing the same concept but different output which for this Logic Gate Simulator, the output will display in Karnaugh Map form. In order to achieve the main objective, there are four sub-objectives to be achieve:

1. To design an electronic educational kit using Proteus for circuit layout, drawing 3D prototype using TinkerCAD and build educational kit using Arduino Mega 2560 as the controller which the program is written using Arduino IDE.
2. To build a low cost, portable and durable educational kit for student. A portable and compact educational kit with size, 25x35x13 box will ease student to handling it to everywhere. Estimated costs for this kit are about RM200.00.
3. To verify the functionality of the educational kit by performing a set of system testing which will be based on a checklist. This will be done by testing one by one of the connection port on the kit and see the results either it produces the expected output or not.
4. To validate the functionality of the educational kit, relate to the problem statement mentioned by performing survey consists of 10 questions to 50 respondents in FTKEE.

1.5 Scope of Work

In designing Logic Gate Simulator this project had limited certain criteria such as number of K-Map input and output. This LCD will display three input in K-Map and outputs in K-Map too. Three inputs will use in Logic Gate Simulator because this project only use TFT LCD. If four inputs K-Map use for this LCD it will produce very small K-Map and too hard for user to see the output. For logic gate IC, Logic Gate Simulator will used only five type of logic gates. Two inputs for AND, OR, XOR, three input AND gate and lastly is NOT gate. As known, logic gates have many types of gates but for this project it used only the basic logic gates that suitable for students who first time to take the subject.

In designing the educational kit, the main concern on creating a portable this kit is to increase inclusively and relevance as the kit is design for the beginner learner. This kit has been tested with a few testings to check durability of the kit using a few tests which are drop test for 0.5m and 1m, temperature test and aging test. The cost to develop the kit is about RM200 as it required a component that is easy to find, which is integrated circuit gate (IC gate), jumper wire, female header and Arduino. For the circuit construction on the box, a PCB circuit was design to apply at the top because to make student easy to use this educational kit. Power bank is a power source for this kit. This is because output voltage for power bank is 5V and it suitable to use at Arduino. Arduino IDE will use to program because Arduino Mega is a microcontroller for this educational kit. Arduino integrated development environment (IDE) will use to program because Arduino Mega is a microcontroller for this educational kit.

Survey forms has been distributed to 50 respondents by using Likert scale. According A.Joshi et.al (2015) the construction of Likert (or Likert type) scale is rooted

into the aim of the research. Sometimes the purpose of the research is to understand about the opinions/perceptions of participants related with single 'latent' variable (phenomenon of interest). This survey has been carried out by Google form with 10 questions related with this project.

1.6 Project Contribution

About 66% surveys strongly agree by prefer to learn this subject by using educational kit rather than theoretical way. The main motivation of this project is to develop an educational kit that quite interesting for student to use in anywhere either in class or not.

This project can be owned by user itself because this kit is designed to make a low-cost kit so that user can be owned and do practice as much as can. This educational kit also can attract student to learn logic gate by practically not only theoretical. About 60% surveys strongly agree that educational kit can help lecturer to teach easily to student about logic gates and about 54% strongly agree with educational kit are according to student's level.

In lab session, this kit will help users to prepare for their lab test or assignments which is equipment in the lab does not allowed to bring out. So, this kit might be helpful for users to bring anywhere for discussion group also for assignment since this kit is designed save user's time. About 56% strongly agree that educational kit save students and educator/teacher's time.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Many theories have been proposed to explain what the usage of educational kit in term of educational. Although the literature covers a wide variety of such theories, this review will focus on major themes which emerge repeatedly throughout the literature reviewed. Even though the literature represents the themes in a variety of contexts, this paper will primarily focus on their application. For this chapter, student will come out with the summarization of the journals that has been searching in many search engines like Scopus, google scholar and etc. The guide to writing this thesis are mainly from references book, research journal and online conference article. The keyword that used in searching the journal like logic “Edu-kit”, “trainer board” and “IC gate simulator”. This section shows the articles about Logic Gate and Educational kit that have been studies for knowledge in this project.

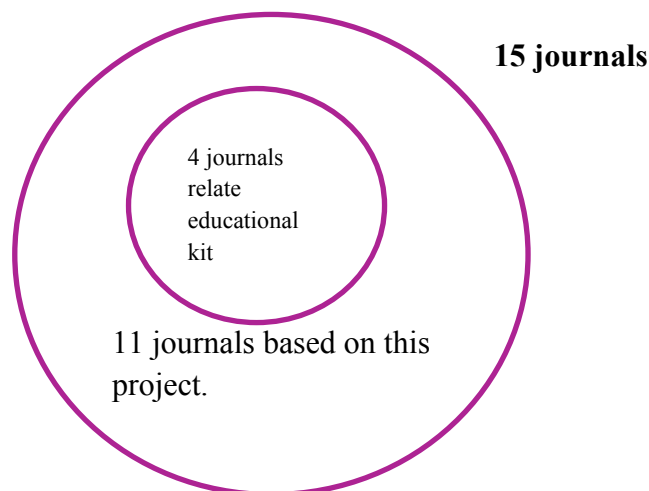


Figure 2.1: Related article and publication journal