



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF AN ELECTRONIC
EDUCATIONAL BOARD THAT TEST STUDENT
KNOWLEDGE ON LOGIC GATE DESIGN CONCEPT
USING ARDUINO**

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

by

AZATI HANANI BINTI MD LAZIM

B071610670

940626-14-5026

FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING

TECHNOLOGY

2019

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: Development Of An Electronic Educational Board That Test Student Knowledge
On Logic Gate Design Concept Using Arduino

Sesi Pengajian: 2019

Saya **Azati Hanani binti Md Lazim** mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (X)

SULIT*

Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972.

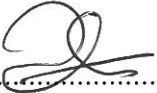
TERHAD*

Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan.

TIDAK
TERHAD

Yang benar,

Disahkan oleh penyelia:


.....

Azati Hanani binti Md Lazim


Alamat Tetap:

No.9, Jalan Semenyih Jaya 5,

Taman Semenyih Jaya,

43500, Semenyih, Selangor,

Tarikh:


.....

Amar Faiz bin Zainal Abidin

Cop Rasmi Penyelia


AMAR FAIZ BIN ZAINAL ABIDIN
Pensyarah
Jabatan Teknologi Kejuruteraan Elektronik & Komputer
Fakulti Teknologi Kejuruteraan Elektrik & Elektronik
Universiti Teknikal Malaysia Melaka (UTeM)

Tarikh:

*Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini

DECLARATION

I hereby, declared this report entitled Development Of An Electronic Educational Board That Test Student Knowledge On Logic Gate Design Concept Using Arduino is the results of my own research except as cited in references.

Signature: 

Author : Azati Hanani binti Md Lazim


Date: 13/1/2020

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 Telecommunication Engineering Technology with Honours. The member of the supervisory is as follow:

Signature: 

Supervisor: Amar Faiz bin Zainal Abidin

Signature: 

Co-supervisor: Izzat Zakwan bin Mohd Zabidi

ABSTRACT

Educational kit is introduced to facilitate learning sessions for students so that they can easily understand the Digital Subject. For those who just learn the concept of logic gate circuits, partial theoretical learning is quite challenging. Student needs to build a logic circuit on the questions of the kit and use the keypad to check the answer. This technique can make the subject of the Digital Electronic easier to learn and can attract students to learn. The objective of this project is to design an electronic educational kit for students to understand the subtopic of Logic Gate in digital electronic subject. Second objective is to build proof of compatible size concept and low cast for make students easier to bring this educational kit to the laboratory session. This project is low cost because it just used a power bank. Lastly, to verify the effectiveness of the educational kit during class and tutorial we did a survey form and will distribute it to students in UTeM which are course in BEEE, BEEI and BEET student.

ABSTRAK

Kit Pendidikan diperkenalkan untuk memudahkan sesi pembelajaran supaya pelajar dapat memahani Subjek Digital dengan mudah. Kepada pelajar yang baru hendak mula belajar tentang konsep Litar Logik, pembelajaran secara teori agak mencabar. Pelajar perlu membina litar logik berdasarkan soalan yang diberi dan untuk memeriksa jawapan pelajar perlu menekan papan kekunci. Kaedah ini menjadikan subjek Digital Elektronik lebih mudah untuk dipelajari dan dapat menarik perhatian pelajar untuk belajar. Objektif projek ini adalah untuk merekabentuk kit Pendidikan elektronik supaya pelajar memahami subtopik litar logic di dalam subjek Digital Elektronik. Objectif kedua adalah untuk membuktikan konsep saiz yang sesuai dan kos perbelajaan yang rendah untuk memudahkan pelajar membawa kit Pendidikan ini ke sesi makmal. Projek ini kos perbelajaan rendah kerana ianya menggunakan bank kuasa. Akhir sekali, untuk mengesahkan keberkesanan kit Pendidikan semasa kelas dan tutorial kami membuat satu boring kaji selidik dan akan mengagihkannya kepada pelajar di UTeM yang mengambil jurusan BEEE, BEEI and BEET.

DEDICATION

This report is dedicated to my beloved parents who educated and always supported me throughout the process of doing this project. I am also wanted to say thank you to my supervisor, co-supervisor and my friends who have encouraged, guided and inspired me to complete this project.

ACKNOWLEDGEMENTS

Syukur and Alhamdulillah to Allah S.W.T because giving me this opportunity to complete my Projek Sarjana Muda (PSM). This report is thankfulness to Universiti Teknikal Malaysia Melaka (UTeM) for giving me this chance to study on Bachelors of Electronics Engineering Technology (Telecommunication) with Honours in Faculty of Electrical Electronic Engineering Technology (FTKEE). I would like to thank you, my Superviso and my Co-Supervisor, En. Amar Faiz bin Zainal Abidin and Encik Izzat Zakwan bin Mohhd Zabidi for the guidance, advice, encouragement and inspriration given in the development of my final year project and while writing this report entitled as a Development of An Electronic Educational Board that Test Student Knowledge on Logic Gate Design Concept using Arduino. My thankfulness goes to my beloved family and my friends that always give courage and support me to achieve the goal of my research. Thanks to their moral support and care they had given to me up until this project are done. Finally, I would also to say thank you to who have been a involved directly or indirectly in helping me complete this project.

TABLE OF CONTENTS

	PAGE
ABSTRACT	vi
ABSTRAK	vii
DEDICATION	viii
ACKNOWLEDGEMENTS	ix
TABLE OF CONTENTS	x
LIST OF TABLES	xivv
LIST OF FIGURES	xv
LIST OF APPENDICES	xixix
LIST OF SYMBOLS	xxx
LIST OF ABBREVIATIONS	xxi
CHAPTER 1 INTRODUCTION	1
1.1 Introduction	1
1.2 Background	1
1.3 Problem Statement	1
1.4 Objectives	3
1.5 Scope of work	4
CHAPTER 2 LITERATURE REVIEW	6

2.1	Introduction	6
2.2	The defination of Education and Technology	6
2.3	Past Related Research	7
2.3.1	The Design of a Portable Programmable Logic Control Training System for use outside of the Automation Laboratory	7
2.3.2	E-TESTER: The Development of an Electronic Board that check commonly used Arduino Based Electronic Components and Modules	8
2.3.3	PLC Kit for Industrial Automation and Control Education	10
2.3.4	Smart Board Quiz with Logic Gate	11
2.3.5	Development of an Educational Quiz kit that Test Student Knowledge On Control System's Second Order Transient response by using DC Motor Speed control as Application (Transient Response Quiz Board	12
2.3.6	E-PLC: The Development of a Programmable Logic Controller that Translate Mnemonic Codes to Hardware Simulation	14
2.3.7	Heat Transfer Lab Kit using Temperature Sensor based Arduino for Educational Purpose	15
2.3.8	Educational Kit for Practicing Electronic Circuit Design	16
2.3.9	Modelling of a Ladder Logic Processor for High Performance Programmable Logic Controller	18
2.3.10	An Electronic Educational Quiz Board that Test Student knowledge on series and parallel resistor connection	19
CHAPTER 3	METHODOLOGY	20

3.1	Introduction	20
3.2	Project Planning	20
3.3	Hardware Development	26
3.3.1	Block Diagram	26
3.3.2	Logic Gate	27
3.3.3	Arduino Mega 2560	29
3.3.4	Thin-Film-Transistor-Liquid-Crystal Display (TFT LCD)	30
3.4	Software Development	31
3.5	Project Flowchart	32
3.6	Project Costing	34
CHAPTER 4	RESULT AND ANALYSIS	35
4.1	Introduction	35
4.2	Reliability Testing	35
4.2.1	Drop Test	36
4.2.2	Temperature Test	37
4.3	Comparison between expected result and actual result	38
4.4	Prototype Simulation Result	41
4.5	Result Analysis and Survey Question	43
CHAPTER 5	CONCLUSION	49
5.1	Summary of Project	49

REFERENCES	50
APPENDIX	51
Appendix 1: Survey Question	51
Appendix 2: Truth Table and connection of Logic Gate	52

LIST OF TABLES

TABLE	TITLE	PAGE
Table 3.1:	Gantt Chart Progress of PSM 1	24
Table 3.2:	Gantt Chart Progress of PSM 2	25
Table 3.3:	Estimating cost and actual for the project	34
Table 4.1:	Drop Test Table	36
Table 4.2:	Temperature Test Table	37
Table 4.3:	The comparison between expected and actual result based on flowchart table	38
Table 4.4:	Prototype Simulation Result Table	41

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2.1(a)	System platform	8
Figure 2.1(b)	PLC and peripherals	8
Figure 2.2	The schematic of E-TESTER using Proteus 8	8
Figure 2.3	The prototype of E-TESTER	9
Figure 2.4	Diagram and photo of Portable PLC Kit Layout	10
Figure 2.5	The prototype of the Smart Board Quiz of Logic Gate	12
Figure 2.6	The hardware front view	13
Figure 2.7	Schematic diagram of PLC kit	15
Figure 2.8	The installation of two sensors of MAX 6657 connected to Arduino Uno	16
Figure 2.9	Schematic of on top the board	17

Figure 2.10	Assemble of the board	17
Figure 2.11	Assemble project PLC	18
Figure 2.12	The prototype of E-circuit	19
Figure 3.1	The illustration of project planning	20
Figure 3.2	The flowchart for FYP 1 and FYP 2	22
Figure 3.3	The complete flowchart for FYP 1 and FYP 2	23
Figure 3.4	The illustration of prototype of e-LG	26
Figure 3.5	Block diagram of Logic Gate Educational Kit	27
Figure 3.6	The symbol, truth table and datasheet of AND gate (7408)	28
Figure 3.7	The symbol, truth table and datasheet of OR gate (7432)	28
Figure 3.8	The symbol, truth table and datasheet of NOT gate (7404)	29
Figure 3.9	The datasheet of Arduino Mega 2560	30

Figure 3.10	The Thin-Film-Transistor Liquid-crystal used in this project	30
Figure 3.11	The front interface of Arduino MEGA software	31
Figure 3.12	The flowchart of project	32
Figure 3.13	The complete flowchart of project	33
Figure 4.0	The prototype of the educational kit	38
Figure 4.1	Bar Chart for Question 1	44
Figure 4.2	Bar Chart for Question 2	44
Figure 4.3	Bar Chart for Question 3	45
Figure 4.4	Bar Chart for Question 4	45
Figure 4.5	Bar Chart for Question 5	46
Figure 4.6	Bar Chart for Question 6	46
Figure 4.7	Bar Chart for Question 7	47

Figure 4.8	Bar Chart for Question 8	47
Figure 4.9	Bar Chart for Question 9	48
Figure 4.10	Bar Chart for Question 10	48

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
Appendix I	Survey Question	50
Appendix II	Truth Table and connection of Logic Gate	51

LIST OF SYMBOLS

cm	-	Centimetre
m	-	Meter
V	-	Voltage
%	-	Percentage
l	-	Length

LIST OF ABBREVIATIONS

LCD	Liquid Crystal Display
TFT LCD	Thin-Film-Transistor Liquid Crystal Display
LED	Light Emitting Diode
PLC	Programmable Logic Controller

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter target on form the framework and introduces the brief idea of the project. It focused on the overview of the project, detailing the objectives, briefly the problem statement, scope and provide outcome of the project. Therefore, the structure of the whole project can be precisely visualized.

1.2 Background

Educational kits support student learning and engaging ways in an interesting environment. Children are already exposed to this technology and devices as the era grows well in the direction of digital and technology society. Especially educational tools are most commonly used by student now days, so they have little patience in teaching when they come to collage and focus on the teacher style. It'll just boredom the student. In today's schools, teaching aids such as educational kit will improve the quality of education while also giving student the sense of excitement, they desire to do hand skills in laboratory. The function of this project is to simplify the Ladder Diagram to the Logic gate. Besides that, this project also functions when needing to upgrade the system to the high voltage by using Ladder Diagram. Logic gate only adapt with 5V until 12V while Ladder Diagram can hold until three phase voltage which is 415V.

Logic Gate is a subtopic inside Physics under the topic of Electronics that generally deals with the application and study of electronics. While Programmable Logic Controller (PLC) is a topic that student electric and electronic will learn in University Syllabus.

Logic Gate Quiz Box is an educational kit used to test student's understanding on how to construct logic gate design to the PLC diagram. It was created to attract student's interest in the basic of Digital system for secondary school and for a student in University. A design of logic circuit will be display on the top of quiz box and student need to connect the logic gate to get the PLC diagram. After construct the circuit, the answer will be display on the LCD display. This educational kit is a method for student to study the principle of Digital System. Student's interest in a subject will be easier if the first approach is fun and interesting. It will make student easy to understand on how to learn it. Additionally, practical application of the knowledge they get from the textbooks, makes the learning process a lot more fun.

1.3 Problem Statement

Digital electronic subjects and Programmable Logic Controller (PLC) subject has been exposed to students engineering. The basic learning for digital electronic subject is recognize type of logic gate, understand the truth table of logic gate and understand the datasheet of every logic gate. While for Programmable Logic Controller (PLC) subject is basic function of PLC, ladder diagram and programming.

When it comes to a high-level question, students need to be thinking more creative how to solve the question based on topic of the working principle of digital electronic.

Theoretical is not enough for a student to really understand about each topic. Thus, a hands-on experience with a guidance of educator during a laboratory session is needed to make the students understand the principle of the topic. Laboratory session has a difficulties and opportunities that have a difference from those in a standard classroom environment, it becomes hard for students to catch-up the lesson due to the laboratory session that sometimes is incompatible to the level of education.

After the syllabus of the subject is complete, a laboratory session will be conducted. Usually learning process for laboratory session is conducted in a group with a limited number of equipment and component. To construct a circuit with a small component is quite complicated because the component is small and can easily misplaced. School or university authorities need to replace component frequently when the component is missing. To buy electronic component is costly and a spending a lot of money to buy because the components need to be purchased in large quantity from the seller.

1.4 Objectives

Based on the background and problem statement that has been stated, the objectives of this experiment are:

1. To design an electronic educational kit using Arduino Mega 2560 and Thin-film-transistor liquid-crystal (TFT LCD) to display Ladder Diagram (PLC) for students to understand the subtopic of logic gate in digital electronic subject.