



DIGITAL VOTLMETER

WAN MUHAMMAD AIZAT BIN WAN KOZIL
JAZLAN HARITH BIN JULAINAI

FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA
MALAYSIA

TK
321
.W36
2015

SEPTEMBER 2015

ACKNOWLEDGE

Thanks to God that is always blessing to me, finally the Final Year Project (FYP) report is completed. In order to complete this report, me and my partner were in contact with many people. They have contributed towards my understanding and thought.

First and foremost, I would like to express my sincere appreciation to our supervisor that is Pn. Noor Hafizah bt Khairul Anuar who is really kind, patience, understanding person when we got many problems that can be avoided and continuously guided us by share her time and knowledge during our study. We are also very thankful to Ms. Norlina for helping and guiding us a lot on the PIC coding in order to complete our coding for the project.

In addition, we also wanted thanks to our coordinator, Sir Rozi for accompanying instructor's and solution manual. Next, we also take opportunity to record our appreciation to University Teknologi Mara (Uitm) Pasir Gudang for providing all the equipment for us to complete our research for final year project 1 and 2.

Our special thanks to all my friends for the collaboration in helping us to complete our site work. Last but not least, million thanks to our beloved parents and our siblings who support and encouraging us all the time. Thanks a lot to them.

ABSTRACT

Background Study

Voltmeter is an instrument used for measuring electrical potential difference between two points in an electric circuit. Analog voltmeters move a pointer across a scale in proportion to the voltage of the circuit; digital voltmeters give a numerical display of voltage by use of an analog to digital converter.

Voltmeters are made in a wide range of styles. Instruments permanently mounted in a panel are used to monitor generators or other fixed apparatus. Portable instruments, usually equipped to also measure current and resistance in the form of a multimeter, are standard test instruments used in electrical and electronics work. Any measurement that can be converted to a voltage can be displayed on a meter that is suitably calibrated; for example, pressure, temperature, flow or level in a chemical process plant.

General purpose analog voltmeters may have an accuracy of a few percent of full scale, and are used with voltages from a fraction of a volt to several thousand volts. Digital meters can be made with high accuracy, typically better than 1%. Specially calibrated test instruments have higher accuracies, with laboratory instruments capable of measuring to accuracies of a few parts per million. Meters using amplifiers can measure tiny voltages of microvolts or less.

Part of the problem of making an accurate voltmeter is that of calibration to check its accuracy. In laboratories, the Weston Cell is used as a standard voltage for precision work. Precision voltage references are available based on electronic circuits.

Analog Voltmeter

A moving coil galvanometer can be used as a voltmeter by inserting a resistor in series with the instrument. The galvanometer has a coil of fine wire suspended in a strong magnetic field. When an electric current is applied, the interaction of the magnetic field of the coil and of the stationary magnet creates a torque, tending to make the coil rotate. The torque is proportional to the current through the coil. The coil rotates, compressing a spring that opposes the rotation. The deflection of the coil is thus proportional to the current, which in turn is proportional to the applied voltage, which is indicated by a pointer on a scale.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	APPROVAL SHEET	iii
	DECLARATION OF ORIGINAL WORK	iv
	ACKNOWLEDGEMENT	v
	ABSTRACT	vi
	TABLE OF CONTENTS	vii
	LIST OF FIGURE	ix
	LIST OF TABLES	x
1	INTRODUCTION	
	1.1 Background Study	1
	1.2 Problem Statement	2
	1.3 Objectives	2
	1.4 Scope of Work	3
	1.5 Project Contribution	4
2	LITERATURE REVIEW	
	2.1 The History of Electric Measuring Instrument	6
	2.1.1 Practical electric measuring instrument: Weston moving-coil DC ammeter: electromagnetic mechanism	6
	2.1.2 The advent of the Fleming Valve and the prototype of AC measurement: Measurement of high-voltage-high frequency	8

2.1.3 De Forest Audion (Audion Vacuum Tube) and BARUBORU (Vacuum Tube Voltmeter): High sensitivity measurement	
2.1.4 Stable BARUBORU: Linear scale	
2.1.5 Challenge to Digital: High precision measurement	
2.2 How Digital Voltmeter Works	13
2.3 Comparison Between Analog Mode	14
2.4 Portable Options	14
2.5 Components used for this Project	15
2.5.1 Microcontroller	15
2.5.2 History of Microcontroller	15
2.4.3 Concept Operation of Microcontroller	17
2.5.4 PIC 16F877A	17
2.5.5 Liquid Crystal Display (LCD)	19

CHAPTER	TITLE	PAGE
3	METHODOLOGY	
	3.1 Methodology	16
	3.2 Flow Chart of Project	17
	3.3 System Operation Flow Chart	19
	3.4 Experimental Setup	21
	3.5 Equipment and Components	21
	3.6 Components	22
	3.6.1 Resistors	22