AUTO VOLTMETER MEASUREMENT TOOL SYSTEM

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Bachelor of Mechatronic Engineering

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"I hereby declare that I have read through this report entitle "Auto-Voltmeter Measurement Tool System" and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Mechatronic)"

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AUTO-VOLTMETER MEASUREMENT TOOL SYSTEM

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A report is submitted in partial of fulfillment of the requirements for the degree of

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Faculty of Electrical Engineering

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I declared that this report entitle “Auto-Voltmeter Measurement Tool System” is the result of my own research except as cited in the references. The report has not been accept for any degree and is not concurrently submitted in candidature of other degree.

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Date :

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Dedicated to my beloved mother, father, my siblings

And all my friends,

For their love and sacrifice

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ABSTRACT

In industry, maintenance routine is compulsory to be done for machines or power station in any factory or office. This is to ensure that the machines or power supply does not have faulty error during any production time or business. If it happen, it will affect the whole company production and cause to money loss and waste of production time. Thus, these will become a problem that need to be solve. As a scenario, during industrial training program that is held for degree students, there is a company conducting a preventive maintenance for uninterruptible power supply (UPS). A voltmeter, is a common item that is use for voltage measurement by maintenance technician. During maintenance routine of UPS, technician need to check the condition of battery backup for UPS system to ensure it does not have faulty error when main power is down. There are several chances of having danger of electrical shock due to a problem while measuring voltage of the backup battery. It is because of narrow space in the battery rack, which is fixed enough for only to place the battery. Thus, there is not enough space for technician to reach the positive and negative battery terminals. Therefore, a project called '**Auto-Voltmeter Measurement Tool System**' were proposed to overcome the problem. The objective of this project is to develop an automatic voltmeter system that can take readings automatically without the needs of technician to take the readings of the backup battery by themselves. This project using the PIC16F877A as a microcontroller to control the meter base and contact point of the auto-voltmeter system. The input is received from readings taken by contact point (meter probe) and the result will be display in LCD for technician record. The project consists of two parts, hardware development and software development. Implementation and works of this project are summarized into the flow chart in this report.

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ABSTRAK

Dalam industri, rutin penyenggaraan adalah satu kewajipan bagi mesin-mesin atau stesen janakuasa dalam mana-mana kilang atau pejabat. Ini adalah bagi memastikan yang mesin-mesin itu atau bekalan kuasa tambahan tidak mengalami ralat rosak semasa proses pengeluaran atau perniagaan sedang dijalankan oleh syarikat atau kilang. Jika ia berlaku, ini akan menjejaskan keseluruhan pengeluaran syarikat dan menyebabkan kerugian kos dan masa pengeluaran. Oleh itu, ini akan menjadi satu masalah yang perlu diselesaikan segera. Wujud satu senario, dimana semasa program latihan perindustrian yang telah dijalankan bagi pelajar ijazah, terdapat sebuah syarikat menjalankan satu penyelenggaraan pencegahan untuk uninterruptible power supply (UPS). Meter voltan adalah perkakasan biasa yang digunakan untuk mengukur voltan oleh juruteknik penyelenggaraan. Semasa rutin penyelenggaraan UPS, juruteknik perlu memeriksa keadaan bateri sandaran agar sistem UPS tidak mengalami kegagalan apabila bekalan kuasa utama putus atau wujudnya ralat rosak. Bahaya kejutan elektrik boleh berlaku apabila juruteknik melakukan pengukuran ke atas bateri sandaran. Ia disebabkan oleh ruang sempit dalam rak bateri, yang hanya cukup sekadar untuk meletakkan bateri. Oleh itu, juruteknik tidak dapat mengambil bacaan pada terminal positif dan negatif bateri sandaran akibat daripada wujudnya ruang yang sempit itu. Maka, projek yang diberi nama ”Auto-Voltmeter Measurement Tool System” dicadangkan untuk mengatasi masalah yang berlaku. Objektif projek ini adalah untuk mencipta meter voltan automatik yang dapat mengambil bacaan secara automatik tanpa melibatkan juruteknik sendiri mengambil bacaan bateri sandaran. Projek ini menggunakan mikropengawal PIC16F877A untuk mengawal tapak utama meter dan prob meter sistem voltmeter. Input akan diterima daripada bacaan-bacaan yang diambil oleh prob meter dan hasilnya akan dipamerkan dalam paparan LCD untuk rekod juruteknik. Projek ini terbahagi kepada dua bahagian iaitu bahagian perisian dan juga bahagian perkakasan. Perlaksanaan dan kerja-kerja pembangunan projek akan diterangkan lebih mendalam berdasarkan carta alir dalam kertas kerja ini.

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TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	ACKNOWLEDGEMENT	v
	ABSTRACT	vi
	ABSTRAK	vii
	TABLE OF CONTENTS	viii – xi
	LIST OF TABLES	xii
	LIST OF FIGURES	xiii – xv
	LIST OF SYMBOLS AND ABBREVIATIONS	xvi
	LIST OF APPENDICES	xvii
1	**INTRODUCTION**	**1**
2	**LITERITURE REVIEW**	**6**
	2.1 Introduction	6
	2.2 Voltmeter as Voltage Measurement Tool	7
	2.2.1 Introduction	7
	2.2.2 Digital Voltmeter	8 – 10
	2.3 Uninterruptible Power Supply (UPS) Battery	10 – 13
	2.3.1 Preventive Maintenance on Uninterruptible Power Supply (UPS) Battery	13

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CHAPTER	TITLE		PAGE
	2.4	Product Comparison	14
		2.4.1 Comparison between Analog Voltmeter and Digital Voltmeter	15 – 16
		2.4.2 Comparison between the SLA Seal Lead-Acid Battery and Motorcycle Battery	16 – 17
		2.4.3 Microcontroller	17 – 18
		2.4.4 Microprocessor	19
		2.4.5 Comparison between Microcontroller and Microprocessor	19 – 20
	2.5	Hardware Specification	21
		2.5.1 PIC16F877A	21 – 23
		2.5.2 DC Motor	24
		2.5.3 H-Bridge (L298)	25 – 27
		2.5.4 Liquid Crystal Display (16x2 Dot Matrix)	27 – 28
		2.5.5 Digital Voltmeter (Voltage Measurer)	28 – 29
	2.6	Software Specification	29
		2.6.1 MikroC 6.2	29 – 30
		2.6.2 Proteus 7.0 Professional	31 – 32
		2.6.3 WinPic800	32 – 33

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CHAPTER	TITLE	PAGE
	2.6.4 SolidWorks 2007	33 – 34
3	**METHODOLOGY**	**35**
	3.1 Introduction	35
	3.2 Project Construction Flow Chart	36 – 37
	3.3 Hardware Development	37
	3.3.1 Main Circuit	38
	3.3.2 Controller Circuit	39 – 40
	3.4 Software Development	40 – 41
4	**RESULT**	**42**
	4.1 Introduction	42
	4.2 Result	42
	4.2.1 Software Phase	43
	4.2.1.1 Simulation of Motor Motion	43 – 47
	4.2.1.2 Simulation of Voltage Reading	48 – 50
	4.2.2 Hardware Phase	50 – 51
	4.2.3 Analysis of the Results	52 – 53

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CHAPTER	TITLE	PAGE
5	**CONCLUSION**	**54**
	5.1 Introduction	54
	5.2 Discussion of the Project	54 – 55
	5.3 Suggestion for Future Works	55
	5.4 Conclusion	56
REFERENCES		57
APPENDIX A		
APPENDIX B		
APPENDIX C		

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LIST OF TABLES

TABLE	TITLE	PAGE
2.9	Comparison between Analog Voltmeter and Digital Voltmeter	15
2.10	Comparison between SLA Sealed Lead Acid Battery and Motorcycle Battery	16
2.13	Difference between Microcontroller and Microprocessor	20
2.16	PIC16F877A Device Features	22
2.22	L298 H-Bridge Pin Functions	27

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LIST OF FIGURES

FIGURE	TITLE	PAGE
1.1	System Block Diagram	4
2.1	Analog Voltmeter and Digital Voltmeter	7
2.2	Digital Voltmeter's Block Scheme Dual Slope's A/D Converter	9
2.3	Dual Slope's A/D Converter Timing Diagrams	10
2.4	Simple Version of Static UPS	11
2.5	Uninterruptible Power Supply	11
2.6	Diagram of how UPS operating when it backup the main system	11
2.7	Formula of calculation to determine the battery capacity	12
2.8	Batteries Installation Layout	13
2.11	Microcontroller	17
2.12	Microprocessor	19
2.14	PIC16F877A Microcontroller	21
2.15	Pin Diagram of PIC16F877A 40-Pin PDIP	22
2.17	PIC16F877A Block Diagram	23
2.18	DC Motor	24

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FIGURE	TITLE	PAGE
2.19	Dual Full-Bridge Driver L298	25
2.20	Block Diagram of L298 H-Bridge	26
2.21	Pin Connections for L298 H-Bridge	26
2.23	Liquid Crystal Display (16x2 Dot Matrix)	27
2.24	Digital Voltmeter	28
2.25	MikroC 6.2	29
2.26	MikroC Windows Interface	30
2.27	Proteus 7.0 Professional	31
2.28	Proteus Professional Windows Interface	31
2.29	WinPic800	32
2.30	WinPic800 Windows Interface	32
2.31	SolidWorks 2007	33
2.32	SolidWorks Windows Interface	34
3.1	Project Design Flow Diagram	36
3.2	Schematic of Main Circuit	38
3.3	Schematic of Controller Circuit	39
3.4	Software Development Diagram	40
4.1	Motor Motion Circuit	44
4.2	Schematic of Motor Planning Motion	44

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FIGURE	TITLE	PAGE
4.3	Power is supplied to the motor circuit and green led is illuminated	46
4.4	Green led turns OFF and instead red led is ON and *forward motor* is in motion	46
4.5	*Forward motor* stopped and *down lid* motor is activated with the yellow led	47
4.6	*Down lid* motor is stopped and *up lid* motor is in motion with the illumination of blue led	47
4.7	*Side motor* is in motion for changing lane on the battery rack	48
4.8	Voltage Reading Circuit	49
4.9	Simulation of the voltage reading	49

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LIST OF SYMBOLS AND ABBREVIATIONS

LCD	Liquid Crystal Display
PIC	Programmable Integrated Circuit
I/O	Input/Output
RAM	Random-access Memory
ROM	Read-only Memory
OTP ROM	One-Time Programmable Memory
KHz	kiloHertz
DC	Direct-current
TTL	Transistor-transistor logic
IDE	Integrated Development Environment
ANSI	American National Standards Institute

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LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	Gantt chart for FYP1	
B	Coding	
C	Datasheets	

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CHAPTER 1

INTRODUCTION

1.1 Background

A voltmeter is an instrument used for measuring the electrical potential difference between two points in an electric circuit. There are two types of voltmeter existed, which are the analog voltmeter and digital voltmeter. Analog voltmeter move a pointer across a scale in proportion to the voltage of the circuit while the digital voltmeter gives a numerical display of voltage by use of an analog to digital converter.

Voltmeters are made in a wide range of styles. General purpose of analog voltmeter 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. While digital voltmeter can be made with high accuracy, typically better than 1 percent. Meters using amplifiers can measure tiny voltages of microvolts or less.

During industrial training program that is held for degree students, there is a company conducting a preventive maintenance for uninterruptible power supply (UPS). A voltmeter, is a common item that is use for voltage measurement by maintenance technician. During maintenance routine of UPS, technician need to check the condition of battery backup for UPS system to ensure it does not have faulty error when main power is down. There are several

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chances of having danger of electrical shock due to a problem while measuring voltage of the backup battery. It is because of narrow space in battery rack, which is fixed enough for only to place the battery. Thus, there is not enough space for technician to reach the positive and negative battery terminals.

Nowadays, with the vast technology application available, it is possible to create a microcontroller based to control a system which it is programmed to take a battery backup voltage measurement automatically with reducing the danger of the technician may have.

The microcontroller based automatic voltmeter measurement system consists of two elements to be considered:

i. Software development
ii. Hardware development

The achievement of the project can be stated that the system will have the ability to make a backup battery voltage measurement automatically with reducing the dangers that technician in maintenance routine may have.

1.2 Problem Statement

During maintenance routine, technician always expose with such dangers like having an electrical shock, electrical spark which can cause paralyzed and sometimes causing some power explosion which is seriously dangerous and can causes death.

There are two problems statement to be carried out of this project. Firstly, the difficulties that technician face while doing the voltage measurement for backup battery during maintenance routine. And lastly, the chances of having danger of electrical shock (short circuit) that the technician may has because of narrow space in the battery rack.

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Therefore, with this project we can reduce the danger that the technician may have in the future. Furthermore, the routine of the maintenance can be done with such efficiency and good performance.

1.3 Objective of Project

There are two objectives of this project:

1. To develop an automatic voltmeter system that can take readings of voltage automatically from the backup battery.
2. To help technician during the maintenance routine.

From the first objective, an automated controller for voltage measurer is created with the application of robotic innovation by using microcontroller based PIC to control the system automatically through the whole battery rack for voltage measurement without the intrusion of technician to take the readings. The system running by itself after power is on.

Second objective, the technician job for voltage measurement can be done with ease and efficient with the help of the automatic voltmeter system in the process of completing their maintenance routine for battery backup. Furthermore, the job can be done without harming the technician directly.

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1.4 Scope of Project

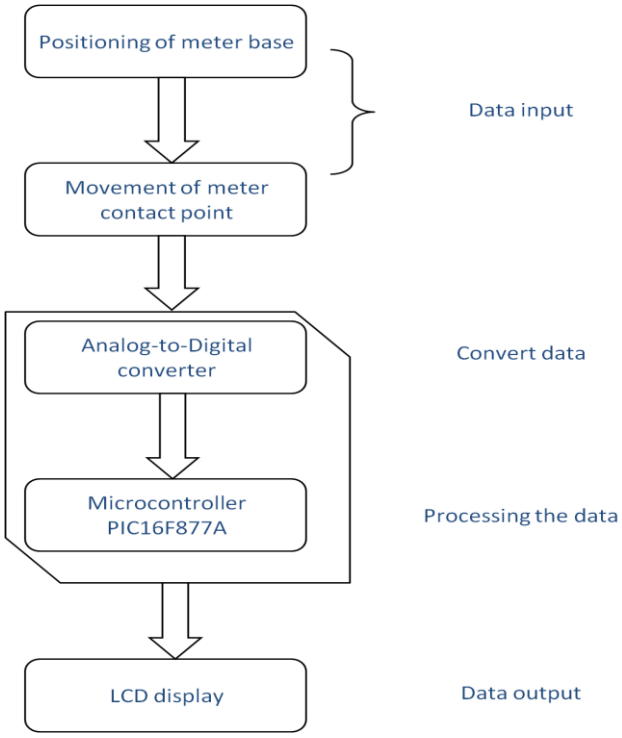

Figure 1.1: System Block Diagram

Auto-voltmeter system consists of three parts, which are the data input, data processing and data output. In the data input part, it has two functioning devices which are the meter base and the contact point mover. As the data processing part, it consist the microcontroller and finally the data output part, LCD display plays the role.

Firstly, the system meter base will reset at the designated initial position. Then, it will move the base according to the battery arrangement. Next, it is the role of the contact point mover. It will take the readings of the battery backup voltage accordingly. After the input of the readings has been received, PIC microcontroller will received the data and display on the LCD.

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Lastly, overall scope of the project is to design an automatic voltmeter system controlled by PIC microcontroller and to make an implementation of mechanical design combining with voltmeter to create a semi-robot product.

1.5 Outline of Progress Report

This progress report consists of five chapters. The first chapter of progress report discussing on the background, problem statement, objective and scope of the project. The second chapter consists more on literature review that has been done. It discusses about the theory on component of software and hardware such as a comparison between microcontroller and microprocessor and also type of voltage measurer used in this project. Others, it will also include the type of hardware and software specification that will be used in the project. Chapter three will be explained about the methodology of this project. It consists of two major parts; there are software development and hardware development. Next, chapter four will be present about the result that has been obtained. Finally, chapter five will be discusses about the discussion and suggestion for this project. In the discussion part, it will explained the problem occur when doing the project. In this chapter also, there will be a conclusion included, it will summarize the research and development of this project.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A literature review is a summary of previous research on topic. The purpose of a literature review is to convey all the knowledge and ideas that have been established on a topic and what are the strengths and weaknesses. Literature review has been conducted prior to undertaking this project to obtain the information on the technology available and the methodologies that used by the other researchers on the same topic. This chapter provides the summary of literature reviews on key topics related to the project.

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