UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF MONITORING SYSTEM FOR NUMBNESS HAND PATIENT USING ELECTROMYOGRAPHY ANALYSIS

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation And Robotics) with Honours.

by

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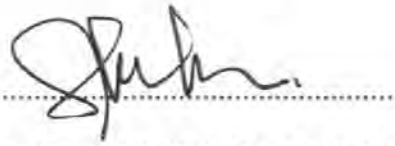

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APPROVAL

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ABSTRAK

Projek ini adalah mengenai pembangunan sistem pemantauan untuk pesakit tangan kebas dengan menggunakan analisis elektromilogi yang memerhatikan dan merekodkan proses pemulihan pesakit tangan kebas. Sarung tangan ini direka dengan elemen penginderaan yang dapat mengesan daya yang digunakan untuk setiap pergerakan jari. Unsur penderiaan yang digunakan ialah sensor tekanan dan sensor otot. Sensor tekanan ditempatkan di setiap jari untuk mengesan daya yang digunakan manakala sensor otot elektromilogi (EMG) Myoware diletakkan di otot tangan untuk mengesan aktiviti otot tangan dan analisis isyarat EMG. Protokol PLX-DAQ digunakan untuk menghubungkan dengan Microsoft Excel untuk memantau dan merekodkan proses pemulihan pesakit tangan kebas. Perisian Sketch Up 3D digunakan untuk merekabentuk sarung tangan dan perisian Fritzing Drawing dan perisian Arduino digunakan untuk menguji dan memberi arahan kepada litar sensor tekanan dan sensor otot.

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ABSTRACT

This project is about the development of monitoring system for numbness hand patient using electromyography analysis which is to observe and record the recovery process of the numbness hand patient. The glove is designed with sensing element that can detect force applied for every finger movement. The sensing element used are pressure sensor and muscle sensor. Pressure sensor is placed at every fingers to detect the force applied while electromyography (EMG) Myoware muscle sensor is placed at hand muscle to detect the hand muscle activity and analysis the EMG signal. The PLX-DAQ protocol is used to link with Microsoft Excel to monitor and record the recovery process of numbness hand patient. The Sketch Up 3D software is used to design the glove and the Fritzing Drawing software and Arduino software are used to test and give instruction to pressure sensor and muscle sensor circuit.

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DEDICATION

To my beloved parents always give support, encouragement and inspiration, I am so grateful for what they have done for me, and I want to express my gratitude in the near future. Without their support, I may not be what I am today.

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TABLE OF CONTENTS

		PAGE
TABLE OF CONTENTS		**ix**
LIST OF TABLES		**xiii**
LIST OF FIGURES		**xv**
LIST OF GRAPHS		**xvii**
LIST OF APPENDICES		**xix**
LIST OF SYMBOLS		**xx**
LIST OF ABBREVIATIONS		**xxi**
CHAPTER 1	**INTRODUCTION**	**1-5**
1.1	Introduction	1
1.2	Background	2
1.3	Problem Statement	4
1.4	Objectives	4
1.5	Scope	5
CHAPTER 2	**LITERATURE REVIEW**	**6-27**
2.1	Introduction	6
2.2	Theory	6
	2.2.1 Hand Numbness	6

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2.2.2 Reasons of Hand Numbness 7

2.2.3 Syndrome of Hand Numbness 7

2.2.4 Treatment of Hand Numbness 9

2.2.4.1 Treatment of Hand Numbness 9

2.2.5 Electromyography (EMG) 10

2.2.6 EMG Electrode and Its Types 11

2.2.6.1 Surface Electrodes 11

2.2.6.2 Fine Wire Electrodes 14

2.2.6.3 Needle Electrodes 15

2.2.7 EMG Signal 16

2.2.7.1 Characteristics 16

2.2.7.2 Signal-to-Noise Ratio (SNR) 16

2.2.8 Force Sensing Resistor (FSR) Sensor 17

2.2.9 Myoware Muscle Sensor 18

2.3 Past Research 19

2.3.1 A Soft Robotic Exomusculature Glove with Integrated sEMG Sensing for Hand Rehabilitation 19

2.3.2 Exo-Glove: A Soft Wearable Robot for the Hand with a Soft Tendon Routing System 20

2.3.3 Design of A Wearable FMG Sensing System for User Intent Detection during Hand Rehabilitation with a Soft Robotic Glove 21

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2.3.4 Comparison of Previous Researches 22

2.4 Conclusion 27

CHAPTER 3 METHODOLOGY 28-40

3.1 Introduction 28

3.2 Flow Chart 28

3.3 Block Diagram 31

3.3.1 Glove 31

3.3.2 EMG 32

3.4 Glove Control System 33

3.4.1 Develop Model Using Sketch Up 3D Software 33

3.4.2 Develop Circuit Diagram Using Fritzing Drawing Software 33

3.4.3 Simulation Circuit Diagram Using SimullDE Software 34

3.4.4 List Components 35

3.5 EMG System 35

3.5.1 Develop Circuit Using Fritzing Drawing Software 35

3.5.2 List Components 36

3.6 Software Development 36

3.6.1 Sketch Up 3D Software 36

3.6.2 Fritzing Drawing Software 37

3.6.3 Arduino IDE Software 38

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3.6.4 PLX-DAQ Software 38

3.6.5 SimullDE Software 39

3.7 Conclusion 40

CHAPTER 4 RESULT AND DISCUSSION 41-71

4.1 Introduction 41

4.2 Glove 41

4.3 Result Analysis 42

4.4 FSR Sensor Analysis 45

4.5 EMG Analysis (Myoware Muscle Sensor) 62

4.6 Conclusion 71

CHAPTER 5 CONCLUSION AND RECOMMENDATION 72-73

5.1 Introduction 72

5.2 Conclusion 72

5.3 Recommendation 73

REFERENCES 74

APPENDIX 77

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LIST OF TABLES

TABLE	TITLE	PAGE
Table 2.1:	Compare Method Used by Previous Researches	22
Table 3.1:	List and Price of Components	35
Table 3.2:	List and Price of Components	36
Table 4.1:	Profile	42
Table 4.2:	Result of Analog Reading of FSR sensors in Excel with connect using PLX-DAQ between Age 87 to 90	46
Table 4.3:	Result of Analog Reading of FSR sensors in Excel with connect using PLX-DAQ between Age 51 to 54	47
Table 4.4:	Result of Analog Reading of FSR sensors in Excel with connect using PLX-DAQ between Age 27 to 30	48
Table 4.5:	Result of Analog Reading of FSR sensors in Excel with connect using PLX-DAQ between Age 16 to 19	49
Table 4.6:	Result of Analog Reading of FSR sensors in Excel with connect using PLX-DAQ between Age 8 to 11	50
Table 4.7:	Result of Force Applied at FSR sensors in Excel with connect using PLX-DAQ between Age 87 to 90	51
Table 4.8:	Result of Force Applied at FSR sensors in Excel with connect using PLX-DAQ between Age 51 to 54	52
Table 4.9:	Result of Force Applied at FSR sensors in Excel with connect using PLX-DAQ between Age 27 to 30	53

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Table 4.10:	Result of Force Applied at FSR sensors in Excel with connect using PLX-DAQ between Age 16 to 19	54
Table 4.11:	Result of Force Applied at FSR sensors in Excel with connect using PLX-DAQ between Age 8 to 11	55
Table 4.12:	Result of EMG Muscle Activity between Age 87 to 90	63
Table 4.13:	Result of EMG Muscle Activity between Age 51 to 54	64
Table 4.14:	Result of EMG Muscle Activity between Age 27 to 30	65
Table 4.15:	Result of EMG Muscle Activity between Age 16 to 19	66
Table 4.16:	Result of EMG Muscle Activity between Age 8 to 11	67

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LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 1.1:	EMG Analysis	2
Figure 1.2:	EEG, EOG, EMG	3
Figure 1.3:	Numbness Hand	4
Figure 2.1:	Numbness Hand	6
Figure 2.2:	Median Nerve, Ulnar Nerve, Radial Nerve	7
Figure 2.3:	Carpal Tunnel Syndrome	8
Figure 2.4:	Cubital Tunnel Syndrome	8
Figure 2.5:	Radial Tunnel Syndrome	9
Figure 2.6:	Step of Nerve Gliding Exercise	10
Figure 2.7:	Gelled EMG Electrode	12
Figure 2.8:	Dry EMG Electrode	13
Figure 2.9:	Active Electrode	14
Figure 2.10:	Fine Wire Electrode	15
Figure 2.11:	Needle Electrode	15
Figure 2.12:	SNR Signal	16
Figure 2.13:	FSR Sensor	17

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Figure 2.14:	Myoware Muscle Sensor	18
Figure 2.15:	Muscle that Connect Finger are Located at Forearm and Hand	20
Figure 2.16:	Glove Design	20
Figure 2.17:	Armband with FSR Sensor	21
Figure 3.1:	Flow Chart of Development Monitoring System	30
Figure 3.2:	Procedure of Glove Control System	31
Figure 3.3:	Procedure of Myoware Muscle Sensor Control System	32
Figure 3.4:	Glove Model using Sketch Up 3D Software	33
Figure 3.5:	Connection of circuit between FSR sensor and Arduino Uno	34
Figure 3.6:	Simulation of circuit between FSR Sensor and Arduino Uno	34
Figure 3.7:	Connection of Myoware Muscle Sensor with Arduino Uno	35
Figure 3.8:	Sketch Up 3D Software	37
Figure 3.9:	Fritzing Drawing Software	37
Figure 3.10:	Arduino IDE Software	38
Figure 3.11:	PLX-DAQ Protocol	39
Figure 3.12:	SimullDE Software	39
Figure 4.1:	Glove	41
Figure 4.2:	Circuit of FSR sensors with Arduino	45
Figure 4.3:	Circuit of Myoware Muscle Sensor with Arduino	62

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LIST OF GRAPHS

GRAPH	TITLE	PAGE
Graph 4.1:	Average Analog Reading of Every Fingers for People in Age 87 to 90	56
Graph 4.2:	Average Analog Reading of Every Fingers for People in Age 51 to 54	56
Graph 4.3:	Average Analog Reading of Every Fingers for People in Age 27 to 30	57
Graph 4.4:	Average Analog Reading of Every Fingers for People in Age 16 to 19	57
Graph 4.5:	Average Analog Reading of Every Fingers for People in Age 8 to 11	58
Graph 4.6:	Total Average Analog Reading of Every Fingers against Age Range	58
Graph 4.7:	Average Force Applied (N) of Every Fingers for People in Age 87 to 90	59
Graph 4.8:	Average Force Applied (N) of Every Fingers for People in Age 51 to 54	59
Graph 4.9:	Average Force Applied (N) of Every Fingers for People in Age 27 to 30	60
Graph 4.10:	Average Force Applied (N) of Every Fingers for People in Age 16 to 19	60

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Graph 4.11:	Average Force Applied (N) of Every Fingers for People in Age 8 to 11	61
Graph 4.12:	Total Average Force Applied of Every Fingers against Age Range	61
Graph 4.13:	EMG Muscle Activity against Time at Age 87 to 90	68
Graph 4.14:	EMG Muscle Activity against Time at Age 51 to 54	68
Graph 4.15:	EMG Muscle Activity against Time at Age 27 to 30	69
Graph 4.16:	EMG Muscle Activity against Time at Age 16 to 19	69
Graph 4.17:	EMG Muscle Activity against Time at Age 8 to 11	70
Graph 4.18:	Total Average EMG Muscle Activity (V) against Age Range	70

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LIST OF APPENDICES

APPENDIX	TITLE	PAGE
Appendix 1	Project Planning Table	77
Appendix 2	Coding of FSR Sensor	
	Coding of Myoware Muscle Sensor	78

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LIST OF SYMBOLS

Hz	-	Hertz
g	-	Gram
V_{pp}	-	Peak-to-peak voltage
Vrms	-	Root-mean-square voltage
M	-	Mega
Ω	-	Ohm
kg	-	Kilogram
"	-	Inches
%	-	Percent
Ag-AgCl	-	Silver-silver Chloride
AgCl	-	Silver Chloride
Ag	-	Silver
V	-	Voltage
N	-	Newtons

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LIST OF ABBREVIATIONS

EMG	Electromyography
EEG	Electroencephalography
EOG	Electrooculography
DSP	Digital Signal Processing
MIDI	Musical Instrument Digital Interface
ICA	Independent Component Analysis
HCI	Human Computer Interaction
CAD	Computer Aided Design
MUAP	Motor Unit Action Potential
SNR	Signal-to-Noise Ratio
FSR	Force Sensing Resistor
ANN	Artificial Neural Network
PIY	Print-it-Yourself
HiM	HandinMind

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CHAPTER 1

INTRODUCTION

This chapter discuss about the background of this project. Besides that, problem statement, objective and work scope of this project will also introduce in this chapter.

1.1 Introduction

According to the Oxford English Mini Dictionary, Eighth Edition, numb is meaning as having no sensation of a body part or lacking the power to feel, thick, or react[1]. Generally, loss of sensibility in the hands is know as numbness. In view of pressure on the nerves or blood vessels at wrists, arms or fingers usually will cause tingling or burning sensation, sharp pain, or weakness at part of the hands, hence it will have the feeling that numb in hands.

Ann Pietrangelo wrote upon medically reviewed by William A Morrison MD about an unusual prickling feeling that happen in any part of body is called numbness and tingling. Generally, people observe these feeling in hands, feet, legs or arms when sitting with leg crossed or falling asleep on arm for a long time and they do not change position. If numbness or tingling persist and there is no apparent cause of the feeling, it may be a symptom of facing a disease or there is an injury. Paresthesia is a medical term for numbness and tingling [32].

Majority physical therapists recommend a nerve conduction test which also known as electromyography (EMG) to observe the compression of nerve and examine

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the extent of nerve damage. Rehabilitate nerve function need to apply physical therapy thus the nerves that compress by bone or other tissue can recover. If the nerve compression left untreated, it can make trouble on hands[4].

Therefore monitoring system will be developed for numbness hand patient using electromyography analysis. A glove with pressure sensor will be designed for sensing the force applied by numbness patient. When numbness patient apply force to the pressure sensor, the pressure sensor will display and save data. EMG will be used when force is applied, muscle sensor will sense electrical activity produced by skeletal muscle and the EMG analysis will be recorded.

Figure 1.1: EMG Analysis [4]

1.2 Background

There was many idea of using EMG for a system and the idea of using EMG is not new. Knapp and Lusted introduced "Biomuse", which knows as a bioelectric controller for music applications of computer in 1990. The system consists of two components, a bioelectric interface and a signal processing unit. Electrodes and sensors that consist in bioelectric interface are placed on user's body. Bioelectric interface used to sense the Electromyography (EMG), which is use to sense the body muscle activity,

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