UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF GRIP STRENGTH MONITORING SYSTEM FOR STROKE PATIENT

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

by

MOHD KHAIRUL BIN AB RAHMAN

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours. The member of the supervisory is as follow:

……

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ABSTRAK

Setiap tahun menurut Pertubuhan Kesihatan Sedunia (WHO) 15 juta orang mengalami strok [1]. Nombor ini akan terus meningkat jika tiada langkah-langkah pencegahan dilaksanakan. Keberkesanan proses pemulihan akan dilihat dan pesakit dinasihat melakukan senam dengan betul untuk merangsang pergerakan otot dan otak untuk fungsi dan mempunyai reaksi dengan sempurna. Selepas melakukan penyelidikan projek ini serta menggunakan kaedah lama dalam cara yang berlainan dan komponen perbezaan untuk membuat peranti ini. Alat ini boleh digunakan di mana sahaja kerana ia tidak memerlukan bekalan kuasa 240Volt AC, tetapi ia menggunakan 12Volt DC, di mana bateri mudah untuk membawa dan sesuai bersama alat.

Peranti ini berfungsi apabila terdapat daya yang dikenakan kepada sensor dan sensor akan mengesan daya dan terus menghantar isyarat kepada mikropemproses. Kekuatan daya yang akan dikenal pasti sama ada kuat atau lemah dengan menggunakan pembahagi formula voltan di mana kuasa yang lebih tingi maka nilai rintangan adalah rendah. Manakala jika daya yang dikenakan adalah lebih rendah, maka rintangan akan menjadi tinggi. Di sana, pesakit boleh tahu jika prosese mereka bertambah baik atau sebaliknya didalam proses pemulihan. Segala keputusan yang dihasilkan akan dibandingkan dengan keputusan sebelum dianalisis oleh doktor untuk menentukan senaman yang sesuai mengikut peringkat pembangunan. Alat ini juga menggunakan cip PIC16F877 sebagai otak untuk mengawal semua fungsi komponen yang terlibat.

Akhir sekali, teknik terbaik dalam proses pemulihan untuk pesakit strok adalah pergerakan senaman berulang-ulang. Peranti ini akan membantu pesakit dengan cara mudah untuk menunjukkan peningkatan dan paparan data supaya pesakit yang tahu keadaan semasa mereka sama ada dalam peningkatan yang baik atau tidak.

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ABSTRACT

Every year according to the World Health Organization (WHO) 15 million people suffer from stroke [1]. This number will continue to increase if no preventive measures are implemented. The effectiveness of the recovery process would be seen and patient is advice to do properly exercise to stimulate muscle movement and brain to function and have reactions perfectly. After doing some research this project used old method in difference ways and difference components to create this device. These tools can be used anywhere because it does not require electricity AC power supply 240 Volt, but it uses 12 volt D/C, where the battery is easy to carry and fits alongside the tool.

This device work when there is force applied to the sensor and the sensor will detect the force and continue to send signals to the microprocessor. The strength of the force will be identified either strong or weak by using the voltage divider formula where the stronger the force applied the low resistance value. While if the force applied is lower then, the resistance will be high. There, patients can know if they improved in recovery process or otherwise. The resulting value will be compared with previous result to be analyzed by a doctor to determine appropriate exercise according to his stage of development. These tools are also using chip PIC16F877 as the brains to control all the functions of the components involved.

Lastly, the best technique in rehabilitation process for stroke patient is repetitive movement. This device will assist patient in easy way to show improvement and display data so that patient know their current condition either in good improvement or not.

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DEDICATION

To my beloved parents, Ab Rahman Bin Hasan and Ainon Bte Lebar for support me until nowadays. Especially to my father, this is a present for you and i hope you are happy with me.

To my friend colleague, who support me and give an opinion in this project.

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TABLE OF CONTENT

Abstrak		vi
Abstract		vii
Dedication		viii
Acknowledgement		ix
Table of Content		x
List of Tables		xiii
List of Figures		xiv
List Abbreviations, Symbols and Nomenclatures		xv
CHAPTER 1: INTRODUCTION		
1.0	Introduction	1
1.1	Problem Statement	3
1.2	Objectives	4
1.3	Work Scope	4
CHAPTER 2: LITERATURE REVIEW		
2.0	Introduction	5
2.1	Theory of Stroke Disease	5
2.2	Symptom of Stroke	6
2.3	Type of Stroke	7
	2.4.1 Ischaemic Stroke	7
	2.4.2 Haemorrhagic Stroke	8
2.4	Stroke Rehab	8
2.5	Conventional Exercise for Stroke Patient	9
	2.6.1 Stretching exercise	9
	2.6.2 Holding exercise ball	9
	2.6.3 Electrical Stimulation Therapy (ES)	10
	2.6.4 Induced Movement Therapy	11
	2.6.5 Practice fine motor skills	11

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2.6 Material for Designing a Glove 12
2.7 Main Component 13
2.8 Previous Research 14
2.8.1 A Rehabilitation Device to Improve the Hand Grasp Function of Stroke Patient using a Patient-Driven Approach 14
2.8.2 A Sensitivity Study of Piezoresistive Pressure Sensor for Robotic Hand 15
2.8.3 A Sensorized Glove and Ball for Monitoring Hand Rehabilitation Therapy in Stroke Patients 16
2.8.4 A Soft Robotic Exomusculature Glove with Integrated sEMG sensing for Hand Rehabilitation 17
2.8.5 Development of a Robot MKW-II for Hand and Wrist Rehabilitation Training 19
2.8.6 Instrumented Glove for Rehabilitation Exercise 20
2.8.7 Wearable Hand Rehabilitation Robot Capable of Hand Function Assistance in Stroke Survivors 22
2.9 Comparison between Previous Research and Grip Strength Monitoring System 22
2.10 Conclusion 26

CHAPTER 3: METHODOLOGY

3.0 Introduction 27
3.1 Flow chart 27
3.2 Block diagram 30
3.3 FSR Working principle 31
3.4 Model 1 (Ball Gripper) 32
3.4.1 Develop model using 3D sketch Up software 32
3.4.2 Develop circuit using Proteus 8 software 32
3.4.3 List of components 33
3.4.4 Model progress 34
3.5 Model 2 (Glove Gripper) 35
3.5.1 Develop model using 3D sketch Up software 35
3.5.2 Develop circuit using Proteus 8 software 36

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3.5.3 List of components 36
3.5.5 Model progress 37
3.6 Conventional Device 38

CHAPTER 4: RESULT & DISCUSSION
4.0 Introduction 39
4.1 Experiment using Conventional Tool 39
4.1.1 Simulation circuit progress using Proteus 41
4.2 Analysis Project 44
4.3.1 Profile subject 44
4.3.2 Data and graph from Ball gripper 46
4.3.3 Data and graph from Glove gripper 49
4.3 Comparison with Conventional Device 52
4.4 Analysis by adjust the Potential Meter (Resistance) 55
4.5.1 Data ball Gripper (5k Ohm) 56
4.5.2 Data Ball Gripper (15k Ohm) 57

CHAPTER 5: CONCLUSION & FUTURE WORK
5.0 Introduction 58
5.1 Limitation 58
5.2 Recommendation 59
5.3 Future Work 59
5.4 Conclusion 59

REFERENCES 60
GANTT CHART 63
APPENDICES 64

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LIST OF TABLES

2.1	Advantage and disadvantage of various type of pressure sensor	16
2.2	Comparison of the method	23
3.1	List and price of component for Ball Gripper	33
3.2	List and price of component for Glove Gripper	36
3.3	Advantage and disadvantage of conventional device	38
4.1	Profile Subject	45
4.2	Collected data form Ball Gripper for Senior Citizen	47
4.3	Collected data form Ball Gripper for Young Citizen	48
4.4	Collected data form Ball Gripper for Junior Citizen	49
4.5	Collected data form Glove Gripper for Senior Citizen	50
4.6	Collected data form Glove Gripper for Young Citizen	51
4.7	Collected data form Glove Gripper for Junior Citizen	52
4.8	Collected data from Conventional device between patient and normal	55
4.9	Data by using 5k Ohm resistance	57
4.10	Data by using 15k Ohm resistance	58

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LIST OF FIGURES

1.1	Impact of stroke on the hand	3
2.1	Ischemic Stroke	7
2.2	Haemorrhagic Stroke	8
2.3	Stretching exercise	9
2.4	Holding or Gripping exercise	10
2.5	Electrical Stimulation Therapy (ES)	10
2.6	Induced Movements Therapy	11
2.7	Practice fine motor skill	11
2.8	Designing the glove	12
2.9	FSR pressure sensor	13
2.10	Grasping Rehabilitation device	14
2.11	Output voltage with difference applied force	15
2.12	Sensorized Glove	16
2.13	Sensorized Ball	16
2.14	Cable system	17
2.15	Device backpack	17
2.16	3D model of wrist and hand rehabilitation mechanism	18
2.17	Glove with HMI module on the left	19
2.18	Interface for rehabilitation and example of exercise chart	20
2.19	Model mechanism in DULEX-II	21
3.1	Flow chart project Development of Hand Grip Device	29
3.2	Experiment Procedure	30
3.3	FSR Sensor	31
3.4	Develop model using 3D Sketch Up software	32
3.5	Develop circuit using Proteus8 software	32
3.6	Step 1 Ball gripper	34

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3.7	Step 2 Ball gripper	34
3.8	Step 3 Ball gripper	34
3.9	Step 4 Ball gripper	34
3.10	Step 5 Ball gripper	34
3.11	Develop model using 3D Sketch Up software	35
3.12	Develop circuit using Proteus8 software	35
3.13	Step 1 Glove gripper	37
3.14	Step 2 Glove gripper	37
3.15	Step 3 Glove gripper	37
3.16	Step 4 Glove gripper	37
3.17	Step 5 Glove gripper	37
3.16	Conventional device	38
4.1	Experiment setup using conventional device	40
4.2	Declaration LCD and No pin at SK40C	42
4.3	Formula using Voltage Divider	42
4.4	Integer Pin at Arduino (Instruction)	43
4.5	Example comment at Serial Print Arduino	43
4.6	Graph Senior Citizen VS Force from Ball Gripper	47
4.7	Graph Young Citizen VS Force from Ball Gripper	48
4.8	Graph Junior Citizen VS Force from Ball Gripper	49
4.9	Graph Senior Citizen VS Force from Glove Gripper	50
4.10	Graph Young Citizen VS Force from Glove Gripper	51
4.11	Graph Junior Citizen VS Force from Glove Gripper	52
4.12	Relationship force between Ball Gripper and Glove Gripper	53
4.13	Comparison between stroke patient and normal	54
4.14	Experiment using Conventional Device	55
4.15	Graph using 5k Ohm resistance	57
4.16	Graph using 15k Ohm resistance	58

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

ADL	-	Activity Daily Living
WHO	-	World Health Organization
LED	-	Light Emitting Diode
GUI	-	General User Interface
PIC	-	Programmable Integrated Circuit
LCD	-	Liquid Circuit Display
FSR	-	Force Sensitivity Resistor
PTF	-	Polymer Thick Film

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CHAPTER 1
INTRODUCTION

This chapter describe the background of the project. Besides that, this chapter also examines the objective of this project including the scope of the project. The problem statement also will be discussed in this chapter. The structure of this report briefly describes the project as well as to ensure better visualization of the whole project.

1.0 Introduction

Every year, according to the World Health Organization (WHO), 1 million people suffer from stroke [1]. Stroke remains the leading causes of disability in the world. The effect of stroke is fatal and affects the brain function such as communication skill, memory, mobility skill, and self-care skill. Many common effects of stroke are physical ones such as weakness, numbness, and stiffness. Therefore, the patient's is advised to do a variety of specific exercises for their recovery process.

Most stroke patients will have to decrease the level of use any elbow where bone grafting in the body feel weak and strength will decrease and if left unchecked it will cause a lasting effect such as paralysis and so on. By using this device frequently, it can help in the recovery process. The main project on this research is to help patient gain their confidence and control muscle to do their activity of daily living (ADL).

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Hand function are essential to ADL such as eating, gripping, bathing and holding a spoon. The brain structure will affect their own strength and muscle this will make hand feel weak. Also the motor function can be reorganized and restored via repetitive movement. Patient need to do some exercise regularly to gain their strength and muscle. The method of rehabilitation will determine whether patient will healing in short of time or not.

In conventional way, patient need to do various exercise but all exercise do not have feedback to show data and reading about the current condition of patient. Also patient need to came 2 or 3 time a month in physiotherapy to do exercise. This process will slow down the healing process of patient. Patient need to have assistant in the house every day to do exercise and show the increasing data to encourage patient to do exercise regularly.

The research proposes a device with repetitive movement to recover strength and hand movement to increase change to recover as soon as possible despite chance to recover is a small percentage. Also this device help patient to know their own progress either improve or not. This device will show data and display pressure (force) that generate by pressure sensor in each finger. From this value patient will know their own strength every day when use this device.

This device use Embedded system as a main control to operated. It use SK40C and PIC16F***** as a brain to function and pressure sensor FSR to generate force. This sensor is type of piezoresistive and their sensitivity will depend on level of resistance. The higher the resistances, the lower the sensitivity and the lower the resistances, the higher the sensitivity. Also FSR pressure sensor is more accurate than the other pressure sensor so all reading are proven correct and has a little error that the other component. This will make this device as a good choice to do exercise and monitoring in rehabilitation process.

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1.1 Problem Statement

Most of the stroke patients are a senior citizen where they are lack in motivations and in a very weak condition. Without the right guidance, they will neglect and take it easy all the advice and ways to treat their illness. Therefore, by inventing this system, it can assist the patients in doing their daily exercise and detect their 'level-of-healing' from time to time. This device will monitor the strength in their hand because most stroke patients suffer from muscle cramps fingers where it is difficult to perform daily activities.

Figure 1.1: Impact of stroke on the hand

In addition, the lack of equipment in hospitals become obstacles in the recovery process because the patient does not know the actual level their recovery because there are no device that can measure the strength of their hands. Most patients will undergo physiotherapy where they were trained to hold, pick-up, and squeezed so that the hand can be recovered as usual and this process takes a long time to heal. During this process, the patient does not know the rates their recovery because no data is stored as a reference.

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1.2 Objective

The main objectives of this project are to propose the development Grip Strength Monitoring System for Stroke Patient. There are several objectives that need to be achieved:

i. To design a device that helps patient to gain control in their hand grip.
ii. To develop a system that improves level of strength of stroke patient using a specific pressure sensor (FSR Sensor).
iii. To test and analyse data from patients to compare with conventional device.

1.3 Work Scope

Work scope includes:

i. This project involves in the recovery process of the stroke's patients where it focuse on the hand specifically the fingers part. The reason why this project just focus on the fingers part because fingers play an important role in their daily activities such as holding a spoon to eat or holding a pen to write.

ii. Most stroke patients were elderly but there are some cases affecting adults and children. The data collected will be taken into consideration several factors such as gender, age, height and weight that involve their BMI. So that the reading level will not be same if some patient is old or young.

iii. This study has practically investigated the response of the piezoresistive pressure sensor during the object gripping operations in different weight.

iv. The components used in this project are a pressure sensor, Arduino UNO, and PIC.

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CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

A literature review is a critical part and in depth evaluation of previous research. It is a summary and synopsis of a particular area of research, allowing reading the paper to establish why pursuing this particular research project. This chapter also explain the research of existing system and identify about the software and hardware requirement needed in order to develop this project.

2.1 Theory of Stroke Disease

Stroke is a medical emergency and leading cause thousands of death in the world. It mostly occur when blood vessel in the brain get stuck (blocked) or bursts. Without proper treatment the cell in the brain will die quickly as a result it can be serious disability or death. The late a person receives treatment the more damage is likely to happen. So please immediately go for help if you are having symptom of stroke. Stroke some time called ‘brain attack’ because it occur when blood vessel get damage and tissues will die when not enough oxygen supply to the brain.

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Some other cases patients die from their first stroke attack and about 30 percent of suffer a stroke will die within a month. Many patients will recover but their left with brain damage depend what type of stroke and affecting area. Some cases victim have a problem with speech, hardly to remember about past, controlling movements and also paralyze on one side of the body

2.2 Symptom of Stroke

The victim of stroke may have face dropped on one side or not be able to smile normally because their mouth or eye may also drop. Their faces will changes drastically because of the symptom. Person with suspected stroke not be able to lift their arm because the body fell numbness and weak. It very difficult to lift even only one arm. Their speech also affected and may be garbled or slurred or not be able to talk even appearing to be awake. The time was very critical because every second counts when seeking treatment for a stroke. Without oxygen brain cell will die within a minute so the patients must get treatment to reduce the damage area in the brain. There are medicine that can reduce brain damage but they need to use within 3 or 4 hour in some people. When late get the treatment the brain tissue will die, the body parts controlled that area won't work properly and this is why stroke is a top cause of long term disability.

2.2.1 There are so many symptom or sign of a stroke include

a. Feel numbness or weakness all of the body
b. Difficulty of swallowing
c. Vision changes both eyes or one eyes
d. Headache with unknown cause
e. Hardly to balance when walking

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2.3 Type of Stroke

A common factor of stroke is atherosclerosis that is plaque made of fat, calcium, cholesterol or other substances. The plaque will build up in the arteries and block the flow of blood and oxygen to the brain. There a two main type of stroke and the first step is to determine which type of stroke is occurring. A CT scan or MRI can help doctor determine whether the symptom is blocked blood vessel or bleeding blood vessel. The other test will determine where the location of damage to get the treatment. The two main cause stroke are:

2.3.1 Ischaemic Stroke

This is the common type of stroke and nearly 8 of a 10 cases fall in this type of stroke. The blood vessel inside the brain gets stuck because of blood clot and stops the flow of oxygen to brain. The clot may develop or travel through the blood vessel from anywhere in the body. The arteries can get naturally narrow time by time because of ages.

Figure 2.1: Ischemic Stroke

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2.3.2 Hemorrhagic Stroke

This type of stroke is less common but it more to be fatal other that ischaemic. Their occur when weakened blood vessel in the brain burst and as a result the bleeding around the brain and it difficulty to stop. The primary cause of haemorrhagic stroke was high blood pressure which can weaken the arteries and make them rupture.

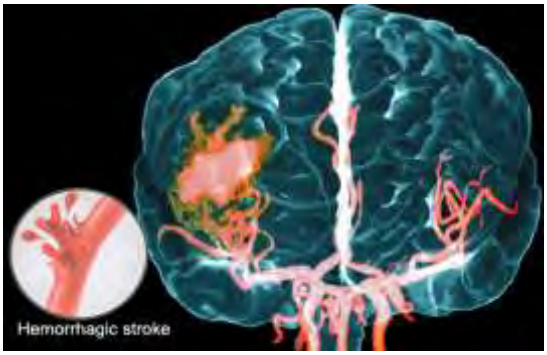

Figure 2.2: Hemorrhagic Stroke

2.4 Stroke Rehab

The common effect of stroke is muscle weakness and also balance problem. Our daily activity will also get affected like walking and eating. The effective way to treat and regain strength, balance and coordination is to do physical therapy. Our major function of this project if to help patient to regain strength and help doctor to collect data to analyse patient from time to time.

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