POST STROKE PALM REHABILITATION FOR HEALTH MONITORING SYSTEM VIA IOT

SHALINI A/P SINGARA VALEN

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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SHALINI A/P SINGARA VALEN

This report is submitted in partial fulfilment of the requirements for the degree of Bachelor of Electronic Engineering with Honours

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(TANDATANGAN PENULIS)

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IR.DR. RIDZA AZRI BIN RAMLEE
Pensyarah Kanan
Fakulti Kejuruteraan Elektronik Dan Kejuruteraan Komputer
Universiti Teknikal Malaysia Melaka (UTeM)
Hang Tuah Jaya
76100 Durian Tunggal, Melaka

Alamat Tetap: 7A-15-24 LEBUHRAYA THEAN TEIK 11500 AYER ITAM PULAU PINANG

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Author : SHALINI A/P SINGARA VALEN

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DEDICATION

Specially dedicated to my beloved parents, Mr. Singara Valen Ahambaram and Mrs. Ahila Nadesan, my sister, brother, cousins, friends, and supervisor Ir Dr Ridza Azri Bin Ramlee.

ABSTRACT

Stroke is one of the five most common illnesses in Malaysia and causes a significant amount of sadness and death in Malaysia and around the world. Although major strokes can be fatal, stroke survivors show weakness, stiffness, and decreased proprioception, depending on which part of the brain is damaged by the stroke. The patient is demotivated to participate in occupational therapy rehabilitation because of the high expense of the sessions as well as the restriction in mobility. Thus, to provide for a more thorough diagnosis of impairment and individualization of rehabilitation therapy, wearable technology offers the ability to objectively assess and monitor patients both within and outside of clinical contexts. The development of an IoT-based post-stroke palm rehabilitation system enables stroke patients to get daily treatment without regular supervision by a physical therapist. The goal of monitoring is for them to enhance the rehabilitation process. This system was developed using flexion sensors to measure hand flexion or flexure and pressure sensors to detect the physical pressure of the patient. In addition, the most suitable microcontroller has been identified for this system, Arduino Mega, and the ESP8266 Wi-Fi Module for Wi-Fi compatibility, which will be helpful to transfer the data to the IoT cloud to view the progress made by each patient. Furthermore, the data from the IoT application can be

exported to an excel file to send to the physiotherapist. The purpose of exporting the data to an excel file is because sometimes the physiotherapist will not be available while the patients are doing the exercises, and they will be missed to monitor their patient's progress. So, by sending the progress excel file to the physiotherapist, they can view and record the patient’s progress by looking at the excel data file. The implementation of this system in the real application will be useful for stroke patients by saving their money, time, and energy with this effective system.

ABSTRAK

Strok adalah salah satu daripada lima penyakit yang paling kerap berlaku dan boleh mengakibatkan kehilangan upaya dan boleh membawa kepada kematian. Keadaan strok yang teruk boleh membawa maut, walaubagaimana pun mereka yang terselamat dari strok kebiasaannya menunjukkan kelemahan daya upaya, kekakuan, dan penurunan proprioception. Keadaan ini bergantung pada bahagian otak yang rosak akibat daripada strok tersebut. Disebabkan kos rawatan yang tinggi dan mobiliti yang menyusahkan, pesakit enggan mengambil bahagian dalam aktiviti pemulihan terapi cara kerja. Oleh itu, kajian ini dijalankan untuk menyediakan diagnosis kecederaan yang lebih teliti dan rawatan pemulihan yang baik, menggunakan teknologi guna boleh pakai serta menyediakan penilaian keupayaan untuk merekod dan memantau pesakit secara objektif di dalam dan di luar persekitaran klinikal. Pembangunan sistem pemulihan pesakit berasaskan IoT untuk pesakit yang mengalami strok membolehkan pesakit strok menjalani aktiviti pemulihan terapi tanpa pengawasan tetap oleh ahli terapi fizikal. Matlamat pemantauan adalah untuk membolehkan mereka mendapatkan komitment dan pemantauan dalam proses pemulihan terapi. Sistem ini menggunakan sensor fleksi untuk mengukur kelenturan anggota badan atau tangan dan sensor tekanan untuk

mengesan tekanan pada badan pesakit. Di samping itu, mikropengawal Arduino Mega didapati paling sesuai untuk sistem dan Modul Wi-Fi ESP8266, yang akan membantu untuk memindahkan data ke IoT untuk melihat tahap kemajuan setiap pesakit strok. Tambahan pula, data daripada aplikasi IoT boleh dieksport ke fail excel untuk dihantar kepada ahli fisioterapi. Tujuan mengeksport data ke fail excel adalah kerana kadangkala ahli fisioterapi tiada semasa pesakit melakukan senaman dan mereka akan terlepas untuk memantau perkembangan pesakit mereka. Jadi, dengan menghantar fail excel kemajuan pesakit kepada ahli fisioterapi, mereka boleh lihat dan merekod kemajuan pesakit dengan melihat fail data excel. Pelaksanaan sistem ini dalam aplikasi praktikal akan membantu pesakit strok menjimatkan wang, masa dan tenaga mereka melalui sistem yang dicadangkan ini.

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IoT: Internet of Things

FSR: Force-Sensitive Resistor

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CHAPTER 1

INTRODUCTION

This chapter explains the purpose of this project and the benefits for post-stroke patients when they use the proposed system. This chapter will consist of an overview of the project, problem statement, objective of the project, scope of the work, and thesis structure. Therefore, the overview of the project will explain the purpose of this system and how useful it is for the patients. Furthermore, the problem statement will explain the patient's problems while performing the rehabilitation at a rehabilitation centre or hospital. The project's objective explains the aim of the system that needs to be achieved at the end of this project. Then, the project's scope will explain the limitations of the project, and the thesis structure will explain the structure of each chapter in this thesis.

1.1 Overview of Project

More than 15 million people worldwide suffer from stroke (Narayana, 2015). The main cause of stroke is high blood pressure, which cuts off or reduces the blood supply to part of the brain, depriving brain tissue of oxygen and nutrients. Once a person is affected by a stroke, it can take weeks, months or years to recover, but unfortunately, some patients face lifelong disabilities. Every stroke patient must undergo rehabilitation, which returns the patient to semi-normal function. It is part of the recovery process, and patients must engage in daily physical activity. Unfortunately, most stroke patients lose interest or motivation when involved in the recovery process without knowing it. For this reason, they do not succeed in the recovery process. The solution is to develop a palm rehabilitation monitoring device that allows patients to do training for grip problems. The patient can do exercises and monitor their progress at the same time. Another advantage is that doctors can also authorize the system to monitor their patients' progress. The project consists of an Arduino Mega, ESP8266 Wi-Fi Module, a pressure sensor, and a flexible bend sensor. The system detects flexion and measures handgrip strength as the patient performs the exercises. The data can be accessed via a mobile application or a website via IoT. Furthermore, the data from the IoT application can be exported to an excel file so that the patient's progress can be viewed by the physiotherapist anytime.