UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF NEURO IOT PAIN SCALE SYSTEM

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

by

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Tajuk: DEVELOPMENT OF NEURO IoT PAIN SCALE SYSTEM

Sesi Pengajian: 2019

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DECLARATION

I hereby, declared this report entitled DEVELOPMENT OF NEURO IoT PAIN SCALE SYSTEM is the results of my own research except as cited in references.

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Author : PAVITHARAH A/P THANGAVELLAH

Date: 13 JANUARY 2020

APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electronic Engineering Technology (Telecommunications) with Honours. The member of the supervisory is as follow:

Signature: ....

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Signature: ....

Co-supervisor:

ABSTRAK

Alat dengar Elektroencefalogram (EEG) merekodkan elektrod yang dilampirkan pada kulit kepala untuk mengenali pergerakan elektrik dalam minda. Projek ini dibangunkan untuk mengatasi kesukaran menafsirkan tahap kesakitan pesakit. Selain itu, para doktor dapat membuat kenyataan perubatan dengan tepat. Objektif utama projek ini adalah untuk membangunkan prototaip skala kesakitan berasaskan neuro dan untuk menganalisis prestasi skala kesakitan berasaskan neuro untuk ketepatan, kebolehpercayaan dan kebolehgunaan. Untuk mencapai matlamat, alat dengar EEG disambungkan dengan mikropengawal NodeMCU. Kemudian, pengaturcaraan mikropengawal ini berkumpul dan disesuaikan melalui ThingSpeak dan Internet of Things (IoT). Pada ketika ini, keputusan alat dengar EEG muncul melalui klasifikasi gelombang otak. Alat dengar EEG ini akan mengenali dimensi tepat tahap kesakitan. Akhir sekali, kehidupan pesakit dapat diselamatkan serta menambah baik sistem hospital.

ABSTRACT

Electroencephalogram (EEG) headset records the electrodes attached on the scalp to recognize electrical movement in the mind. This project is developed to overcome the difficulty of interpreting the pain level of a patient. Besides that, the doctors unable to make the medical statement accurately. The main purpose of this project is to develop a prototype of neuro-based pain scale and to analyse the performance of neuro-based pain scale for accuracy, reliability and usability. To achieve the objective, EEG headset is connected with NodeMCU microcontroller. The microcontroller gathered programmed data and customized through ThingSpeak and Internet of Things (IoT). At this point, the pain level and EEG result will be collected and displayed. This system will recognize the exact dimension of pain level. Last but not least, a patient life can be spared as well as to improve the hospitalize framework.

DEDICATION

Special dedicate to my beloved parents and sibling and also my friends who give support and encouragement for me to complete this project. Not forget to my supervisor, Khairul Azha Bin A.Aziz who gave me a lot of advices and guidance during this project until successfully. Thank you very much to all of you.

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EEG	Electroencephalogram
IoT	Internet of Things
AIN	Artificial Intelligence network
PSD	Power Spectrum Density
API	Application Programming Interface
VAS	Visual Analog Scale
NRS	Numerical Rating Scale
AV	Action Unit
FACS	Facial Action Coding System
K-NN	K-nearest neighbour
MPS	Mankoski Pain Scale
NFCS	Neonatal Facial Coding Sytem
N-PASS	Neonatal Pain Agitation and Sedation Scale
CRIES	Crying require O2 Increased versus Expression Sleepless
DCT	Discrete Time Fourier
PNN	Probalistic Neural Network
SSQ	Single Scale Self-Quotient Image
PR	Pulse Rate
Q-EEG	Quantitative Electroencephalogram
BCI	Brain Computer Interfaces
ICU	Intensive Care Unit

PCS	Pain Catastrophizing Scale
NICU	Neonate Intensive Care Unit
PIPP	Premature Infant Pain Profile
SGB	Susan Given Bell
PE	Permutation entrophy
SampleEn	Sample entrophy
VRS	Verbal Rating Scale
FIC	Facial Image Scale
GRADE	Grading of Assessment Development Evaluation
AIoas	Artificial Intelligence of a Service
AI	Artificial Intelligence
ANFIS	Adaptive Neuro Fuzzy Interference System
Rpi	Raspherry Pi

. CHAPTER 1

INTRODUCTION

1.1 Background

This project concentrating on the protype that can scale the pain of an individual. This pain scale utilizing Electroencephalogram (EEG) sensor project, brain wave classifications, EEG sensor, Internet of Things (IoT) and ThinkSpeak. The pain is test and measures by utilizing Electroencephalogram (EEG) headsets and records the cathodes joined on the scalp to identify electrical movement in the cerebrum. Nowadays, the rates of pain scale between 1 to 10 have low precision to gauge patient's wounds. Therefore, the point of this venture is to build up a representation interface of neuro-based model pain scale and investigate the execution of the pain scale.

1.2 Pain Scale Issues

The difficulty of describing pain level of patients is one of the major problems faced by most doctors. This makes the doctors difficult to make medical statement for their patients. Moreover, doctors also a human that cannot run from making mistakes. This is because there are certain medical machines that cannot detect accurately a patient's pain and there are certain cases that pain is only a little but actually it is worse pain. This make the doctor become frustrated as they cannot detect the pain and save a patient live. In addition, the pain faced by children and senior citizens as well as blind and deaf people faced a big problem in interpreting their pain level. This pain assessment need database from self-report, health history and behavioural observation of patients.

The Figure 1.1 below illustrate on the pain management. This model of the Neuro matrix remains as opposed to a long held logical model of pain that connects the generation of pain with tissue damage and its resultant identification by the peripheral nervous system. Neuropathic pain is a term used to indicate to nerve motivations. In this view, the doctor explained on how the peripheral nervous system recognizes agonizing tissue harm, which at that point sends "pain signals" to the central nervous system, including the cerebrum, where the pain registers as a conscious experience in the brain. The spinal cord and brain are essentially recipients of the pain that is sent from the site of tissue harm by the peripheral nervous system. This logical model of pain along these lines benefits the peripheral nervous system and tissue harm over the mind and spinal cord with respect to the to the generation of pain.

Figure 1.1: Pain management matrix

1.3 Objectives

The targets of this project are:

1) Develop a prototype of neuro-based pain scale including visualization interface system.
2) Analyse the performance of neuro-based pain scale system for accuracy, reliability and usability.

1.4 Project Scopes

The project scope of this pain scale system is the pain scale controlled by EEG headset. First and foremost, this project used NodeMCU microcontroller. The function of this microcontroller receives data from biosensor and transfer data to web view platform. Then, this biosensor technology called Electroencephalogram (EEG) used as a sensor to observe brain signal activity wave data from the subject. Moreover, the application used to ThingSpeak to display recorded data is through web-view platform. All the data transferred from the microcontroller to the web-view platform used Internet of Things (IoT) system. The outcomes of all data analysed in ThingSpeak used to create a pain scale system. Last but not least, the motivation behind this pain scale framework is to distinguish and identify precisely the pain dimension of patient utilizing EEG Headset.

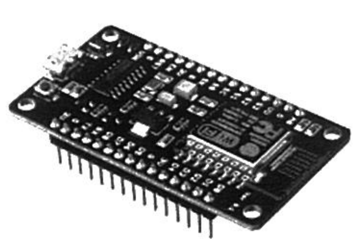

Figure 1.2: NodeMCU Microcontroller

1.5 Project Methodology

This project will be a successful project as it follows the correct method and procedures. The methodology of this project is to certify the project is done smoothly within required time and execute as the outcomes are observed. Construction of this project is to illustrate the idea and the definition of this project and purpose this project is chosen. The process or known as method of this project includes the Flowchart figures, NodeMCU microcontroller setup and EEG headset setup gadget.

1.6 Thesis Structure

This thesis is a combination of overall five chapters that contain the introduction, literature review, methodology, results and discussion as well as conclusion.

1) Chapter 1:
   In this chapter, this project introduced the short thought of the project. This project focused on the project background, the details in objectives, the problem statement, project scope and methodology of the project.
2) Chapter 2:
   In this chapter, this project discusses about its background. The concepts, theory, characteristics of component and hardware that cover in this project are included in this chapter. This section additionally covers term definition used. The observation is done in this chapter by making a research from previous available project to apply in this project.

3) Chapter 3:
In this chapter, it discusses methodology. This methodology discusses steps and procedures that involved completing this project. This methodology also includes the schedule and report detailed of studies with objective achievement. The detail development of the project is also discussed in this chapter.

4) Chapter 4:
In this chapter, it discusses the results and discussion of the project. All the simulation recorded data and data analysed is discussed and attached in detail. The hypothesis, discussion and conclusion of this project included in this chapter. Those parts are based on comparison and elaboration according to the outlined objectives.

5) Chapter 5:
In this chapter, it consists of the summary of overall project and recommendation for future work of the project. This chapter also summarised what the project has done and followed by a recommendation on how to improve the performance of the system based on the desired results.