

VERIFICATION OF BRAINWAVE BALANCING INDEX (BBI) USING EEG

This thesis is presented in partial fulfillment for the award of the
Bachelor of Electrical Engineering (Hons.)
UNIVERSITI TEKNOLOGI MARA



Muhammad Aymynul Hafeez Bin Mustaffa
Faculty of Electrical Engineering
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM, SELANGOR

ACKNOWLEDGEMENT

In the name of Allah the most Beneficent and Merciful. A deep sense of thankfulness to Allah who has given me the strength, ability and patience to complete this project and thesis as it is today.

Firstly, I would like to express my gratitude and sincere appreciation to my supervisor, Pn Ros Shilawani Bt S. Abdul Kadir for her suggestions, support, guidance and invaluable advice throughout the preparation and completion of my final year project. My appreciation also goes to Associate Professor Zunairah Binti Hj. Murat for her advice, guidance, abundance of idea and suggestion that had helped me during the completion of this task.

I also would like to thank Puan Rosnah Kassim, who assisted me at Biomedical Research Laboratory for Human Potential. Not to forget to those who had given me support and guidance that enables me to complete this project, thank you very much.

Finally, with my love and gratitude, I want to dedicate this thesis to my family who has supported me through, especially to my mother and father.

Thank you

Muhammad Aymynul Hafeez Bin Mustaffa

ABSTRACT

Abstract - This paper presents on verification of brain wave balancing index system using EEG. In this research, both left and right side of human brainwave was recorded using non-invasive techniques called EEG. The brainwave signal was analyzed via intelligent signal processing method to determine the correlation between the left and right brain hemisphere resulting in brainwave balancing index. The index results involved in five categories that are Highly Balanced, Balanced, Moderately Balanced, Less Balanced and Un-Balanced. This research involves 53 samples. A set of brainwave dominance questionnaire were given to the samples during an interview session with them. Then the samples were test via EEG. The data collected were analyzed using three methods that are RAW data, Power Spectrum Density (PSD) and Artifact removed. Finally, all the result were compared and it is shows that PSD give the best result with 82% accuracy which is greater than the RAW data and Artifact Removed that give 75% accuracy.

Keywords: EEG, brainwave, BBI and PSD, artifact removed.

TABLE OF CONTENTS

DECLARATION	ii
ACKNOWLEDGEMENT	iii
ABSTRACT	iv
TABLE OF CONTENTS	v
LIST OF FIGURES	vii
LIST OF TABLE	ix
LIST OF ABBREVIATIONS	x
CHAPTER 1 INTRODUCTION	1
1.1 BRAINWAVE.....	1
1.2 ELECTROENCEPHALOGRAPH (EEG)	1
1.3 LEFT AND RIGHT BRAIN HEMISPHERES	2
1.4 BRAINWAVE BALANCING INDEX (BBI)	3
1.5 POWER SPECTRUM DENSITY (PSD) AND ARTIFACT REMOVED.....	3
1.6 PROBLEM STATEMENT	4
1.7 OBJECTIVE.....	4
1.8 SIGNIFICANCE OF PROJECT	4
1.9 SCOPE AND LIMITATION OF PROJECT	5
1.10 THESIS ORGANIZATION	5
CHAPTER 2 LITERATURE REVIEW	6
2.1 BRAINWAVES	6
2.2 ELECTROENCEPHALOGRAM (EEG).....	8
2.2.1 EEG Applications.....	11
2.2.2 EEG Recording Techniques.....	12
2.2.3 EEG Amplitudes and Frequency Band	13
2.2.4 EEG Analysis.....	13
CHAPTER 3 METHODOLOGY	14
3.1 INTRODUCTION.....	14
3.2 RESEARCH METHODOLOGY	14
3.3 EXPERIMENTAL PROCEDURES	15
3.4 PSYCHOANALYSIS TESTS.....	16
3.5 EXPERIMENT DESIGN.....	17
3.6 DATA COLLECTING.....	18

CHAPTER 1

INTRODUCTION

1.1 BRAINWAVE

The brainwave is defined as a rhythmic fluctuation of electric potential between parts of brain as seen on electroencephalogram. This brainwave can determine a person's behavior and also their personality because different types of brainwave can be associated with certain types of personality [1]. Brainwaves have been grouped according to their frequencies and labelled with Greek letters. Their most common frequencies include beta, alpha, theta and delta. All this frequency have their different range with 13Hz to 40Hz for beta(β), 8Hz to 12Hz for alpha(α), 4Hz to 7Hz for theta(θ) and 0Hz to 3Hz for delta(δ). These brainwave patterns commonly form sinusoidal wave shapes.

1.2 ELECTROENCEPHALOGRAPH (EEG)

Electroencephalography is a medical imaging technique that reads scalp electrical activity generated by brain structures. EEG is defined as electrical activity of an alternating type recorded from the scalp surface after being picked up by metal electrodes and conductive media [2]. EEG measures the brain waves of different frequencies within the brain. Electrodes are placed on specific sites on the scalp to detect and record the electrical impulses within the brain.