



**Faculty of Electrical and Electronic Engineering Technology**



**IMPLEMENTATION OF NEURO BASED SWITCHING SYSTEM  
CONTROL FOR IOT SMART HOME**

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**Bachelor of Electronics Engineering Technology (Industrial Electronics) with  
Honours**

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**IMPLEMENTATION OF NEURO BASED SWITCHING SYSTEM CONTROL  
FOR IOT SMART HOME**

**NURUL AZIRAH BT ABD RASID**

**A project report submitted  
in partial fulfillment of the requirements for the degree of  
Bachelor of Electronics Engineering Technology (Industrial Electronics) with  
Honours**



اونيورسيتي تیکنیکل ملیسيا ملاک  
**Faculty of Electrical and Electronic Engineering Technology**

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## DEDICATION

*Special dedication to my beloved parents for their endless support, their constant love and inspiration. To my supervisor, Ts. Khairul Azha Bin A. Aziz, for his knowledge, motivation and guidance that has been poured tirelessly throughout completion of this project as well as to my fellow friends for their support and encouragement on me.*



## ABSTRACT

A biosensor is a type of analysis that converts a biological response into an electrical signal. Although an electroencephalogram (EEG) is a process that allows a metal electrode to measure and record electric impulses from the brain. The smart home controller featuring biosensors is a system which allows human brain and house appliances, microcontrollers or computers to communicate. The major purpose of this work is to implement a neuro-based switching system for biosensor-based home appliance control and to assess system performance in terms of biosensor and IoT performance. To achieve the goal, an EEG signal was collected using a low-cost EEG biosensor. The EEG signal was also analysed and classified using a Nodemcu ESP8266 serial monitor. This classification signal was already set up to send a command to the NODEMCU ESP8266 which could be used to control a real-time home appliance. To turn on and off home appliances, the EEG device communicates with a microcontroller or computer. Apart from analyzing biosensor data, an IoT platform such server can track the use of household appliances through the internet.

## ***ABSTRAK***

Biosensor ialah sejenis analisis yang menukarkan tindak balas biologi kepada isyarat elektrik. Electroencephalography (*EEG*) ialah satu proses yang membolehkan elektrod logam mengukur dan merekod impuls elektrik dari otak. Pengawal rumah pintar dengan biosensor ialah sistem yang membolehkan otak manusia berkomunikasi dengan perkakas rumah, mikropengawal atau komputer. Tujuan utama kerja ini adalah untuk melaksanakan sistem pensuisan berasaskan saraf untuk kawalan perkakas rumah berasaskan biosensor, dan untuk menilai prestasi sistem dari segi prestasi biosensor dan *IoT*. Untuk mencapai matlamat ini, peranti Neurosky Mindflex biosensor *EEG* kos rendah digunakan untuk mengumpul isyarat *EEG*. Monitor bersiri *Nodemcu ESP8266* juga digunakan untuk menganalisis dan mengklasifikasikan isyarat *EEG*. Isyarat pengelasan ini telah disediakan untuk menghantar arahan kepada *Nodemcu ESP8266*, yang boleh digunakan untuk mengawal perkakas rumah masa nyata. Untuk menghidupkan dan mematikan perkakas rumah, peranti Neurosky Mindflex berkomunikasi dengan mikropengawal atau komputer. Selain menganalisis data biosensor, platform *IoT* pelayan tersebut juga boleh menjejaki penggunaan peralatan rumah melalui Internet.



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## LIST OF SYMBOLS

$\delta$	-	Voltage angle
	-	
	-	
	-	
	-	
	-	
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	-	



## LIST OF ABBREVIATIONS

V	-	Voltage
	-	
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## CHAPTER 1

### INTRODUCTION

#### 1.1 Background

EEG stand for electroencephalogram is a test that measures and records electrical signal from the scalp of the brain through a metal electrode. This electrode connected by wires to a computer. The computer records the brain's electrical activity and display it on the screen. Electrical signal consists of alpha waves, beta waves, theta waves and delta waves. All this have own frequency (in Hz) and mental condition.

Currently, some low-cost EEG systems are developed to provide a new way to explore human mind with affordable price in the market. Emotive EPOC is one of the selections as it offers lower price (499 USD) with 14 electrodes mounted on a wireless headset which can connect to laptop and computer wirelessly using Bluetooth at bandwidth of 2.4 GHz.

Utilizing EEG technology, the wireless headset reads user brainwave activity and moving and object. The device used a variation of EEG technology to "read" the intensity of these brainwaves via sensors positioned on forehead and ear. The sensors do not generate or interfere with brainwaves, they only read what is already there.

An analytical equipment that converts a biological response into an electrical signal is known as a biological. Biosensors must typically be very specific, related to physical conditions like temperature or reusable. Integrated research in chemistry, biology, and engineering is required to develop biosensors, their materials, transducing devices, and implantation methods. One of the biosensor applications is the EEG bio amplifier.

Biosensor used for the detection of an analytic that combines a biological component with a physicochemical detector. It is commonly used to refer to an electrical bio signal. Electrical bio signals (bio-electrical signals) are the electrical currents generated by electrical potential differences across a tissue, organ or cell system like the nervous system.

Through the Internet, anyone may control and monitor any home device. Every day, the Internet of Things evolves from little machines to enormous machines capable of sharing information and achieving goals while people are busy with other tasks. A system is one that manages the house's daily operations, such as having a constant room temperature and lighting.

## **1.2 Problem Statement**

Human wishes to get better and more convenience life with the advance of technologies nowadays. Creations nowadays are so smart until things and stuffs can be control wirelessly and digitally by sensors, smartphones, robots, tablets, laptops and so on. Smart Home is one of the examples that loves by mankind and it is still being developed. Current trend for smart home nowadays is by using sensors and thumbprint which is troublesome sometimes. It is not ubiquitous with the use of sensors and thumbprint as the task designed can be executed only if the user is within the range of execution of the sensors.

Also, the cost for a complete smart home system is very high and thus most of the people is not affordable to own this technology. Apart from that, there are a lot of people in this world suffering malfunction in the motor activities that cause them facing inconvenience in their daily life. They have difficulties in performing their daily activities. Hence, this project is to develop a brand new and attractive switching control with an affordable EEG system to monitor home appliances wirelessly using ESP8266 Nodemcu with the knowledge in Blynk Application.

### 1.3 Project Objective

The objectives that should be taken as to obtain the goal of this project. Specifically, the objectives are as follows:

- a) To develop prototype of smart home controller using low-cost EEG system and ESP8266 Nodemcu
- b) To use Blynk Application to control home appliances using electroencephalogram Brain.
- c) To visualize Electroencephalogram brain sensor data through IoT platform.

### 1.4 Scope of Project

Smart Home Controller is a project that introduces the development of biosensor-based home automation control. First of all, as shown in Figure 1.1, this project employs the ESP8266 NodeMCU microcontroller, which may be used to control any application. This microcontroller collects data from the biosensor and sends it to the web view platform. It was then used to process data, such as transforming binary signals to digital signals. This brain works in the same way as an Arduino and plc microcontroller. Additionally, electroencephalogram is a reducing biosensor technology (EEG). This brain sensor is known as a Brainwave sensor, and it consists of a reference sensor for identifying human brain signals and a ground node connected to the user's head.

The brainwave sensor has its own Bluetooth module that has been designed to operate as the master device. As a result, another HC-05 Bluetooth module is required for this project, which will serve as a slave device for receiving commands from the sensor.

A software called brainwave visualizer can be used to visualize the signal collected from the human brain. Attention, meditation, alpha, beta, theta, and gamma are only few of the signals displayed by this software. It functions as a sensor to monitor the subject's brain signal activity wave data.

This monitoring system is designed to keep record of and control when a house user wants to turn on or off appliances. The hardware used in this project includes a NodeMCU, a HC-05 Bluetooth module, a relay channel, switch, a fan, and a light.

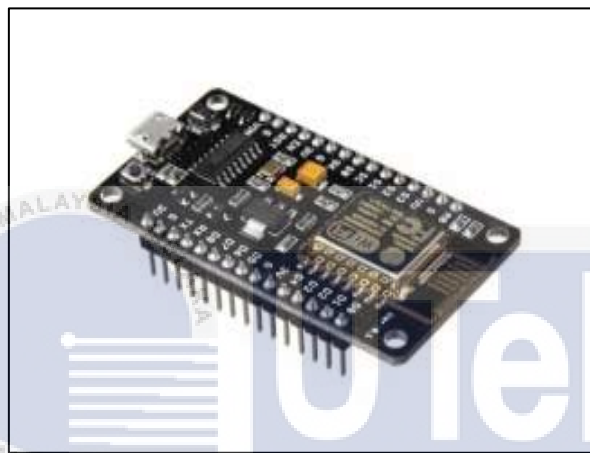


Figure 1.1 : ESP8266 Nodemcu

## **1.5 Thesis organization**

### **Chapter 1: Introduction**

Discussing the background of the project and the problems it aims to solve. Chapter 1 essentially brings with it the overall project ideas. It consists of the background of the project, objectives, statements of problems, scopes, and outline of the project.

### **Chapter 2: Literature review**

The preview of previous research and project concerning this issue is documented in this chapter

### **Chapter 3: Methodology**

This chapter describes all of the strategies or ways of executing the idea. The chapter contains much of the plan and development knowledge for the project.

### **Chapter 4: Result**

This chapter documented the representation of data and results. The findings are important in the future for further study.

### **Chapter 5: Conclusion**

This chapter is made up of recommendations and conclusions which state whether or not the goals are being achieved.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

The Internet of Things (IoT) is a technology that allows items to be connected to the Internet and monitored remotely. The Internet of Things (IoT) concept has changed greatly, and it is now employed in a variety of fields, including smart homes, healthcare, and industrial environments. Moreover, IoT-integrated wireless sensor network technologies enable the global interconnection of smart devices with advanced capabilities. The main technology for creating intelligent homes is a wireless home automation network, which is made up of sensors and devices that share resources and are connected to one another. The developed system is an element of the Internet of Things, and its purpose is to integrate home automation. Allow users to control the objects and devices in their homes remotely. This chapter will summarize articles and findings from previous research on artificial intelligence-based smart home controllers.

#### 2.2 Overview of Smart Home Controller

The A detail survey on the smart home controller has be found in these review articles in [1]. The authors described the home automation is to use of computer and information technology for control home appliances and features like lighting and fan. System will range from simple of remote control of lighting through to complex computer. Plus, the microcontroller based networks varying degrees of intelligence and automation. The home automation is adopted for easy, security and energy efficiency.

Furthermore, the home automation make a different to be better energy management and usage of renewable of energy sources. The system software consists assembly language for programming the microcontroller. Plus, the visual basic language is that use for communication between transmitter (TX) and receiver (RX) of model.

In this project [2] the main objective is designed to assist people, particularly the elderly, in controlling electrical appliances and ensuring their safety. A smart home system is critical, according to this article. Assist those with disabilities and the elderly in controlling electrical appliances and ensuring their safety. In critical situations, the Internet of Things (IoT) system is beneficial to these individuals. These procedures can be accessed in two ways.

The Wi-fi stands for wireless Internet access, or the ability to connect to a router. This technique is low-cost and can control a large number of devices in a single circuit. According to this post, smart home systems are highly popular in modern times since they provide a variety of applications that make things simple and easy to handle. Home appliances use wireless technology and can be accessible through the internet, making life easier and more organized for occupants.

In addition, the human brain wave signal has a pattern of millions of neurons. This pattern interaction produces a brain motion created of many types of electrical waves. A sensor in the NeuroSky headset detects human attention level, suggesting that human focus occurs during strong concentration and directed mental activity. This signal is translated into a raw data packet and sent via Bluetooth to the Nodemcu (microcontroller). The microcontroller analyzes the received signal and controls the device's relay circuit to turn on and off automatically.