



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF MICROSLEEP DETECTION SYSTEM BY
USING BIOSENSOR MODULE AND PULSE RATE**

This report submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Electronics Engineering Technology (Telecommunications) (Hons).

by

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ABSTRAK

Pada masa kini, bilangan kemalangan meningkat dari hari ke hari. Banyak kemalangan berlaku kepada mana-mana generasi rakyat kerana banyak faktor. Salah satu yang paling sering faktor adalah pemandu dia berasa mengantuk apabila memandu atau yang mempunyai tingkah laku yang microsleep. Apabila mereka mempunyai microsleep tidak ramai yang dapat membantu kemudian apabila di tempat duduk penumpang kosong. Projek ini dibina untuk membantu mereka yang mempunyai microsleep atau perasaan apabila memandu mengantuk atau membuat kerja-kerja yang memerlukan tumpuan. Skop projek ini adalah bukan sahaja untuk pemandu tetapi kepada semua orang yang melakukan kerja-kerja yang memerlukan tumpuan penuh seperti guru, pelajar, dan juga atlet. Tujuan projek ini adalah untuk Microsleep Sistem Pengesanan dengan menggunakan Biosensor Modul dan kadar Pulse dengan menggunakan arduino sebagai peralatan yang penting untuk mengawal kadar nadi yang akan dibaca dengan menggunakan sensor ECG. Kod sumber arduino akan digunakan C atau C ++ Bahasa dalam persekitaran pembangunan bersepadu (IDE). The Matlab software juga digunakan dalam projek ini untuk melakukan klasifikasi kadar nadi dengan menggunakan Fungsi Radial Asas (RBF) Rangkaian neural. Kesimpulannya, produk ini bukan sahaja untuk pemandu tetapi juga untuk orang yang bekerja atau pelajar kerana ia boleh memberi isyarat kepada rakyat apabila mereka mempunyai microsleep itu.

ABSTRACT

Nowadays, the number of accident increased from day to day. Many accident happen to any generation of people because of many factors. One of the most often factor is he driver feels sleepy when drive or having the microsleeep behaviour. When they are having microsleeep not many people are be able to help then when on the passenger seat are empty. This project is built to help those who have microsleeep or feeling sleepy when drive or do some work that need concentration. The scope of this project are not only for the driver but to all people that do the work who need a full concentration such as teacher, student, and also athletes. The aim of this project is to Microsleeep Detection System by using Biosensor Module and Pulse rate by using the arduino as the important equipment to control the pulse rate that will be read by using the ECG Sensor. The source code of the arduino will be use C or C++ Language in the integrated development environment (IDE). The Matlab sotware is also being used in this project to do the classification of the pulse rate by using the Radial Basis Function (RBF) neural network. As conclusion, this product are not only for the driver but also for the working people or even student because it can give the signal for the people when they are having the microsleeep.

DEDICATION

This humble effort specially dedicated to my beloved parents, family, friends and lecturers whose love can never be forgotten for their support, guidance and encouragement upon completing this project and report.

Special dedicated to my family
MD YUSOFF BIN ABDULLAH
RUZINA BINTI DERAMAN

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

RBF	-	Radial Basis Functions
MS	-	Microsleep
BMs	-	Behavioural Microsleeps
IDE	-	Integrated Development Environment
BPM	-	Beats per Minutes
fMRI	-	Functional Magnetic Resonance Image
EEG	-	Electroencephalography
PSG	-	Polysomnography
EOG	-	Electrooculogram
FD	-	Fractal Dimension
LSTM	-	Long Short-Term Recollection
fROI	-	Face Region of Interest
ESN	-	Echo State Network

CHAPTER 1

INTRODUCTION

1.0 Introduction

In this chapter, it covers the background of the microsleep, problem statements, objectives, scope, limitation, project's methodology and project expectation. This chapter presents all of the general knowledge the project and overall knowledge about the microsleep. The problem statements that stated on this chapter is according to the current issue and the facts from the data of accident which occur because of the microsleep. The general method that will be used is also stated in this chapter.

1.1 Background

The development of microsleep detection system by using biosensor module and pulse rate is a system where the ECG sensor takes the role to control the detection of the microsleep. Nowadays, many people having a problem to concentrate to do things that need the great concentration without getting sleepy or microsleep. Sometimes they need other people to help them to wake up them in the middle of having microsleep or help them to cheer them up to avoid having microsleep.

This project will train in a new way to see the performance of microsleep without getting helps from the others. The development of microsleep detection system by using biosensor module and pulse rate consists of ECG sensor to read the pulse rate of

the person that used it. the pulse rate that the person who are having microsleep is in condition of slow heartbeat with rates around 40–50 BPM. However, the overall microsleep detection system operation is using arduino which can control the whole process by using suitable coding.

1.2 Problem Statement

Nowadays, from the police and forensic report, most the accidents happened because of microsleep behavior from the driver. The accidents that occur are not cause by the older driver, but also teenagers because the microsleep states happen to everyone who is doing the activity that need concentration. As we know, microsleep (MS) is a fleeting scene of rest which may keep going for a transitory of a moment or up to 30 seconds. In this type of condition, a person could not react to some subjective tactile info and gets to be distinctly oblivious respond to some arbitrary sensory input and becomes unconscious. By developing the microsleep detection system by using biosensor module and pulse rate, the accidents can be prevented as the pulse rate will detect the changing of pulse behavior when microsleep. So, in the end when the pulse rate is detected, it will trigger the driver and realize that they are having microsleep condition. However, the application of this project is focus for vehicle driver and students.



Figure 1.2 : Example of accidents happen

1.3 Objectives

The project is implemented in order to achieve the following objectives which are:

- i. To develop the microsleep detection by using biosensor module and pulse rate.
- ii. To analyse the performance of microsleep detection accuracy by using biosensor module and pulse rate.

1.4 Scope of Project

The scope of the project is to study and develop microsleep detection system by using biosensor module and pulse rate. Besides, the scopes of the project are to study about microsleep, the types of systems that had been used and understand and develop the biosensor module and pulse rate. Moreover, the criteria of the project scopes are including man, material and methods.

1.4.1 Man

Males and females drivers (lectures, students, workers, athletes and etc) with no certain of ages and personality.

1.4.2 Material

There are five main components that will be used in this projects which are ECG sensor, arduino and pulse rate.

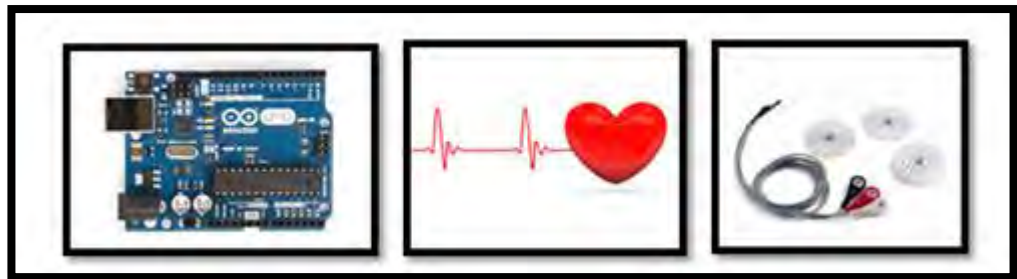


Figure 1.4a : The materials in this projects from left arduino, pulse rate and ECG Sensor

1.4.3 Methods

The methods that will be used are consists of one important method which is by using the Matlab of Radial Basis Function (RBF) neural network to train the pulse rate and to detect the accuracy of the pulse rate.

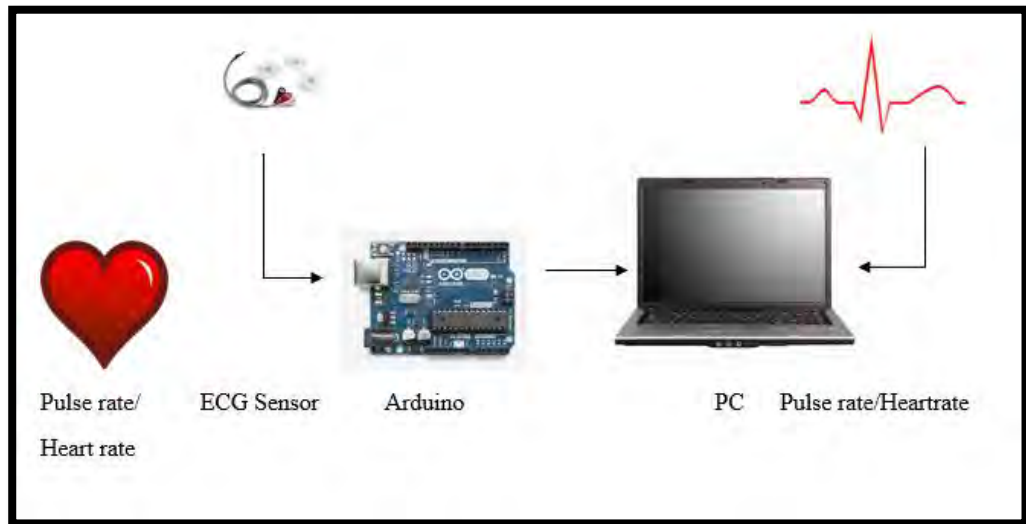


Figure 1.4b : The overview of project diagram

1.5 Project Methodology

In order to produce a good project, there are several procedures that must be followed. Initially, information about the microsleep problem must be identified. Then, more information about the developments of the microsleep problem are gathered from the journals, internet, books and also articles. Besides that, the research continues with the search on the type of the basic application of the arduino that will be used in this project and also search on coding on the arduino to be programmed by using integrated development environment (IDE). Next, after finishing the research, the coding will be simulated in arduino in order to identify whether the coding can be simulated without any error. The pulse rate then will display at the pulse rate amped visualizer to show the heart beat according to the pulse rate read. After that, the hardware for microsleep detection system will be designed. Lastly, the hardware will be combined with the coding to get the complete microsleep detection system by using biosensor module and pulse rate. The microsleep detection system is also develop by using the buzzer to alarm people if the microsleep condition is detected.

1.6 Thesis Structure

Chapter 1:

The first chapter introduces the summary of the idea of the project. It focused on the overview of the project flow, satisfying the objectives, the problem statement, scope and result of the project.

Chapter 2:

In this chapter, the project background is discussed. The methodology of the concept, theory, and several characteristic of components of hardware that are used in this project are also discussed in this chapter. This chapter also defines the terms that is being used in this project and discussed the concept of the research and how it is related with the theory.

Chapter 3:

Chapter 3 describes the detail of the methodology used in this project. The time table or steps that need to be completed and the detailed reports regarding the studies about the project to achieve the objectives of the project are presented.

Chapter 4:

Chapter four shows the result and discussion. All the simulations, data of the projects and results analysis obtained will be discussed in detail on every part of the process. The results will be compared with the aims outlined in order to satisfy for some hypothesis and conclusion.

Chapter 5:

Chapter five discuss about the conclusion and future work that can be undertaken in the future as the seed to design new project. Some recommendations and suggestion on how to surpass the performance of the system based on the desired results will be given.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter introduces the summary of literature review on the development of the microsleep detection system by using biosensor module and pulse rate. The development of the different control system of the microsleep that aims to help people stay alert while doing their work is discussed. The advantages and disadvantages of each microsleep development are also presented and compared. This chapter also presents the development of the control system as main system that will be used will be utilized in this project.

2.1 History of Microsleep

A microsleep (MS) is a fleeting scene of rest which may keep going for a transitory of a moment or until 30 seconds. In this state, the person would not be able to react to some subjective tactile info and gets to be distinctly oblivious respond to discretionary tactile inputs and becomes unconscious. Microsleep is transpire when a person unable to find his cognizance and eventually receives cognizance after a moment in cognizance, or when there are sudden switches between conditions of alertness and sleep. In comportment terms, microsleep is striking as sagging visual perceivers, moderate visual cover conclusion, and head gesturing.