

**POTENTIOSTAT READOUT CIRCUIT DESIGN FOR A 3  
ELECTRODE ELECTROCHEMICAL BIOSENSING  
MEASUREMENT SYSTEM**

**AHMAD JAZLAN BIN JAMIL**

**FACULTY OF ELECTRICAL ENGINEERING  
UNIVERSITY TEKNOLOGI MARA  
MALAYSIA**

## **ACKNOWLEDGEMENT**

First and foremost, I would like to express my deepest gratitude upon Allah S.W.T for giving me strength and patience during completing my final year project. To both of my parents, thank you for always being there for me. For giving me endless support and always encourage me whenever I am down during this two semesters dealing with the final year project. A special appreciation to my supervisor, Dr. Wan Fazlida Hanim Binti Abdullah who had always guiding me without failing all the time during this research. Thank you for all the advice given. And finally for all of my friends, thank you for helping me whenever I need help, for helping on anything that I am not capable of. All for your good deeds will not be forgotten. And for all above, May Allah blessed all of you.

## **ABSTRACT**

This project addresses the need for an interfacing circuit of a biosensor measurement system that operates on immobilization and hybridization process. The purpose of this project is to design a readout circuit that can sense small current changes in the working electrode of a 3 electrode electrochemical biosensor measurement system. The potetioostat consist of a current to voltage converter that will convert the input current into output voltage. The potentiostat is also a medium for biasing the electrodes for electrochemical technique. It also consist of several amplifiers to amplify the input that could be read by the microcontroller. This potentiostat will then be able to detect low microamperes changes in the working electrode.

## TABLE OF CONTENTS

<b>CONTENT</b>	<b>PAGE</b>	
TITLE	i	
APPROVAL	ii	
DECLARATION	iii	
ACKNOWLEDGEMENT	iv	
ABSTRACT	v	
TABLE OF CONTENTS	vi	
LIST OF FIGURES	viii	
LIST OF TABLES	x	
LIST OF ABBREVIATIONS	xi	
<b>CHAPTER 1</b>	<b>INTRODUCTION</b>	
1.1	INTRODUCTION	1
1.2	PROBLEM STATEMENT	2
1.3	OBJECTIVES	3
1.4	SCOPE OF STUDY	4
<b>CHAPTER 2</b>	<b>LITERATURE STUDY</b>	
2.1	INTRODUCTION	5
2.2	RESEARCH TREND IN ELECTROCHEMICAL SENSOR	6
2.3	DEVELOPMENT OF SENSORS READOUT CIRCUIT	8
<b>CHAPTER 3</b>	<b>METHODOLOGY</b>	
3.1	INTRODUCTION	9
3.2	METHODOLOGY DESCRIPTION	9
3.3	USAGE OF POTENTIOSTAT AND TOTAL	

# CHAPTER 1

## INTRODUCTION

### 1.1 INTRODUCTION

This project deals with the detection of DNA mutation which is called BRCA1, a human tumor suppressor gene, using electrochemical biosensing technique. Taking into account that cancer biomarker refers to a substance or process that is indicative, not definitive, of the presence of cancer in the body [1], detection of cancer biomarkers based on gene mutation allows early intervention. This approach offers alternative for different stages of cancer screening. The conventional method for cancer detection is by image processing of samples that is definitive but is for a later stage in cancer development.

Detection based on DNA is also mostly done based on image processing albeit accuracy and processing time issues. Since breast cancer clinical detection is time consuming, costly, and sometimes inaccurate, the electrochemical DNA biosensor is more preferred [2]. The electrochemical DNA biosensor is reported to be highly sensitive, more stable, and low in cost and possess a low detection limit [3]. These characteristics suggest that it should be used as a preferred method for clinical detection to replace the conventional method. With a very low detection limit which made them highly sensitive, it may help to detect breast cancer or the BRCA1 in its very early stage. Recently, many researches on DNA biosensor have been conducted after researchers found the capability of the biosensor. There are many types of DNA biosensor that have been fabricated for various purposes for example in cancer studies where it is able to diagnose mutation and provide early cancer, detection [4]. Research has shown that for