

**DESIGN OF A DISPENSER SYSTEM BY FINITE STATE  
MACHINE USING HARDWARE DESCRIPTION LANGUAGE**

**JAMIL ARIF BIN ROSLI**

**This thesis is presented in partial fulfilment for the award of the  
Bachelor of Engineering (Hons) Electrical**

**NOVEMBER 2008**



**BACHELOR OF ENGINEERING (HONS) ELECTRICAL  
FACULTY OF ELECTRICAL ENGINEERING  
UNIVERSITI TEKNOLOGI MARA  
PULAU PINANG**

## **ACKNOWLEDGEMENT**

**In the name of Allah**

**Most Gracious Most Merciful**

For the most part, I would like to thank to ALLAH S.W.T. Only with god permission, I am able to complete this Final Year Project. Alhamdulillah.

I also would like to express my special gratitude to my Final Year Project supervisor, Mr Mohd Daud bin Alang Hassan for his continuous guidance, support, commitment, and valuable opinions. Thank you for supervise me for the two semester in Final Year Project 1 and Final Year Project 2.

Then, I would like to thank Pn. Nur Fadzilah Mokhtar for teaching me Digital System that helps in this project. Besides that, I also would like to thank all the lecturers that taught me for the past few years. Besides that, I would like to share my great feelings of thankful and a very high dense of appreciation to family members and all my friends who are always stand by me with full support and encouragement.

Other than that, I would never forget to those people around me that support and help me directly or indirectly. Genuine thanks for them.

## **ABSTRACT**

This project is to design a dispenser system which can be used in reality. This system is designed to dispense items based on the customer's choice. It detects coins inserted to allow customer press the button choices based on their needed so that the system dispenses the item. It is designed by using finite state machine mainly including other parts or circuit in order to make it fully operate dispenser system machine. The controller of the dispenser system is including finite state machine and data path which connected with signal that has been control by control unit. Moreover, the system has been written in Very High Speed Integrated Circuit Hardware Description Language (VHDL) to describe all the behaviour. Therefore, this project is also concentrate how to design a complete system in HDL based on the requirement. It has been synthesized by Xilinx ISE software while ModelSim® PE is used for the simulation.

**Keywords:** Finite State Machine, Xilinx ISE, ModelSim® PE, VHDL, HDL.

## TABLE OF CONTENTS

|                                                                         | PAGE |
|-------------------------------------------------------------------------|------|
| DECLARATION                                                             | i    |
| ACKNOWLEDGEMENT                                                         | ii   |
| ABSTRACT                                                                | iii  |
| TABLE OF CONTENTS                                                       | iv   |
| LIST OF FIGURES                                                         | vii  |
| ABBREVIATION                                                            | viii |
| CHAPTER 1                                                               | 1    |
| INTRODUCTION                                                            | 1    |
| 1.1 Background                                                          | 1    |
| 1.2 Objectives                                                          | 2    |
| 1.3 Scope of Work                                                       | 2    |
| 1.4 Outline                                                             | 3    |
| CHAPTER 2                                                               | 4    |
| LITERATURE REVIEW                                                       | 4    |
| 2.1 Introduction                                                        | 4    |
| 2.2 Comparison of Verilog HDL and VHDL                                  | 4    |
| 2.3 Advantages of HDL Based Design Compare to Schematic Based Design    | 5    |
| 2.4 Comparison of Simple System and Complete System of Dispenser System | 6    |
| 2.5 Xilinx ISE WebPack Software                                         | 8    |
| 2.6 Model Sim PE (Personal Edition)                                     | 9    |
| CHAPTER 3                                                               | 10   |
| DESIGN METHODOLOGY                                                      | 10   |
| 3.1 Design Specification                                                | 10   |
| 3.2 Design Methodology                                                  | 11   |

# CHAPTER 1

## INTRODUCTION

### 1.1 Background

This project is aim to learn the Hardware Description Language (HDL), and be able to use state of the arts tools design, simulate and generate real circuits and system. Therefore, design of the system through the HDL and Register Transfer Level (RTL) need to highlight as a main structure of this project.

In digital system, designing a processor can be practiced by using a top-down design methodology using hardware description language. In addition, all of the RTL design and verification process can be rapidly and systematically performed through methodology. Besides that, a hierarchical RTL simulation verification methodology and a support tool can provide flexible and real environment for Field Programmable Gate Array (FPGA).

HDL based design is quite similar to digital system design in RTL design in industry. Since every design must be verified, we perform it in simulation. Therefore, an electronic design automation (EDA) tool has been used in this project for the simulation purpose. In digital fundamental, sequential logic design has been applied to the component level design. Block level design can be done using the logic components. Then, the blocks can be interfaced with one another to build a system in RTL.

As the implementation, this dispenser system is a complete system represents the methodology for RTL design. Many dispenser machines available provide various services to make life easier. For example, water fill machine, fruit dispenser machine, canned drinks machine and many more. Although, people actually do not know what type of system that has been implemented in the machine. They used to purchase an item by using the machine but they do not know how the machine operates. This project is to