PLATE DISPENSER USING PIC MICROCONTROLLER

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Special dedication to my loving family, all my siblings, and my kind hearted supervisors Ms. Muzalifah Mohd Said, Ms. Syafeeza Ahmad Radzi and also dearest friends.

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ABSTRACT

Plate Dispenser Project is a way to organize a large canteen or cafeteria systematically. The purpose of this system is to develop a smart cafeteria where the job of waiter is replaced by a machine. During peak hour, large canteen and food court always encounter problem where clean plate is unavailable and the dirty plate is messed up on the table. This problem happens when customers enter a premise in a large quantity at the same time while the workers are in limited number to do all the work. The solution for this problem is to develop a system which can ensure the customer return the used plate in a proper place (machine). When the customer returns their plate, they will get back their coins that they had inserted during taking the clean plate. Through this system, a plate can dispense more systematically. This system is developed the vending machine concept.

ABSTRAK

Projek Plate Dispenser ini adalah salah satu usaha untuk menguruskan kantin atau kafeteria dengan lebih bersistematik. Sistem ini juga direka untuk mewujudkan kafeteria yang berkonsepkan sistem “smart” di mana tugas-tugas pelayan diganti dengan mesin. Masalah yang selalu wujud di kantin adalah pada waktu puncak di mana semua pelanggan datang serentak ke kantin. Biasanya, pinggan bersih tidak mencukupi kerana banyak pinggan kotor tidak diambil dari meja makan disebabkan kekurangan pekerja. Penyelesaian kepada masalah ini adalah dengan mereka bentuk suatu sistem yang dapat memastikan pelanggan sendiri memulangkan pinggan kotor ke dalam mesin.Dengan berbuat demikian, pelanggan akan mendapat semula duit yang telah dimasukkan semasa mengambil pinggan bersih. Melalui sistem ini, pengagihan pinggan dapat diuruskan dengan sistematik. Konsep sistem ini adalah sama dengan konsep mesin runcit.

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LIST OF SYMBOLS AND ABBREVIATIONS

CPU	-	Central Processing Unit
DC	-	Direct Current
EEPROM	-	Electrical Erasable Programmable Read Only Memory
I/O	-	Input/ Output
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
MOSFET	-	Metal Oxide Semiconductor Field Effect Transistor
PCB	-	Printed Circuit Board
PIC	-	Programmable Interrupted Controller
PSM	-	Projek Sarjana Muda
RAM	-	Random Access Memory

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CHAPTER I

INTRODUCTION

1.1 Project Overview

This project implements the vending machine concept in plate dispensing for self service food outlets such as food court or large canteen. This is to ensure that customer return the used plate when a proper and valid coin is inserted into the coin acceptor. Once the plate returned into the dirty plate receptor, the coin will be returned to the customer. The implementation of the system is using PIC microcontroller as it is easy to design and modify, cheap and robust.

1.2 Objectives Of Project :

Specifically the objectives of this project are:

- To ensure the customer returns the used plate in a proper place.
- To ensure the workers alert when the dirty plate is full and the clean plate is empty.
- To organize the food court and large canteen more systematically.
- To gain more profit to the company. High technology equipment and systematic management in food court or restaurant can attract more people to come.

- To design and develop system which consists of PIC microcontroller circuit, coin acceptor, DC motor circuit, LCD display, buzzer and limit switch.
- To combine other circuits as input and output to the PIC16F877A microcontroller circuit.

1.3 Problem Statement

The problems are observed from large canteen and cafeteria which happened almost every day. All the problems can be summarized as below:

- During peak hour, large canteen and food court always have problem where clean plate is unavailable and the dirty plate is messed up on the table.
- This problem happens when customers enter a premise in a large quantity at the same time while the numbers of workers are limited to do all the work.
- The increase number of workers may require more cost.
- Customers have to wait so long before they can get new plate. This situation can cause a big profit loss to the canteen or food courts if the customers go to another place.

1.4 Scope Of Project

This project is involves hardware and software. Microcontroller PIC16F877A is a brain of the project where it is use to control the whole system of plate dispenser. The PIC microcontroller will control coin acceptor circuit, DC motor circuit, buzzer and LCD display in this system. Coin acceptor and limit switch will be the input of the microcontroller while buzzer, DC motor circuit and LCD display will be the output of the microcontroller.

The software part consists of assembly language programming for the PIC microcontroller. The software used to assemble the program is MPLAB and WINPIC is used to download the program to the microcontroller. To make the process easier to

debug and test, the program will be constructing part by part before it combine for the final design.

1.5 Project Planning

This project is implemented base on the project planning schedule. The project started from July 2009 to March 2010. The project planning schedule is presented in Appendix A.

1.6 Significance of the Project

The significant of this project are :

- To reduce the workers in a canteen of food court.
- To save time, energy and cost.
- To improve the customer service in the canteen or food court.
- To give amenity to the management, workers and customers.
- To introduce high technology application in canteen and food court.

1.7 Thesis Outline

This report contains five chapters that explain in detail about the entire project to provide the understanding of the whole project.

Chapter 1 is introduction of the project. This chapter presents an overview to plate dispenser system, the objectives of the project, project schedule and thesis outline.

Chapter 2 covers the literature review on the circuit that will use in this system. The circuits are DC motor circuit, Coin Acceptor and PIC16F877A microcontroller circuit. This chapter discusses about source or article that is related to the project. This chapter also reveals the products that have been appeared in the market nowadays. This

chapter is also relates the theory of the components, equipments and programming languages that is used in the project. So, it is very important to understand the overall concepts and how this system works.

Chapter 3 describes in details in methodology and the system design. This chapter will cover up all the project implementation to achieve the goal where the method or procedure to finish the project successfully has specially discussed. It also contains the flowchart that shows the step by step procedures in order to complete the entire task. The hardware and software technical details are also explained in this part. The testing procedures, devices and method used to generate the expected results will be included in this chapter.

Chapter 4 represents the results of both simulation and hardware implementation. It also contains the analysis of the project that has been created. This chapter also contains picture and photo for the initial result of this project.

Chapter 5 discusses the overall conclusions and limitations of the project. This chapter includes of suggestion to improve this project for future works. The overall conclusion of this project is shown.

CHAPTER II

LITERATURE REVIEW

This chapter will explain and discusses the sources or articles that are related to the project. It reviewed some products that have been appeared in the market nowadays. This chapter is also describes about the theory of the components, equipments and programming languages that is used in the project. The literature review is done to comprehend the whole system and decide the best inputs, outputs and devices. From literature review, there will be an analysis concerning the advantages and disadvantages for each phase in this project. Equipment and part inclusive some important include information such as dimension, operation and specification is also provided.

2.1 PIC16F877A Microcontroller

The main component of the Plate Dispenser system is a microcontroller. A microcontroller is a small computer on a single integrated circuit consisting of a relatively simple CPU combined with support functions such as a crystal oscillator, timers, watchdog timer, serial and analog I/O etc. PIC is a family of Harvard architecture microcontrollers made by Microchip Technology.

PICs are popular with both industrial developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability.

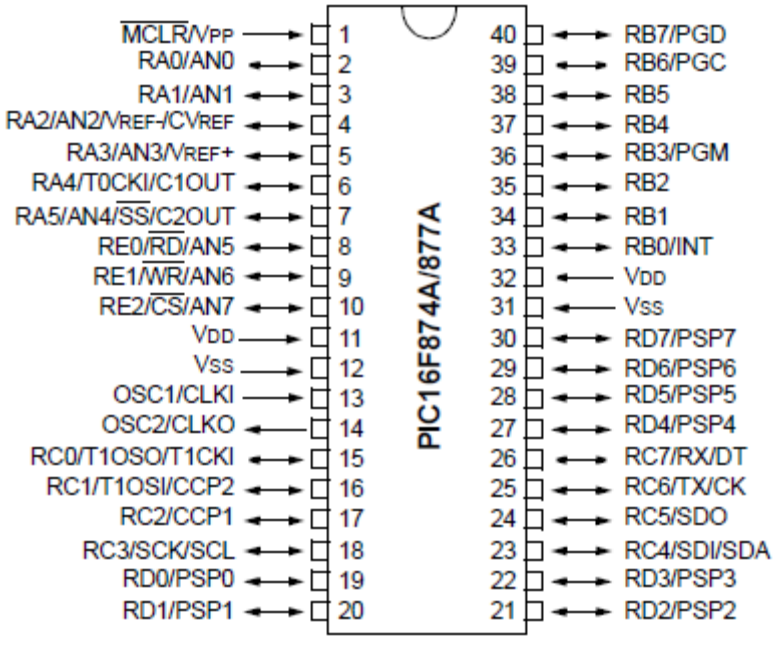

Figure 2.1 PIC16F877A

The PIC architecture is distinctively minimalist. It is characterized by the following features [1]:

- Separate code and data spaces (Harvard architecture).
- A small number of fixed length instructions.
- Most instructions are single cycle execution (4 clock cycles), with single delay cycles upon branches and skips.
- A single accumulator , the use of which (as source operand) is implied (i.e. is not encoded in the opcode) .

- All RAM locations function as registers as both source and/or destination of math and other functions.
- A hardware stack for storing return addresses.
- A fairly small amount of addressable data space (typically 256 bytes), extended through banking.
- Data space mapped CPU, port, and peripheral registers.
- The program counter is also mapped into the data space and writable (this is used to implement indirect jumps).

Unlike most other CPUs, there is no distinction between memory space and register space because the RAM serves the job for both memory and registers, and the RAM is usually just referred to as the register file or simply as the registers.

Table 2.1 : Features of PIC16F877A

Key Features	**PIC16F877A**
Operating Frequency	DC – 20 MHz
Resets (and Delays)	POR, BOR (PWRT, OST)
Flash Program Memory (14-bit words)	8K
Data Memory (bytes)	368
EEPROM Data Memory (bytes)	256
Interrupts	15
I/O Ports	Ports A, B, C, D, E
Timers	3
Capture/Compare/PWM modules	2
Serial Communications	MSSP, USART
Parallel Communications	PSP
10-bit Analog-to-Digital Module	8 input channels
Analog Comparators	2
Instruction Set	35 Instructions

Packages	40-pin PDIP 44-pin PLCC 44-pin TQFP 44-pin QFN

The microcontroller used in this project is the Microchip PIC16F877A. This controller has 33 inputs and outputs. The input and output for the microcontroller can be used in any combination. All input and output are connected to the outside world through the registers which are called port. For this microcontroller, it has 5 ports which are PORTA, PORTB, PORTC, PORTD and PORTE. PORTA has 6 bits, PORTB PORTC and PORTD has 8 bits. But PORTE has 3 bits. This project has 2 circuits. The Master Board circuits uses PORTA, PORTB and PORTC only as the input and output ports.

2.2 DC Motor Circuit

This project uses DC motor type. The DC motors are fairly simple to understand. They are also simple to construct and only requires a battery or dc supply to make them function successfully.

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. The opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.