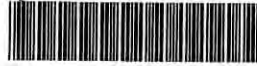


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Snack vending machine / Mohd Alif Mohd Yusoff.

SNACK VENDING MACHINE

MOHD ALIF BIN MOHD YUSOFF

MAY 2006

"I hereby declared that I had read through this report and found that it has comply the partial fulfillment for awarding the Degree of Bachelor in Electrical Engineering (Industrial Power)."

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SNACK VENDING MACHINE

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**This Report Is Submitted In Partial Fulfillment Of Requirements For The
Bachelor Degree of Electrical Engineering (Power Industry)**

**Faculty of Electrical (FKE)
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MAY 2006

“Hereby, I declare that this report is a result of my own research idea except for works that have been cited clearly in the references.”

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**To My beloved
Father, Mother & Brothers**

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ABSTRACT

The aim of this project is to design and built a snack vending machine that is capable of handling many kinds of new peripherals on allowing user to have easy access when using a snack vending machine. The snack vending machine is controlled by the 8051 microcontroller where it will monitor the system cycle and also the input and output operations of the vending machine. The scope of the project is to design a basic snack vending operation using a coin detector. The project consists of the hardware and the software design where the hardware design is divided into two parts which is the input and output operations to the microcontroller. The coins detector which has been emulated by a switching device and the snack push button is the input operations where it allows the user to operate with the vending machine. Meanwhile the output operation consists of the spiral ring snack holder, Liquid Crystal Display (LCD unit) and a 12Vdc motor to rotate the spiral ring. The LCD (Liquid Crystal Display) will display orders to the users in alphabetical character on how to operate the vending machine. It will also display the amount of coins inserted to the snack vending machine and the type of snack chosen by the user. For the software programming, the assembly language is used to interface all the peripherals to the 8051 microcontroller which will operate the system cycle of the vending machine.

ABSTRAK

Projek *Snack Vending Machine* ini adalah untuk menghasilkan sebuah mesin yang dapat menjalankan sistem pengoperasian sebuah mesin membeli makanan. Mesin ini dapat menguruskan pelbagai jenis cara pembelian untuk memenuhi keperluan pengguna dengan kemudahan teknologi terkini. Pada peringkat permulaan, skop projek adalah tertumpu kepada penghasilan sebuah mesin membeli makanan dengan menggunakan sistem pengendalian duit syiling. Ini adalah bertujuan untuk mengetahui pengoperasian asas sebuah *Snack Vending Machine*. Mesin ini akan dikawal oleh mikropengawal 8051 dari famili MCS51. Mikropengawal ini akan mengurus dan mengawal segala jenis operasi yang berlaku didalam mesin membeli makanan ini. Projek ini melibatkan pembinaan perkakasan dan juga pembangunan perisian. Perkakasan yang digunakan adalah seperti gelung pemegang makanan, motor 12Vdc, skrin paparan *LCD (Liquid Crystal Display)*, butang-butang pengendalian pemilihan makanan dan juga butang pemilihan jenis duit syiling. Skrin paparan LCD ini akan memaparkan setiap arahan kepada pengguna, jenis duit syiling yang dimasukkan dan jenis snack yang dipilih. Segala aturan perkakasan ini akan dikendalikan oleh perisian yang menggunakan bahasa komputer iaitu bahasa pengaturcaraan.

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LIST OF ABBREVIATIONS

ABBREVIATION	DEFINITION
MCU	Microcontroller unit
PIC	Personal Interactive Communicators
PLC	Programmable Logic Controller
LCD	Liquid Crystal Display
PSM	Projek Sarjana Muda
DES	Discrete-event System
LED	Light Emitter Diode
ROM	Read Only Memory
RAM	Random Access Memory
EEPROM	Electrical Erasable Programmable ROM
IC	Integrated Circuit
DC	Direct Current

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CHAPTER 1

INTRODUCTION

1.1 Overview

The purpose of this project is to build a Snack Vending Machine using the 8051 microcontroller. The project consists of designing the hardware and the software of the vending system.

For the hardware design, the implementation of the Liquid Crystal Display unit (LCD), 12V dc motor and a coin counter for the input and output operation will be used to build the snack vending machine. All of these appliances were used to interface with the microcontroller unit (M.C.U). The Microcontroller unit (MCU) is the monitoring and the processing system for the snack vending machine.

The Microcontroller unit consists of the 8051 microcontroller, PPI 8255, EEPROM, 6264RAM, 74LS373 Decoder, 74LS138 Decoder and a crystal 11.0592 MHz. This microcontroller unit has been successfully constructed and tested from the previous semester.

The assembly language is used for the software design of the snack vending machine. This language was used to initialize the LCD display, the steps of operation, and the switching of the 12V dc motor for the spiral winding of the snack vending machine.

1.2 Project Objective

1. To design the monitoring system (8051 microcontroller unit) for the vending machine that is capable of interfacing with the input and output of the system. This will entitle the coin slot operator, the Liquid Crystal Display unit (LCD) display and the DC motor that will rotate the spiral ring.
2. To design and built a vending machine using the spiral ring method. This is one of the methods used in a vending machine that is currently available in the market.
3. To design a reliable and user-friendly snack vending machine that will able to run its full operation to the consumer.

1.3 Scope of the Project

In order to design a vending machine that is capable of interfacing with many kinds of new peripherals, a basic operational vending machine using a coin slot operator must be design first. This basic design of the vending machine is to ensure that the microcontroller will able to interface with the input and output operation. Thus, the scope of the project is:

- 1.3.1 To design a basic operation of the snack vending machine using the 8051 Microcontroller with a coin operating system
- 1.3.2 To design the spiral ring with the dc motor driver to rotate the spiral that is used to hold and drop the snack
- 1.3.3 To design a program for the microcontroller using the assembly language that can accept coins for the input and display the steps of operation on the LCD display

- 1.3.4 To design a switching device to emulate the types of coins, snack push button and the drop dispenser

1.4 Problem Statement

In some countries, it's hard to find shops that can operate 24 hours daily. This is because the high number of crimes and robbery happened at night. Another factor is there were not many sales personnel willing to work late at night and exposed to many kinds of risks and danger.

Shop owners usually require spaces or a place to sell their goods. In order to operate the shop, they need to buy or rent shop lots and hires a few sales personnel. All of these require a lot of work and commitment.

Consumers always have problems when they want to use a vending machine. This is because the conventional vending machines only have coin operating system to operate the machine. Nowadays consumers dislike carrying a large amount of coins with them. A vending machine that is capable of handling many kinds of new peripherals would be an advantage and useful for the consumers.

The causes of vending machine malfunction are usually related to the coin operation. Coin acceptors often jam up, especially if a child inserts a bill or other foreign object into the coin slot. Certain vending machines use a spiral kind of mechanism to separate and to hold the products

Some of the conventional vending machines have a complicated way of operating. Thus, consumer will have doubts on using the system. For an example, some of the conventional vending machine requires the consumer to follow complicated steps of operation.

CHAPTER 2

SNACK VENDING MACHINE SYSTEM

A Literature survey on the types of Snack Vending Machine was done in the early stages of the project. The main objective of doing this particular work is to gain knowledge of the different types of method and application used in a snack vending machine.

2.1 Introduction of the Vending Machine

A vending machine is a machine that dispenses merchandise when a customer deposits money, validated by a currency detector, sufficient to purchase the desired item (as opposed to a shop, where the presence of personnel is required for every purchase). It is believed to have been first invented by Hero of Alexandria, a 1st century inventor. His machine accepted a coin and then dispensed a fixed amount of "holy water" [9].

The first commercial coin-operated vending machines were introduced in London, England, in the early 1880s. They dispensed post cards. Richard Carlisle, an English publisher and bookshop owner, invented a vending machine for selling books, around the same time. In 1888, the Thomas Adams Gum Company introduced the very first vending machines to the United States. The machines were installed on the elevated subway platforms in New York City and sold Tutti-Fruiti gum. In 1897, the Pulver Manufacturing

Company added animated figures to its gum machines as an added attraction. The round candy coated gumball and gumball (vending) machines were introduced in 1907.

Vending machines soon offered everything including; cigars, postcards, stamps, etc. In Philadelphia, a completely coin-operated restaurant called Horn & Hardart was opened in 1902 and stayed opened until 1962. In the early 1920's, the first automatic vending machines started dispensing sodas into cups. In 1926, an American inventor named William Rowe invented a cigarette-vending machine [9].

Snack vending machines come in a number of different formats and styles. Most snack machines are see-through or glass-front merchandisers. This is because the customer likes to see what he or she is getting, and likes to be able to browse. Soda machines are usually solid, because most people know what a can of soda looks like and exactly how big it is; however, even that is changing as more manufacturers realize that most consumers think with their eyes. This is especially true of vending machines, where almost every purchase is an impulse purchase. On the other hand, some employees of companies that have vending machines on-site rely on those vending machines every day for a lunch break snack. Some snack vending machines have closed-faced interfaces, but that is rare.

The area in which a machine is placed at a location can make a difference in sales. There are many places where a vending machine is situated such as:

1. Next to the entrance
2. Near to the exit
3. Next to the water fountain
4. In front of the restroom
5. In the break room
6. By the coffee maker
7. Next to the other vending machines
8. By the receptionist

9. Next to the cash register
10. Next to the listening station at a music store
11. Next to the change machine
12. In the waiting area (e.g. at oil change places).

There are 3 factors to be considered on designing a fully operating snack vending machine. The first factor is the type of snack vending machine that will be design. The second factor that must be considered is the type of microcontroller to operate the vending system and finally the types of operation and application that will be used to operate the vending machine.

2.2 Snack Vending Machine Controllers

There are many types of snack vending controller that were used to control and monitor the operation of a vending system. Below are some of the controllers that used in a vending machine:

2.2.1 Vending Machine Using the PIC16F84

This particular vending machine system uses the application, implementation and integration of discrete event System Control Theory. It uses the PIC16F84 as its monitoring system of the vending machine. The project was prepared b Michael Matthias Wood from Queen's University Kingston, Ontario Canada

The hardware and several variations of it were used in investigation into the issues and principles involved in implementation of DES control theory. It is composed of two PIC16F84 microcontrollers, an LCD, some push buttons and some Light Emitting Diodes (LEDs). The switches and wiring to the left of the microcontrollers are necessary for programming the chips and are not part of the circuit. Two

microcontrollers are necessary in this model because of the limited number of input and output I/O pins on the PIC16F84. The upper microcontroller manages the LCD and functions as a slave unit to the lower microcontroller [6].

The master microcontroller delegates simple commands to the slave microcontroller, allowing alternate views of this system as one of distributed control. The master microcontroller is also connected to the COM1 port of a PC for integration with the IDES software.

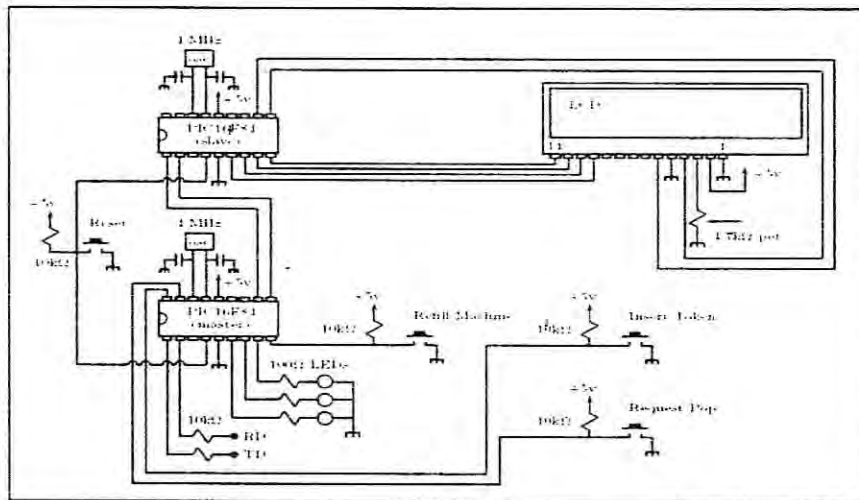


Figure 2.1: The circuit Diagram for The Vending Machine Using PIC

The machine works as follows. The LCD allows output to the human user in the form of text messages such as the current number of credits in the machine or whether or not a requested type of pop is available. The LEDs represent pop in the vending machine. When they are lit, they represent individual units of pop in the machine. The act of an LED becoming unlit represents the delivery of a pop from the machine to a human user [6].

The significant portion that can be implemented to this project is the way it interfaces with the user via LCD display. The LCD display will display text command to the user. For the LED indicator, it will be used to notify the user whether the snack is

available on its tray or not in this project. The pushbuttons allow input from a human user.

2.2.2 Design and Implementation of a vending machine using SLC500 PLC

The design of the snack vending machine was done by Sohail Anwar, Ph.D and Damien Marchetti, Ph.D. The project consists of design and implementation of a vending machine using a Programmable Logic Control (PLC). The key objective of the vending machine project is to design and implement an electro-mechanical system using a programmable logic controller (PLC). An Allen-Bradley SLC500 PLC is used in this project. The main interface software used is known as RS Logix which creates the programming environment in which the actual PLC program is written before it is downloaded into the PLC. The design specifications for the vending machine are as follows:

- I. Machine accepts only \$.05 (nickels), \$.25 (quarters), and \$.10 (dimes).
- II. There are two outputs, ejectors A and B.
- III. Returns change with \$.05 (nickels) only.
- IV. The price for all drinks is \$.35.

The design also includes a test model in which the PLC program can be tested and operated. The test model includes a mechanism for inputting various amounts of change to the system, the output ejectors, and a change return ejector. A list of the items used for the test model is shown below.

1. Two push buttons
2. Coin separator/change box
3. Two pneumatic ejectors
4. One coin return ejector - pneumatic
5. Coin input – contacts