WASHING MACHINE SIMULATOR

MOHD ZERTY IQRAM BIN KHIDZER

MAY 2007

'I hereby declare that this report is qualified in form of scope and quality to earn a graduation in Bachelor of Science in Electrical Engineering
(Control, Instrumentation and Automation)"

Signature : .....
Supervisor name : AHMAD IDIL B ABDUL RAHMAN
Date : 7/5/2007

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This Report Is Submitted In Partial Fulfillment Of Requirements For
The Degree of Bachelor In Electrical Engineering
(Control, Instrumentation and Automation)

Fakulti Kejuruteraan Elektrik
Universiti Teknikal Malaysia Melaka

MAY 2007

"I hereby declared that this report is a result of my own work except for the excerpts that have been cited clearly in the references"

Signature : .....

Student : MOHD ZERTY IQRAM BIN KHIDZER

Date : MAY 2007

To my beloved

Father, Hj Khidzer Bin Hj Ahmad;

Mother, Hjh Khadijah Binti Hassan;

Brother, Mohd Zerte Eqbal Bin Khidzer

Brother, Mohd Zerty Iqmal Bin Khidzer

Sweetheart, Akma Nurain Fairuz Bte Mahamad Arif

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ABSTRACT

This project will cover about designing a washing machine simulator using microcontroller system, sensor and several other devices. This washing machine simulator is housed in a hard box consists a user controls. The unit incorporates a series of input and output devices which together simulate the action of a typical domestic washing machine. This system uses microcontroller as a tool to collect input data, process and release output data. Proteus 6 Professional software used to simulate the microcontroller program. This system will function when the water level sensor detect the proper fixed water level. The sensor setup level is low and full condition. If overflow situation happens, the system will automatically stop and then the buzzer will activate. The input signal from the sensor will be send to microcontroller system, output actions released base on requirement programmed. Motor will generates with certain speed depends on load condition (clothes) which is drive by a speed stimulator. The seven-segment display is used to display the operation status same as real operation of domestic washing machine. The significant of project is to give an idea to combine a microcontroller system with additional devices (motor, sensor, buzzer, etc). Microcontroller is also flexible and can be applied to control other system quickly and easily. Besides, this project will be a reference material to the future student or consumer in order to understand the application of washing machine easily.

ABSTRAK

Projek ini membincangkan berkaitan pembinaan dan merekabentuk sebuah simulator mesin basuh yang menggunakan sistem pengawalmikro, sensor dan beberapa peranti lain. Simulator mesin basuh ini direka khas di dalam bentuk kotak logam kukuh yang terdapatnya pengawal-pengawal pengguna. Unit ini bersepadu antara peranti masukan dan keluaran, beroperasi dan berfungsi seakan-akan sebuah mesin basuh domestik. Sistem ini menggunakan pengawalmikro sebagai alat untuk mengumpul data, memproses dan menyalurkan keluaran data. Perisian Protues 6 Professional digunakan untuk simulasi program pengawalmikro. Sistem ini akan mula berfungsi apabila sensor paras air megesan kehadiran paras air tertentu. Sensor paras air direka mengesan paras air dari keadaan 'Low' hingga ke 'Full'. Seterusnya jika berlaku limpahan air (overflow), sistem secara automatik akan berhenti dan isyarat bunyi buzer akan kedengaran. Isyarat masukan daripada sensor akan dihantar ke sistem pengawalmikro untuk diproses, maka isyarat keluaran bertindak mengikut arahan yang telah diprogramkan. Motor akan terjana megikut kelajuan tertentu di mana motor akan dikawal oleh peransang kelajuan bergantung pada keadaan beban pakaian. Status operasi cucian dipaparkan oleh paparan tujuh segmen. Kepentingan projek ini adalah melahirkan suatu idea untuk menggabungkan sistem pengawalmikro menggunakan peranti tambahan contohnya motor, sensor, buzzer, paparan tujuh segmen dan lain-lain. Projek ini akan menjadi bahan rujukan kepada pelajar masa hadapan atau pengguna lain dalam konteks pemahaman aplikasi sebuah mesin basuh dengan lebih mudah.

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CHAPTER 1

INTRODUCTION

1.1 Background of project.

Nowadays the application of washing machine is widely used for consumer. The invention of the washing machine relieved householders of an age-old drudgery--for centuries, clothes had been cleaned by soaking them in stream water and pounding them with rocks. In 1797, the invention of the washboard for scrubbing eliminated the need for rocks. Hundreds of mechanical washing machines were designed in the first half of the nineteenth century, but they were hand powered. The user either turned a handle to rotate or rock the washing box or pumped a dolly to agitate the clothes. Steam power was applied to commercial washing machines in the 1850s. An underwater agitator design was patented in 1869 and the Blackstone washer of 1874 featured a handle-and-gear device. A washing machine using a spinning basket to extract water was patented in 1873. Electric washing machines first appeared in the early 1900s. Both the Automatic Electric Washer Company and the Hurley Machine Corporation offered electric washers in 1907. In 1911 the Maytag Company, which had produced its first hand-powered machine in 1907, introduced an electric Hired Girl wringer washer. These early electric washers were adaptable to gasoline power and could be hand operated as well. Maytag added the vane agitator to its machines in 1922. Although a wringer less model was marketed as early as 1926 by the Easy Washing Machine Company, wringer washers continued to be the industry standard.

The automatic washing machine was introduced in 1937 by Bendix. A fully automatic Bendix appeared in 1947, the contemporary washing machine offers many

options so that the user can tailor the type of washing to the type of garment being washed. For example, the user can select cycles for permanent press, synthetic, or delicate fabrics; a range of temperatures for both wash and spin cycles; length of cycles; and rewash and soak options. Modern washing machines are either front loading or top loading--front loaders wash by tumbling the clothes inside a revolving basket, while top loaders agitate the clothes within the basket.

A washing machine has a variable speed motor. The washing machine has a basket for holding articles to be washed and has a first axis of rotation. A basket drive shaft connected to the basket drives the basket. An agitator disposed in the basket along the first axis of rotation agitates the article in the basket. An agitator drive shaft connected to the agitator drives the agitator. A variable speed motor, having a second axis of rotation which is not coincident with the first axis of rotation, drives the basket drive shaft and the agitator drive shaft. A coupler couples motion of the variable speed motor to the agitator drive shaft and basket drive shaft. The variable speed of motor depends on the load of clothes. Optimum performance can be achieved for a load of heavy cotton laundry by using wash and spin speeds specifically for that material.

The technology washing machine becomes more sophisticated. It is because the application the fuzzy logic controls more effective than conventional system. However the application of using microcontroller still important, so I take an initiative to design the washing machine simulator system more reliable to control by using microcontroller system.

Figure 1.1: Pedal-powered washing machine.

Figure 1.2: Modern machine

1.2 Objectives of the Project

This project focuses on the following five objectives:

1. Design a washing machine simulator by using microcontroller system.
2. To study the function of microcontroller and how apply into this project.
3. Applying control system using several sensors and other devices.
4. To test the functional of the whole system.
5. To demonstrate the process running in the system built.

1.3 Scopes of the project

The project scopes are:

1. Develop program for microcontroller (PIC 16F877)
2. Simulate the program (using Proteus 6 Professional).
3. Built a circuit for:
   a. Control circuit (Microcontroller system)
   b. Seven segment display circuit
   c. Sensor circuit (water level sensor)
   d. H- bridge circuit (forward- reverse)
   e. Multiplex circuit (using 74LS373N IC as connector for output)
4. Demonstrate the output of project using led (indicator), buzzer, seven- segment display and small DC motor.
5. Hardware - Design and build a unit panel display.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter reviews existing project created to get an idea about the project design, conception and any information that related to improve the project. There are many creations and innovations of projects that have been done by other people with differences concept and design. This chapter also covers the researches related to the subject. This will provide a clearer understanding of the system and its design. This project is all about the washing machine simulator and the root design of this system is based on using microcontroller system and sensor.

2.2 Fuzzy Optical Sensor for Washing Machine

This paper discussed about the intelligent washing using fuzzy technology which focused on optical sensor (refer Appendix E). By using fuzzy logic, the wash time was adjusted to laundry dirtiness. Laundry dirtiness was detected by optical sensor, which measured the water transparency.

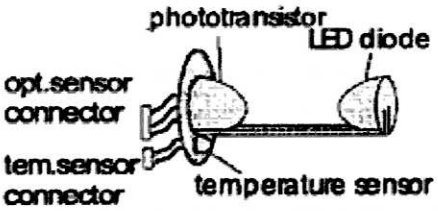

Figure 2.1: Construction including the optical and temperature sensor

An optical sensor is constituted of the light emitting element (LED diode) and the light receiving element (phototransistor) placed opposite each other. When the output LED diode light intensity is constant, phototransistor emitter voltage shows water transparency. Led diode intensity is controlled by the pulse width of transistor base PWM signal, from the microcontroller. The voltage on sensor emitter resistor is sensor output voltage and connected to microcontroller A/D converter. In that case, the temperature measuring is done by the temperature sensor, which is included in the optical sensor construction above.

Figure 2.2: Fuzzy controller block diagram

Fuzzy controller gives correct wash time; it also provides additional washing time to have optimal values for different laundry dirtiness. The decision making capabilities of fuzzy controller are confided in a set of rules. The rules are intuitive and easy to understand, qualitative statements written in English like IF-THEN sentences.

By using the optical sensor, the washing machine becomes "intelligent" because laundry is washed until it is clear and rinsed. In that way, energy saving is achieved and laundry life time is prolonged.

2.3 WAWAMA-Water Saving Washing Machine

This paper discussed about the new invention of an intelligent washing machine that can accomplish a satisfying purgation and save on water bill for customers (refer Appendix F). WAWAMA is able to calculate the optimum volume of water needed and choose an effective washing scheme, according to the weight of clothes, concentration of detergent, and users' request. Besides, it able continues operation in the event of an internet connection failure, compensating for errors in watering upon reconnection. WAWAMA also able to save the rate of progress when the power is accidentally cut, and automatically continues the last operation when the power resumes, from that the function can save much more water than those products that only restart automatically if running into the same case. WAWAMA using E-BOX instead of Selected Communication Mode (SCM), most of the washers in the market adopt SCM as its Multipoint Control Unit (MCU). SCM has a very small storage capacity and its data processing ability is correspondingly weak. E-BOX advantages are:

a) It has a bigger storage capacity and stronger capability to process a large amount of data quickly and stores all the correlative data in case the suddenness happens.
b) Its software can update through internet, which is not achieved by SCM.
c) It has much stronger expansibility in that its Windows CE core enables us to conveniently develop new functions.
d) It can be transplanted easily.

There are three main detectors are responsible in collecting all the data in the process of rinsing and feeding back to E-Box. The detectors are:

i) Weight detector : Determine the quantity of clothes from their circumrotate inertia.
ii) Photoelectric detector : Detect the transparency of water to judge whether the clothes satisfy the clean standard or not.
iii) Water level detector : Control the water level.

2.4 Bytronic 68K System Washing Machine Simulator

This paper discussed about the washing machine simulator application for use on microprocessor programming and computer control courses (refer Appendix G). The unit incorporates a series of input and output devices which together simulate the action of a typical domestic washing machine. The Bytronic 68K simulator is housed in a strong box with detachable lid and consists of fully labeled printed circuit board clearly divided into two sections.

The electronic circuits and connector sockets are grouped on the left and the user controls, displays and the motorized disc (washing machine drum) are on the right section. The user control includes push buttons of 'wash program' selection, push button for cancellation of current choice, mechanical latched push button which simulates the open/closed status tub door, seven segment display wash program status and the infra-red sensor which detect the speed rotation of motorized disc. The reflection of the infra-red beam is interrupted when one of the four holes in the disk rotates across the sensor. The circuit board incorporates test points, a fuse and four switches faults which provides for practice in electronic fault finding and may be used to increase the complexity of the control programs that can be written.

For the computer control, only PC fitted with Bytronic internal interface card or one of new parallel port interfaces connection are allowed. Control algorithms may be implemented by means of high level computer programming languages such as:

a) C
b) QBasic
c) PASCAL

d) Visual Basic

e) Delphi

f) Lab VIEW 'G'

This simulator may also be used as a control target for microprocessor trainer boards. Bytronic supplies suitable system based upon the Intel 8051, PIC16 and Motorola 68K.

CHAPTER 3

METHODOLOGY

3.1 Introduction.

In this chapter, it describes the methodology of this project with more details so that it will give us more information about how the methodology can influence the results that we get. Flow chart below described the methodology that used to complete the proposed project.

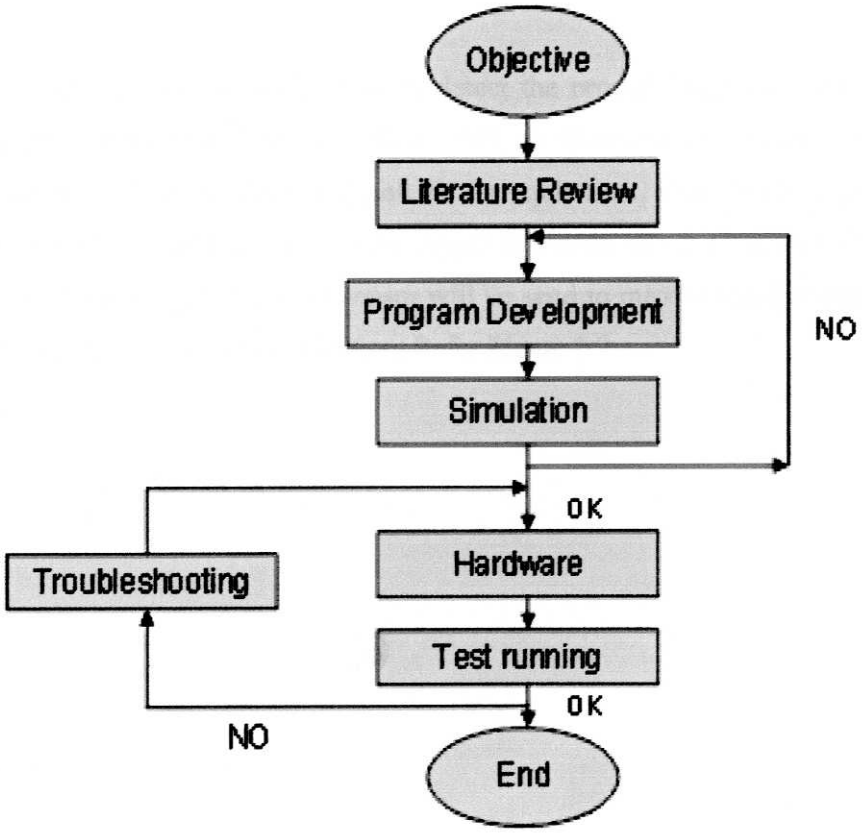

Figure 3.1: Flow chart of methodology