MINI AUTOMATIC CYCLE WASHING MACHINE USING AT89S51 MICROCONTROLLER

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MAY 2009

"I hereby declared that I have read through this report and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Power Electronics and Drive)"

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This Report Is Submitted In Partial Fulfillment Of Requirements For The Degree of Bachelor In Electrical Engineering (Power Electronics and Drive)

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"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 : .....

Name : MUHAMMAD SILMI BIN MAT ISA

Date : 11 / 5 / 2009

Dedicated especially to my father
and my beloved mother.

ABSTRACT

This project is about designing a mini automatic cycle washing machine using microcontroller system, sensor and several other devices. This simulator consist a housed unit with user control interface. Series of input and output devices are included to simulate process of a typical automatic washing machine. This system uses microcontroller as a tool to collect input data, process and release output data. The significant of this project is to briefly show how to connect a microcontroller system with input and output devices (motor, sensor, buzzer, valves, etc). This project will be a reference material to the future student or consumer in order to understand usage of a microcontroller and make use of its features. Reprogramming function of the microcontroller is enabled in order to allow user to explore and experience how to program a microcontroller. Output and input device are presented in such interactive way to actually show how microcontroller does the controlling part of the project.

ABSTRAK

Projek ini membincangkan tentang merekabentuk sebuah mesin basuh mini kitaran automatik menggunakan sistem mikropengawal, penderia dan beberapa alat lain. Pensimulasi ini mengandungi unit perumah dengan antara muka kawalan pengguna. Siri peranti masukan dan keluaran dimasukkan untuk mensimulasi proses sebuah mesin basuh automatik yang biasa. Sistem ini menggunakan mikropengawal sebagai sebuah alat untuk mengumpul data masukan, memproses dan membebaskan data keluaran. Kepentingan projek ini adalah untuk menunjukkan secara ringkas bagaimana untuk menghubungkan sebuah sistem mikropengawal dengan peranti masukan dan keluaran (motor, penderia, pembaz, beberapa injap dan sebagainya). Projek ini akan menjadi bahan rujukan untuk pelajar masa depan atau pengguna bagi memahami penggunaan sebuah mikropengawal dan mempergunakan cirri-cirinya. Fungsi memprogram semula pada mikropengawal dibolehkan bagi membenarkan pengguna untuk meneroka dan mengalami sendiri bagaimana untuk memprogram sebuah mikropengawal. Peranti masukan dan keluaran dipersembahkan dalam cara yang interaktif untuk menunjukkan bagaimana mikropengawal melaksanakan bahagian pengawalan projek.

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LIST OF ABBREVIATION

AD	-	Analog Digital
A/D	-	Analog / Digital
ADCTL	-	Analog to Digital Control Register
ADPU	-	Analog to Digital Disable Bit
BB	-	Big Beat
BDLC	-	Byte Data Link Communication
BDM	-	Background Debug Mode
CCW	-	Counter Clockwise
CPU	-	Central Processing Unit
CW	-	Clockwise
DC	-	Direct Current
DPTR	-	Data Pointer Register
DISRTO	-	Disable/Enable Reset-Out
EEPROM	-	Electrically Erasable Programmable Read Only Memory
IC	-	Integrated Circuit
I/O	-	Input / Output
LED	-	Light Emitting Diode
MOSI	-	Master Output Slave Input
MISO	-	Master Input Slave Output
NPN	-	Negative-Positive-Negative
PAD	-	General Purpose Input Pin
PAEN	-	Pulse Accumulator A System Enable Bit
PC	-	Personal Computer
PNP	-	Positive-Negative-Positive
PWEN	-	Pulse Width Enable Register
PWM	-	Pulse Width Modulation

RAM	-	Random Access Memory
RS	-	Recommended Standard
SCI	-	Serial Communication Interface
SCK	-	Serial Clock
SPI	-	Serial Peripheral Interface
TEN	-	Timer Enable Register
TSCR	-	Timer System Control Register
TTL	-	Transistor-Transistor Logic

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CHAPTER 1

INTRODUCTION

1.1 Background of Project

Nowadays the application of microcontroller is widely used by consumers. A microcontroller is a functional computer system on a chip. It contains a processor core, memory and programmable input and output peripheral. It emphasizes high integration, unlike a microprocessor which only contains a CPU. Adding up to the usual arithmetic and logic elements of a microprocessor, microcontrollers include an integrated CPU, memory (a small amount of RAM, program memory, or both) and peripherals capable of input and output.[1]

Microcontrollers often operate at relatively very low speed compared to microprocessors, but this is sufficient for typical applications. Microcontroller consumes relatively little power and will generally have the ability to maintain functionality while waiting for a process such as a button press or interrupt. Power consumption while inactive may be just nanowatts, making microcontroller ideal for low power and long lasting battery applications. Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, remote controls, office machines, appliances, power tools, and toys.

By reducing the size, cost, and power consumption compared to a design using a separate microprocessor, memory, and input and output devices, microcontrollers make it economical to electronically control many more processes. Operations of a microcontroller are difficult to be demonstrated without an application. Most of applications available are in big

and bulky automatic machine. In commercial applications, sensors are often hidden to improve appearance of the whole unit. Operation of sensors observation cannot be done thoroughly.

One of the best solutions is by developing a simulator of an application that is widely used and have easily understandable operations. Selected application is an automatic washing machine. A washing machine, or washer, is a machine designed to clean laundry, such as clothing, towels and sheets. The term is mostly applied only to machines that use water as the primary cleaning solution. All washing machines work by using mechanical energy, thermal energy, and chemical action. Mechanical energy is imparted to the clothes load by the rotation of the agitator in top loaders as shown in Figure 1.1 below, or by the tumbling action of the drum in front loaders as shown in Figure 1.2 below. [2] Thermal energy is supplied by the temperature of the wash bath. Chemical action is provided by detergent used during washing process.

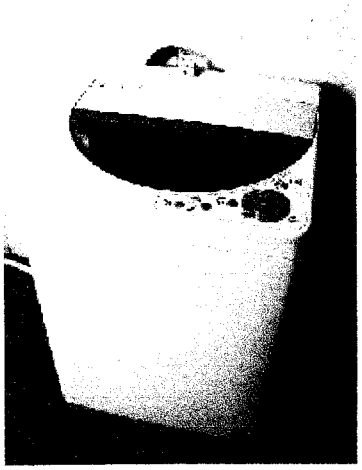

Figure 1.1: Top loading machine.

Figure 1.2: Front loading machine.

A washing machine has a variable speed motor. The washing machine has a tub 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 automatic washing machine is proposed to be the application of the simulator drive by a microcontroller.

1.2 Problem Statement

Problem statements that lead to implementation of this project are:

1. Operations of a microcontroller are difficult to be demonstrated without an application.
2. Most of applications available are in big and bulky automatic machine.
3. In a commercial machine, I/O devices are often hidden to improve appearance of the whole machine.
4. Operation of I/O devices observation cannot be done thoroughly.

1.3 Objectives of Project

The aims of doing this project are stated below;

1. To create and design a mini automatic cycle washing machine by using microcontroller circuit.
2. To program and study functions of a microcontroller.
3. To demonstrate application module and interface between hardware and software.
4. To allow thorough observation on I/O devices function and operation.

1.4 Scopes of Project

In this project, the scope is based on five main parts. They are:

1. Design a mini automatic cycle washing machine.
2. Fancy control panel and fuzzy logic function of an automatic washing machine are not included.
3. Design and develop communication protocol between microcontroller and I/O devices.
4. Develop C language program to manipulate data from input devices and afterward control output devices.
5. Interface microcontroller with I/O devices using I/O port.

The scopes of tasks are stated below:

1. Develop program for microcontroller (AT89S51).
2. Simulate the program.
3. Build a circuit for:
   a. Control circuit (microcontroller system)
   b. Seven-segments display circuit
   c. Sensor circuit (water level sensor)
4. Demonstrate the output of project using valves, water pump, buzzer, Seven-segment LED display and an AC induction motor.

Hardware assembly and build a unit panel display.

Programmer develops a program based on desired operation of the automatic washing machine. Microcontroller executes operation designed in the program. Data from input devices manipulated by microcontroller and then microcontroller will control output devices according to the program. User will only deal with I/O devices. Figure 1.3 next shows overall system block diagram of the project.

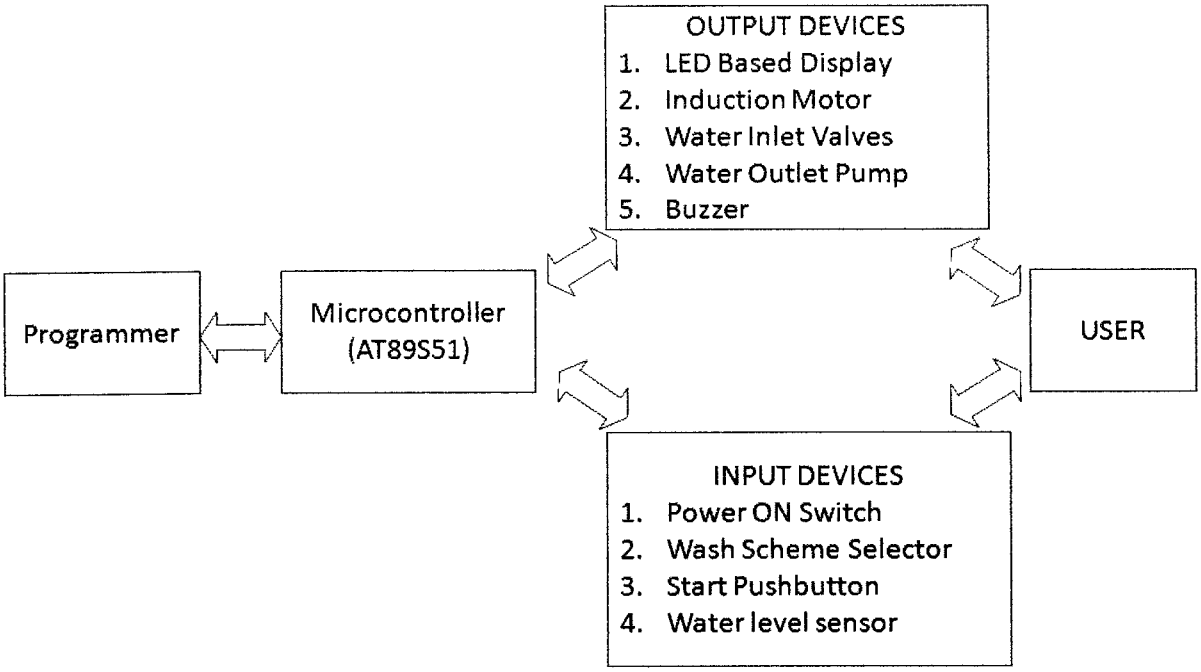

Figure 1.3: System block diagram.

1.4 Outline of Thesis

This thesis consists of five chapters. The first chapter discuss about background, problem statement, objective and scope of this project. Chapter two discuss more on theory and include literature reviews that have been done. It also will discuss on components of the hardware and software used in this project. Chapter three discuss on the methodology hardware and project development. Chapter four will discuss about project's testing and results. Finally in chapter five it will discuss about conclusion and future work proposal for the project.

CHAPTER 2

LITERATURE REVIEW AND THEORY

2.1 Literature Review

This part of this chapter discuss about reviews of existing project created to get an idea about the project design, conception and any information that related to improve the project. With different concept and design, there are other creations and innovations of projects done by other people. Researches related to this project also covered in this chapter.

2.1.1 Bytronic Washing Machine Simulator

This part discussed about the washing machine simulator application for use on microprocessor programming and computer control courses (refer Appendix A). The unit consists of 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 labelled printed circuit board clearly divided into two sections as shown in Figure 2.1 next.

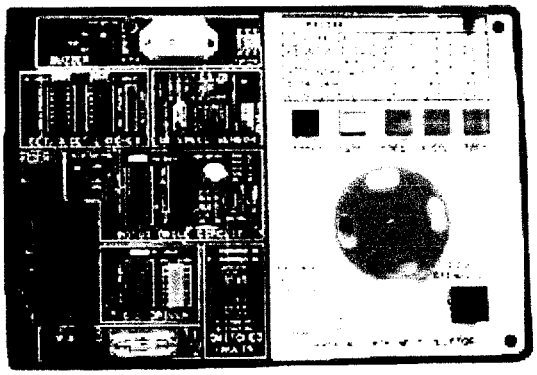

Figure 2.1: Bytronic washing machine simulator front panel.

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:

1. C
2. QBasic
3. PASCAL

4. Visual Basic
5. Delphi
6. 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.

2.1.2 Load Detecting System

Magnetostrictive elements have such a property that the element has its magnetic permeability varied and is deformed by the variation of the magnetic permeability when subjected to a magnetic field by passing current through a coil disposed in the vicinity of the element. The magnetostrictive element is used as an actuator or oscillator since the amount of deformation and the stress produced due to the deformation are great.

Conversely when the magnetostrictive element is deformed by applying an external force thereto, the element has its magnetic permeability altered by the deformation. For example, JP-U No. 1-105834(1989) discloses a load sensor for detecting the magnitude of an external force by utilizing these characteristics. The sensor comprises a magnetostrictive element, two primary coils provided around the element, and a secondary coil magnetically coupled to one of the primary coils by the magnetostrictive element to provide a differential transformer for detecting load acting on the magnetostrictive element. [3]

The load sensor is serviceable as a high-sensitivity sensor since great variations in electrical impedance are available in the load detecting range owing to the characteristics of the magnetostrictive element. Although adapted to realize high sensitivity, such a load sensor has the problem of being great in hysteresis because the magnetostrictive element itself has great energy of crystal magnetic anisotropy to thereby impair the accuracy of detection.