USB MUG WARMER

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Specially Dedicated to:

To my beloved father and mother …

Who always give me a courage to finish this thesis.

Also, to those people who have guided and inspired me throughout my journey. Thank you for the supports and advices that have been given.

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ABSTRACT

The using of USB technology is quite popular in this era. We can prove it by looking at the latest products which using it such as USB fan, USB lamp, USB mouse, USB printer and many other types of equipment. Another proves is by looking at the specification of latest computer. For example, latest laptop does not provide other port except USB port. Usually, we can found another port such as parallel port and serial port at Personal computer (PC) only. For this PSM project, UBS will be using as power supply for this mug warmer.

ABSTRAK

Penggunaan teknologi USB amat popular pada masa kini. Buktinya, kita boleh melihat pelbagai produk terkini yang menggunakan teknologi USB seperti kipas USB, lampu USB, printer USB, dan produk-poduk yang lain. Bukti yang lain pula ialah dengan melihat specifikasi komputer pada masa kini. Contohnya, komputer riba terkini tidak menyediakan soket selain soket USB. Biasanya, kita cuma menjumpai soket-soket seperti soket paralal dan soket serial pada komputer meja. Untuk projek PSM ini, USB akan digunakan sebagai sumber tenaga bagi pemanas cawan ini.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

In this sophisticated era, people are basically likes to do multiple jobs at certain time. This is because of nowadays condition which forces them to do it. For example, a lot of peoples nowadays use computer or laptop as a medium or equipment for them to do their jobs. So, at the same time, they drink and sometimes eat while they are using the computer. Peoples also like the portable equipment and portable software because this will convenient them. As a solution, by combining multiple works with portable equipment concept, we can create some prototype for their needs. In this case, we take a word “drink” as a main idea. By combining this idea with portable USB technology, we can create a mug warmer. This warmer will not heat water until it boiled. But it only heats the water to certain temperature only which classified as warm condition. By using USB as power supply, computer users that like warm water while doing their job can using this equipment in order to ensure their water in warm condition. Basically, this project used USB 2.0 technology as a power supply. Mug will act as heating item where the 5V from USB will trigger the heater to heat the iron plate. At the same time, graphical user interface are applied onto this project.

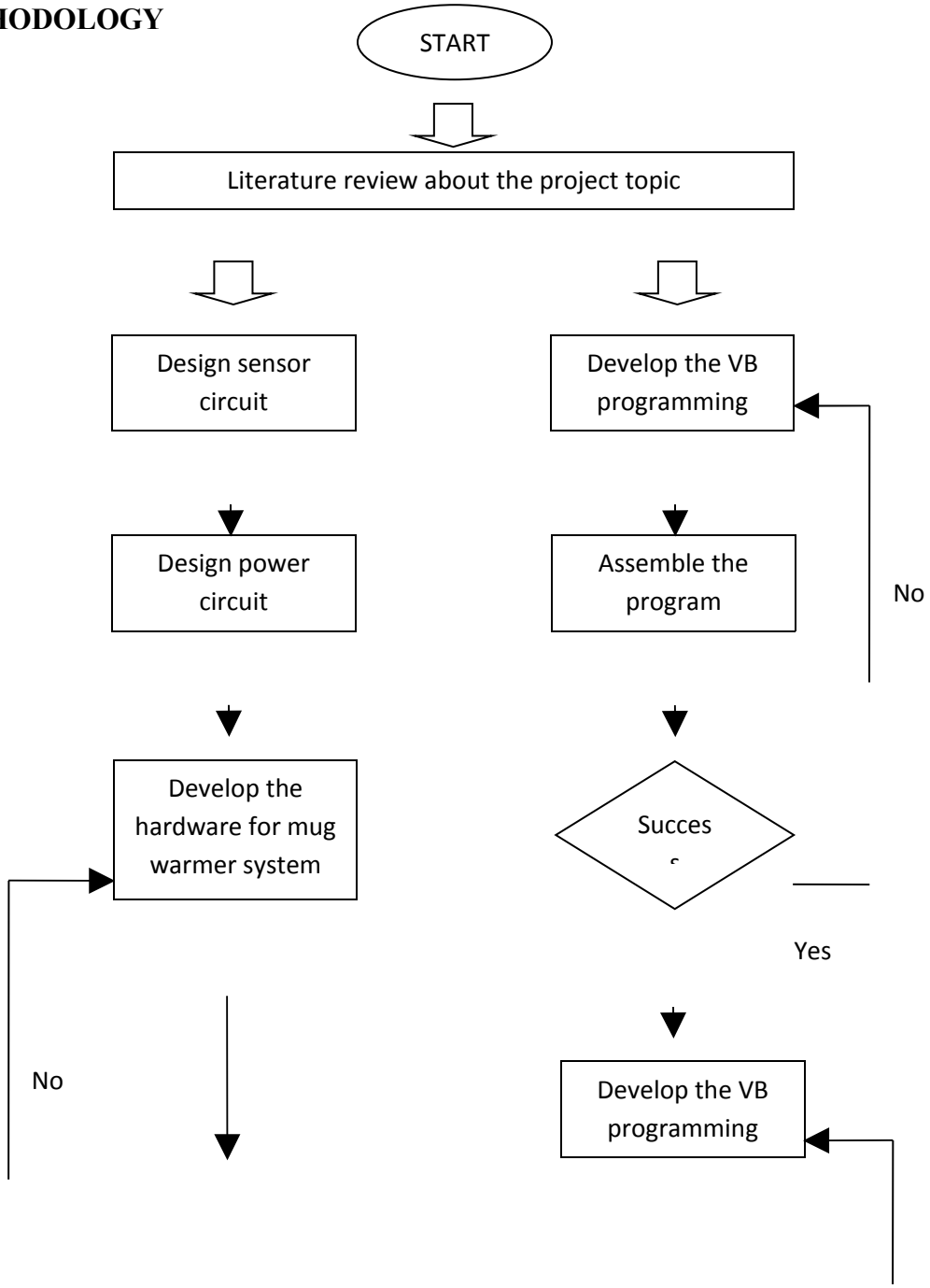
1.2 SCOPE OF PROJECT

This project is focused on heating the iron plate and display the temperature of the iron plate at the computer. This project is restricted / effective to a small type of mug with a low volume of water. Graphical User Interface is also applied into this project.

1.3 OBJECTIVE

The objective of this project is to develop a mug warmer based on USB technology. This prototype will be able to heat a specific type of mug with a specific volume of water. Another objective is to apply GUI technique based on temperature sensor.

1.4 METHODOLOGY



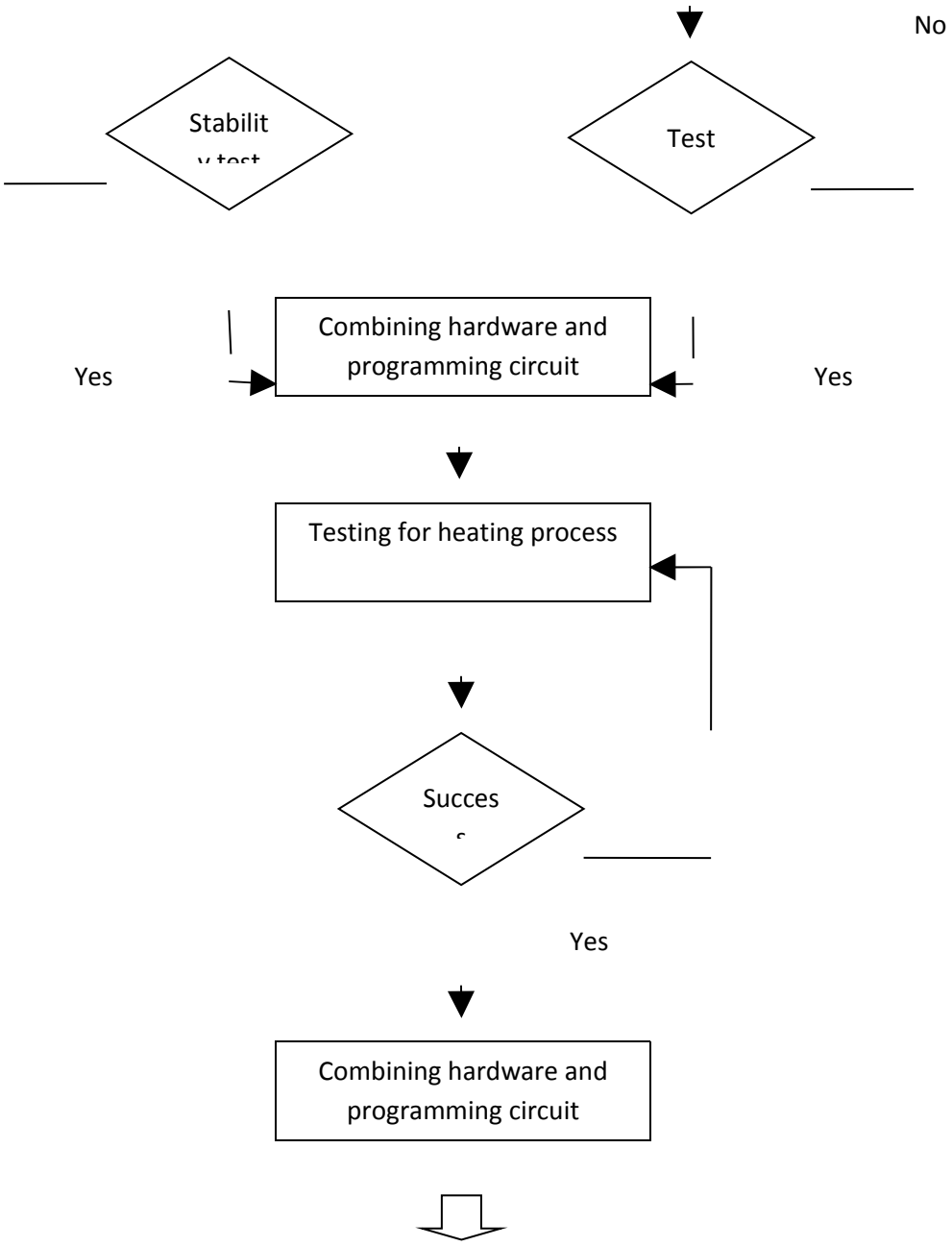


Figure above show the [illegible] ork progress. First of all, the literature review is done after decided the title project that is USB Mug Warmer. The content of the literature review are from the internet, library, and also from the lecturer. All of them have to be saving because it can be use it as references soon. Then, by referring the sources, the better hardware and the software are chosen.

Basically the process was divided into two parts. The first part one is hardware development and the second one is software development. For the hardware, the system's circuit is studied especially the temperature sensor, USB architecture and heater plate design. Then, all are combining and assemble together. The detail about hardware is as below:

[1]**Hardware Development**:

For hardware, it divided into 2 parts which is heater circuit and sensor circuit. Both circuits will require 5V voltage and 2.5W from power supply. That value of power supply is same with the value that supplied by USB 2.0 ports. Data from digital temperature sensor DS1621 will be sending to ADC before sending to computer by serial communication.

For software development, the main purpose is to display the temperature in computer either in words or graphically. The detail about hardware is as below:

[2]**Software development**:

Software development involved the application of Graphical User Interface (GUI) into the circuit. Visual Basic 6.0 are selected as main software for this project. Data from analog digital converter (ADC) will be sending to computer by serial port. Then, the data will be modified in visual basic and will be displayed in computer as indicator to the heating process at hardware. Anything that occurs at hardware will cause changes in software.

After both parts are ok, process of integration are made. Then, this system has to be tested to the mug. Usually in the simulation result is not same as the real. That why testing and analyzing are did in order to get the better result. Lastly, the report is writing.

1.5 THESIS OUTLINE

Chapter 1 discuss on the background of the project, objectives, scope of the project, problem statement, methodology and also the thesis outline. Chapter 2 focuses on literature reviews of this project based on journals and other references. Literature review is based on the previous project or journal that related to this project. Chapter 3 mainly discuss on the system design of the project. Details on the progress of the project are explained in this chapter. Details on the progress include figure of circuits and picture about this prototype. Chapter 4 presents the results of the project. The discussion focused on the result based on the experiment. Chapter 5 concludes overall about the project. Obstacles faces and future recommendation are also discussed in this chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 **INTRODUCTION**

In this chapter include the study of previous journal and project that related to this project.

2.2 **PREVIOUS JOURNAL**

2.2.1 **Thermostat**

A thermostat is a device for regulating the temperature of a system so that the system's temperature is maintained near a desired set point temperature. The thermostat does this by controlling the flow of heat energy into or out of the system. That is, the thermostat switches heating or cooling devices on or off as needed to maintain the correct temperature. Thermostats

can be constructed in many ways and may use a variety of sensors to measure the temperature. The output of the sensor then controls the heating or cooling apparatus.

2.2.2 **Automatic Egg Incubator.**

There are prominent needs for egg incubators around the globe, because of many factors. A person fascinated by birds likes to raise ornamental birds but he couldn't find or get a broody bird as such, non vegetarians eat birds where in most cases they are imposed to take birds that are raised through artificial injections, in many cases even if we have an egg in hand we can't hatch the egg naturally since it is difficult to find the bird and get it hatched etc. All these matters expose the importance of this project called Automatic Egg Incubator.

The project that is being portrayed here implements an Automatic Egg Incubator using ATMEL AVR ATMEGA32. The main four parameters in any bird hatching would be incubation temperature, relative humidity inside the incubator, ventilation and egg turning. Hatching temperature, optimum relative humidity, number days for hatch etc depends on the bird species. The incubation area is an enclosed chamber with various mechanisms and controls. There is a carrier which holds the eggs inside the chamber for an easy rotation of eggs. Above mentioned four vectors have its own importance that failure in any one of them can cause lose of entire hatch. Temperature of the incubation decides quality of the batch. Both low and high temperatures lead to decreased hatchability and produce weak chicks. So keeping incubation temperature at optimum value is a must. Mixing ensures uniformity of temperature and humidity inside the chamber to prevent localization of any factors. Aeration takes in fresh oxygen and removes carbon dioxide gas evolved out of egg shells out. Egg turning ensures entire mixing of albumen to provide sufficient nutrients. Looking holistically, all of the above factors matters a lot and an overall stability has to be attained by adjusting all of them. AVR ATMEGA32 maintains

this equilibrium perfectly by using the features and peripherals available on it. The design files and relevant documents explains how the entire system is setup and ATMEGA32 manage those four vectors. Two digital thermometer chips DS1631 acts as dry and wet electronic thermometers, DS1307 acts as the time keeping RTC for the entire system and the LCD provided shows live status of the incubator. Both digital thermometer chips and RTC utilize the TWI available on the ATMEGA32 microcontroller. Temperature control of the chamber is met through a motorized kerosene wick lamp. Depending on the wet temperature reading, AVR controls exposure of the wick to keep temperature within the range. Relative humidity is calculated from the dry and wet electronic thermometer readings and duration of aeration is decided on this reading. RTC maintains overall timing of the system which includes; aeration, mixing of air inside the chamber, rotation of eggs, tracking the number of days etc Additional features of the system are: signaling first hatch and monitoring the baby, by detecting sound of the baby bird once baby breaks egg shell. This feature is being implemented by utilizing ADC of ATMEGA32. Sound is picked up using a condenser microphone and is amplified and fed to ADC input. Risk in any malfunction of motorized wick lamp is monitored using a LM35 based temperature to voltage converter, with the voltage fed to another ADC channel. A siren will blow sound in case of wick lamp and a C application has been developed to configure the no of days for hatch, temperature etc depending on the bird. The communication protocol between PC and the AVR is serial, implemented using USART module available on ATMEGA32. DC motors are provided for rotation, mixing, aeration and wick lamp control, which are driven through motor driver chips. Separate voltage regulator is provided for these motors to prevent spurious signals and momentary currents from entering the AVR supply line. To provide necessary torque, simple gear from a mechanical clock is used. The entire board works on 5V power supply. For normal operation, system is powered from 230V line with rectifiers to convert AC to DC. NiCd Battery backup is provided to power the system during power failures. There is a relay which manages the switching between the rectifier supply and battery supply. A 2200uF capacitor provided on the rectifier output eases the switching task without any fluctuations in the voltage. AVR manages charging intervals of the battery along with RTC. Although there are many incubators available in market, most of them are not affordable to the common man and many of them rely on heating coils which uses AC power supply. Those incubators can’t be used in remote areas and where there are frequent power failures. As a remedy for this problem, this project

implements a kerosene lamp based design, which is more reliable. In the case of remote locations, whole control circuit and related stuffs can be powered from a 12V solar panel.
Below is the block diagram of this past project:

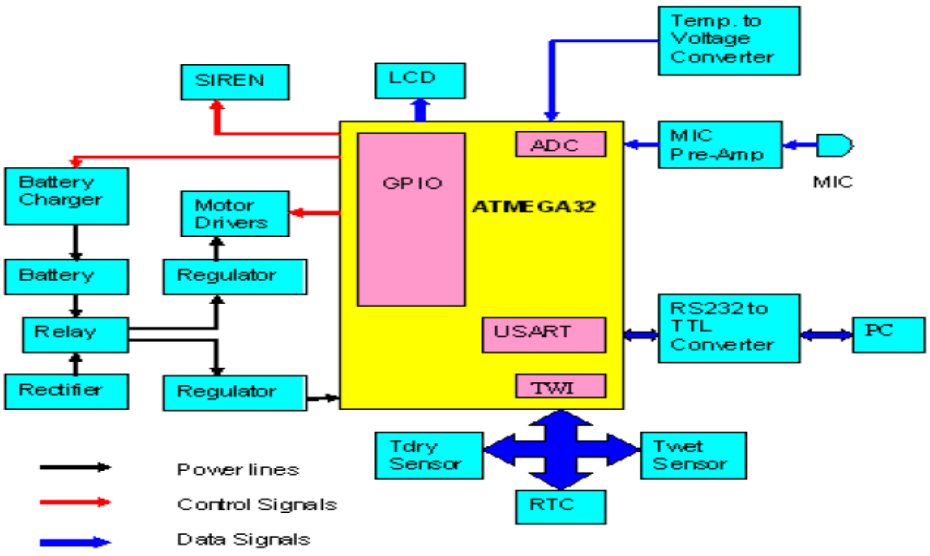


Figure 2.2.2

2.2.3 **Digital Temperature Sensor**

The use of temperature devices in temperature measurement and sensing has made tremendous progress in the last few decades. There are a few types of measurement solutions that you can implement in your projects. The use of thermostats or thermocouples is the two most widely used devices in measurement solutions. The recent decade has seen the use of integrated circuits devices in many temperature control related systems because they are much smaller, provide a more accurate measurement and simpler to be integrated to other digital control devices.

Most of the digital temperature sensor system has a built-in communication bus to enable it to communicate with the master control IC. The most used communication interface is

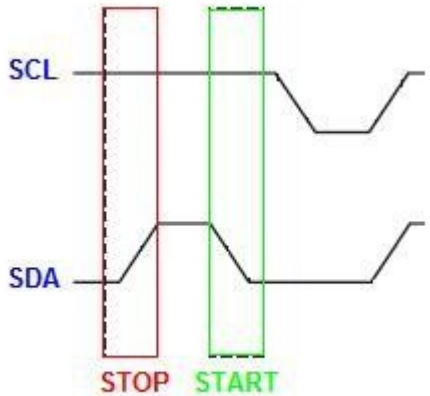
called I2C, a simple bi-directional 2-wire bus that was developed by Philips Semiconductors in the 1980's. Since then, many devices have this built in communication protocol that enables all devices that have this feature to be linked together without any other additional components. The I2C interfacing standard has become a world standard that is used in more than 1,000 integrated circuits.

I2C in Brief

The I2C standard basically defines the start, stop, and device selection addressing and data transfer interfacing protocol. The hardware consists of 2 I/O lines called SDA and SCL lines.

START Condition

The Start Data Transfer is initiated when there is a change of state of SDA line from HIGH logic to LOW logic while the SCL line is at HIGH logic. This is the START condition.



Start and Stop Bit State

STOP Condition

The Stop Data Transfer is initiated when there is a change of state of SDA line from LOW logic to HIGH logic while the SCL line is at HIGH logic. This is the STOP condition.

DATA Transfer Condition

The data transfer is done between the START and STOP conditions with the data being transferred when SCL transition from LOW to HIGH logic. Data is read when SCL is at HIGH logic. SDA line data will only change when SCL line is at LOW logic. There is no limit to the number of data bytes transferred and is determined by the master device. Acknowledgement of successful transfer of data is done between the master and the slave devices at regular interval.

Digital Temperature Sensor Applications:

This device can be connected to the microcontroller using the SCL and SDA lines.

The features of the TMP100 sensor include:

- Low Quiescent standby current of 0.1uA means if you choose a proper microcontroller, the device using battery powered could last for years compared to the use of thermostat.
- Temperature range from -55 °C to 125 °C.
- Wide Power supply range from 2.7V to 5.5V.
- Accuracy of +/- 2.0 °C.
- Resolution up to 0.0625 ° C.

The typical application of the TMP100 digital temperature sensor is as shown in the diagram below.

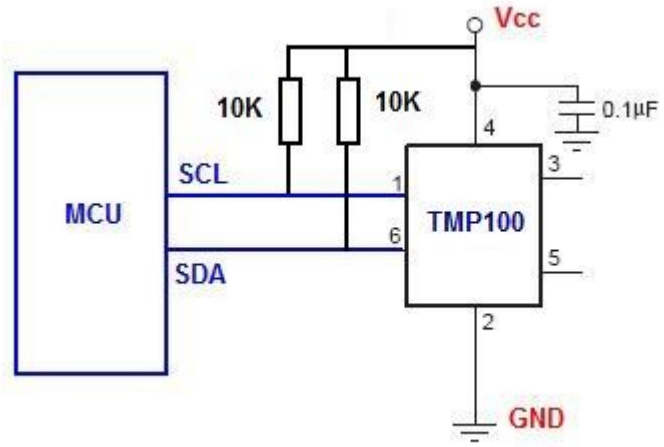


Figure 2.2.3

CHAPTER 3

SYSTEM DESIGN

3.1 OVERALL SYSTEM DESIGNS

For this chapter, it divided into two main parts which is hardware part and software parts. Further explanation is as below:

3.2 HARDWARE DESIGN AND DEVELOPMENT

3.2.1 Introduction

The main purpose of this research is to develop the heater system design circuit that suitable with USB 2.0 technology. According to the scope of the project, the main scope for the hardware is only to develop circuit that can heat water but not to boil it. The main supply is from USB 2.0 which is 5V voltage. For data transfer, it does not detail by using a specific port. As mention before in previous chapter, hardware development is divided into two parts which is power circuit/ heater circuit and sensor circuit.

3.2.1.1 Heater Circuit/Power Circuit

For this circuit, we connect the USB with 2 resistors. The selection of resistor value is depended on some consideration. Firstly, the resistors should be able to handle the