UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF BABY BATHTUB TEMPERATURE CONTROLLER USING ARDUINO

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Computer Engineering Technology (Computer Systems) with Honours.

by

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Sesi Pengajian: 2020

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I hereby, declared this report entitled DEVELOPMENT OF BABY BATHTUB TEMPERATURE CONTROLLER USING ARDUINO is the results of my own research except as cited in references.

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Date: 14/2/2021

APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree Bachelor of Computer Engineering Technology (Computer Systems) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Sistem kawalan suhu terdiri daripada mikrokontroler yang dapat diprogramkan yang telah disambungkan ke elemen pemanasan atau penyejukan. Sistem kawalan suhu air dibina untuk mendapatkan suhu air yang sesuai untuk bayi. Sistem kawalan suhu tab mandi ini tertumpu kepada pencegahan ketidakselesaan kepada bayi dan juga mencegah kulit bayi daripada melecur ketika mandi. Ia juga mencegah kematian bayi yang mungkin berlaku disebabkan oleh hipotermia. Projek ini bertujuan untuk mengkaji sistem pengawal suhu ketika mandi dan memahami ilmu tentang suhu yang sesuai untuk bayi. Projek ini akan menggunakan mikrokontroler Arduino Uno sebagai unit utama pemprosesan. Paparan hasil digunakan untuk mendapatkan nilai output. Paparan hasil diguna untuk memaparkan nilai suhu air yang dimasukkan dan nilai suhu air yang dibaca oleh sensor suhu. Secara keseluruhan, reka bentuk pengawal suhu air ini memberikan nilai suhu air yang sesuai untuk bayi ketika mandi dan semua data yang diperoleh akan dipaparkan di alat paparan hasil.

ABSTRACT

Temperature control system consists of the programmable core controller device that has been wired to heating elements. The specific water temperature controller will be design and build in order to obtain the correct water temperature for a baby. This bathtub temperature controller focus on prevention of the discomfort and skin scalding of baby when take their bath time. It also prevent the infant death that might happen causes by hypothermia. The project mainly focus to study the current system of temperature controller in bathing system and understand the baby bath temperature in order to obtain correct temperature for a baby. It will utilize the Arduino Uno microcontroller as its core processing units. There are also a display interface to generate outputs processes. The display interface will use to display the measured value of water coming from temperature sensor. Overall, the design of water temperature controller will provide the desired value of water temperature for a baby when taking their bath and all the data is display on the display interface.

DEDICATION

I would like to dedicate this thesis to my beloved family especially my parent Mr. Jamaludin bin Yunoh and Mrs. Wan Ramlah binti Wan Ahmad whose encourage and support me in completing the thesis.

ACKNOWLEDGEMENTS

Alhamdulillah, thanks you Allah with His blessing that I manage to complete this Final Year Project report. I want to thank my parents for their support emotionally and financially to maintain my progress in completing the project report. I also would like to thank my supervisor, Mrs Nurliyana Binti Abd Mutalib for her guidance and advices during completing this project. Not forgetting to all of my friends as they help me by giving ideas and share their information to complete this project report especially in writing the programming code. Thanks also to individuals who directly or indirectly helped me in completing my project.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 Background

1.1.1 Bath Water Temperature for Baby

Bath time always been the best and fun time for a baby. A baby may love to play in the water, but there are rule that a parent need to follow when bathing a baby. When bathing a baby, the most important thing is the temperature of bath water. The water must be not too hot and too cold. Basically, most of parents usually mixed the water with the hot water manually to adjust the temperature. They also have to check the water temperature by inserting an elbow or a wrist into the water. The water need to be warm and comfortable before put the baby into bath tub. The temperature of water that safe and suitable for a baby especially newborn baby is 37 degrees Celsius to 38 degrees Celsius. If there are much lower than 37 degrees Celsius, it can causes the baby shivering and turn blue, and lower the baby normal body temperature. Besides, when the temperature higher than the 38 degree Celsius, it might easily causes the scald or burn the baby's skin.

1.1.2 Temperature Control System

A temperature control system consists of a programmable core controller device that has been wired to heat elements. Besides, there are temperature sensor utilized to detect or measure the temperature of bath water. Basically, it works as it set the

programmed temperature to the desired value also known as a set point. Then, the system will use the heater to reach and maintain the set point temperature value.

1.2 Problem Statement

These days, most of the parents still use to mixed water with hot water manually to prepare the bath water for their baby. They also check the water temperature by inserting their elbow into the bath water and use the thermometer. This method cannot give the accurate temperature during the bath time which can cause the discomfort for the baby itself. The baby might crying if they feeling uncomfortable during the bath time which mean the bath water might be too hot or too cold for them. Besides, there is a case of infant death that happen because it was bathed with cold water. Bathing the baby might look easy but the parents need to be careful especially with the baby is below 6 months. This might happen because of the temperature effects can harm the baby. The baby that has been bath with water that is too cold might cause the hypothermia happen to the baby. Hypothermia is a dangerous drop in body temperature. Hypothermia usually causes the baby hard to breathe and their lips turn blue. Moreover, too hot water can cause the scald and burn the baby's thin skin.

1.3 Objectives

Based on the problem statement above, the main objective focus on the aspect as listed below:

1. To study the system of temperature controller in bathing system.
2. To understand baby bath temperature and obtain the correct temperature.

3. To develop a bath tub temperature controller that can provide suitable temperature for baby bath water.

1.4 Scope

The scope of this project is established based on the objectives mentioned previously. The project scope consists of designing hardware and software to build up the current temperature controller in bathing system for a baby. The software that is used is Arduino IDE and the hardware is from the technologies that involve to build temperature controller such as temperature sensor devices and heating elements. Besides, the project is limited to help the parents prepare the suitable and correct bath water temperature for their baby without manually check water temperature. The knowledge about baby temperature have integrate with knowledge about programming of the microcontroller to obtain the correct temperature. Moreover, the way to develop the prototype of the bathing system are integrate with the design of microcontroller in action to perform the function of each component in the temperature controller system.

1.5 Thesis Outline

In a conclusion of this chapter, the project focusses on the design of baby bathtub temperature controller using Arduino as a core microcontroller in whole system. The report consists of the five chapters which are introduction, literature review, methodology, results & discussion and conclusion & suggestions from overall research project.

Chapter 1 is consists of introduction, objectives, problem statement, scope of project, and project methodology to enhance readers in understanding the structure of the project paper.

Chapter 2 includes literature review that study concept and theory from previous research paper in order to solve the problem occurs and provide suggestion of method to use in building up the project.

Chapter 3 covers the research methodology that discuss about the methods in order to develop the hardware and software.

Chapter 4 explains the results and discussion that involve the observation or analysis about the project. This chapter also discuss about recorded data analysis.

Chapter 5, the conclusion and suggestion have been discuss. Usually, the conclusion is a summary of project and the suggestion is the recommendation for future research project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter mainly focuses on the information and theory, previous research and comparison between methods used by the researcher. This chapter will be discussed about the baby bathtub temperature controller using different approaches such as different types of technologies and components used in every reliable sources information. Furthermore, the differences will be compared and analyzed to provide the most advancement for this project.

2.2 Related Previous Works

2.2.1 Water Bath Design Equipped With Temperature Distribution Monitor (Temperature And Timer Control Parameters)

A research group members (Febri Indiani, Dyah Titisari, Lamidi 2019) proposed water bath design equipped with temperature distribution monitor (temperature and timer control parameters) using Arduino Atmega 328 as system controller and control timer. An Atmega328 is a microcontroller chip found on Arduino Uno boards. Atmega328 are from the 8 bit Advanced Virtual RISC (AVR) microcontrollers. In this project, the researchers also used a DS18B20 sensor as a temperature sensor. This sensor is small temperature sensor built in 12 bit ADC that can be easily connected to the Arduino digital input. It is requires the additional components as the sensor communicates over a one wire bus. This sensor also have accuracy +/-0.5 degree celcius in the range of -10 degree

celcius to +85 degree celcius. The heater that were used was the tubular type heater with specification voltage 220 V and 1000 Watt. The advantage of using this type of heater is the precision. It is advanced in temperature controls, good in temperature maintenance, and precise heat transfer.

From the figure 2.1, the block diagram has discussed about the buttons (up, down, enter and reset) were used to setup the temperature and timer of the water bath. Then, the microcontroller used to read the water temperature sensor, water heater and display the results on the LCD. The water bath works as the heater used to heating the water until it reaches the specified temperature. The heater also stop working when the timer setting has been completes and the buzzer used will make a sound indicates the end of process.

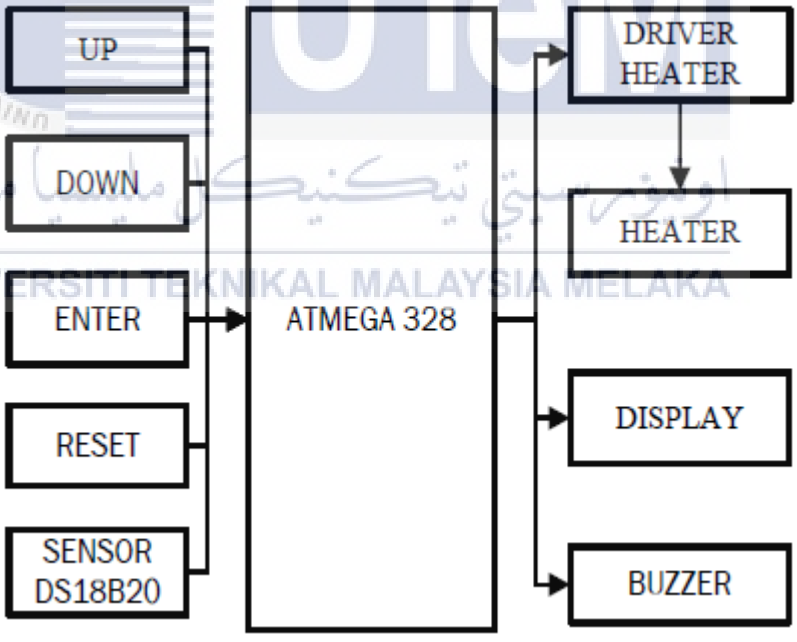

Figure 2.1: The block diagram of water bath (Febri Indiani, 2019)

In figure 2.2, there are shows the flowchart of Arduino program. The program start with the initialization of the Arduino and detect water level. When the water reach

the desired level, the temperature and timer can be set. Then, the temperature sensor will read and display on the LCD. If the temperature data value that is read by microcontroller less than the setting value, the heater will start working. Otherwise, the heater stop working. For the timer, it will works when the specified temperature has been reached. If time has been spent, the process was finished. The heater also been turn off and buzzer will make sounds.

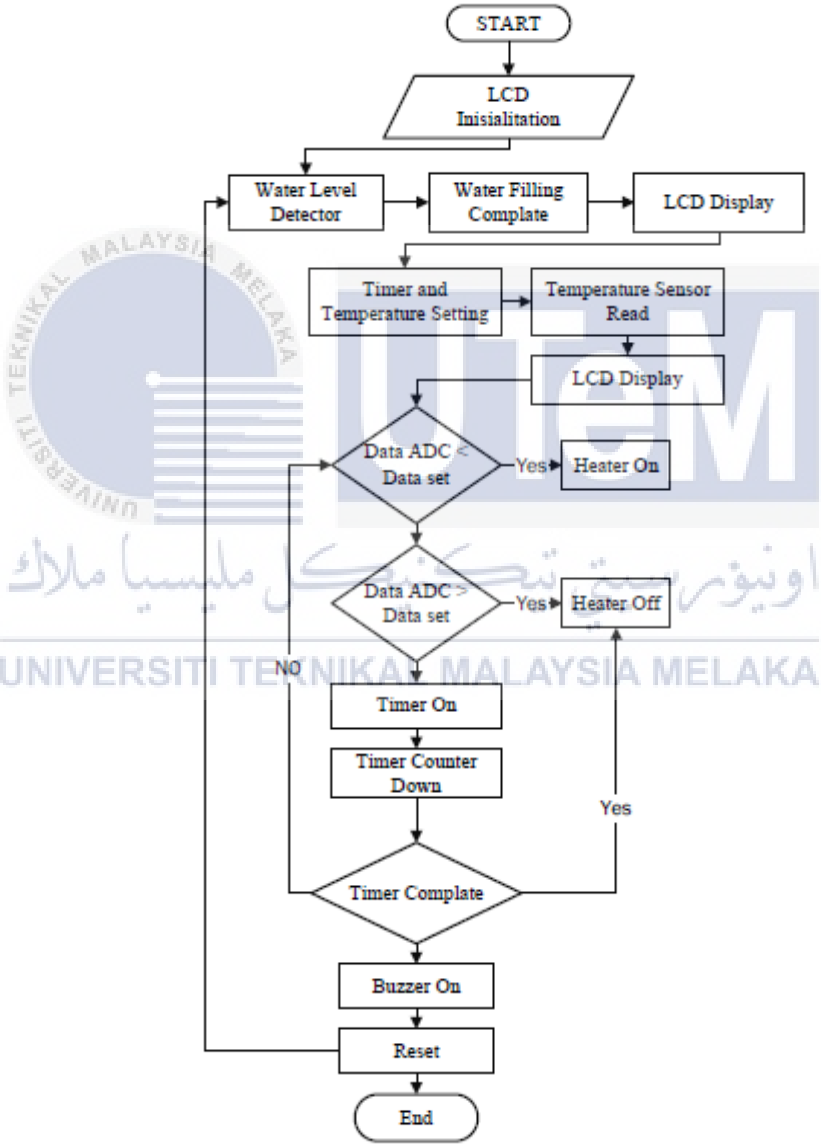

Figure 2.2: The flowchart of the Arduino program (Febri Indiani, 2019)

2.2.2 Design of Water Temperature Control System Based On Single Chip Microcomputer

Hanhong T. and Qiyan Y. (2017) proposed a design of water temperature control system based on single chip microcomputer. This research introduce a multifunction water temperature controller designed with 51 single chip microcomputer (AT89C51) that provides the automatic and manual water supply. This includes the function to set the temperature, real-time display of water level, temperature and alarm function. Besides, this design has the simple structure, high reliability and low cost. The development of technologies, the application of a single-chip with a simple design and high reliability easily built to maximize the function of the project. Water temperature measurement components used in this research is single wire digital temperature sensor DS18B20 that using one-wire bus protocol with simple connection and high precision. Figure 2.3 shows the block diagram of single chip design of water temperature control system.

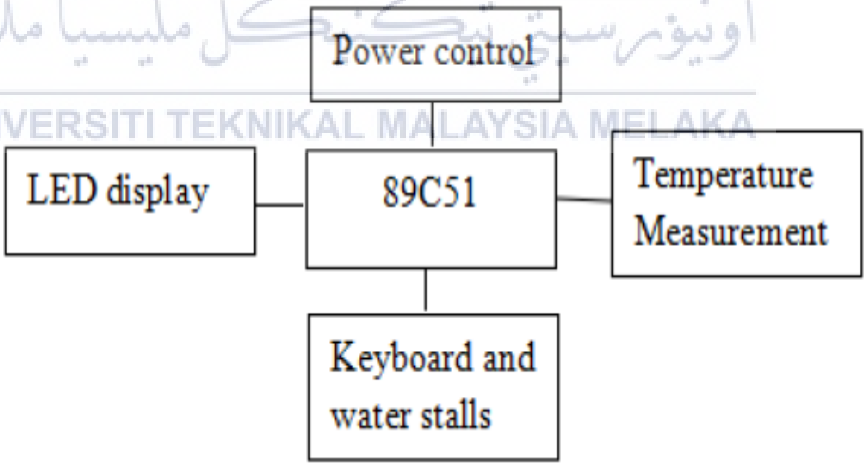

Figure 2.3: Single chip design of the water temperature control system (Hanhong T., 2017)